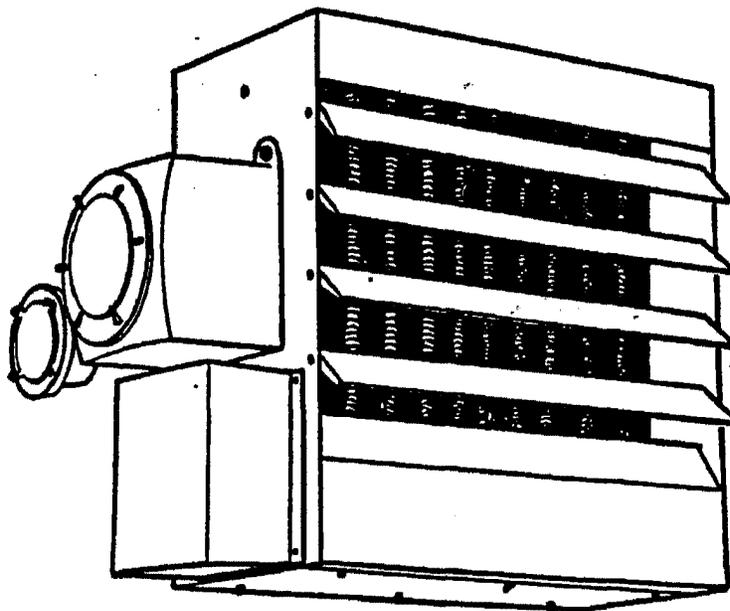


INSTALLATION, PARTS, SERVICE & MAINTENANCE MANUAL FOR HLA SERIES

Electric Air Heaters for Hazardous Locations

Divisions 1 & 2

Class I, Groups C, D – Class II, Groups E, F, & G



LR61144



Listed 916X
E 71237

Models covered by this manual:

HLA12 - 3, 5 and 7.5 KW

HLA16 - 10 KW

HLA20 - 15, 20 and 25 KW

WARNING!
READ ALL WARNINGS AND NOTICES.

WARNING

To prevent ignition of hazardous atmospheres adhere to the following:

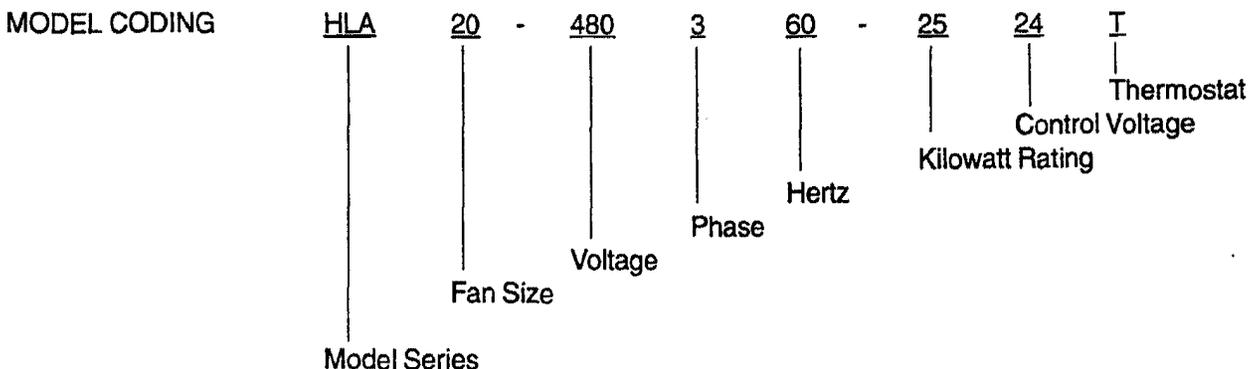
1. Read and follow the instructions in this manual.
2. The HLA Series electric unit heaters have been Listed by the Underwriters Laboratories and have a maximum operating temperature of 165°C. DO NOT install heaters where the marked operating temperature exceeds the ignition temperature of the hazardous atmosphere.
3. Before opening any enclosure, first disconnect the heater from the power supply.
4. It is absolutely essential that the high-limit thermostat provided in the heater be left in operation. Never bypass the high-limit from the contactor coil circuit. When installing an external control thermostat, connect it to the terminal block provided in the control box. Refer to 'INSTALLATION—ELECTRICAL' for more details.
5. Operate heater only while permanently mounted in an upright position. See 'INSTALLATION—MECHANICAL' for tilt limits.
6. To operate correctly, the heater must be kept clean. When operating in a dirty environment, regularly clean the finned tubes, fan and fan guard, and motor cooling fan, if provided.
7. If any fluid leakage occurs, withdraw the heater from service and have it repaired. See 'REPAIR AND REPLACEMENT PROCEDURES—HEAT EXCHANGER CORE' for details.
8. Never operate the heater with all or any louvers fully closed. Set all louvers to similar angles to obtain required air flow direction. Stops have been provided in the cabinet side walls to limit the amount to which the louvers may be closed. DO NOT OVERRIDE THESE STOPS.
9. Do not Operate in atmospheres corrosive to steel and aluminum.
10. During installation, ensure that the 1" plastic protector cap in the control box is discarded and replaced with either an incoming conduit or the remaining 1" explosion-proof plug not being used. Do not operate the heater without proper explosion-proof plugs installed in all unused threaded openings.

WARRANTY WILL BE VOIDED IF THESE WARNINGS ARE NOT ADHERED TO.

INTRODUCTION

APPROVED SERVICE USES

HLA Series Electric Air Heaters for Hazardous Locations are U.L. Listed for use in hazardous locations Divisions 1 and 2, Class I, Group D and Class II, Groups E, F and G. For details of the particular hazardous environments having the potential for explosion, refer to articles 500 through 516 of the National Electrical Code.



DESCRIPTION

The HLA Series heaters use a permanently sealed, liquid-to-air finned tube heat exchanger core. This consists of a bottom tank containing three immersion type heating elements and two rows of finned heat exchanger tubes welded between the bottom tank and a top header tank. A specific mixture of ethylene glycol to water mixture is placed in the heater core to act as the heat transfer fluid. Heat is transferred to the fluid mixture by the heating elements causing vigorous convective vapor circulation and condensation within the heater core, ensuring even heat distribution. The ethylene glycol provides freeze damage protection to -49°F (-45°C). An electric motor driven fan blows air over the finned tubes to transfer heat to the air flow, thus heating the area.

Over temperature protection is effected by a manual reset capillary type high-limit rated for 6,000 cycles of reliable service, which is housed in a thermowell tube next to the heating elements. Over-pressure arising from excessive external temperature is relieved by a pressure relief valve provided in the top header tank.

The heater core assembly is contained in a sturdy steel cabinet which also carries the controls, motor and fan assembly. A narrow gap safety fan guard is provided to shield all moving parts. Adjustable louvers are provided to allow directional control of the airflow.

All electrical power is carried by copper conductor wires enclosed in rigid metal conduits. Only within the enclosures are wires exposed to permit connection to terminals.

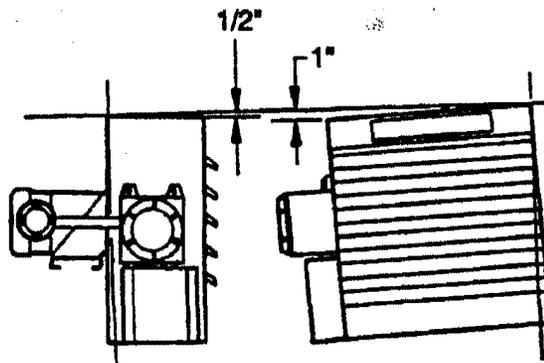
NOTE—In order to provide the highest possible outlet air temperatures, yet operate safely in hazardous atmospheres, these heaters operate in a narrow temperature band between normal operating temperature and that temperature at which the high-limit control shuts off to limit maximum temperature. It is probable therefore, that the heater will not operate continuously should ambient temperatures exceed 104°F (40°C).

INSTALLATION

MECHANICAL

The HLA Series heaters are designed for use only while permanently mounted in an upright position. The supporting assembly must ensure that the heater is installed such that it operates in an upright attitude. The maximum out of plane attitude shall not exceed the values indicated in the following sketch.

To insure proper heating of floor surfaces, observe the following recommended maximum mounting heights (to bottom of heater):



Maximum tilt angles allowed during operation (applicable front to back and side to side in either direction). Heater must be permanently mounted.

Max. Mtg. Height from Floor:	<u>HLA12</u> 8 ft.	<u>HLA16</u> 10 ft.	<u>HLA20</u> 13 ft.
------------------------------	-----------------------	------------------------	------------------------

The heaters should be installed to allow clearances for service access and air circulation as follows:

Back	-	2" from motor
Front	-	84" HLA20, 72" HLA12 & HLA16
Right side	-	1"
Left side	-	30" from control box
Top	-	0"
Bottom	-	Cabinet height plus 6" (optional - for easier core removal)

To permit removal of the heater core assembly from a suspended heater, leave space beneath the heater at least equal the cabinet height plus 6". Installations with less than specified clearances from the heater bottom make it necessary to dismount the entire unit should core removal be required.

It is essential that the supporting assembly be of adequate strength to suspend the heaters. See "Specifications" for heater weights. Adequate stiffness should be provided to ensure that unwanted vibrations or movements of the complete system do not occur. Such vibrations or movement could be induced by electric motor start-up, or be transmitted to the heater from the structure to which it is mounted, as in mobile installations. Where heaters are installed in applications that are of a relocatable or transportable nature (such as drilling rigs) design the mounting structure to withstand all probable load conditions. Such load conditions should recognize abuse situations such as truck off-loading impacts. The heaters should be suspended from the supporting assembly by two 5/8 NC bolts fitted with lock washers.

ELECTRICAL

The HLA heaters have been designed for explosion proof service, with single and three-phase inputs of 208, 240, 480 or 600 volts. They meet stringent U.L. requirements. However, it is essential that correct installation procedures be followed to eliminate all potential hazards arising from faulty installation.

Follow these instructions:

1. Should it be deemed desirable to install a room temperature control thermostat, refer to the appropriate electrical wiring diagram and follow these steps:

Remove the jumper wire from the small terminal block marked C1 - C2 located in control enclosure. Connect the external thermostat to these terminals. The external thermostat will then be connected in series with the heater high limit and correct operation of the heater will result.

Any room thermostat used with these heaters must be of an explosion-proof type, open on temperature rise, suitable with control voltage selected.

WARNING

It is imperative that the high-limit (in the heater core junction box enclosure) remain connected in series with the room thermostat, the secondary output of the control transformer and the contactor coil. Under no circumstances are the heaters to be operated with the high-limit disabled or disconnected.

2. Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal is marked and is located in the control enclosure.
3. Avoid placing conduit runs directly beneath the heater in a way that would prevent removal of the heater core assembly.
4. On all 3-phase heaters, it is necessary to verify that the fan is rotating in the proper direction. If air delivery is not from the front of the heater, exchange any 2 input wires at the contactor. Do not needlessly remove the electric motor conduit box cover. In the event that the motor cover is removed, ensure that it is securely tightened when replaced.
5. Use only an approved explosion-proof means of wiring such as mineral insulated cable or copper conductors in rigid conduit to make connections to the heater.
6. External electric circuit breaker protection is required. See 'TECHNICAL DATA' table and follow code recommendations. Check nameplate for voltage and amperage.
7. Follow all applicable electrical and building codes related to the intended use of the heater. Similarly, any National, State, or Local codes must be observed and adhered to.
8. When doing any work on a heater, including the initial electrical connection, disconnect the electrical current at the main switch. Where possible lock the switch in the off (open) position and/or Tag **WARNING** to prevent shock hazards.

9. Refer to the appropriate wiring diagram to ensure that all connections are as required and securely fastened.
10. Ensure conductors are of appropriate gauge size. Size all input conductors according to accepted standards consistent with the temperature rating of the wire being used. Use minimum 90°C rated wire. Minimum size for the thermostat circuit is 16 - AWG (90°C). Use only copper conductors.
11. Ensure that input conductors and conduiting have adequate strain relief at installation.
12. Confirm that the electrical power supply is compatible with the nameplate rating of the heater to be connected.
13. Before application of electrical power, recheck all connections to ensure compliance with the wiring diagram and any code requirements. Remove any foreign objects from the control box and reinstall cover lid tightly. Make certain that all three conduit box covers are securely in place.

MAINTENANCE RECOMMENDATIONS

CAUTION—Before undertaking any maintenance, disconnect the heater from the electrical power source. If possible, lock the main power switch in the off (open) position and/or tag to prevent shock hazards.

ELECTRICAL

Annually inspect all terminal connections, contactor and visible insulation for damage, looseness, fraying, etc. as applicable. Retighten any loose terminals and replace or repair damaged or deteriorated insulation. If contactor contacts are badly pitted, welded together, or burned, replace the contactor. Check all explosion-proof conduit for visible damage and tightness. Contact TPI for replacement parts.

If reduced heat output is suspected, verify the condition of the heating elements by using an amperage meter to check the current draw of each input line. All input lines should draw approximately equal current which should agree with nameplate rating. If they do not, one or more of the heating elements could be burned out. See 'REPAIR AND REPLACEMENT PROCEDURES'.

The electric motor is permanently lubricated and thermally protected. Check for smooth and quiet running at all inspections. Check shaft for bearing play. Replace motor if excessive bearing play is detected. Contact TPI for replacement parts.

MECHANICAL

Explosion-proof conduit boxes are designed with threaded joints and metal-to-metal contact at lid and cover joints to prevent an explosion. Do not attempt to install gasket materials of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.

Annually check the tightness of all visible bolts or nuts, in particular the support structure bolts and nuts. Similarly check the electric motor mounting bolts and nuts.

Periodically, depending on environmental service condition, check the cleanliness of motor, fan and heater core fins. Clean if required by air jet. Check louvers for tightness and equal angle settings. Check motor and fan for smooth running. Any unusual noise or vibration must be investigated and rectified.

Check the fan blade for cracks. In the unlikely event that a crack is found, the fan blade should be replaced immediately.

Should there be any evidence of fluid leakage from the heater core, the heater should be withdrawn from service and repaired immediately. The heater will not function properly and must be repaired.

REPAIR AND REPLACE PROCEDURES

CAUTION—Before undertaking any maintenance, disconnect the heater from the electrical power source. If possible, lock the main power switch in the off (open) position and/or tag to prevent shock hazards.

Should problems arise requiring repair or replacement of any major component, the following procedures should be followed where applicable:

HEAT EXCHANGER CORE

(Including HEAT TRANSFER FLUID, HEATING ELEMENTS, and PRESSURE RELIEF VALVE)

The HLA Series heater core assemblies have been deliberately designed to permit only limited field service. Repair and overhaul is intended to only be by complete replacement of the core assembly with either a new or factory reconditioned core assembly. Such new or reconditioned core assemblies will be supplied with heating elements, pressure relief valve, the correct amount of fluid, and a new high-limit. Each core assembly will have been factory assembled, inspected and electrically tested for correct heat output and proper operation of the high-limit. Because of the equipment and test procedures required to test core assemblies, it is not practical for cores to be field serviced. Incorrect field service procedures may render a heater potentially hazardous.

The only core assembly field service work sanctioned by the manufacturer is replacement of the capillary high-limit and cleaning.

To remove the heater core from the heater cabinet proceed as follows:

1. First remove all threaded and screw-attached sheet metal covers from the control box side of the heater. Then remove the bottom cover.
2. Remove all 5 wires from within the conduit between the upper and lower boxes.
3. The heater core assembly is secured by three 5/16 diameter x 1/2 capscrews; two on one side and one above the aluminum control box enclosure. Before removing these screws assistance will be required to support the weight of the core.
4. With a second person to support the weight of the core assembly, remove the three 5/16 diameter x 1/2 capscrews and have the helper carefully lower the heater core assembly from the cabinet.

HEAT TRANSFER FLUID

The heater cores are partially filled with an ethylene glycol/water solution similar to that used in automotive applications. Oral ingestion of this solution could prove fatal since ETHYLENE GLYCOL IS POISONOUS. Should ingestion occur, seek medical attention immediately.

Field service of the core assembly with respect to refilling it with fluid is not permissible. A new or factory reconditioned core assembly must be used and shall be provided by the manufacturer or one of its agents.

HEATING ELEMENTS

In the event of failure of the heating elements it will be necessary to replace the core assembly with a new or reconditioned unit.

PRESSURE RELIEF VALVE

The pressure relief valve is factory installed and pressure tested. Contact the manufacturer or authorized service agent should suspected problems occur.

ELECTRIC MOTOR

Remove the cover lid on the motor junction box and disconnect all the wires. Carefully loosen the union between the motor and control box enclosures. Loosen and remove the motor mounting bolts and fan guard bolts, being careful not to damage the fan blades. Note the relative axial position of the fan hub on the motor shaft and remove the fan.

To replace the motor, fan guard and fan assembly, reverse the above procedure. Position the fan on the shaft to the previously noted position. It is helpful to leave the motor bolts loose while connecting the union. The back of each fan blade should be about 3/4" from the inside of the fan guard. When everything is in place, make certain all fasteners are secure and that the conduits have at least 5 threads engaged. Manually spin the fan blade with a screwdriver before application of power to make certain it does not foul the cabinet or fan guard.

HIGH-LIMIT

The high-limit is rated for operation of 6,000 cycles. Experience indicates that nuisance tripping is generally not the fault of the high-limit but is usually caused by excessive input voltage, high ambient temperatures, or an excessively dirty heater core. The high-limit is unlikely to cause any difficulty, but if it should, follow these procedures:

Gain access to the high-limit by removing the sheet metal cover from the cabinet and the threaded aluminum cover from the core junction box. Once inside, pull off the two wires attached to the high-limit. Remove the two screws that retain the capillary high-limit and withdraw it by pulling.

To replace the high-limit, reverse the above procedure. Reconnect the thermostat wires on terminals. **DO NOT OMIT THIS OPERATION AND DO NOT BYPASS.**

Never use any replacement high-limit other than one supplied by the manufacturer as the heaters may be rendered potentially hazardous.

CONTROL TRANSFORMER

HLA heaters are provided with multi-tap primary transformers on 208, 240 and 480 volt models. If replacement is necessary, select the voltage tap compatible with the line voltage of the unit and cap off all unused taps. All 600 volt units are furnished with non selectable dedicated primaries.

NOTE: Transformer secondaries should not be sparked or shorted as they may be provided with embedded over current protection.

CONTACTOR

A contactor should be replaced if excessive pitting or burning of the contact points is found, or if the coil has burned out. (Note—the contactor is rated for 100,000 cycles of operation at its full rated capacity).

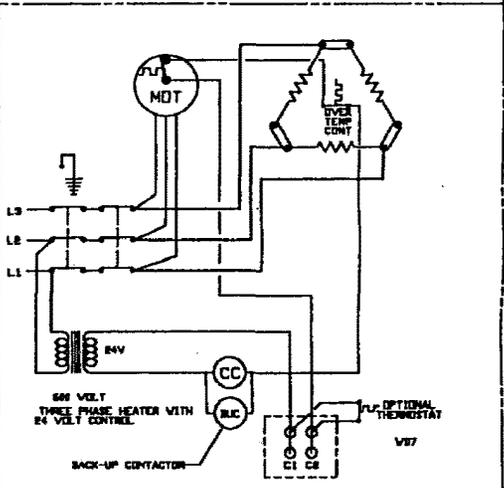
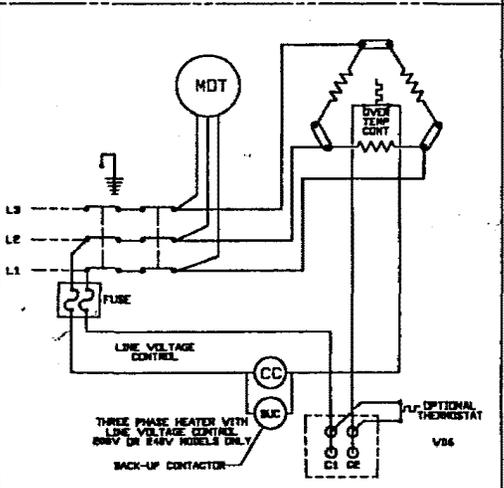
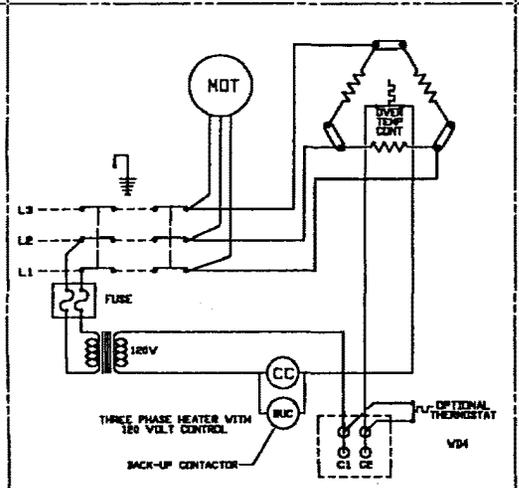
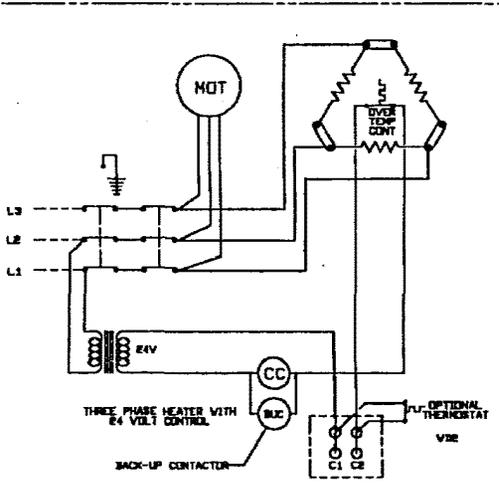
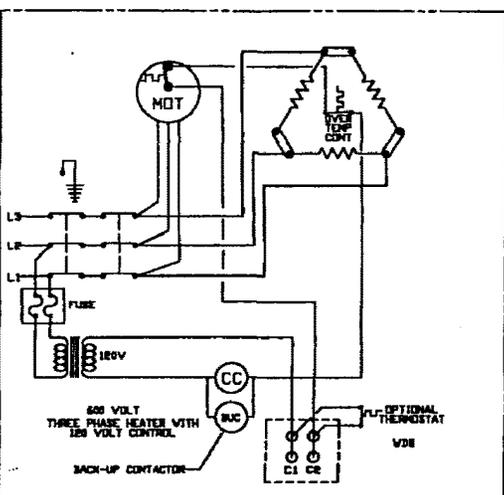
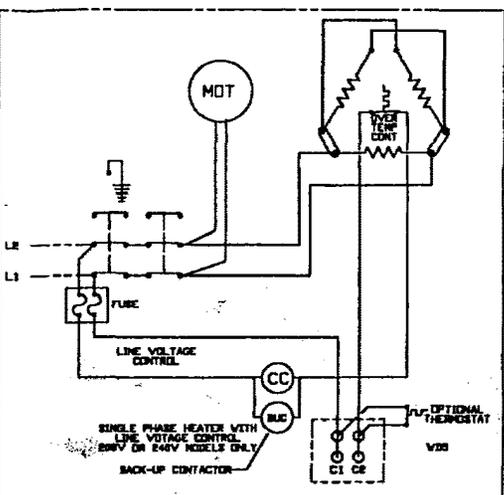
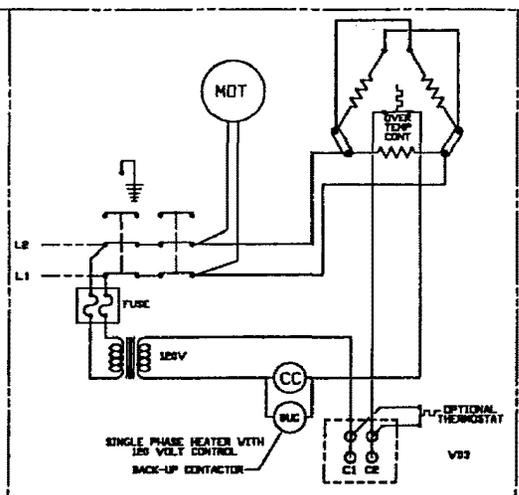
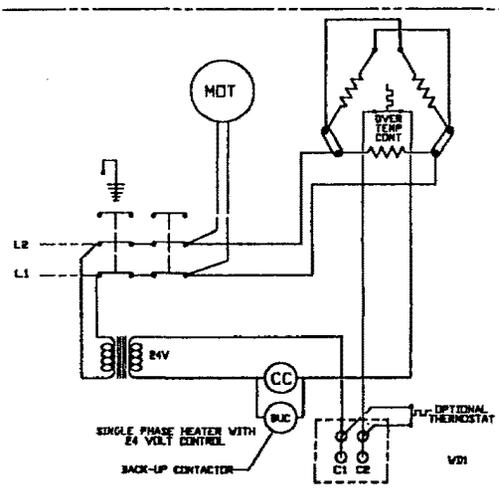
REPLACEMENT PROCEDURES—CONTROLS

BEFORE OPENING ANY ENCLOSURE, DISCONNECT HEATER FROM POWER SUPPLY.

Remove top plate located in control enclosure, by removing three (3) No. 8 screws. One of the screws also retains the grounding lug. Associated wiring must be removed from control block, fuse block, and contactor. Remove three (3) screws that retain the contactor mounting plate. Remove contactor mounting plate, which will have two stand-off posts and contactor assembled as a unit. The contactor can be replaced if necessary, at this time.

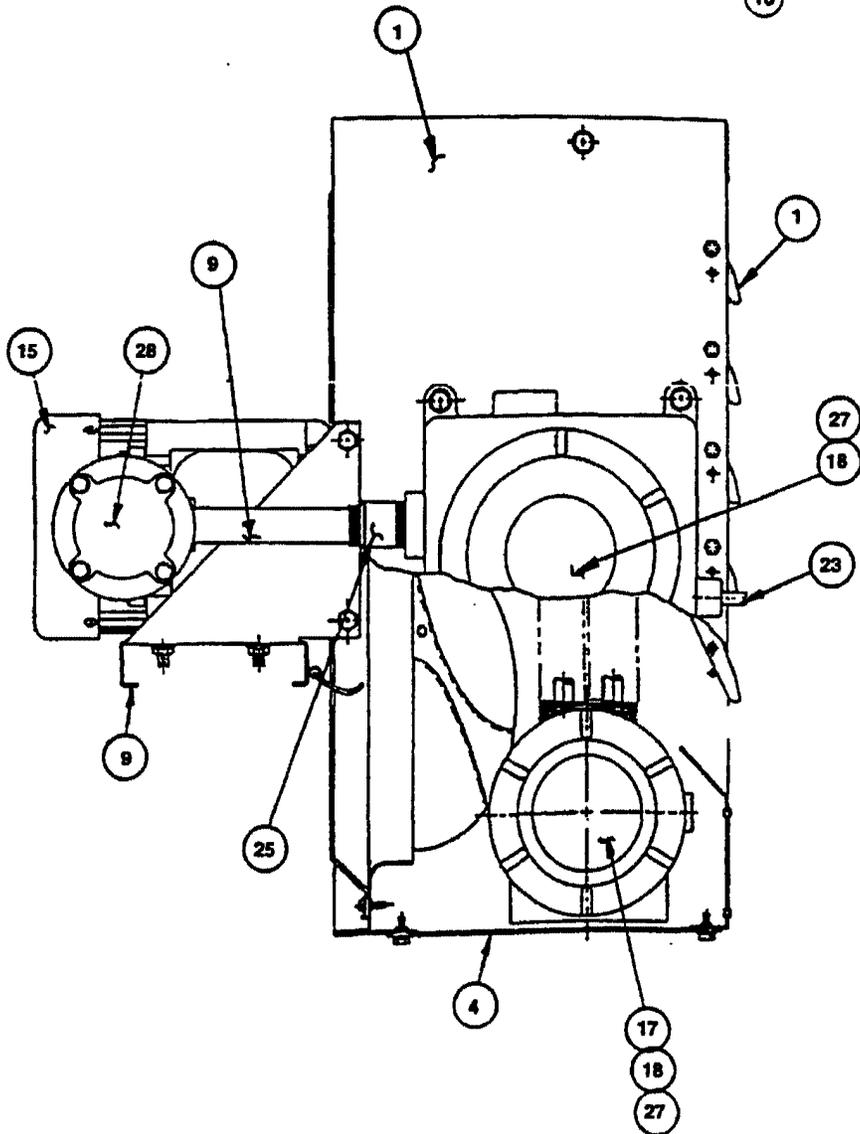
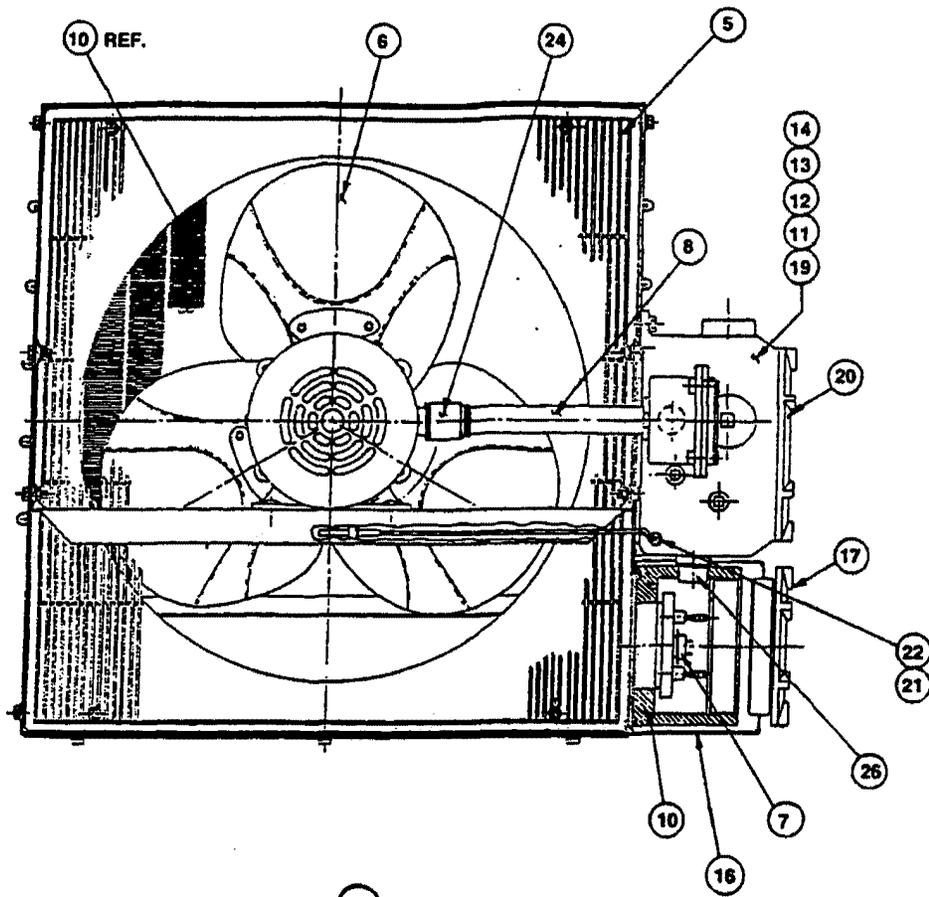
If transformer or thermostat is to be replaced, remove three (3) screws retaining the plate on which they are mounted. Both parts will be removed together. If a thermostat is provided, the operating shaft must be withdrawn through its clearance hole or shaft hub screw loosened to free assembly. Transformer can now be replaced.

To replace thermostat, loosen bulb retaining clamps, and remove capillary plug retaining ring located on outside of enclosure. Withdraw thermostat and its capillary bulb through enclosure opening. Thermostat may be replaced at this time. When reassembling thermostat, retaining rings should be firmly seated in capillary plug seal grooves on both sides of enclosure wall. Inside retaining ring should be placed on seal plug before passing capillary bulb through enclosure opening provided. To prevent any possible shorting of terminals, route thermostat capillary close to lower enclosure wall. Refer to wiring diagram covering your model. For reassembly reverse the order to above procedure.



RATINGS

Model	Volts	Phase	KW	Motor HP	A			Minimum Circuit A	Maximum Fuse A	Supply Connections Wire Size No. AWG
					Motor	Heater	Line			
HLA12	208	1	3	1/4	1.9	14.4	16.3	20.4	25	10
			5	1/4	1.9	24.0	26.0	32.5	35	8
			7 1/2	1/4	1.9	36.1	38.0	47.5	50	8
HLA12	240	1	3	1/4	2.3	12.5	14.8	18.5	20	12
			5	1/4	2.3	20.8	23.1	28.9	30	10
			7 1/2	1/4	2.3	31.3	33.6	42.0	45	8
HLA12	208	3	3	1/4	1.5	8.3	9.8	12.3	15	14
			5	1/4	1.5	13.9	15.4	19.2	20	12
			7 1/2	1/4	1.5	20.8	22.3	27.9	30	10
HLA12	240	3	3	1/4	1.4	7.2	8.6	10.8	15	14
			5	1/4	1.4	12.0	13.4	16.8	20	12
			7 1/2	1/4	1.4	18.0	19.4	24.3	25	10
HLA12	480	3	3	1/4	0.7	3.6	4.3	5.4	15	14
			5	1/4	0.7	6.0	6.7	8.4	15	14
			7 1/2	1/4	0.7	9.0	9.7	12.1	15	14
HLA12	600	3	3	1/4	0.6	2.9	3.5	4.4	15	14
			5	1/4	0.6	4.8	5.4	6.8	15	14
			7 1/2	1/4	0.6	7.2	7.8	9.8	15	14
HLA16	208	3	10	1/4	1.5	27.8	29.3	36.6	40	8
HLA16	240	3	10	1/4	1.4	24.1	25.5	31.8	35	8
HLA16	480	3	10	1/4	0.7	12.0	12.7	15.9	20	12
HLA16	600	3	10	1/4	0.6	9.6	10.2	12.8	15	14
HLA16	240	1	10	1/4	2.3	41.7	44.0	55.0	60	6
HLA20	208	3	15	1/2	1.9	41.6	43.3	54.4	60	6
HLA20	240	3	15	1/2	2.0	36.1	38.1	47.6	50	8
HLA20	480	3	15	1/2	1.0	18.0	19.0	23.3	25	10
			20	1/2	1.0	24.1	25.1	31.3	35	8
			25	1/2	1.0	30.1	31.1	38.8	40	8
HLA20	600	3	15	1/2	0.8	14.4	15.2	19.0	20	12
			20	1/2	0.8	19.2	20.1	25.1	30	10
			25	1/2	0.8	24.1	24.9	31.1	35	8



REPLACEMENT PARTS LIST HLA

ITEM	QTY	3, 5, 7.5 KW	10 KW	15, 20, 25 KW	DESCRIPTION
1	1	70667-001	70667-002	70667-003	Cabinet Weldment
2	3	62022-001			Louver
2	4		62022-002		Louver
2	5			62022-003	Louver
3	1	62023-001	62023-002	62023-003	Motor Support
4	1	51634-001	51634-002	51634-003	Bottom Cover
5	1	70671-001	70671-002	70671-003	Fan Guard
6	1	62003-001	62003-002	62003-003	Fan
7	1	51510-004	51510-005	51510-006	High Limit Control
8	1	52823-001	52823-002	52823-003	Conduit Motor 3/4
9	1	52823-001	52823-002	52823-004	Conduit Junction Bos 3/4
10	1	Provide Model Number			

Heat Exchanger Complete with relief valve, elements, fluid charge, slip-joint and element enclosure cover.

ITEM	COMMON TO ALL SIZES PARTS LIST	
11	58027-036	Contactora, 50 Amp 3 Pole 24V Coil
11	58027-037	Contactora, 50 Amp 3 Pole 120V Coil
11	58027-038	Contactora, 50 Amp 3 Pole 208/240V Coil
12	50704-001	Transformer 208/240/480/24V Sec
12	51512-001	Transformer 208/240/480/120V Sec
12	51704-002	Transformer 600/24V Sec
13	51511-002	Fuse Block 2 Pole
14	43810-003	Fuse 3.0 Amp Time Delay
14	43810-002	Fuse 4/10 Amp Time Delay
14	43810-001	Fuse 2/10 Amp Time Delay
15	3.5, 7.5, 10KW	62034-001 Motor, 1/4 HP 208/240/480V 1 Phase
15	3.5, 7.5, 10KW	62034-002 Motor, 1/4 HP 208/240/480V 1 Phase
15	3.5, 7.5, 10KW	62034-003 Motor, 1/4 HP 600V, 3 Phase
15	15, 20, 25KW	62034-004 Motor, 1/2 HP 208/240/480V 3 Phase
15	15, 20, 25KW	62034-005 Motor, 1/2 HP 600V, 3 Phase
16	62024-001	Element Enclosure Cover
17	62032-001	Element Enclosure)Exp. Proof) Threaded Cover
18	41352-001	Caution Plate
19	70672-003	Control Box Exp. Proof (Provisions for thermostat option)
20	62031-002	Control Box Exp. Proof Cover
21	51637-001	Thermostat (Stainless Steel Capillary)
22	43633-001	Thermostat Retaining Ring (2 Required)
23	41341-001	Thermostat Shaft Assembly
24	43758-001	3/4" Conduit Union Female (Motor)
25	43755-001	3/4" Conduit Union Male (Junction Box)
26	51638-001	3/4" Slip-Joint Fitting (Junction Box to Element Enclosure)
27	43672-001	Drive Screw # 6 x 3/16"
28	62034-000	Motor Junction Box (Exp. Proof)

TERMS AND WARRANTY

RETURNED MERCHANDISE

Goods may not be returned without the company's written permission. All transportation costs for return goods must be -> paid by the customer.

FREIGHT DAMAGE CLAIMS

Title to goods shipped passes to the consignee upon delivery by the company to the carrier. All claims for shortages or damage must be made to the carrier by the consignee. In case of concealed damage it is important that such damage be reported to the delivering carrier within one week.

WARRANTY LIMITED WARRANTY TO OWNER TPI Corporation Effective May 1, 1977

The warranty herein set forth is in lieu of all other warranties expressed or implied, and shall not apply to any accessory not part of the product.

TPI Corporation, hereafter referred to as the company of Johnson City, Tennessee 37602, warrants its products to the owner against defects in material and workmanship for a (12) month period under normal use and services following date of manufacture or installation when proof of such is provided to seller.

This Warranty requires that the owner, or his agent, install the equipment in accordance with the National Electrical Code, any other applicable heating or electrical codes, and the manufacturer's installation instructions. It further requires that he perform reasonable and necessary maintenance on the unit. The company is not liable for abuse or misuse of product as may be finally determined by inspection by the company.

The obligation of the manufacturer, under the terms of this warranty, shall be to supply a new part, or the repair of defective part at the company's option with no costs to owner for the new or repaired part. Such parts are to be returned to the factory, or such other location as the company may designate at the owner's expense. This warranty does not obligate the manufacturer to bear the cost of labor in replacing any assembly, unit or component part thereof, nor does the company assume any liability for secondary charges, expenses for installing or removal, or any other consequential losses, freight or damages. The company's maximum liability shall not in any case exceed the list price for the product claimed to be defective.

IN CASE OF PRODUCT FAILURE

It shall be the obligation of the owner to furnish to the company within the designated warranty period, the following information:

1. Model Number and date of manufacture of product involved.
2. Complete description of the problem encountered with product.

Upon receipt of the above, the company will reply to the owner within a period not to exceed fifteen (15) working days, the action to be taken by owner.

When requested, it shall be the obligation of the owner to return the defective part to the company within thirty (30) days after its removal, or otherwise to follow instructions from the company.

HAZARDOUS LOCATIONS DEFINITIONS

HAZARDOUS LOCATION - Areas where the possibility of explosion or fire exists because of the presence of flammable gases, vapors, or dusts, etc.

DIVISION 1 - Locations where the hazard is expected to be present during normal production operations, or during frequent maintenance and repair activities.

DIVISION 11 - Locations where the hazards would only exist as a result of an accident or other abnormal event such as a rupture or spillage.

CLASS 1 - Areas where sufficient quantities of flammable gases or vapors exist in the air to be explosive or ignitable.

- Offshore and land based drilling rigs, petroleum exploration and testing facilities.
- Petroleum refineries, gasoline storage and dispensing areas.
- Industrial firms that use flammable liquids in dip tanks for parts cleaning or other operations.
- Petrochemical companies that manufacture chemicals from gas and oil.
- Dry cleaning plants where vapors from cleaning fluids can be present.
- Aircraft hangars and fuel servicing areas.
- Utility gas plants and operations involving storage and handling of liquefied petroleum gas or natural gas.

GROUP C - Gases or vapors with specific explosive characteristics grouped together including:

Acetaldehyde, Allyl Alcohol, N-Butyraldehyde, Carbon Monoxide, Crotonaldehyde, Cyclopropane, Diethyl Ether, Diethylamine, Epichlorohydrin, Ethylene, Ethylenimine, Hydrogen Sulfide, Morpholine, 2-Nitropropane Tetrahydrofuran, Isoprene, or Unsymmetrical Dimethyl Hydrazine (UDMH)

GROUP D - Gases or vapors with specific explosive characteristics grouped together including:

Acetone, Acrylonitrile, Ammonia, Amyl Acetate, Amyl Alcohol, Benzene, Blast Furnace Gas, Buta-1:3 Diene, Butane, Butyl Acetate, Carbon Monoxide, Cyclohexane, Decane, Ethane, Ethylene Dichloride, Ethyl Acetate, Ethyl Alcohol, Ethyl Methyl Ketone, Ethyl Nitrite, Heptane, Hexane, Iso Butyl Alcohol, Isooctane, Isoprene, Methane, Methanol, Methyl Acetate, Methyl Alcohol, Naphtha, Natural Gas, N-Butyl Alcohol, Pentane, Propane, Propylene, Propyl Acetate, Styrene, Toluene, Vinyl Acetate, Vinyl Chloride, Xylene

CLASS II - Areas which are made hazardous by the existence of combustible dusts.

- Coal preparation plants and other carbon handling or processing areas.
- Grain elevators, flour and feed mills.
- Plants that manufacture, use or store magnesium or aluminum powders.
- Plants that have chemical or metallurgical processes. . producers of plastics, medicines and fireworks, etc.
- Producers of starch or candies.
- Spice grinding plants, sugar plants and cocoa plants.

GROUP E - Powdered metals such as aluminum and magnesium, and other metal dusts with similar characteristics.

GROUP F - Dusts such as carbon black, coke, and coal dust.

GROUP G - Dusts, including flour, starch, spices, and grain dust.

INSTALLATION, OPERATION AND MAINTENANCE OF GENERAL PURPOSE DRY TYPE TRANSFORMERS

600 VOLTS AND BELOW

1. GENERAL

The installation, operation and maintenance of dry type transformers should be performed by an electrician or other qualified personnel who are familiar with international, national, and/or local electrical codes and with the potential shock hazards associated with electrical equipment.

These instructions cover two types of enclosure construction: ventilated and encapsulated.

A) Ventilating units are NEMA type 2 enclosures suitable for indoor use. They are UL-3R listed and CSA certified for outdoor use with the addition of an optional weather shield kit. The proper weather shield part number is listed on the nameplate.

B) Encapsulated units are NEMA 3R enclosures suitable for either indoor use in harsh environments or for outdoor use. CE marked units have a protection index of IP23.

This transformer is ready for installation and operation. It must be installed per the National Electrical Code® and local code requirements. It is recommended that these instructions be read carefully prior to installation and kept for future reference.

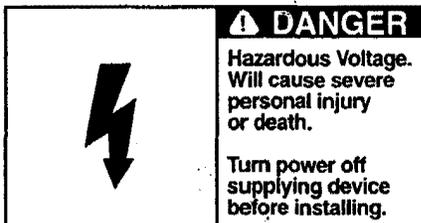
CE marked transformers must be installed per EN 60742.

2. INSPECTION AND HANDLING

The transformer should be inspected carefully upon receipt to check for any visible or concealed damage that may have occurred during shipment. If damage is found, a claim should be filed immediately with the carrier.

Single and three phase transformers, in smaller KVA sizes, are provided with lifting ears. Larger KVA sizes are palletized and can be lifted with appropriately sized fork lifts or hoisted by the lifting lug bolts provided on the core frame after removal of the top cover. Incorrect handling can bend the enclosure or cause other damage or result in personal injury.

3. INSTALLATION



WARNING: There is a potential danger of electrical shock when working on electrical equipment! Make sure power is off before installation. Replace all covers before energizing transformer.

A) Ventilating Dry Type Transformers

Ventilated units can be installed indoors or outdoors. Outdoor installation requires the addition of a weather shield to be UL-3R listed. For outdoor installation, check electrical codes for the proper protection of transformer against adverse weather conditions.

Ventilated units should be installed in a upright position on walls (optional wall mounting brackets are available for certain KVA sizes), beams, platforms, floors or other structures capable of supporting their weight.

The ambient air should be dry and free from dust, dirt, corrosive fumes, heat or other adverse conditions. The unit should be installed a minimum of 6" from the wall or other obstructions that might prevent proper air flow through the vents.

Ventilated transformers are designed for operation in an average ambient temperature of 30 degrees C (86° F) and a maximum of 40 degrees C (104° F) not to be exceeded.

Large KVA sizes contain "shipping bolts" to prevent damage during shipping. These should be removed just prior to installation of the unit.

B) Encapsulated Dry Type Transformers

Encapsulated units can be installed indoors or outdoors. When installed outdoors, these units should be installed with the wiring compartment down to prevent the entrance of moisture. Some encapsulated units have a top entry wiring compartment and can be installed vertically (wiring compartment up).

For indoor floor mounting of an encapsulated unit that has a bottom entry wiring compartment, the unit can be installed horizontally (on its back side) for ease of making wire connections.

4. ELECTRICAL CONNECTIONS

WARNING: Danger of electrical shock! Do not remove parts or make connections while the transformer is energized.

Refer to the transformer nameplate label or enclosed wiring diagram for primary and secondary voltage combinations, frequency and number of phases. Tap connections and voltage combinations are also listed on the diagram or nameplate.

CAUTION: Do not make connections other than those shown. The transformer must be as large (KVA) as the load it must operate. Never exceed the nameplate rating as this could result in overheating, reduced life expectancy, or in worst cases, fire.

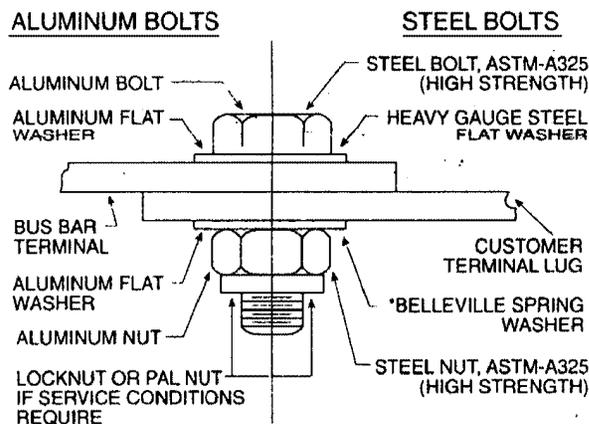
A) Ventilated Dry Type Transformers

Proper assembly of the connector (lug) to the transformer terminal is extremely important. Make certain that the connector is sized for the cable and is of the correct type to match cable and terminal metals. Always follow recommendations of the connector (lug) manufacturer. Space and insulate connectors per the NEC®.

INSTRUCTIONS FOR ALUMINUM BUS BAR CONNECTIONS

The following steps should be followed when making connections to transformers with ALUMINUM BUS BAR TERMINALS.

- 1) Remove oxide form joint area of transformer bus terminal. This may be done with a wire brush or emery cloth. Other tools may be used but care should be taken to avoid scratching or gouging terminal.
- 2) Coat terminal area with joint compound, following manufacturer s instructions.
- 3) Make connections using one of the bolting methods shown.



CAUTION: Care should be taken to avoid shearing aluminum bolts. Follow manufacturer s maximum torque rating.

- * Place cup in washer toward bus bar. Draw washer to flat position for proper torque.

B) Encapsulated Dry Type Transformers

Proper assembly of the field wiring to the transformer leads is extremely important. Make certain that the connector or terminal is sized for the cable. Space and insulate connectors or terminals per the NEC®.

CE marked transformers must be connected per EN 60742.

5. GROUNDING

All dry type transformers have a ground stud in the enclosure. The transformer enclosure should be solidly grounded to protect personnel. The customer supplied grounding conductor should have a current-carrying capacity to meet international, national, and/or local requirements.

6. MAINTENANCE

Non-ventilated encapsulated styles only require periodic wiping of dust and dirt from the outside of the case under normal conditions and environments. Adverse conditions may require more frequent inspections.

Ventilated units should be inspected within one to three months after initial installation. Air ducts should be kept clear at all times. Vacuum cleaners or low pressure compressed dry air can be used to remove dirt or dust. A regular inspection schedule for cleaning and maintenance will help ensure added safety and longer transformer life.

If a dry type transformer accidentally gets wet, it must be cleaned and thoroughly dried before energizing. Otherwise, complete failure could result!

CAUTION: Never perform internal maintenance while the unit is energized!

7. STORAGE

Both ventilated and encapsulated transformers should be stored in a clean, dry area. Care should be taken to prevent moisture or condensation from entering the transformer, and vent openings should be covered on ventilated units. If stored outside, the transformer must be covered and protected from water, dust and other airborne contaminants.

8. LIMITED PRODUCT WARRANTY

All dry type transformers are warranted against defects in materials and workmanship. This is a limited product warranty and certain conditions apply. Please contact the manufacturer for further information on warranty claims.

NOTICE: These instructions are general in nature and may not cover all variations in transformer design or conditions of installation, operation and maintenance in enough detail to meet customer needs. Additional instructions may be included with this transformer. If you need further information or should a problem arise, please contact the manufacturer.

Redi-Flo4

Stainless Steel Submersible Pumps
for Environmental Applications

US Installation and operating instructions



Please leave these instructions with the pump for future reference.

SAFETY WARNING

Grundfos Stainless Steel Submersible Pumps

Your Grundfos Redi-Flo4 Environmental 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.

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 Redi-Flo4 Environmental 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 contaminated, 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.

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. Dispose of discharged materials in accordance with the specific job site requirements. The stainless steel construction of the Redi-Flo4 Environmental Pump makes it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy groundwater.

Determine the maximum depth of the well, and the drawdown 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.

PRE-INSTALLATION CHECKLIST

B. Condition of the Water

Redi-Flo4 pumps are designed for pumping cold groundwater that is free of air or gases. Decreased pump performance and life expectancy can occur if the groundwater is not cold or contains air or gases.

C. Installation Depth

Pumping sand or well sediment can occur when the pump motor is installed lower than the top of the well screen or within five feet of the well bottom. This can reduce the performance and life expectancy of the pump and should be avoided.

If the pump is to be installed in a lake, containment 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.

WIRE CABLE TYPE

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor insulation should have a continuous Teflon® jacket with no splices and must be suitable for use with submersible pumps.

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 attaching a riser pipe or metallic nipple to the pump. The pump should only be gripped 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:

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.

INSTALLATION

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.

If Plastic or Flexible Riser Pipe Is Used:

Use the correct compound recommended by the pipe manufacturer or specific job specifications. Besides making sure that joints are securely fastened, the use of a torque arrester is recommended when using these types of 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 using an approved clip or tape to prevent sagging, looping and possible cable damage.

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 enough 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. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When these types of pipe are used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of Redi-Flo4 submersibles is designed to accommodate this cable (Figure 4).

Protect the Well from Contamination

While installing the pump, proper care should be used not to introduce foreign objects or contaminants into the well. The well should be finished off above grade to protect against surface water from entering the well, causing contamination.

FIGURE 4



NOTE: Teflon® is a registered trademark of DuPont.

ELECTRICAL

WARNING: To reduce the risk of electrical 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 C.

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.

Engine-Driven Generators

If the Redi-Flo4 pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

Control Box/Panel Wiring

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 5-A).

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. The correct voltage-rated surge arrester should be installed on the supply(line) side of the control box (Figure 5-B). **The arrester must be grounded in accordance with the National Electric Code, local codes and regulations.**

FIGURE 5-A

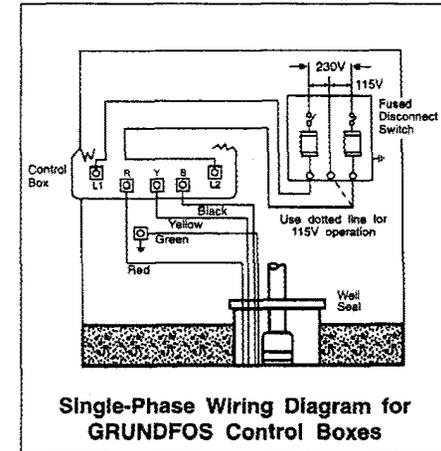
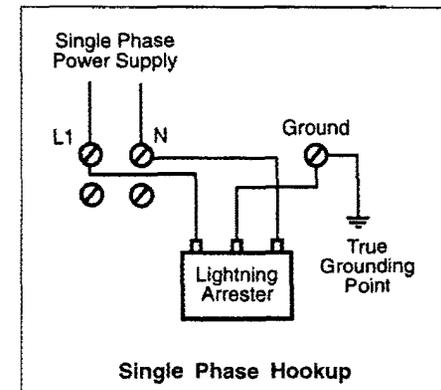


FIGURE 5-B



ELECTRICAL

Control Box and Surge Arrester Grounding

The control box 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, 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

Before making the final wiring connections of the drop cable to the control box terminal, it is a good practice to check the insulation resistance to ensure that the cable is good. Measurements for a new installation must be at least 1,000,000 ohm. Do not start the pump if the measurement is less than this. If it is higher, finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box and high voltage surge arrester have been grounded.

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. If required, make provisions to capture discharged fluids for disposal.
- C. Adjust the gate valve one-third open.
- D. Start the pump and let it operate until the water runs clear of sand and silt.
- E. As the water clears, slowly open the gate valve in small increments until the desired flow rate of clear water is reached. The pump should not be operated beyond its maximum flow rating and should not be stopped until the groundwater runs clear.
- F. If the groundwater is clean and clear when the pump is first started, the valve should still be opened until the desired flow rate is reached.
- G. Disconnect the temporary piping arrangements and complete the final piping connections.
- H. **Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed.** This can result in motor 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.
- I. Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

OPERATION

- A. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling, and operation of controls. **Under no circumstances should the pump be operated for any prolonged periods 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.
- B. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 7.

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 charts cover 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.

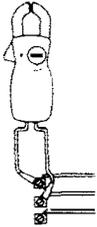
Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

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.

TROUBLESHOOTING

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

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. See the Electrical Data, Table C, for motor amp draw information.

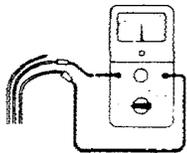
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA), check for the following:

1. Loose terminals in control box or possible cable defect. Check winding and insulation resistances.
3. Too high or low supply voltage.
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. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

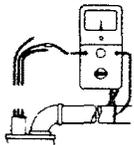
Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table C. Cable resistance values are in Table D.

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 of 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 C.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohm or mega ohmmeter, set the scale selector to Rx 100K 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.

TROUBLESHOOTING CHART

OHM VALUE	DROP (MV) VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor.
1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
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.
20,000 - 500,000		Motor which may have been damaged by lightning or other cause, but the motor is still in good condition.
10,000 - 20,000	0.01 - 0.02	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.
less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

A. Pump Does Not Run

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
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. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
4. 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.
5. Defective capacitor.	Turn off the power, then discharge capacitor. Disconnect leads and 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.

TROUBLESHOOTING CHART

B. Pump Runs But Does Not Deliver Water

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Groundwater level in well is too low or well is collapsed.	Check well draw-down.	Lower pump if possible. If not, 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: PSI x 2.31 ft/PSI = ____ 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 reinstall.
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

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Draw-down is larger than anticipated.	Check drawdown during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
3. Pump strainer or check valve are clogged.	Remove pump and inspect.	Clean, repair, rinse out pump and reinstall.
4. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.

D. Pump Cycles Too Much

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
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. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.

TROUBLESHOOTING CHART

E. Fuses Blow or Circuit Breakers Trip

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
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. Control box wiring and components.	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.
3. Defective capacitor.	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.
4. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

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

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.

Table B
Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP	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

NOTES:

1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single 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 1.25 to obtain KVA.

TECHNICAL DATA

Table C

Electrical Data – 60 Hz Submersible Pump Motors

GRUNDFOS MOTORS

HP	PH	VOLT	SER. FACT.	CIRC. BRK. OR STD. FUSE	DUAL ELEMENT FUSE	AMPERAGE			FULL LOAD		LINE-TO-LINE RESISTANCE (OHMS)		KVA CODE **	MAX. THRUST (LBS)	GRUNDFOS PART NO.
						FULL LOAD	LOCK ROTOR	S.F. AMPS	POWER EFF.	FACTOR	Blk-Yel	Red-Yel			
Delta															

4-Inch, Single Phase, 2-Wire Motors (control box not required)

1/3	1	230	1.75	15	5	3.4	25.7	4.6	59.0	77.0	6.8-8.2	S	770	79.952301
1/2	1	230	1.60	15	7	4.5	34.5	6.0	62.0	76.0	5.2-6.3	R	770	79.952302
3/4	1	230	1.50	20	9	6.9	40.5	8.4	62.0	75.0	3.2-3.8	N	770	79.952303
1	1	230	1.40	25	12	8.0	48.4	9.8	63.0	82.0	2.5-3.1	M	770	79.952304
1-1/2	1	230	1.30	35	15	10.0	62.0	13.1	64.0	85.0	1.9-2.3	L	770	79.952305

4-Inch, Single Phase, 3-Wire Motors

1/3	1	230	1.75	15	5	3.4	14.0	4.6	59.0	77.0	6.8-8.3	17.3-21.1	L	770	79.453301
1/2	1	230	1.60	15	7	4.5	21.5	6.0	62.0	76.0	4.7-5.7	15.8-19.6	L	770	79.453302
3/4	1	230	1.50	20	9	6.9	31.4	8.4	62.0	75.0	3.2-3.9	14-17.2	L	770	79.453303
1	1	230	1.40	25	12	8.0	38.0	9.8	63.0	82.0	2.6-3.1	10.3-12.5	K	770	79.453304
1-1/2	1	230	1.30	35	15	9.4	45.9	11.6	68.0	89.0	1.9-2.3	7.8-9.6	H	770	79.453305

FRANKLIN MOTORS

(refer to the Franklin Submersible Motors Application Maintenance Manual)

TECHNICAL DATA

Table D

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.
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 C.
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.

Wire Resistances

DISTANCE FROM CONTROL BOX TO PUMP MOTOR (FT.)	12 AWG WIRE RESISTANCE (OHMS)	14 AWG WIRE RESISTANCE (OHMS)
10	0.03	0.05
20	0.06	0.10
30	0.10	0.15
40	0.13	0.21
50	0.16	0.26
60	0.19	0.31
70	0.23	0.36
80	0.26	0.41
90	0.29	0.46
100	0.32	0.51
110	0.36	0.57
120	0.39	0.62
130	0.42	0.67
140	0.45	0.72
150	0.49	0.77
160	0.52	0.82
170	0.55	0.87
180	0.58	0.93
190	0.62	0.98
200	0.65	1.03

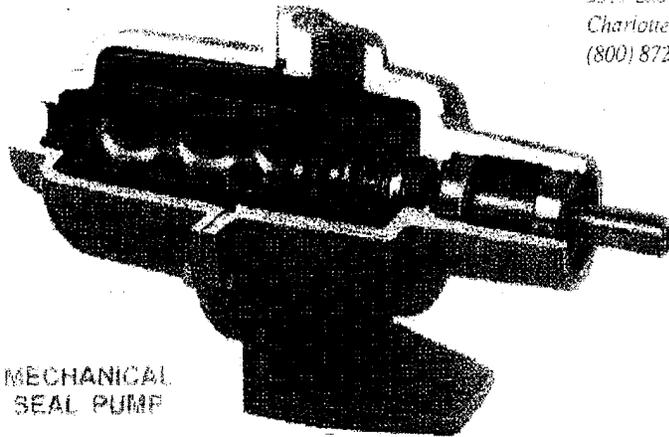
CONTINENTAL[®]

PROGRESSING CAVITY PUMPS



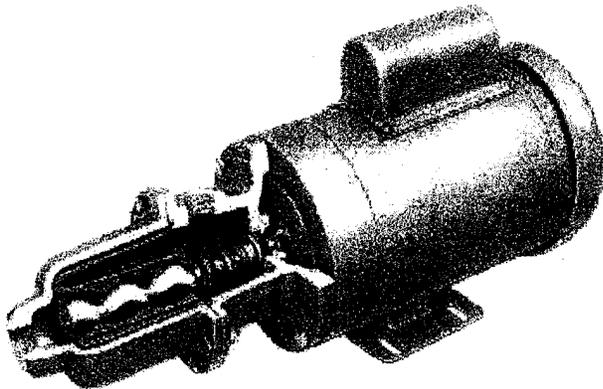
Liquid Handling Equipment, Inc.

2311 Executive Street, Post Office Box 668525
Charlotte, North Carolina 28266-8525 (704) 399-8700
(800) 872-8414 FAX # (704) 393-2412

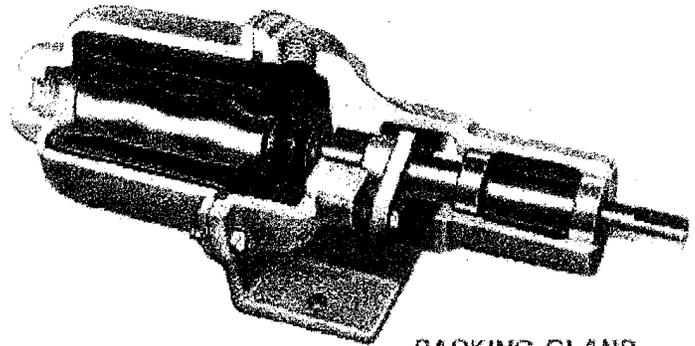


MECHANICAL
SEAL PUMP

**ONLY
ONE MOVING
PART!**



CLOSE COUPLED
MOTOR DRIVEN PUMP



PACKING GLAND
PUMP

Continental Pump Co.

11811 WESTLINE INDUSTRIAL DRIVE
ST. LOUIS, MISSOURI 63146 U.S.A.
PHONE: 314-432-5940 FAX: 314-432-5962
www.continentalultrapumps.com

CATALOG CPU-9000

CONTINENTAL

PROGRESSING CAVITY PUMPS

Amazingly Versatile Units

FOR A WIDE VARIETY OF APPLICATIONS

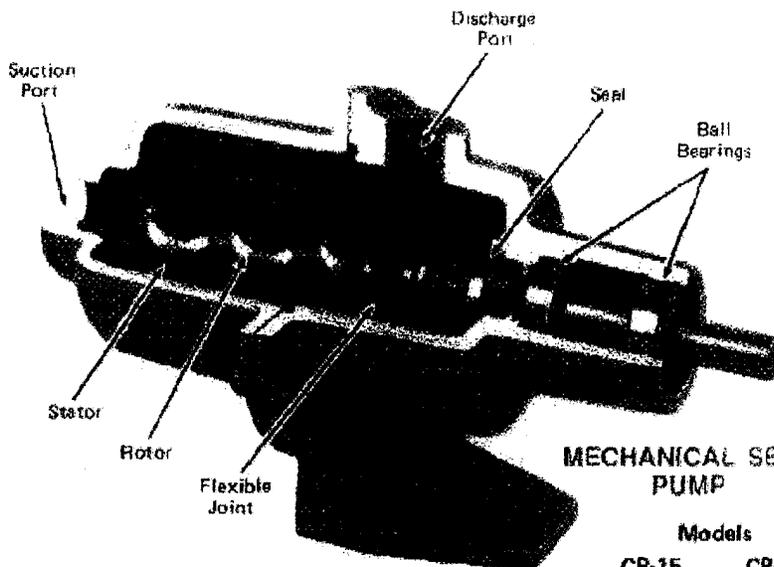
Revolutionary in design
yet simple and economical,
their performance is out-
standing on hundreds of dif-
ferent applications for indus-
try, farm and home.

Proven for 35 years on the toughest pumping problems in industry this amazingly versatile pump is now available in compact, low-cost models for a wide range of uses.

The famed, time-tested and proven simple principle of a helical screw rotor—**ONLY ONE MOVING PART**—turning in a tough rubber stator provides positive displacement, is self-priming to as much as 25 feet of suction lift, has high reserve pressure, low internal turbulence, continuing uniform flow and freedom from air locking.

Properly applied these pumps will yield performance never before accomplished with other types.

Small in size, light in weight, easy to maintain, requiring no lubrication . . .
CONTINENTAL PUMPS are ideal for many kinds of transferring, circulating, metering, filling, sprinkling, irrigating, drainage, and spraying jobs.



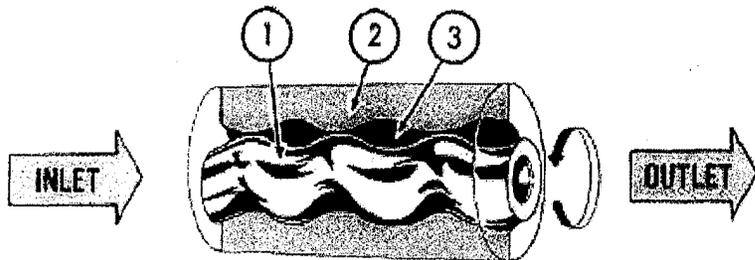
MECHANICAL SEAL PUMP

Models

CP-15	CP-44
CP-22	CP-56
CP-33	CP-67

HOW THEY WORK . . .

Rotor (1) turns within the flexible rubber stator (2) forming tightly sealed cavities (3) which move toward the discharge port, carrying the liquid. Pumping action starts the instant the Rotor turns. Liquid acts as the lubricant between the pumping elements.



THE PERFECT PUMP FOR:

- TRANSFERRING
- CIRCULATING
- SPRAYING
- SPRINKLING
- IRRIGATING
- DRAINING
- FILLING
- METERING
- SEWAGE
- WATER SYSTEMS
- WASHING
- CLEANING

Ideal for Handling

CLEAN WATER
DIRTY WATER (Slightly)
(Extremely)

HOT WATER
SALT WATER
SOAPY WATER
COLD WATER
BEET SUGAR LIQUORS
CANE SUGAR LIQUORS
KEROSENE
NAPHTHA
BENZINE
ENGINE OIL (Light)
(Heavy)

CREOSOTE
ALCOHOLS (Ethyl)
(Methyl)

BRINE (Light)
COTTON SEED OIL
AMMONIA WATER
WET VACUUM APPLICATIONS
CONDENSATE
LIQUID SOAP
MINERAL OIL

SYRUP (Light)
(Heavy)

HYDRAULIC OIL (Light)
(Heavy)

WATER BASE PAINTS
TREE SPRAYS (Thin)
(Containing Insolubles)

LAWN SPRINKLING (Water)
LAUNDRY TRAY TRANSFER
GREENHOUSE MIST SPRAYING
SWIMMING POOL CIRCULATION
SWIMMING POOL FILTRATION

WHISKEY
GLYCERINE
WINE
TURPENTINE
BEER

INK
FLAVORS AND EXTRACTS
DYE
FIRE FIGHTING
URINE
IRRIGATING
SEWAGE

VEGETABLE OILS (Light)
(Heavy)

STARCHES (Light)
(Heavy)

LIME WATER
COOLANTS
AQUARIUM CIRCULATION (Salt Water)
(Fresh Water)

INSECTICIDES (Thin)
(Containing Insolubles)

WEEDICIDES (Thin)
(Containing Insolubles)

WOOD TREATMENTS (Oil Base)
(Pastels)

LINSEED OIL
LIVESTOCK SPRAYS (Thin)
(Containing Insolubles)

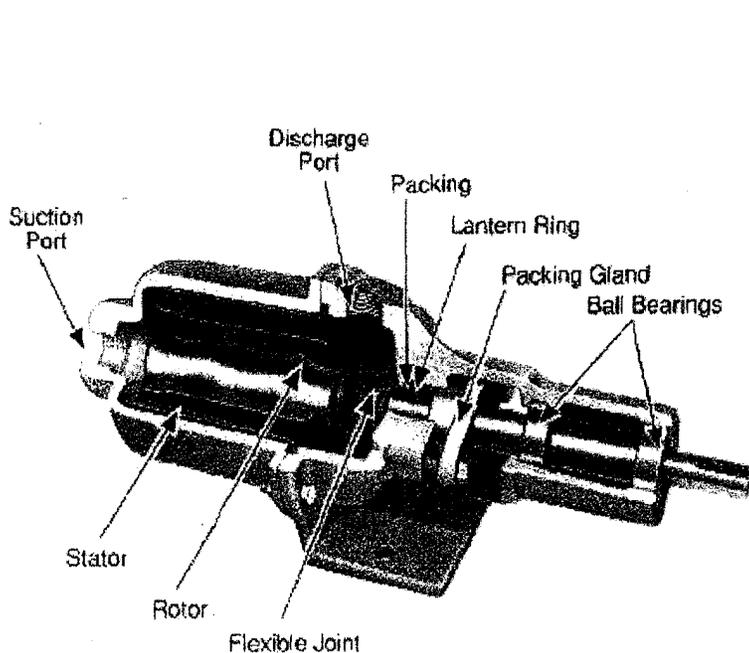
LIQUID FERTILIZER (Thin)
(Containing Insolubles)

WHITEWASH (Thin)
(Heavy)

ANIMAL OILS (Hard)
MOLASSES (Blackstrap)
(Diluted)

and many more!

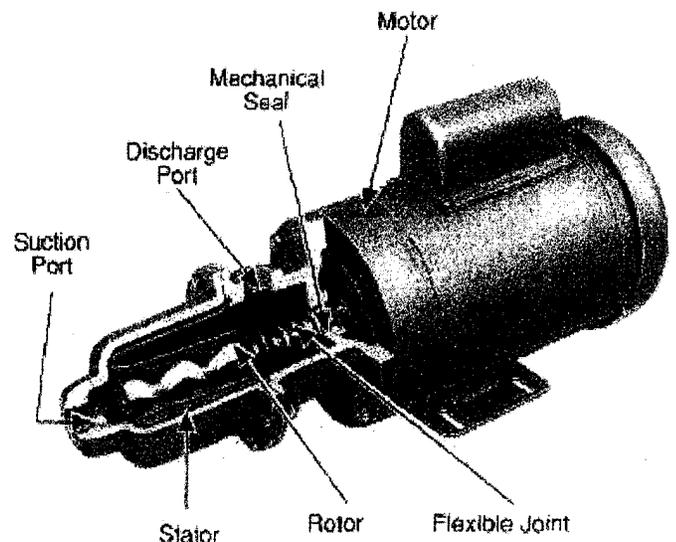
Fill out the **PUMP APPLICATION DATA SHEET** and return for a prompt recommendation.
Request copies if not with this Catalog.



PACKING GLAND PUMP

Models

CP-15D	CP-44D
CP-22D	CP-56D
CP-33D	CP-67D



CLOSE COUPLED MOTOR-DRIVEN PUMP

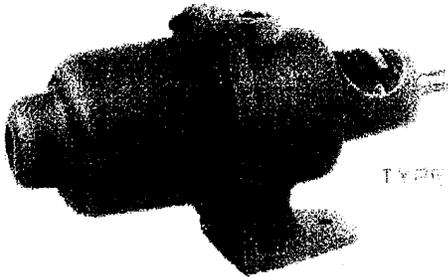
Models

CPM-15	CPML-15
CPM-22	CPML-22
CPM-33	CPML-33
CPM-44	CPML-44
CPM-56	CPML-56
CPM-67	CPML-67

CONTINENTAL

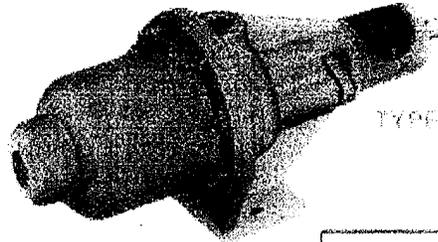
PROGRESSING CAVITY PUMPS

... are the solution to handling many liquids in a range of capacities from less than one gallon to more than 50 gallons per minute versus discharge pressures to 150 PSI depending upon liquid and conditions of the application.



TYPE M

MECHANICAL SEAL PUMP



TYPE D

PACKING GLAND PUMP

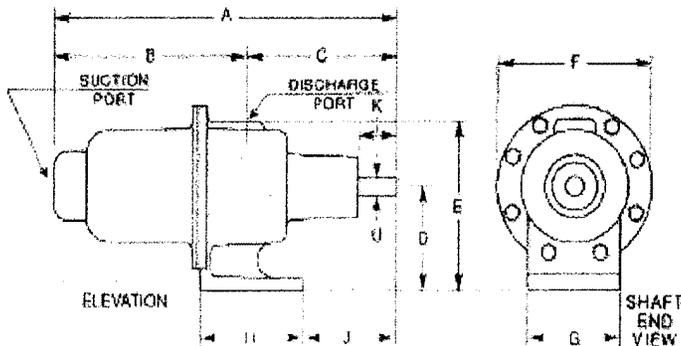
CONTINENTAL
PROGRESSING

PUMP FRAME SIZES	PORT SIZES NPT		PUMP TYPE MATERIALS OF CONSTRUCTION						
	INLET SUCTION	OUTLET DISCHARGE	BODY CASTINGS		ROTORS	STATORS			M
			"C" CAST IRON	"S" STAINLESS STEEL	"S" STAINLESS STEEL	"G" UN A	"B" P D M	"F" T I O N	
CP-15 • CP-22 • CP-33 • CP-44	3/4"	3/4"	/	/	/	/	/	/	/
CP-15 • CP-22 • CP-33 • CP-44	3/4"	3/4"	/	/	/	/	/	/	/
CPM-15 • CPM-22 • CPM-33 • CPM-44	3/4"	3/4"	/	/	/	/	/	/	/
CPML-15 • CPML-22 • CPML-33 • CPML-44	3/4"	3/4"	/	/	/	/	/	/	/
CP-56	1-1/2"	1-1/4"	/	/	/	/	/	/	/
CP-56	1-1/2"	1-1/4"	/	/	/	/	/	/	/
CPM-56	1-1/2"	1-1/4"	/	/	/	/	/	/	/
CPML-56	1-1/2"	1-1/4"	/	/	/	/	/	/	/
CP-67	2"	2"	/	/	/	/	/	/	/
CP-67	2"	2"	/	/	/	/	/	/	/
CPM-67	2"	2"	/	/	/	/	/	/	/
CPML-67	2"	2"	/	/	/	/	/	/	/

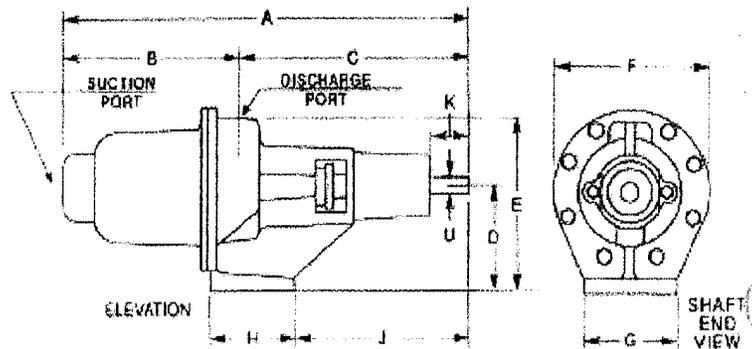
CP-56 090NT

NOTE: TYPE PUMP DESIGNATION:
AFTER PUMP FRAME SIZE
1ST LETTER - BODY CASTING - "C" OR "S"
2ND LETTER - ROTOR - "S"
3RD LETTER - STATOR - "G", "B" OR "F"
4TH LETTER - TYPE OF SEAL - "M" OR "D"

EXAMPLES OF COMPLETE MODEL DESIGNATIONS
FRAME CP-15-CSQM
FRAME CP-15-SSGD
FRAME CPM-56-CSQM
FRAME CPML-56-CSQM
FRAME CP-67-CSGD



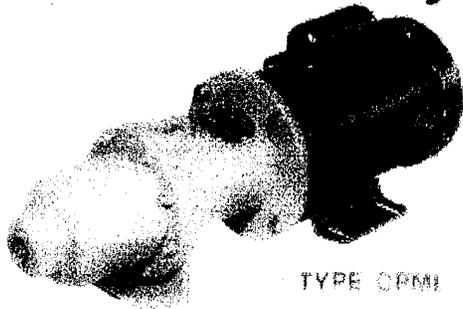
PUMP MODELS
CP-150 • CP-220 • CP-330 • CP-440 • CP-560 • CP-670
MECHANICAL SEAL TYPE



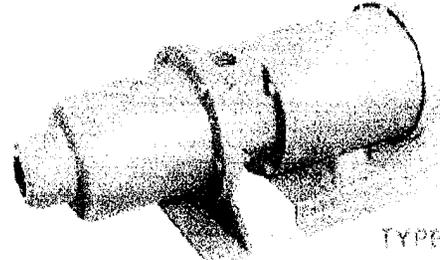
PUMP MODELS
CP-150 • CP-220 • CP-330 • CP-440 • CP-560 • CP-670
PACKING GLAND TYPE

LOW COST COMPACT UNITS

for every requirement!



TYPE CPM1



TYPE CPM2

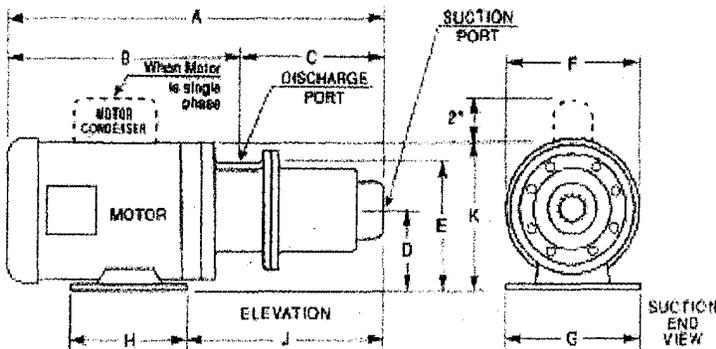
PUMP MODELS
CAVITY TYPE

CLOSE COUPLED
MOTOR-DRIVEN PUMP

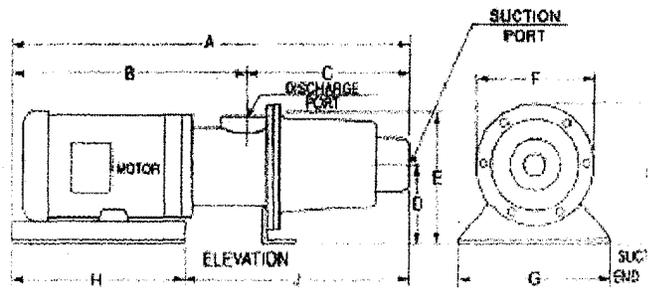
CLOSE COUPLED
MOTOR-DRIVEN PUMP

S	DIMENSIONS SEE NOTE BELOW											SHIPPING WEIGHTS (APPROXIMATE)	
	"D" PACKING GLAND	A	B	C	D	E	F	G	H	J	K		U
		12-7/16"	6-13/16"	5-5/8"	3-1/2"	5-3/4"	5-1/2"	3-1/4"	3-1/16"	3-3/8"	1-7/16"	5/8"	15 Lbs.
✓		14-3/4"	6-1/4"	8-1/2"	3-1/2"	5-13/16"	5-1/2"	3-1/4"	3"	6-7/16"	1-7/16"	5/8"	18 Lbs.
		18-5/16"	11-1/2"	6-13/16"	3-1/2"	5-7/8"	6-5/8"	6-1/2"	4-1/2"	10-5/8"	7"		48 Lbs.
		20-9/16"	13-3/4"	8-13/16"	3-1/2"	5-7/8"	6-5/8"	6-1/2"	4-1/2"	12-7/8"	7"		52 Lbs.
		16-11/16"	9-3/4"	6-15/16"	4-9/32"	7-9/32"	7-1/2"	6"	4-3/4"	3-9/16"	2-3/8"	3/4"	40 Lbs.
✓		18-13/16"	9-3/4"	9-1/16"	4-9/32"	7-9/32"	7-1/2"	6"	4-3/4"	5-11/16"	2-3/8"	3/4"	44 Lbs.
		22-1/4"	12-1/2"	9-3/4"	4-1/2"	7-1/2"	7-1/2"	9"	10"	12-1/4"	8-1/4"		80 Lbs.
		24-11/16"	14-15/16"	9-3/4"	4-1/2"	7-1/2"	7-1/2"	9"	10"	14-11/16"	8-1/4"		85 Lbs.
		19-9/16"	11-15/16"	7-5/8"	4-1/2"	8-1/4"	8-1/4"	6"	4-7/8"	4-9/16"	2-1/8"	1"	85 Lbs.
✓		22"	12"	10"	4-1/2"	8-1/4"	8-1/4"	6"	4-3/4"	7-1/8"	2-1/8"	1"	90 Lbs.
		24-5/8"	12-5/8"	12"	4-1/2"	7-3/4"	8-1/4"	9"	10"	14-5/8"	8-5/8"		117 Lbs.
		27-1/16"	15-1/16"	12"	4-1/2"	7-3/4"	8-1/4"	9"	10"	17-1/16"	8-5/8"		125 Lbs.

NOTE: ALL DIMENSIONS, EXCEPT "U" MAY VARY BY 1/8".
DO NOT USE ABOVE DIMENSIONS FOR LIMITED SPACE INSTALLATIONS.
REQUEST CERTIFIED DRAWING.
WHERE "U" IS 5/8", +.000"-.002" SHAFT HAS FLAT KEYSEAT 1/16" DEEP x 1" LONG
"U" IS 3/4", +.000"-.002" SHAFT HAS FLAT KEYSEAT 1/16" DEEP x 1" LONG
"U" IS 1", +.000"-.002" KEYWAY 1/4" WIDE x 1/8" DEEP x 2" LONG



PUMP MODELS
CPM15 - CPM22 - CPM32 - CPM44 - CPM15 - CPM22 - CPM33 - CPM44
CLOSE COUPLED MOTOR DRIVEN TYPE



PUMP MODELS
CPM50 - CPM56 - CPM57 - CPM67
CLOSE COUPLED MOTOR DRIVEN TYPE

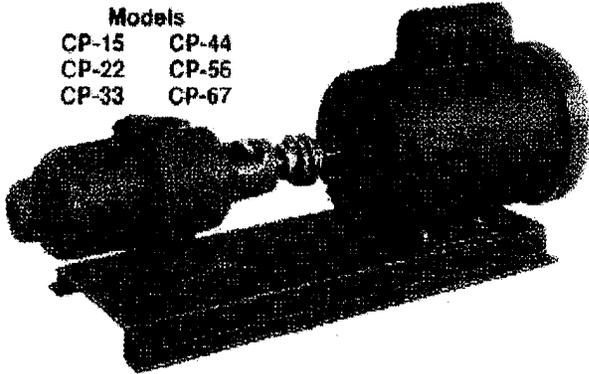
CONTINENTAL

PROGRESSING CAVITY PUMPS

CONTINENTAL offers Low Cost Compact Pumping Units for every requirement. They are available complete and ready for prompt installation.

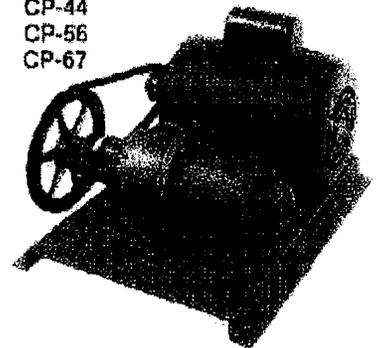
DIRECT CONNECTED MOTOR-DRIVEN UNITS

Models
 CP-15 CP-44
 CP-22 CP-56
 CP-33 CP-67



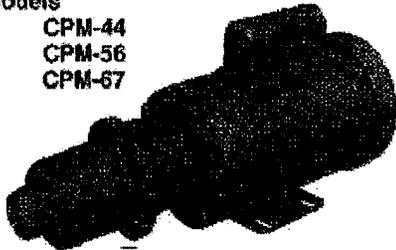
V-BELT MOTOR-DRIVEN UNITS

Models
 CP-15 CP-44
 CP-22 CP-56
 CP-33 CP-67

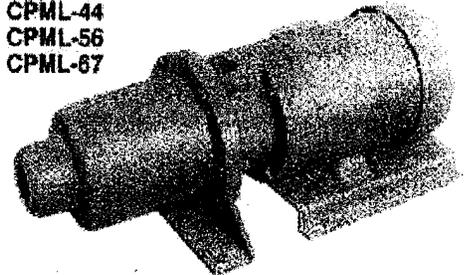


CLOSE-COUPLED MOTOR-DRIVEN UNITS

Models
 CPM-15 CPM-44
 CPM-22 CPM-56
 CPM-33 CPM-67

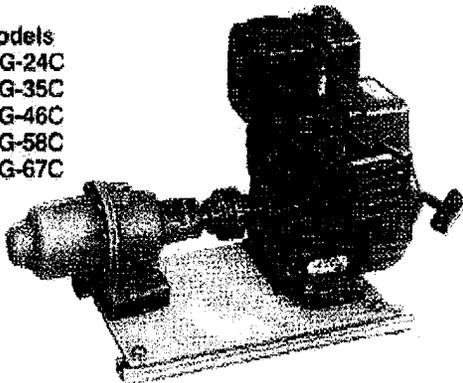


Models
 CPML-15 CPML-44
 CPML-22 CPML-56
 CPML-33 CPML-67



GASOLINE ENGINE-DRIVEN PUMP

Models
 CPG-24C
 CPG-35C
 CPG-46C
 CPG-58C
 CPG-67C



PORTABLE 3 HORSEPOWER ENGINE UNITS

Model CPML Pumps can be CLOSE-COUPLED to a Large Selection of Motor and Drive Units including:

- Open Drip Proof
 - Totally Enclosed Fan Cooled
 - Explosion Proof
 - Direct Current Motors
 - Direct Current SCR Drives
 - AC Variable Speed Drives
- WITH A WIDE RANGE OF ELECTRICAL CURRENT CHARACTERISTICS

**ALSO AVAILABLE WITH
 VARIABLE SPEED DRIVES
 OR
 SPEED REDUCER UNITS**

YIELD OUTSTANDING PERFORMANCE

APPLICATION OF CONTINENTAL PROGRESSING CAVITY PUMPS

Speed, temperature, viscosity, suction lift, discharge pressure, abrasive content and corrosive action of the liquid to be handled should all be considered in applying these pumps. Pump should always be filled with the liquid to be handled before running. The liquid serves as a lubricant and is easily poured into pump through the discharge port before final assembly of the piping or hose connections. A filling tee with a plug or valve can be installed above the discharge port for ease in filling.

Liquid to be pumped should never exceed 190°F temperature. Maximum speed that any of these pumps should be run is 2,800 rpm and then only in handling thin, abrasive-free liquids. Preferably the speed should be 1,750 rpm for longest life. When liquid contains abrasive material or is viscous, the speed should be reduced.

For various viscosities of abrasive-free liquids, the maximum operating speed of the pump is set forth below:

SUGGESTED MAXIMUM OPERATING SPEED OF PUMP							
2000 RPM	1750 RPM	1150 RPM	870 RPM	580 RPM	430 RPM	310 RPM	180 RPM
VISCOSITY (Centipoise)							
1 to 100	100 to 500	500 to 1000	1000 to 3000	3000 to 5000	5000 to 10,000	10,000 to 20,000	
Water	Concentrated Milk	30 Weight Oil	Table Syrup	Heavy	Motor Oil	Paraffin	Power Butter
ABRASIVE FLUIDS							
None	None	None	Light	Medium	Medium	Heavy	Heavy
Clear Water			Dirty Water	Clay Slurries		Lapping Compounds	
Glycerine				Pumice		Mill Scale in Water	

Capacity and life of these pumps will depend upon the liquid being handled.

Piping to pump should be properly selected and should not be smaller in size than the suction and discharge ports of the pump. All pipe and hose fitting joints should be tight. Discharge lines should be open or if pump is operated in an enclosed system, provision should be made for pressure relief when the pump pressure exceeds the limits as set forth for each model pump.

Pump bearings do not require lubrication as they are pre-lubricated.

We recommend that the pump be flushed after its use.

PUMP SHOULD NOT BE RUN DRY.

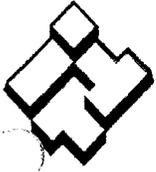
We will be glad to collaborate on any proposed applications.

Fill in **CONTINENTAL** PUMP DATA Sheet and return for a prompt recommendation. Request copies if not with this Bulletin.

hundreds of different applications for

INDUSTRY COMMERCE AGRICULTURE

PERFORMANCE DATA							
MODEL NO.	DISCHARGE PRESSURE	CAPACITY-Gallons per Minute (Water at 70°F)					MOTOR HORSE POWER
		1750 rpm	1150 rpm	870 rpm	580 rpm	430 rpm	
CP-15	0	1.9	1.3	1.0	.7	.5	1/2
	25	1.7	1.0	.5	.2	.1	
	50	1.5	.9	.2			
	75	1.2	.8				
	100	1.0	.7				
	125	.8	.5				
CP-22	0	4.0	3.2	2.4	1.6	1.2	1/2
	25	4.1	2.7	2.0	1.3	.9	
	50	3.4	2.2	1.6	1.0	.7	
	75	2.8	1.7	1.3	.8	.6	
	100	2.0	1.5	1.0	.5	.4	
CP-33	0	8.4	6.0	4.6	3.1	2.3	1/2
	25	7.8	4.6	3.4	2.3	1.7	
	50	4.2	2.7	2.0	1.3	.9	
CP-44	0	15.0	9.7	7.3	4.9	3.6	1/2
	25	12.0	7.8	5.8	4.0	3.0	
	50	8.4	6.1	4.6	3.1	2.3	
CP-56	0	24.0	15.6	11.7	7.9	6.8	1
	25	22.0	14.3	10.7	7.2	6.3	
	35	20.5	13.3	10.0	6.7	4.9	
	50	18.5	12.7	9.5	6.4	4.1	
CP-67	0	53.0	34.5	26.0	17.5	13.0	1
	10	48.0	31.0	23.4	15.8	11.7	
	20	43.0	28.0	21.0	14.0	10.3	
	35	34.0	22.0	16.5	11.0	8.1	
	50	25.0	16.3	12.3	8.3	6.1	
						2	



ITT

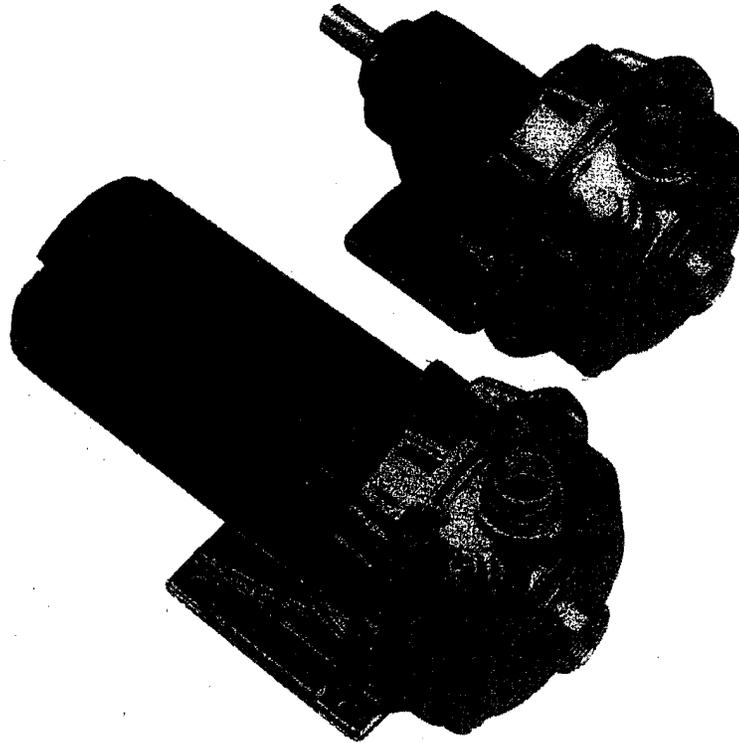
Commercial Water

Goulds Pumps

G&L SERIES

MODEL NPE/NPE-F

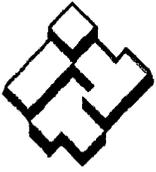
Installation, Operation and
Maintenance Instructions



Goulds Pumps is a brand of ITT Water Technology, Inc.
- a subsidiary of ITT Industries, Inc.

www.goulds.com

Engineered for life



ITT

**Systèmes d'alimentation
en eau commerciaux**

Declaration of Conformity

We at,
Goulds Pumps/ITT Industries
1 Goulds Drive
Auburn, NY 13021

Declare that the following products: NPE, MCS, MCC, 3656, 3656 SP, GB, SSV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS comply with Machine Directive 98/37/EC. This equipment is intended to be incorporated with machinery covered by this directive, but must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the actual provisions of the directive.

Declaración de Conformidad

Nosotros en
Goulds Pumps/ITT Industries
1 Goulds Drive
Auburn, NY 13021

Declaramos que los siguientes productos: NPE, MCS, MCC, 3656, 3656 SP, GB, SSV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB, LBS cumplen con las Directivas para Maquinarias 98/37/EC. Este equipo ha sido diseñado para ser incorporado a la maquinaria cubierta por esta directiva pero no debe ponerse en funcionamiento hasta que se declare que la maquinaria en la que será incorporado cumple con las disposiciones reales de la directiva.

Déclaration de Conformité

Nous, à
Goulds Pumps, ITT Industries
1 Goulds Drive
Auburn, NY, U.S.A. 13021,

déclarons que les produits NPE, MCS, MCC, 3656, 3656 SP, GB, SSV, SVI, NPO, Prime Line SP, HB, HMS, LC, NPV, LB et LBS sont conformes à la directive 98/37/CE (législation relative aux machines). Ils sont destinés à être intégrés dans la machinerie faisant l'objet de ladite directive, mais ne doivent pas être mis en service tant que la machinerie en question ne sera pas déclarée conforme aux stipulations de la directive.

James M. Allocco
Product Manager/
Encargado de productos/
Directeur des produits



Goulds Pumps, G&L et le logo à blocs siglés ITT sont des marques déposées et de commerce d'ITT Industries.

LES CARACTÉRISTIQUES PEUVENT CHANGER SANS PRÉAVIS.

IM013R07 Février, 2006

© 2006, ITT Water Technology, Inc.

Engineered for life

Table of Contents

SUBJECT	PAGE
Safety Instructions.....	3
Important.....	3
Installation.....	3
Suction Piping.....	4
Discharge Piping.....	4
Motor-To-Pump Shaft Alignment.....	4
Rotation.....	5
Operation.....	5
Maintenance.....	5
Disassembly.....	5
Reassembly.....	6
Troubleshooting Chart.....	6
NPE Standard Repair Parts List.....	7
Mechanical Seal Application Chart.....	7
Limited Warranty.....	8
Declaration of Conformity.....	24

Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Dealer: _____

Dealer Phone No.: _____

Date of Purchase: _____

Date of Installation: _____

Current Readings at Startup:

1 Ø	3 Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

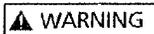
THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.



This is a **SAFETY ALERT SYMBOL**. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.



DANGER Warns of hazards that **WILL** cause serious personal injury, death or major property damage.



WARNING Warns of hazards that **CAN** cause serious personal injury, death or major property damage.



CAUTION Warns of hazards that **CAN** cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.



UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.



Hazardous fluids can cause fire, burns or death.

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.



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 PSI
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.



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.



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. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.

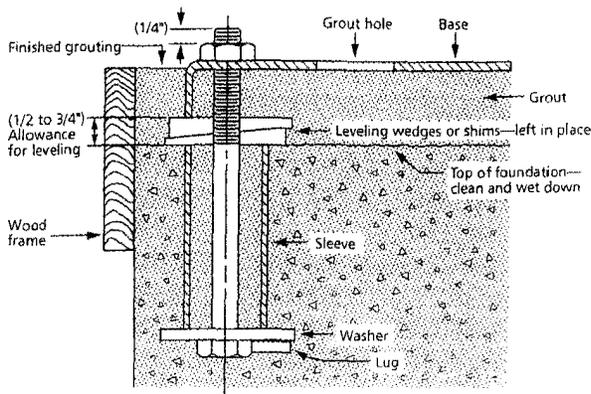


Figure 1

- 2.3.2. Place unit in position on wedges located at four points (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 Figures 2-5
- 3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

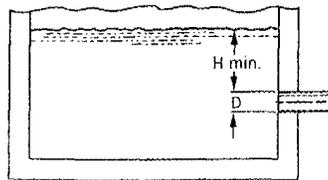


Figure 2

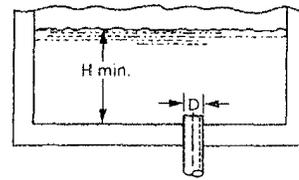


Figure 3

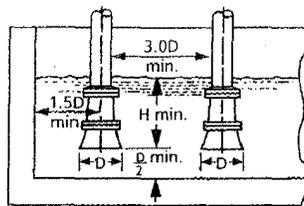


Figure 4

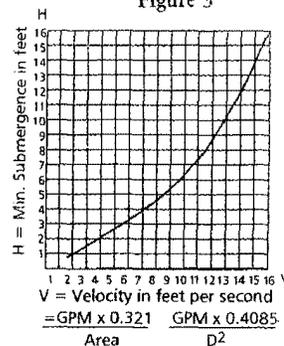


Figure 5

4. DISCHARGE PIPING:

- 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 Figure 6.

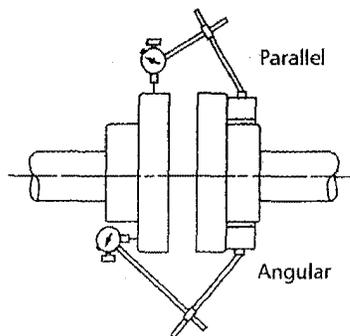


Figure 6

- 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.

- 7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion 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 and 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 and 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.
- 10.3. Reassembly is the reverse of disassembly.
 - 10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.
- 10.4. Observe the following when reassembling the bearing frame:
 - 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

NPE STANDARD REPAIR PARTS LIST

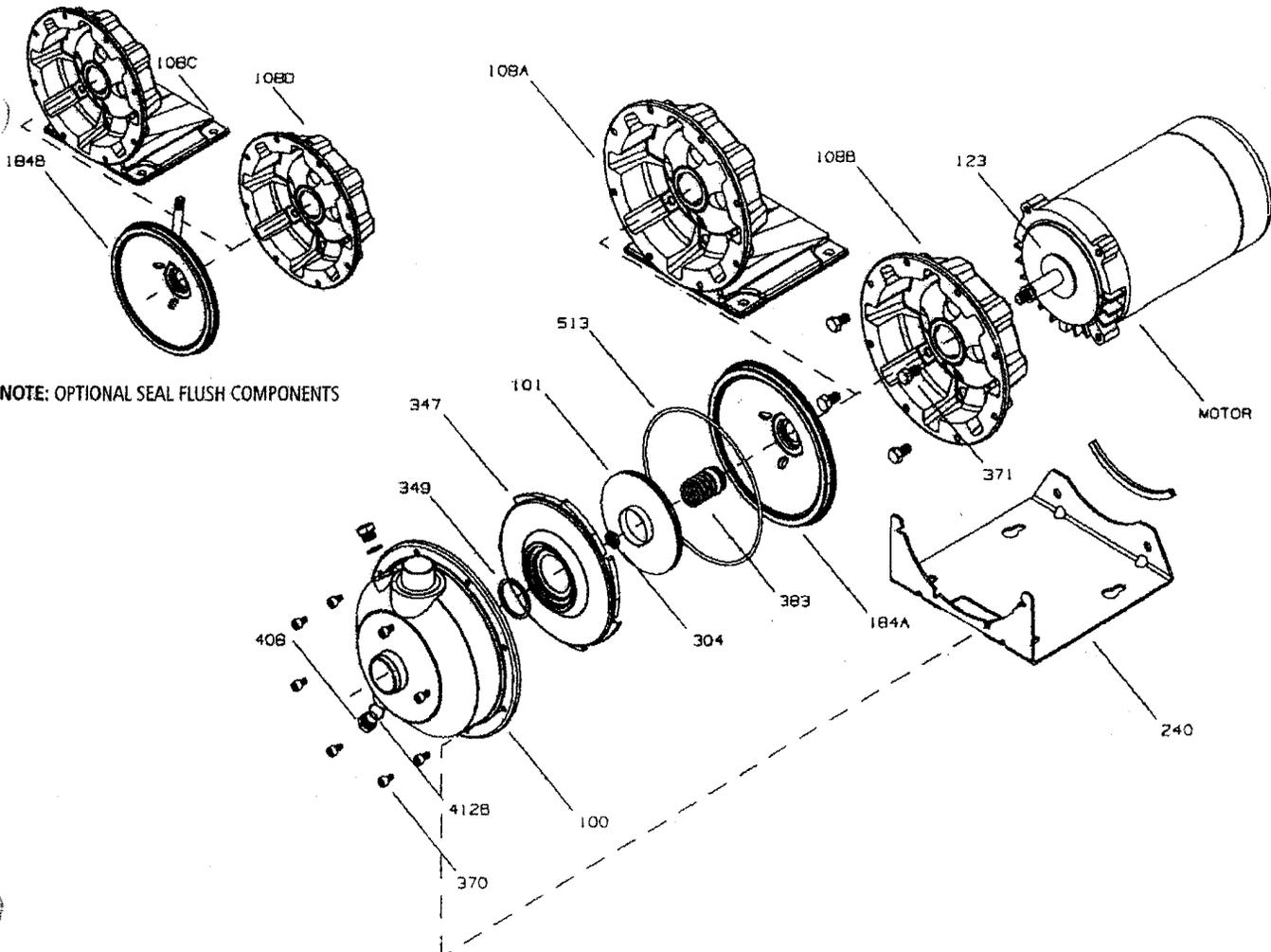
Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	
123	Deflector	BUNA-N
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton (standard)
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
412B	O-Ring, drain plugs	Viton (standard)
		EPR
		BUNA
513	O-Ring, casing	Viton (standard)
		EPR
		BUNA

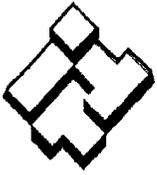
MECHANICAL SEAL APPLICATION CHART

Item 383 Mechanical Seal (1/8" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62

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





ITT

Commercial Water

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.



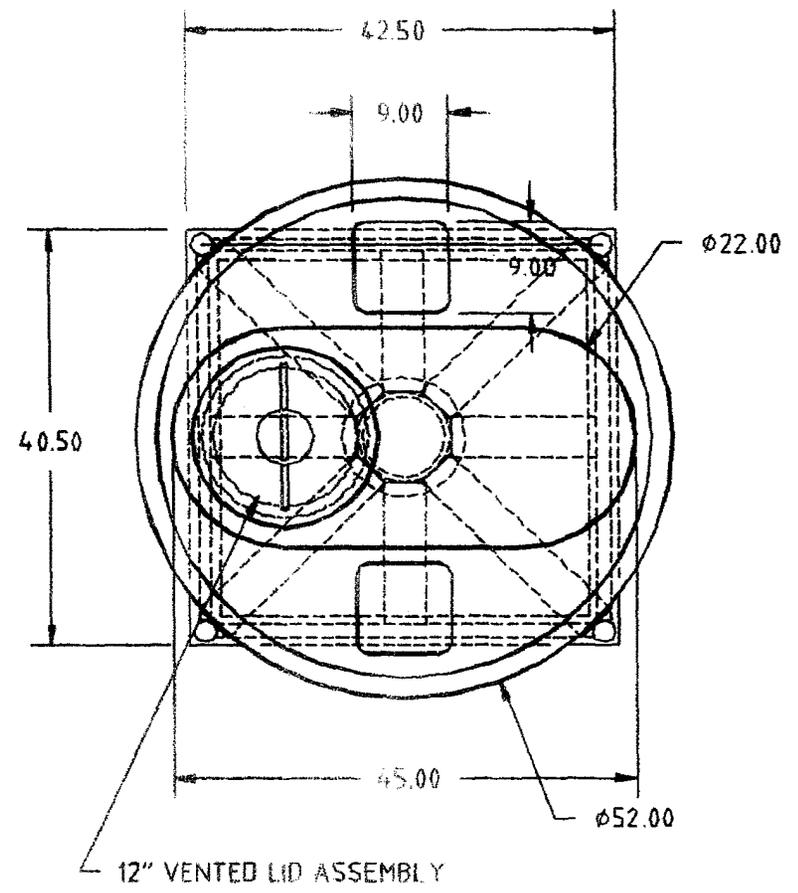
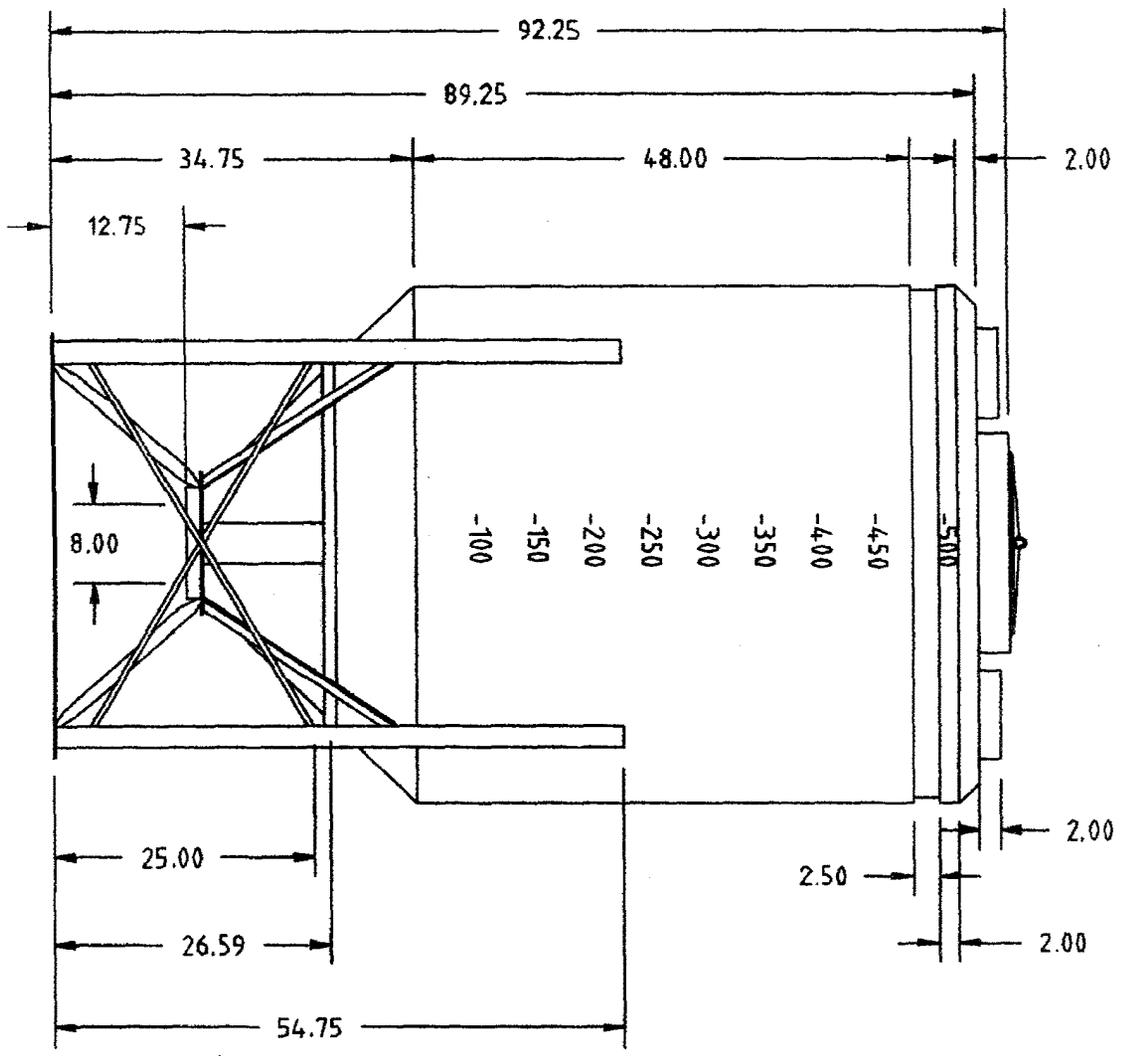
Goulds Pumps, G&L and the ITT Engineered Blocks Symbol are registered trademarks and tradenames of ITT Industries Inc.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IM013R07 February, 2006
© 2006 ITT Water Technology, Inc.

Engineered for life

CB0500-52



				DRAWN / DATE REH/08/08/01		MOBIL 111 = 131 LB.		ACE ROTO-MOLD A DIVISION OF DEN HARTOG INDUSTRIES, INC. 4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238	
				APPRD. / DATE REH/08/08/01					
REV	DESCRIPTION	DATE	APPRD.			CLIENT / DESCRIPTION		ACE 500 GAL. CONE BOTTOM TANK AND STAND	
ALL DIMENSIONS ARE IN DECIMAL INCHES TOLERANCES UNLESS OTHERWISE SPECIFIED $\pm 1X \bullet 68^\circ F$				THIRD ANGLE PROJECTION ANSI 14.3M 		SCALE		PART NO.	
						N.S.		CB0500-52	

Important Points!

Product must be maintained and installed in strict accordance with the National Electrical Code and Dwyer product catalog and instruction bulletin. Failure to observe this warning could result in serious injuries or damages.

For hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammable materials, use an appropriate explosion-proof enclosure or intrinsically safe interface device.

The pressure and temperature limitations shown on the individual catalog pages and drawings for the specified flow switches must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.

Selection of materials for compatibility with the media is critical to the life and operation of Dwyer products. Take care in the proper selection of materials of construction, particularly wetted materials.

Life expectancy of switch contacts varies with applications. Contact Dwyer if life cycle testing is required.

Ambient temperature changes do affect switch set points, since the specific gravity of a liquid can vary with temperature.

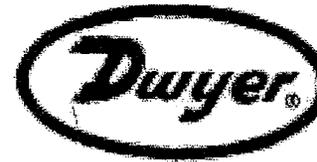
Dwyer Products have been designed to resist shock and vibration; however, shock and vibration should be minimized.

Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.

Electrical entries and mounting points in an enclosed tank may require liquid/vapor sealing.

Dwyer Products must not be field-repaired.

Physical damage sustained by the product may render it unserviceable.



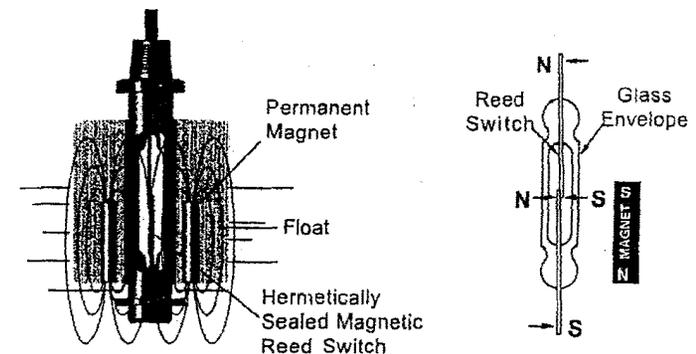
Model F7-WBB Level Sensor Instruction Bulletin No. 204126

Note: F7-WBB sensors are non-voltage producing devices and do not contain energy storing components. However, since primary use is in hazardous locations, an appropriate intrinsically safe interface device is required.

With its compact size, the Dwyer's F7-WBB single float, liquid level sensor is ideally suited for use in steel double-wall tanks. It requires no calibration, and is easy to install and maintain. When positioned vertically at the bottom of a steel tank's stand pipe, it reliably senses the presence of a liquid. It detects hydrocarbons and water as low as 3/4" from the bottom of a tank or sump. The F7-WBB sensor features an epoxy-encapsulated design providing an environmental seal, that makes it a fine choice for harsh environments. An integral slosh shield guards the float from debris; thereby assuring dependable service.

Sensor Operating Principle

Dwyer's F7-WBB liquid level sensor operates on a direct, simple principle. A float is equipped with powerful, permanent magnets. As the float rises or lowers with liquid level, it actuates a magnetic reed switch mounted within the stem. This condition either opens or closes the electrical circuit to operate an external alarm or control circuit. When mounted vertically, this basic design provides a consistent accuracy of $\pm 1/8$ th inch.

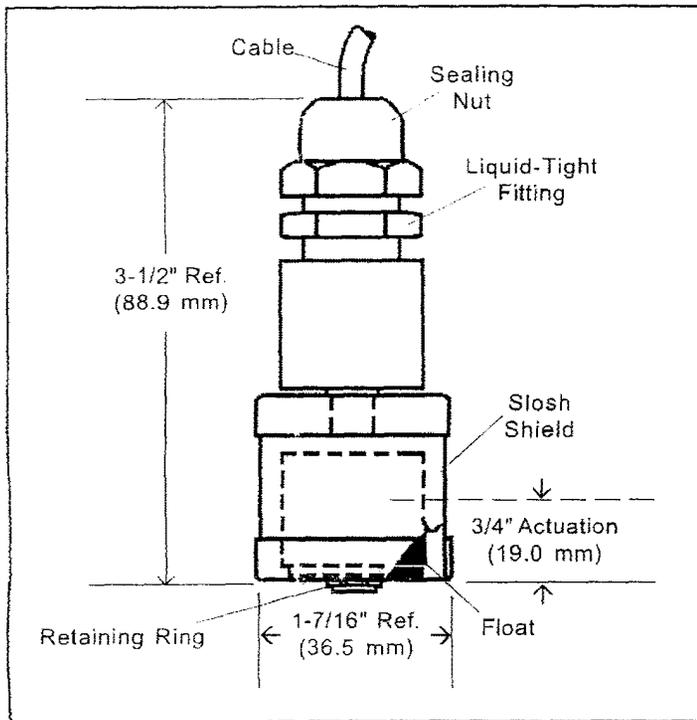


Note: Please refer to specific Dwyer's outline drawings for operational specifications.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 MICHIGAN CITY, INDIANA 46361, U.S.A.

Phone: 219/879-8000
Fax: 219/872-9057
Lit-By Fax: 888/891-4963
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

Dimensions



WARNINGS

Read the instructions and warnings carefully before installing the sensor. This unit must be installed in accordance with National Electrical Code ANSI/NPFA-70, 1990; as well as Federal, State and local codes and any other applicable safety codes.

1. To avoid electrical shock, which could kill you, be sure AC power to monitor is off during installation.
2. The nature of the sensor is that it is a non-voltage producing device, containing limited energy-storing components. However, since its primary use is in a hazardous location, an appropriate intrinsically safe interface device must be used.

Note: Failure to observe these warnings could result in serious injury and death, as well as undetected potential environmental and health hazards.

Maintenance/Repair

Regular maintenance of the total system is recommended to assure sustained optimum performance. These devices are not field repairable and should be returned to the factory if recalibration or other service is required. After first obtaining a Returned Goods Authorization (RGA) number, send the unit freight prepaid to the following. Please include a clear description of the problem plus any application information available.

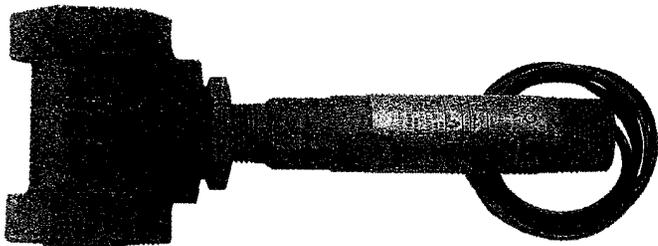
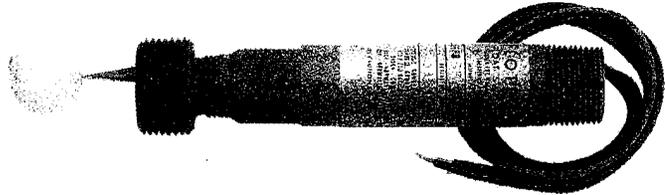
Dwyer Instruments, Inc.
Attn: Repair Department
102 Highway 212
Michigan City, IN 46360



Model L6 **FLOTECT**® Float Switch

Specifications - Installation and Operating Instructions

Explosion-Proof; UL and CSA Listed -
Class I, Groups *A, B, C, & D
Class II, Groups E, F & G
Directive 94/9/EC (ATEX) Compliant for
II 2 G EEx d IIC T6 Process Temp ≤ 75°C CE Ⓢ
 *(Group A, stainless steel body only)



SPECIFICATIONS

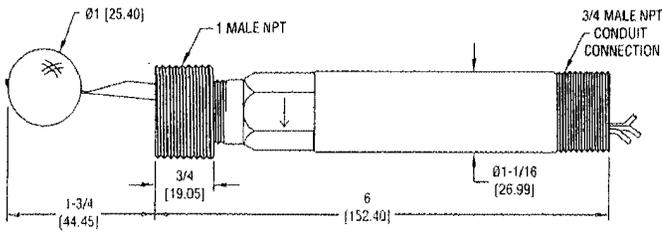
Service: Liquids compatible with wetted materials.
Wetted Materials:
Float: Solid polypropylene or 304 SS.
Lower Body: Brass or 303 SS.
Magnet: Ceramic.
External Float Chamber (Tee): Matches lower body choice of brass or 303 SS.
Other: Lever Arm, Spring, Pin, etc.: 301 SS.
Temperature Limit: -4 to 220°F (-20 to 105°C) Standard, MT high temperature option 400°F (205°C) (MT not UL, CSA or ATEX). ATEX compliant AT option ambient temperature -4 to 167°F (-20 to 75°C) process temperature: -4 to 220°F (-20 to 105°C).
Pressure Limits: See next page.
Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups A, B, C and D; Class II, Groups E, F, and G. (Group A on stainless steel body models only). CE 0344 Ⓢ II 2 G EEx d IIC T6 Process Temp ≤ 75°C.
 EC-Type Certificate No.: KEMA 04ATEX2128
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL models: 5A @ 125/250 VAC (V-). CSA and ATEX models: 5A @ 125/250 VAC (V-); 5A res., 3A ind. @ 30 VDC (V-). MV option: .1A @ 125 VAC (V-). MT option: 5A @ 125/250 VAC (V-). [MT option not UL, CSA or ATEX].
Electrical Connections: UL models: 18 AWG, 18" (460 mm) long. ATEX/CSA models: terminal block.
Upper Body: Brass or 303 SS.
Conduit Connection: 3/4" male NPT standard, 3/4" female NPT on junction box models.
Process Connection: 1" male NPT on models without external float chamber, 1" female NPT on models with external float chamber.
Mounting Orientation: Horizontal with index arrow pointing down.
Weight: Approximately 1 lb (.5 kg) without external float chamber, 1.75 lb (.8 kg) with external float chamber.
Specific Gravity: See next page.

Example	L6	EP	B	B	S	3	B	MT	L6EPB-B-S-3-B-MT level switch; brass upper housing, brass lower housing, brass tee with Polypropylene spherical float, SPDT snap switch, and high temperature option
Series	L6								Series L6 level switch
Construction		EP							Explosion proof and weatherproof
Upper Body Material			B	S					Brass 303 Stainless Steel
Lower Body Material				B	S				Brass 303 Stainless Steel
Circuit (Switch) Type					S	D			SPDT DPDT
Line Size						3			1" NPT 1-1/4" NPT (No tee models only) 1-1/2" NPT (No tee models only) 2" NPT
Tee and Float Options							O A B C H L S		No Tee, Solid Polypropylene Spherical Float* No Tee, 304 SS Cylindrical Float Brass Tee, Solid Polypropylene Spherical Float* No Tee, 304 SS Spherical Float Brass Tee, 304 SS Spherical Float 303 SS Tee, 304 SS Spherical Float 303 SS Tee, Solid Polypropylene Spherical Float*
Switch Options								MV MT	Gold Contacts on snap switch for dry circuits (see specifications for ratings) High Temperature switch rated 400°F (205°C) (see specifications for ratings)*
Options								AT CSA GL ID JCT TBC TOP	ATEX approved construction (with JCT option standard) CSA approved construction (with JCT option standard)* Ground Lead* Customer Information on standard nameplate Weatherproof and explosion-proof junction box* Terminal Block Connector* Top Mounted (No tee models only)*

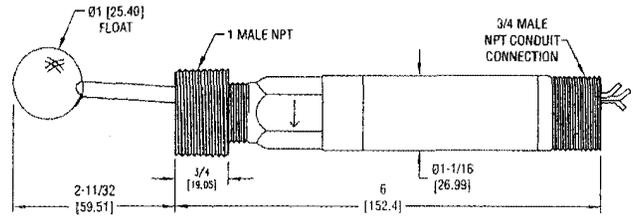
* Options that do not have ATEX

Caution: Units without the "AT" suffix are not Directive 94/9/EC (ATEX) compliant. These units are not intended for use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.

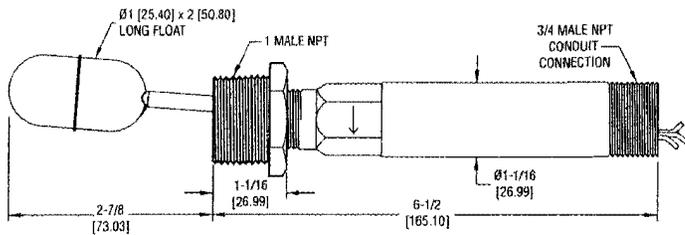
FLOTECT® MODEL L-6 FLOAT SWITCH — DIMENSION DRAWINGS



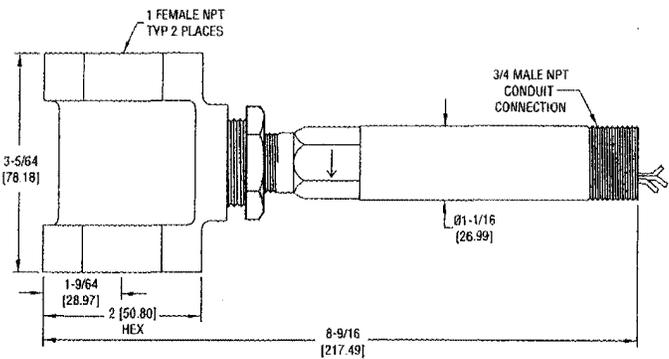
Polypropylene Float



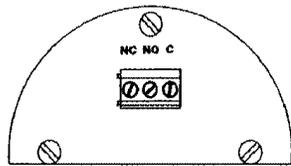
Round Stainless Steel Float



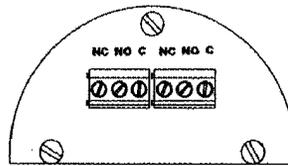
Cylindrical Stainless Steel Float



With External Chamber (Tee)

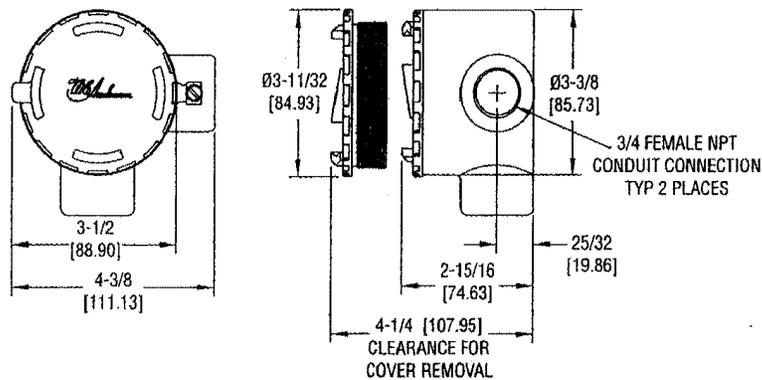


SPDT



DPDT

Terminal Connections CSA, ATEX Enclosures

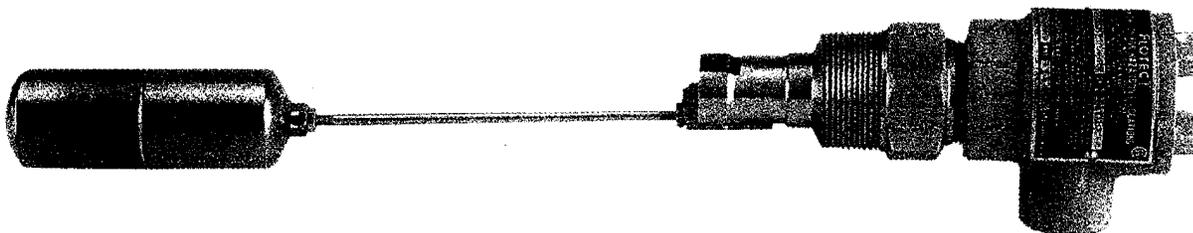


CSA, ATEX Conduit Enclosure



Series L4 **FLOTECT**® Float Switch

Specifications - Installation and Operating Instructions



Rugged and reliable the FloTECT® L4 Level switch operates automatically to indicate tank level. Perfect for starting or stopping pumps, opening or closing valves, or actuate level alarm signals. A unique magnetically actuated switching design gives superior performance. There are no bellows, springs, or seals to fail. Instead, the free-swinging float attracts a magnet within the solid metal switch body, actuating a snap switch by means of a simple lever arm. Float arm hinge design limits the arm angle to prevent vertical hangup.

FEATURES

- Leak proof body machined from bar stock
- Choice of floats dependent on maximum pressure and specific gravity
- Weatherproof, designed to meet NEMA 4
- Explosion-proof (listings included in specifications)
- Installs directly and easily into tank with a thredolet or flange (see application drawings on page 4)
- Electrical assembly can be easily replaced without removing the unit from the installation so that the process does not have to be shut down.
- Horizontal installation or optional top mount vertical installation

APPLICATIONS

- Direct pump control for maintaining level
- Automatic tank dump operations
- Control levels or provide alarms in sumps, scrubber systems, hydro-pneumatic tanks, low pressure boilers, and various waste water/sewage treatment processes

SPECIFICATIONS

Service: Liquids compatible with wetted materials.

Wetted Materials:

Float and Rod: 316 SS

Body: Brass or 316 SS standard.

Magnet Keeper: 430 SS standard, 316 SS or Nickel optional.

Temperature Limits: 4 to 275°F (-20 to 135°C) standard, MT high temperature option 400°F (205°C) [MT option not UL, CSA, ATEX, or SAA].

Pressure Limit: Brass body 1000 psig (69 bar), 316 SS body 2000 psig (138 bar). Standard float rated 100 psig (6.9 bar). For other floats see model chart on next page.

Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups C and D; Class II, Groups E, F, and G. ATEX $\text{CE} 0344 \text{ Ex II 2 G EEx d IIB T6 } -20^{\circ}\text{C} \leq \text{T amb} \leq 75^{\circ}\text{C}$

EC-Type Certificate No.: KEMA 03 ATEX 2383

SAA: Exd II C T6 (T amb = 60°C).

IP66 C1 I, Zone I. Also FM approved.

Switch Type: SPDT snap switch standard, DPDT snap switch optional.

Electrical Rating: UL, FM, ATEX and SAA models: 10A @ 125/250 VAC (V~). CSA models: 5A @ 125/250 VAC (V~); 5A res., 3A ind. @ 30 VDC (V-). MV option: 1A @ 125 VAC (V~); 1A res., .5A ind. @ 30 VDC (V-). MT option: 5A @ 125/250 VAC (V~). [MT and MV option not UL, CSA, FM, ATEX or SAA].

Electrical Connections: UL and CSA models: 16 AWG, 6" (152 mm) long. ATEX and SAA unit: terminal block.

Process Connection: 1-1/2" male NPT standard, 2-1/2" male NPT standard optional floats.

Mounting Orientation: Horizontal installation standard, optional vertical top mount.

Weight: 4 lbs. 9 oz. (2.07 kg).

Dead Band: 3/4" (19 mm) for standard float.

Specific Gravity: 0.7 minimum with standard float. For other floats see model chart.

INSTALLATION

NOTES:

• Check all ratings given in the instructions and on the product to make sure that the product is suitable for your application. Do not exceed electrical ratings, pressure ratings, or temperature ratings of the product.

• Disconnect power supply before beginning installation to prevent possible equipment damage or electrical shock.

1. Remove packing material from switch body-cap and remove tape from magnet keeper. Install standard switch in thredolet previously welded to tank. Install optional switch mountings per application drawings. Make sure locknuts on float are tight.

2. When mounting switch in the side of a tank, the arrow on the side of the switch must point up.

3. Wiring: **UL and CSA units only:** Thread connecting wires through conduit and connect. Wire in accordance with local electrical codes.

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.

EC-Type Certificate Installation Instructions:

Cable Connection

The cable entry device shall be an EEx d certified cable gland suitable for conditions of use and correctly installed. The certified cable gland and cable shall be rated for a minimum temperature of 80°C.

Conduit Connection

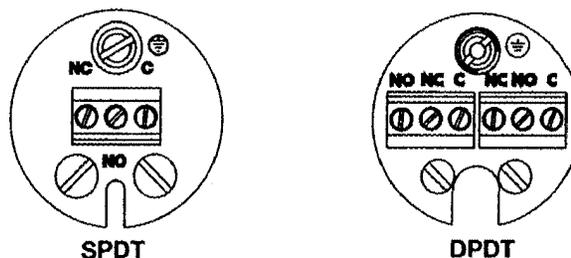
An EEx d certified seal device such as a conduit seal with setting compound suitable for conditions of use and correctly installed shall be provided immediately to the entrance of the electrical housing. The certified conduit seal with setting compound and cable shall be rated for a minimum temperature of 80°C.

NOTE: The switch is deactivated and contacts are in normal condition when the liquid is below the float.

4. 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.

NOTE: ATEX units only: The temperature class is determined by the maximum ambient or medium/process temperature. The approved ratings are: T6 $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 75^{\circ}\text{C}$. Product may be used in a maximum ambient or medium/process temperature of 75°C.



TERMINAL CONNECTIONS

MAINTENANCE

Inspect and clean wetted parts at regular intervals. The cover should be in place at all times to protect the internal components from dirt, dust, and weather, and to maintain hazardous location ratings. Disconnect device from the supply circuit before opening to prevent ignition of hazardous atmosphere.

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 NON-CONFORMING 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.

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.

Buyers Remedies: THE BUYER'S EXCLUSIVE AND SOLE REMEDY ON ACCOUNT OF OR IN RESPECT TO THE FURNISHING OF NON-CONFORMING 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.

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.



MAXIMUM PRESSURE CHART

Model Number	Float	Minimum Sp. Gr.	Pressure Rating psig (bar)
L6EPB-B-S-3-A	Cylindrical SS	0.5	200 (13.8)
L6EPB-B-S-3-B	Polypropylene	0.9	250 (17.2)
L6EPB-B-S-3-C	Round SS	0.7	350 (24.1)
L6EPB-B-S-3-H	Round SS	0.7	250 (17.2)
L6EPB-B-S-3-O	Polypropylene	0.9	1000 (69.0)
L6EPB-S-S-3-A	Cylindrical SS	0.5	200 (13.8)
L6EPB-S-S-3-C	Round SS	0.7	350 (24.1)
L6EPB-S-S-3-L	Round SS	0.7	350 (24.1)
L6EPB-S-S-3-O	Polypropylene	0.9	2000 (138)
L6EPB-S-S-3-S	Polypropylene	0.9	2000 (138)

INSTALLATION

Unpack switch and remove any packing material found inside lower housing or float chamber.

Switch must be installed with body in a horizontal plane and arrow on side pointing down.

If switch has an external float chamber (tee), connect it to vertical sections of 1" NPT pipe installed outside vessel walls at appropriate levels. If unit has no external float chamber, it must be mounted in a 1" NPT half coupling welded to the vessel wall. The coupling must extend through the wall.

Inspect and clean wetted parts at regular intervals.

ELECTRICAL CONNECTIONS

Connect wire leads in accordance with local electrical codes and switch action required. N.O. contacts will close and N.C. contacts will open when liquid level causes float to rise. They will return to "normal" condition on decreasing liquid level. Black = common, Blue = N.O. and Red = N.C.

For units supplied with both internal and external grounds the ground screw inside the housing must be used to ground the control. The external ground screw is for supplementary bonding when allowed or required by local code. Some CSA listed models are furnished with a separate green ground wire. Such units must be equipped with a junction box, not supplied but available on special order.

EC-Type Certificate Installation Instructions:

Cable Connection

The cable entry device shall be an EEx d certified cable gland suitable for conditions of use and correctly installed. The certificate cable gland and cable shall be rated for minimum temperature of 80°C.

Conduit Connection

An EEx d certified seal device such as a conduit seal with setting compound suitable for conditions of use and correctly installed shall be provided immediately to the entrance of the electrical housing. The certified conduit seal and setting compound and cable shall be rated for a minimum temperature of 80°C.

WETTED MATERIALS CHART

Model	Brass	Bronze	Ceramic	Polypropylene	301SS	303SS	304SS
B-S-3-A	X		X		X		X
B-S-3-B	X	X	X	X	X		
B-S-3-C	X		X		X		X
B-S-3-H	X	X	X		X		X
B-S-3-O	X	X	X	X	X		
S-S-3-A			X	X	X		X
S-S-3-C			X		X	X	X
S-S-3-L			X		X	X	X
S-S-3-O			X	X	X	X	
S-S-3-S			X	X	X	X	

Note: ATEX units only: The temperature class is determined by the maximum ambient and or process temperature. Units are intended to be used in ambient of $-20^{\circ}\text{C} \leq T_{\text{amb}} \leq 75^{\circ}\text{C}$. Units may be used in process temperatures up to 105°C providing the enclosure and switch body temperatures do not exceed 75°C . The standard Temperature Class is T6 Process Temp $\leq 75^{\circ}\text{C}$.

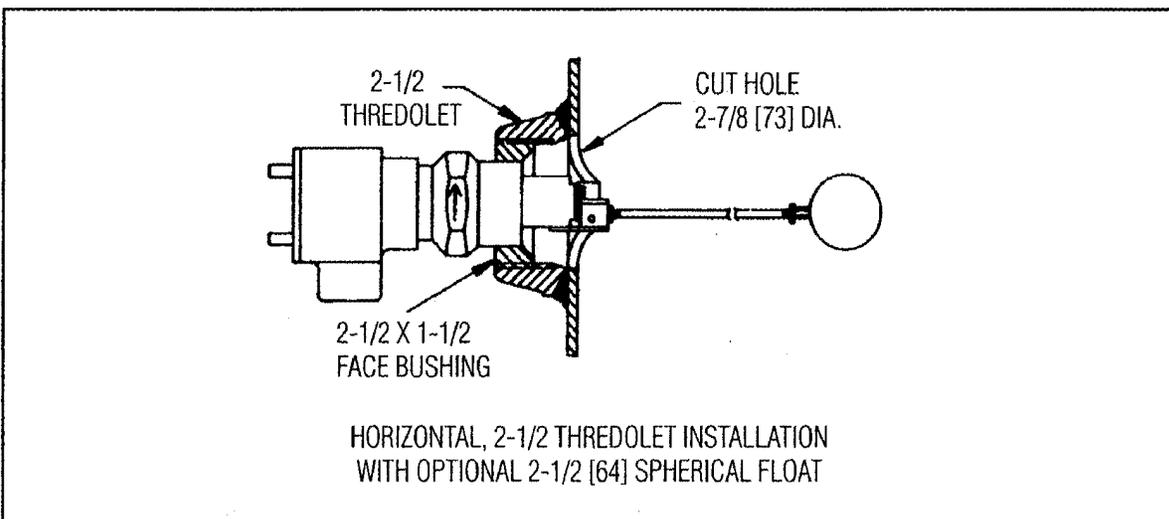
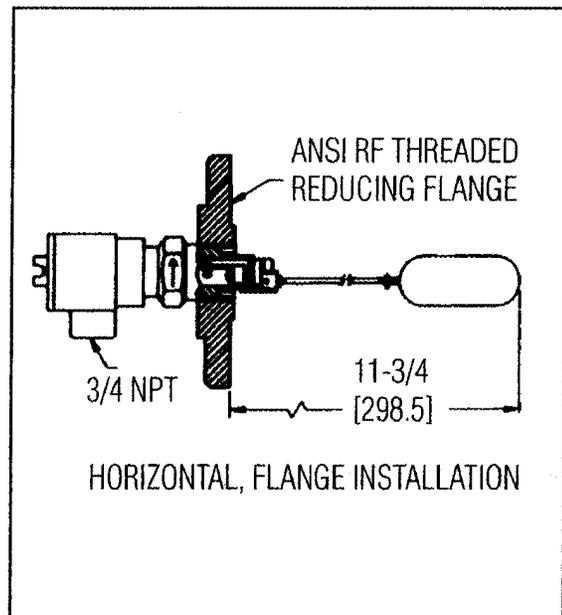
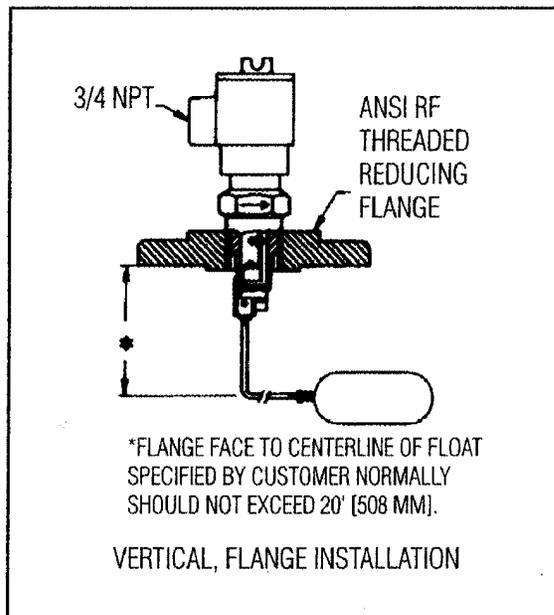
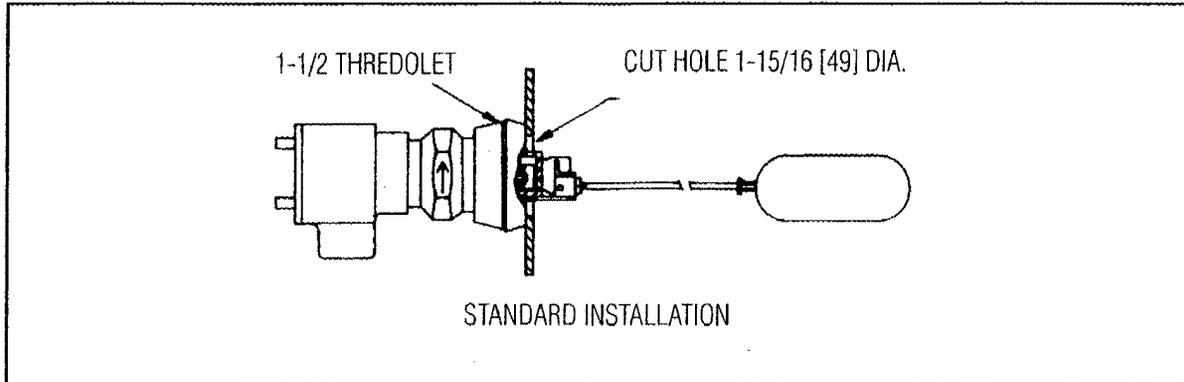
All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside switch or enclosure. Electrical components must be kept dry at all times.

CAUTION: To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

MAINTENANCE

Inspect and clean wetted parts at regular intervals. The cover should be in place at all times to protect the internal components from dirt, dust and weather and to maintain hazardous location ratings. Disconnect device from the supply circuit before opening to prevent ignition of hazardous atmosphere.

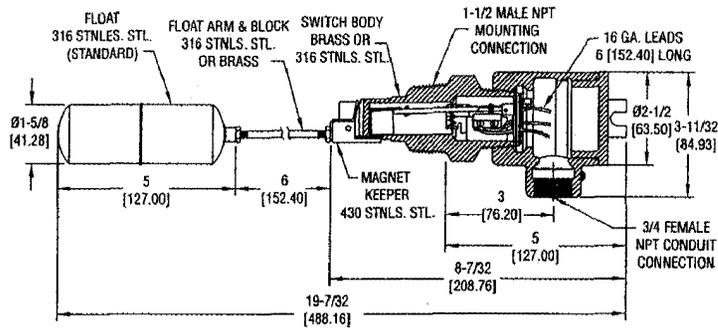
APPLICATION DRAWINGS FOR FLOTECT® AUTOMATIC FLOAT SWITCHES



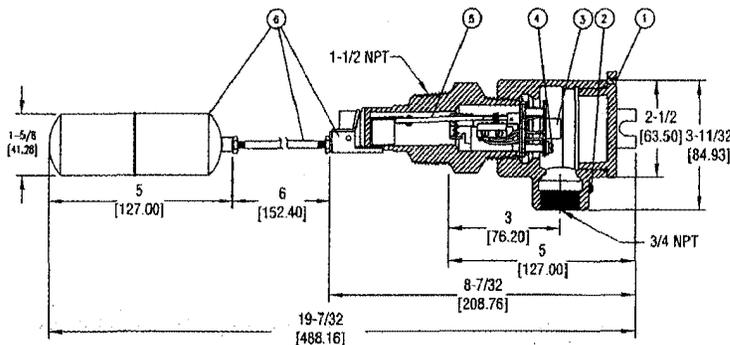
Example	L4	SS	D		C	F	2	C	1	L4-SS-D-C-F2C1
Construction	L4 L4-TOP									Side Mount, Brass Body, SPDT Switch Top Mount, Brass Body, SPDT Switch (Specify rod length)
Wetted Material Options		SS 316 NI								316 SS Body with 430 SS Magnet Keeper 316 SS Body and Magnet Keeper (Order with SS option) Nickel 20 Magnet Keeper
Switch Options			D							DPDT Switch
Float Options				50 150 300						2-1/2" Spherical, 304 SS rated 50 psi (3.5 bar), > 0.5 s.g. 2-1/2" Spherical, 316 SS rated 150 psi (10.3 bar), > 0.7 s.g. 2-1/2" Spherical, 304 SS rated 300 psi (20.7 bar), > 0.7 s.g.
Other Options					AT SAA EPOXY MT MV NB NH TBC TRD TRI					ATEX SAA Construction Epoxy Coated Housing High Temperature* (See specifications for rating) Gold Contact Snap Switch* (See specifications for rating) Neoprene Boot* No Electrical Housing* Terminal Block Wire Connections* Time Delay Relay* (On flow decrease) Time Delay Relay* (On flow increase)
Flange*						F				Flange Process Connection
Flange Size							2 3 4			2" 3" 4"
Flange Material								C S		Carbon Steel 316 SS
Flange Rating									1 3 6 9	150 # 300 # 600 # 900 #
Bushing*						B				Bushing Process Connection
Bushing Size							1 2 4			2" 2-1/2" 4"
Bushing Type								H F		Hex Flush
Bushing Material									B C S 4	Brass Carbon Steel 316 SS 304 SS

* Options that do not have ATEX

Attention: Units without the "AT" suffix are not Directive 94/9/EC (ATEX) compliant. These units are not intended for use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.



UL/CSA unit



ATEX/SAA unit

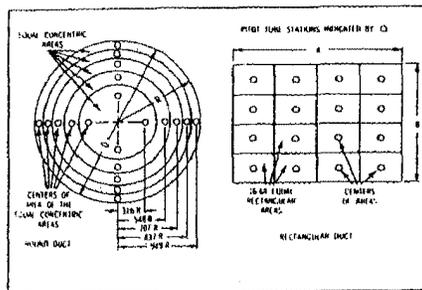
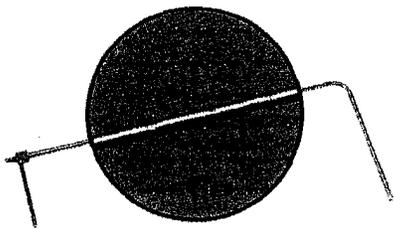
PARTS LIST

1. Cover lock. (ATEX/SAA unit only).
2. External ground. (ATEX unit only).
3. Enclosure housing and cover.
4. Terminal block. (ATEX and SAA unit only, UL/CSA unit has 6" leads).
5. Internal ground.
- * 6. Magnet arm and switch assembly.
7. Switch body.
- * 8. Float, arm and block assembly.
- * Approved replacement parts



Series 160 Stainless Steel Pitot Tubes

Specifications - Installation and Operating Instructions



The total pressure of an air stream flowing in a duct is the sum of the static or bursting pressure exerted upon the sidewalls of the duct and the impact or velocity pressure of the moving air. Through the use of a pitot tube connected differentially to a manometer, the velocity pressure alone is indicated and the corresponding air velocity determined.

For accuracy of plus or minus 2%, as in laboratory applications, extreme care is required and the following precautions should be observed:

1. Duct diameter to be 30 times pitot tube diameter, or greater.
2. Make an accurate traverse per sketch at right, calculate the velocities and average the readings.
3. Provide smooth, straight duct sections a minimum of 8 1/2 diameters in length upstream and 1 1/2 diameters downstream from the pitot tube.
4. Provide an egg crate type straightener upstream from the pitot tube.

In making an air velocity check select a location as suggested above, connect tubing leads from both pitot tube connections to the manometer and insert in the duct with the tip directed into the air stream. If the manometer shows a minus indication reverse the tubes. With a direct reading manometer, air velocities will now be shown in feet per minute. In other types, the manometer will read velocity pressure in inches of water and the corresponding velocity will be found from the curves in this bulletin. If circumstances do not permit an accurate traverse, center the pitot tube in the duct, determine the center velocity and multiply by a factor of .9 for the approximate average velocity. Field tests run in this manner should be accurate within plus or minus 5%.

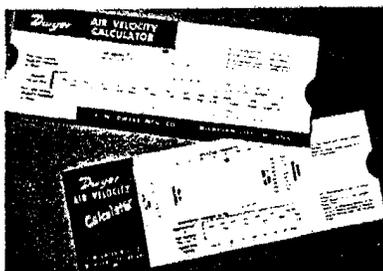
The velocity indicated is for dry air at 70°F, 29.9" Barometric Pressure and a resulting density of .075#/cu. ft. For air at a temperature other than 70°F. refer to the curves in this bulletin. For other variations from these conditions, corrections may be based upon the following data:

$$\text{Air Velocity} = 1096.2 \sqrt{\frac{P_v}{D}}$$

where P_v = velocity pressure in inches of water
 D = Air density in #/cu. ft.

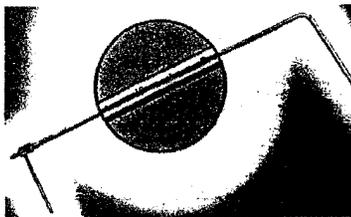
$$\text{Air Density} = 1.325 \times \frac{P_b}{T}$$

where P_b = Barometric Pressure in inches of mercury
 T = Absolute Temperature (indicated temperature °F plus 460)
 Flow in cu. ft. per min. = Duct area in square feet x air velocity in ft. per min.



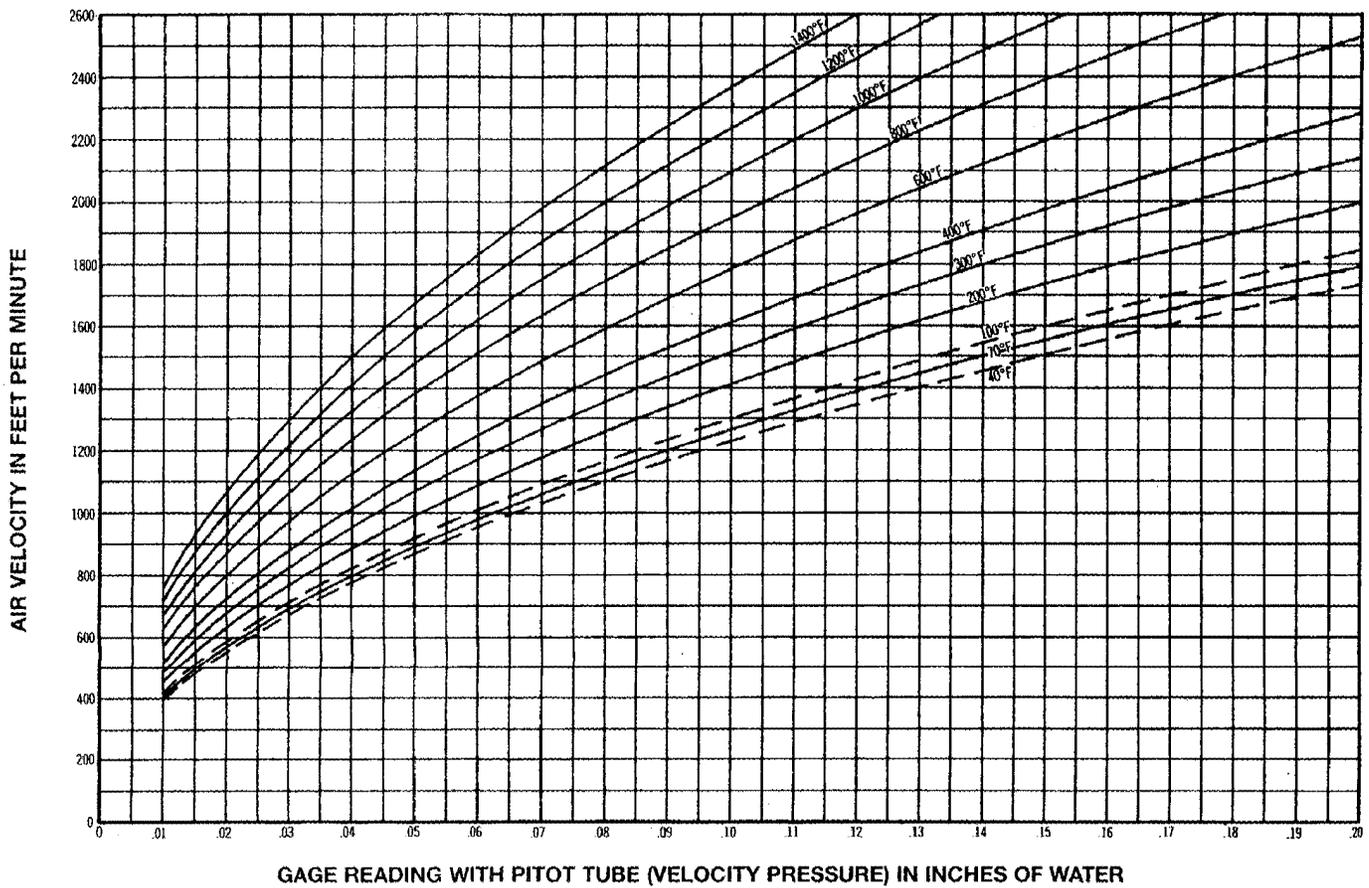
AIR VELOCITY CALCULATOR

Computes velocity based on air density corrected for conditions of temperature and pressure. Eliminates tedious calculations. Ranges from .01 to 10" water corresponding to 400 to 20,000 FPM. Furnished with each pitot tube.

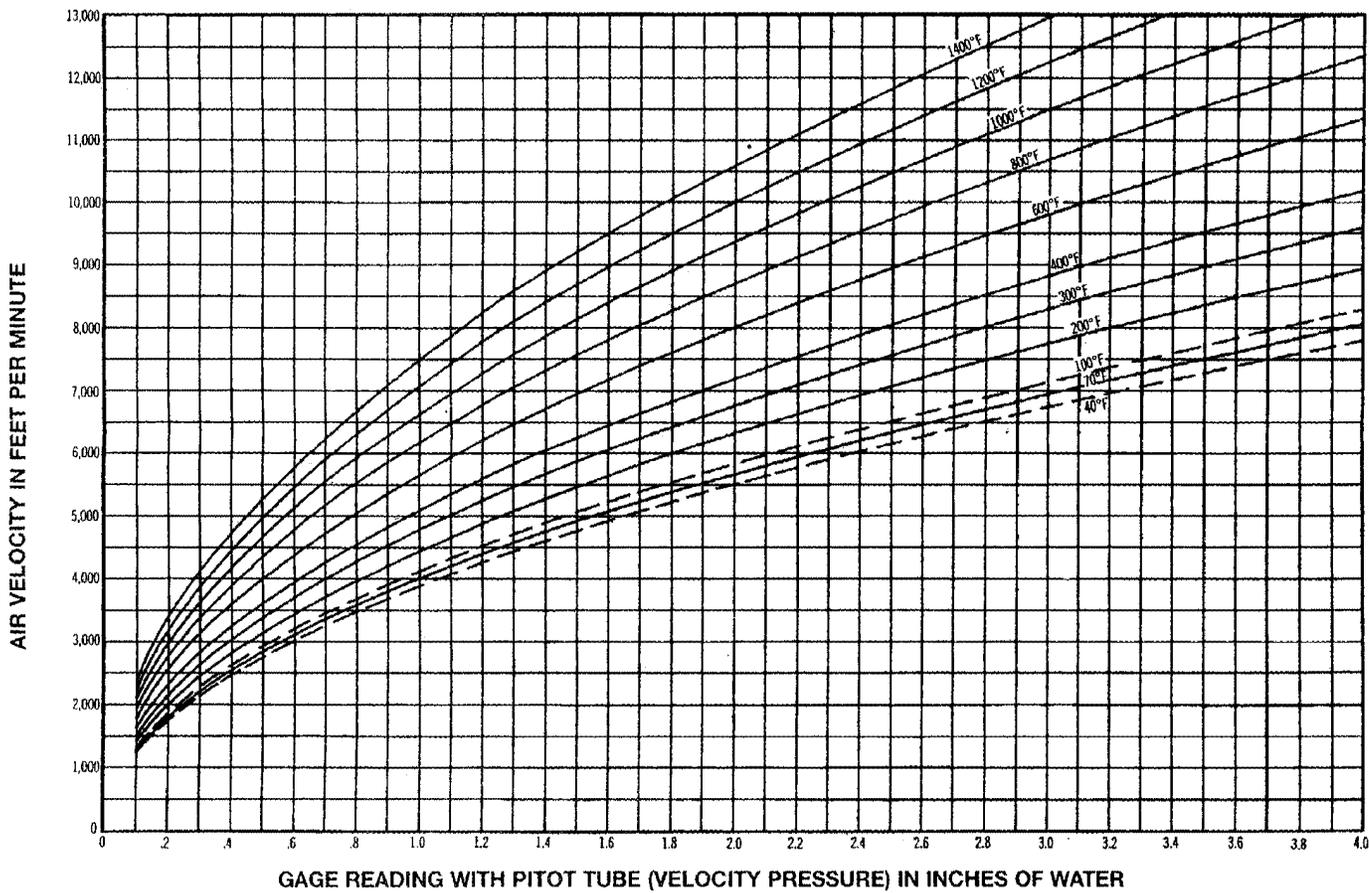


STAINLESS STEEL PITOT TUBES

Test confirmed unity coefficient and lifetime construction of No. 304 stainless steel. Inch graduations show depth of insertion for traversing. Model 160 is designed to meet ASME "Fluid Meters" 6th Ed, ANSI/AMCA 210-99, ANSI/ASHRAE 51-1999, and British Standard 1042. Sizes 12" to 60" long. Hand or fixed mounting types.



GAGE READING WITH PITOT TUBE (VELOCITY PRESSURE) IN INCHES OF WATER

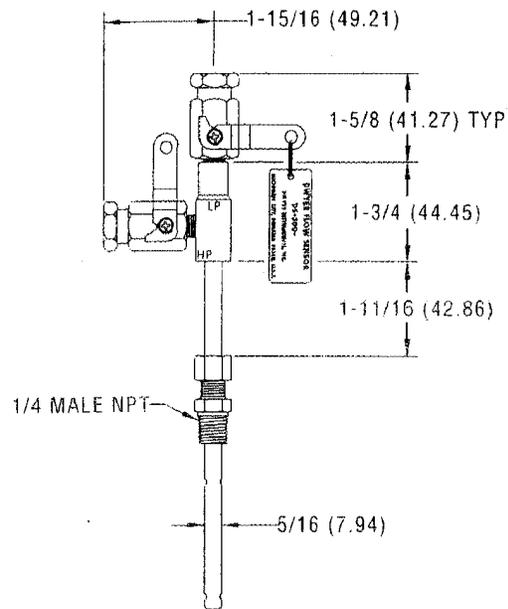
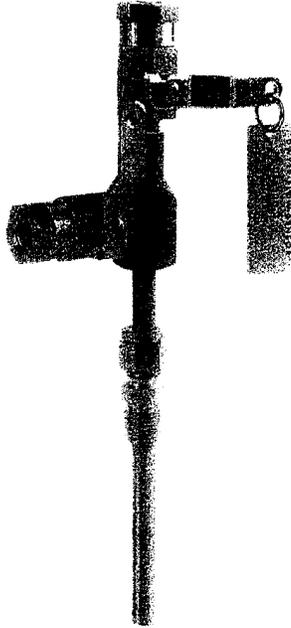


GAGE READING WITH PITOT TUBE (VELOCITY PRESSURE) IN INCHES OF WATER



Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system offered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8" female NPT connections. Accessories include adapters with 1/4" SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1" to 10".

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*			
Upstream Condition	Minimum Diameter of Straight Pipe		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

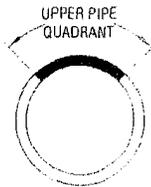
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

How sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

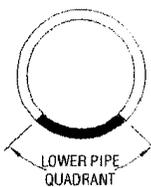
Install in upper quadrant of pipe



Condensate drains back to pipe

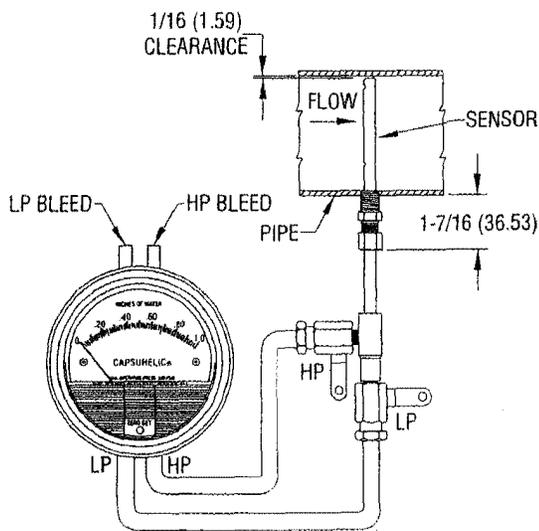
For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

Water Flow



INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4" x 3/8") will be needed.
2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.
3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.
4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16" to allow for thermal expansion.
5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

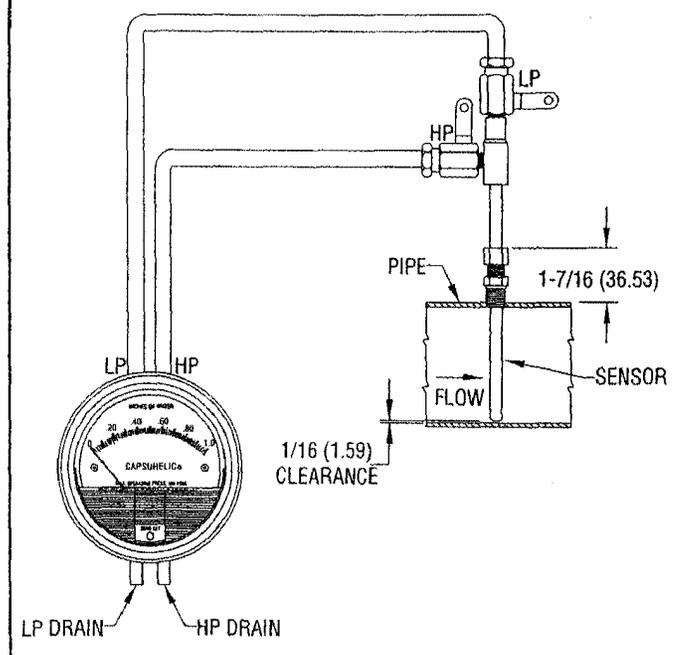
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Air or Gas Flow

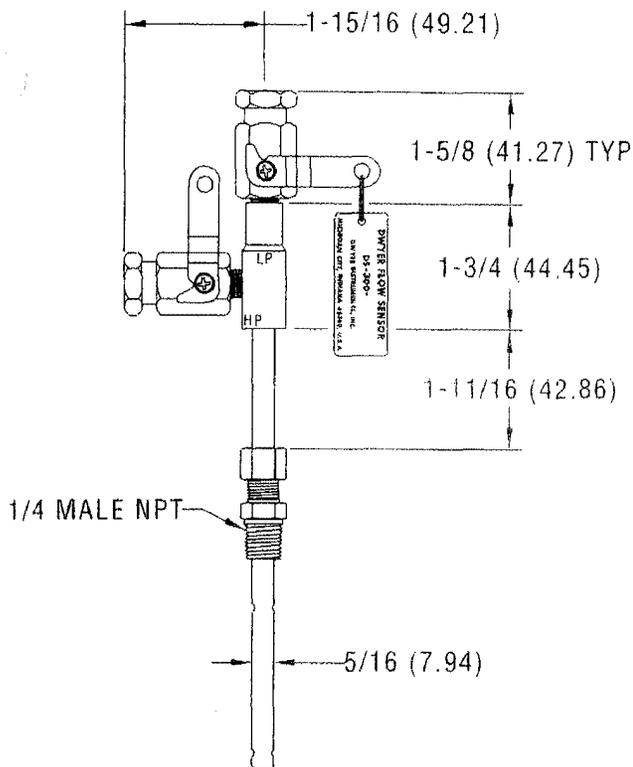


Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Company, www.cranvalve.com.



Using the appropriate differential pressure equation from Page 4 of this bulletin, calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids and/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q \text{ (GPM)} = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q \text{ (lb/Hr)} = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q \text{ (SCFM)} = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P \text{ (in. WC)} = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P \text{ (in. WC)} = \frac{Q^2}{K^2 \times D^4 \times p \times 128,900}$$

3. Any Gas

$$\Delta P \text{ (in. WC)} = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16,590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column

Q = Flow expressed in GPM, SCFM, or PPH as shown in equation

K = Flow coefficient— See values tabulated on Pg. 3.

D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

f = Static Line pressure (psia)

T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)

p = Density of medium in pounds per square foot

S_r = Sp Gr at flowing conditions

S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$\text{SCFM} = \text{ACFM} \times \left(\frac{14.7 + \text{PSIG}}{14.7} \right) \times \left(\frac{520^*}{460 + ^\circ\text{F}} \right)$$

$$\text{ACFM} = \text{SCFM} \times \left(\frac{14.7}{14.7 + \text{PSIG}} \right) \times \left(\frac{460 + ^\circ\text{F}}{520} \right)$$

$$\text{POUNDS PER STD. CUBIC FOOT} = \text{POUNDS PER ACT. CUBIC FOOT} \times \left(\frac{14.7}{14.7 + \text{PSIG}} \right) \times \left(\frac{460 + ^\circ\text{F}}{520^*} \right)$$

$$\text{POUNDS PER ACT. CUBIC FOOT} = \text{POUNDS PER STD. CUBIC FOOT} \times \left(\frac{14.7 + \text{PSIG}}{14.7} \right) \times \left(\frac{520^*}{460 + ^\circ\text{F}} \right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.

* (520° = 460 + 60°) Std. Temp. Rankine



HAYWARD INDUSTRIAL PRODUCTS

INSTALLATION OPERATION & MAINTENANCE

OF DIAPHRAGM VALVES

PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD VALVES, STRAINERS, FILTERS, AND OTHER ASSOCIATED PRODUCTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS INJURY.

1. Hayward guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for damage or injuries resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for damage or injury resulting from chemical incompatibility between its products and the process fluids to which they are subjected. Compatibility charts provided in Hayward literature are based on ambient temperatures of 70F and are for reference only. Customer should always test to determine application suitability.
3. Consult Hayward literature to determine operating pressure and temperature limitations before installing any Hayward product. Note that the maximum recommended fluid velocity through any Hayward product is eight feet per second. Higher flow rates can result in possible damage due to the water hammer effect. Also note that maximum operating pressure is dependent upon material selection as well as operating temperature.
4. Hayward products are designed primarily for use with non-compressible liquids. They should NEVER be used or tested with compressible fluids such as compressed air or nitrogen.
5. Systems should always be depressurized and drained prior to installing or maintaining Hayward products.
6. Temperature effect on piping systems should always be considered when the systems are initially designed. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward equipment due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
7. Because PVC and CPVC plastic products become brittle below 40F, Hayward recommends caution in their installation and use below this temperature.
8. Published operating torque requirements are based upon testing of new valves using clean water at 70F. Valve torque is affected by many factors including fluid chemistry, viscosity, flow rate, and temperature. These should be considered when sizing electric or pneumatic actuators.
9. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration, and pipe loading forces **DIRECT INSTALLATION OF METAL PIPE INTO PLASTIC CONNECTIONS IS NOT RECOMMENDED.** Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameter in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.

SOCKET CONNECTION:

Socket end connections are manufactured to ASTM D2467-94. Solvent cementing of socket end connections to pipe should be performed per ASTM specifications D2855-87. Cut pipe square. Chamfer and deburr pipe. Surfaces must be cleaned and free of dirt, moisture, oil and other foreign material. Remove assembly nuts and end connectors from valve body. Slide assembly nuts, with threads facing valve, onto pipe to which the end connector is to be cemented. Apply primer to inside socket surface of end connector. Never allow primer or cement to contact valve or end connector o-ring sealing surfaces, as leaking may result. Use a scrubbing motion. Repeat applications may be necessary to soften the surface of the socket. Next, liberally apply primer to the male end of the pipe to the length of the socket depth. Again apply to the socket, without delay apply cement to the pipe while the surface is still wet with primer. Next apply cement lightly, but uniformly to the inside of the socket. Apply a second coat of cement to the pipe, and assemble the end connector to the pipe rotating the end connector 1/4 turn in one direction as it is slipped to full depth on to the pipe. The end connector should be held in position for approx. 30 seconds to allow the cement to "set". After assembly wipe off excess cement. Full set time is a minimum of 30 minutes at 60 to 100 F. Full cure time should be based on the chart below.

JOINT CURE SCHEDULE:

The cure schedules are suggested as guides. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual manufacturer's recommendations for their particular cement should be followed.

Temperature Range During Cure Period(B) °F(°C)	Test Pressures for Pipe Sizes 1/2 to 1-1/4 In.		Test Pressures for Pipe Sizes 1-1/2 to 3 In.		Test Pressures for Pipe Sizes 4 to 5 In.		Test Pressures for Pipe Sizes 6 to 8 In.	
	Up to 180 PSI (1240 kPa)	Above 180 to 370 PSI (1240 to 2550 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2170 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2170 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2170 kPa)
60 to 100 (15 to 40)	1 h	6 h	2 h	12 h	6 h	18 h	8 h	24 h
40 to 60 (-5 to 15)	2 h	12 h	4 h	24 h	12 h	36 h	16 h	48 h
20 to 40 (-7 to 5)	6 h	36 h	12 h	72 h	36 h A	4 days A	3 days A	9 days A
10 to 20 (-15 to 7)	8 h	48 h	16 h	96 h	72 h A	8 days A	4 days A	12 days A
Colder than 10 (-15)	Extreme care should be exercised on all joints made where pipe, fittings or cement is below 10°F.							

1: It is important to note that at temperatures colder than 20°F on sizes that exceed 3 in., test results indicate that many variables exist in the actual cure rate of the joint. The data expressed in these categories represent only estimated averages. In some cases, cure will be achieved in less time, but isolated test results indicate that even longer periods of cure may be required.

2: These cure schedules are based on laboratory test data obtained on Net Fit Joints (NET FIT™) in a dry fit the pipe bottoms snugly in the fitting socket without meeting interference).

THREADED CONNECTION:

Threaded end connections are manufactured to ASTM specifications D2464-88, F437-88 and ANSI B2.1. Wrap threads of pipe with Teflon tape of 3 to 3-1/2 mil thickness. The tape should be wrapped in a clockwise direction starting at the first or second full thread. Overlap each wrap by 1/2 the width of the tape. The wrap should be applied with sufficient tension to allow the threads of a single wrapped area to show through without cutting the tape. The wrap should continue for the full effective length of the thread. Pipe sizes 2" and greater will not benefit with more than a second wrap, due to the greater thread depth. To provide a leak proof joint, the pipe should be threaded into the end connection "hand tight" using a strap wrench only. (Never use a stillson type wrench) tighten the joint an additional 1/2 to 1-1/2 turns past hand tight. Tightening beyond this point may induce excessive stress that could cause failure.

SPIGOT ENDS:

Polypropylene valves are furnished with Nominal pipe size spigots. These spigot ends are sized to either be used with socket fittings or fusion welded directly into the lines. In all cases follow the recommended fusion joining instructions of the Fusion joining machine's manufacturer.

VDF valves are furnished with Metric pipe size spigots. These spigot ends are sized to either be used with socket fittings or fusion welded directly into the lines. In all cases follow the recommended fusion joining instructions of the Fusion joining machine's manufacturer.

ACTUATOR CONNECTION:

On all 1/2" (15mm) air actuated diaphragm valves and 3/4" (20mm) air to open / air to close actuated diaphragm valves the air connection is a 1/8" NPT. All other air actuators have 1/4" NPT air connections. The bottom connection opens the valve. The top connection closes the valve.

REPAIR:

Maintenance on the diaphragm valves is generally limited to the replacement of the diaphragms. The diaphragm life is effected by application and frequency of cycle.

EXTREME CAUTION MUST BE TAKEN WHEN WORKING ON THIS VALVE.

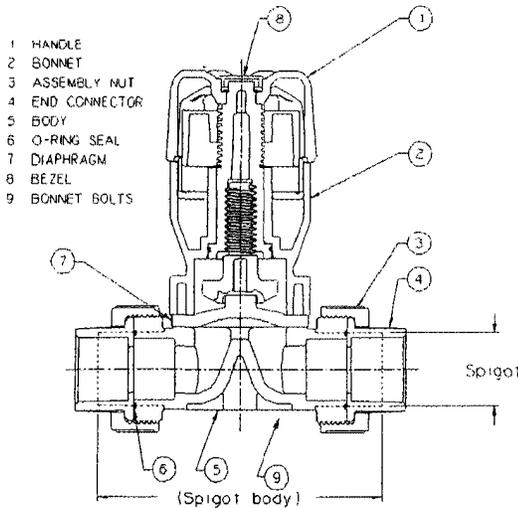
THE PIPING SYSTEM MUST BE DEPRESSURIZED AND DRAINED. PROPER CARE MUST BE TAKEN. CONSULT M.S.D.S. (MATERIAL SAFETY DATA SHEETS) INFORMATION REGARDING YOUR SPECIFIC APPLICATION.

There is no need to remove the valve from the line to replace the diaphragm. Four bolts hold the bonnet to the valve body, sandwiching the diaphragm. The diaphragm and end connector o-ring material should be selected for compatibility with the specific application.

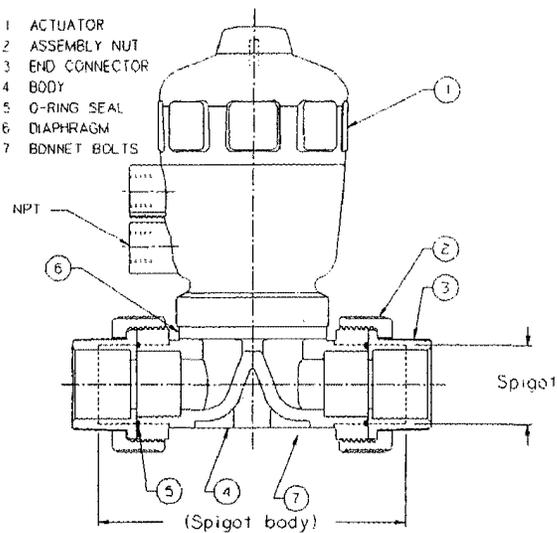
Open the valve. This may require application of air pressure to the actuator on fail-close design actuators. Remove the four bolts (See Detail drawing) and where applicable the washers under the bolts. Remove the bonnet with the diaphragm. Remove the air pressure from fail close actuators or rotate the handle to extent the compressor to allow access to the diaphragm.

- On 1/2" (15mm) and 3/4" (20mm) valves the diaphragm snaps into the bonnet assembly. Remove the diaphragm by peeling it out of the compressor. Inspect the diaphragm for wear and replace as needed. Make sure the holes in the diaphragm align with the holes in the bonnet. The line on the diaphragm will align with the weir in the body.
- On all other diaphragm valves the diaphragm has a right hand thread. Unscrew the diaphragm by rotating it counterclockwise from the compressor. Inspect the diaphragm for wear and replace as needed. Make sure the holes in the diaphragm align with the holes in the bonnet. The identification tab on the diaphragm will align with the weir in the body.

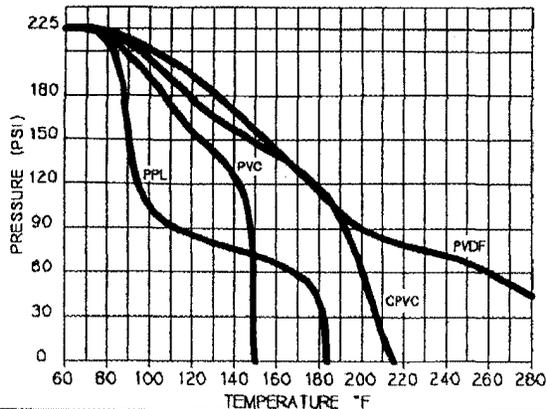
In most applications the diaphragm life can be greatly increased by the application of a small amount of silicon lubricant on the compressor side of the diaphragm. Install the four bolts and washers to the recommended torque below.



MANUAL VALVE



ACTUATED VALVE



TEMPERATURE VS USABLE PRESSURE

BODY BOLT TORQUE

SIZE	TORQUE INCH*LBS RUBBER DIAPHRAGM	TORQUE INCH*LBS TEFLON DIAPHRAGM
1/2" (15MM)	40	55
3/4" (20MM)	40	55
1" (25MM)	70	80
1 1/2" (40MM)	100	120
2" (50MM)	100	120

DVIN REV C
8/18/99
ECR 819R

Magnetic Drive Positive Displacement Disc Meters
Sizes 5/8" - 3/4" - 1"

Features

APPLICATIONS: Measurement of cold water for residential and small commercial applications where water volumes are low, and low flow sensitivity is important.

CONFORMANCE TO STANDARDS: Hersey Series 400 IIS Water Meters comply with latest version of ANSI/AWWA Standard C700. Meters which are manufactured with the EnviroBrass® maincase option meet the requirements of NSF Standard 61. Each meter is tested to ensure compliance.

CONSTRUCTION: Hersey 400IIS Water Meters consist of three basic parts: maincase; measuring chamber; and permanently sealed register. The maincase is made of bronze for long life. Direction of flow arrows and model are cast into each maincase. The bottom cover is epoxy-coated cast iron with a molded plastic liner separating it from the waterway. Optional plastic and bronze bottom covers are available. The measuring chambers are large for reduced wear during operation. The measuring chamber, integral strainer, nutating disc and thrust roller are thermoplastic, which is dimensionally stable and will not corrode. The thrust roller moves smoothly along a stainless steel wear plate to reduce friction and maintain accuracy. The register box and lid are available in plastic or bronze. The meter is designed so that the register can be replaced without removing the meter from the line.

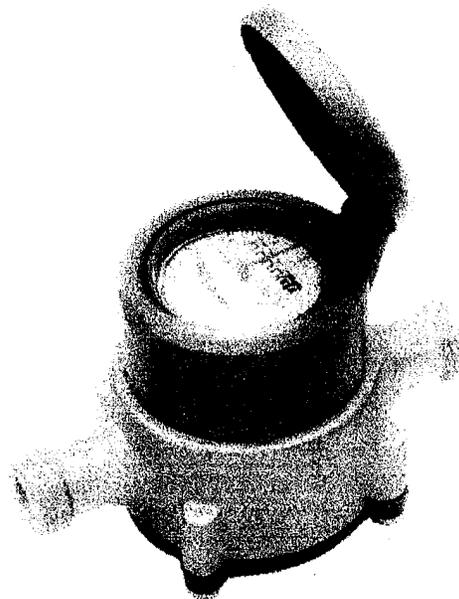
REGISTER: The permanently sealed register has a unique seal and heat-treated glass to eliminate dirt, moisture infiltration and lens fogging. An integral tamper-proof locking feature is provided to resist tampering with the register. The totalizing register has a straight-reading odometer type display, a 360° test circle with center sweep hand and a low flow (leak) detector. Standard gearing is used, making registers interchangeable by size.

All Hersey meter Models have electronic meter reading systems available for increased reading efficiency (see Meter Reading Systems.)

OPERATION: Water flows through the meter's strainer where debris is screened out. The incoming water fills a known volume of the measuring chamber on one or the other side of a movable disc that separates the chamber into two sections. As water enters, it moves the disc (nutates), forcing a known volume of water out of the meter from the opposite side of the disc. The process repeats as the sections refill and empty in turn. The nutating action of the disc is coupled magnetically to the register to indicate the volume of water that passes through the meter. The large capacity measuring chamber requires fewer nutations of the disc for each gallon measured, which helps to limit wear, extend the life of the meter, and reduce pressure loss.

MAINTENANCE: The Hersey Series 400 IIS Water Meters are designed and manufactured to provide long service life with virtually no maintenance required.

CONNECTIONS: Supplied with external straight pipe threads (NPSM) per ANSI B1.20.1.



Materials and Specifications

- **MODEL NUMBER** 430IIS, 442IIS, 452IIS
- **SIZES** 5/8"x1/2", 5/8"x3/4", 3/4"x3/4", 3/4"x1" and 1"x1"
- **STANDARDS** Manufactured and tested to meet or exceed all applicable parts of ANSI/AWWA C700 Standard. EnviroBrass options meet requirements of NSF Standard 61.
- **SERVICE** cold water measurement with flow in only one direction
- **OPERATING FLOW RANGE** See Chart on page 1.2
- **ACCURACY** See Chart on page 1.2
- **PRESSURE LOSS** See Chart on page 1.2
- **MAXIMUM WORKING PRESSURE** 150 PSI
- **TEMPERATURE RANGE** 33F to 100F Water Temperature
- **MEASURING ELEMENT** Nutating Disc
- **DISC NUTATIONS (per Gallon)** 430IIS: 49.6, 442IIS: 22.4, 452IIS: 11.7
- **REGISTER TYPE** Straight reading, permanently sealed, magnetic drive with low flow indicator. Remote reading units optional.
- **METER CONNECTIONS** 1/2", 3/4", 1" external (NPSM) straight pipe threads per ANSI B1.20.1
- **MATERIALS** Meter case - bronze UNSC84400; Bottom cover - cast iron ASTM A126 CL. B; Chamber top/bottom - thermoplastic; Nutating disc - thermoplastic; Disc pin - stainless steel; Thrust roller - thermoplastic; Wear plate - stainless steel; Coupling - Ceramic magnet; Strainer - thermoplastic; Coupling shaft - stainless steel ANSI B18; Bottom cover bolts - stainless steel ANSI B18; Register box and lid - thermoplastic.
- **OPTIONS** Meter case - EnviroBrass® UNSC89520
Bottom cover - bronze UNSC84400 or thermoplastic;
Register box and lid - bronze UNSC85700; AMR Reading Systems

400 Series IIS

Hersey® Meters

Magnetic Drive Positive Displacement Disc Meters
 Sizes 5/8", 3/4" and 1"

Meter Registration

Meter Size	Initial Dial*	Capacity	Initial Dial*	Capacity
5/8"	10 Gallons	10 Million	1 Cubic Feet	1 Million
3/4"	10 Gallons	10 Million	1 Cubic Feet	1 Million
1"	10 Gallons	10 Million	1 Cubic Feet	1 Million

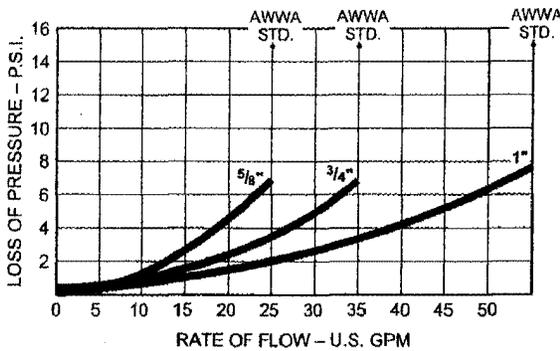
*Registration equal to one full revolution of the sweep hand.

Flow Characteristics

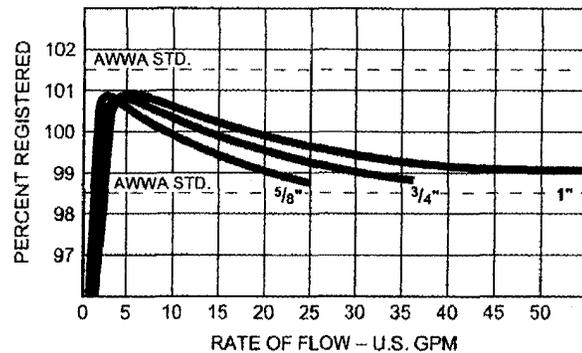
Meter Size	Typical Low Flow (95% Minimum)	Typical Operating Range (100% ± 1.5%)	Maximum Continuous Operation
5/8"	1/4 GPM	1/2 to 25 GPM	15 GPM
3/4"	1/2 GPM	3/4 to 35 GPM	25 GPM
1"	3/4 GPM	2 to 50 GPM	35

Performance

HEAD LOSS - 5/8", 3/4" AND 1" (Figure 1)



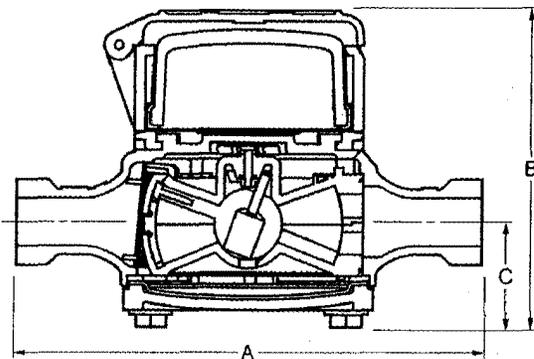
ACCURACY - 5/8", 3/4", AND 1" (Figure 2)



NOTE: Performance curves are typical only and NOT a guarantee of performance.

Dimensions and weights

Meter Size	5/8"	3/4"	3/4" Short	3/4" x 1"	1"
Ends External (NPSM) straight pipe threads					
Model	430	442	442	442	452
Dimension					
A	7-1/2"	9"	7-1/2"	9"	10-3/4"
B	4-15/16"	5-11/16"	5-11/16"	5-11/16"	6-5/8"
C	1-5/8"	1-15/16"	1-15/16"	1-15/16"	2-1/8"
Width	4.25"	6.39"	6.39"	6.39"	7.22"
inlet and outlet:	1/2" or 3/4"	3/4"	3/4"	1"	1"
Net weight	4-1/2	8-1/2	8	9	11



Note: Weights are in pounds and are approximate.

Magnetic Drive Positive Displacement Disc Meters
 Sizes 5/8" - 3/4" - 1"

Features

APPLICATIONS: Measurement of cold water for residential and small commercial applications where water volumes are low, and low flow sensitivity is important.

CONFORMANCE TO STANDARDS: Hersey Series 400 IIS Water Meters comply with latest version of ANSI/AWWA Standard C700. Meters which are manufactured with the EnviroBrass® maincase option meet the requirements of NSF Standard 61. Each meter is tested to ensure compliance.

CONSTRUCTION: Hersey 400IIS Water Meters consist of three basic parts: maincase; measuring chamber; and permanently sealed register. The maincase is made of bronze for long life. Direction of flow arrows and model are cast into each maincase. The bottom cover is epoxy-coated cast iron with a molded plastic liner separating it from the waterway. Optional plastic and bronze bottom covers are available. The measuring chambers are large for reduced wear during operation. The measuring chamber, integral strainer, nutating disc and thrust roller are thermoplastic, which is dimensionally stable and will not corrode. The thrust roller moves smoothly along a stainless steel wear plate to reduce friction and maintain accuracy. The register box and lid are available in plastic or bronze. The meter is designed so that the register can be replaced without removing the meter from the line.

REGISTER: The permanently sealed register has a unique seal and heat-treated glass to eliminate dirt, moisture infiltration and lens fogging. An integral tamper-proof locking feature is provided to resist tampering with the register. The totalizing register has a straight-reading odometer type display, a 360° test circle with center sweep hand and a low flow (leak) detector. Standard gearing is used, making registers interchangeable by size.

All Hersey meter Models have electronic meter reading systems available for increased reading efficiency (see Meter Reading Systems.)

OPERATION: Water flows through the meter's strainer where debris is screened out. The incoming water fills a known volume of the measuring chamber on one or the other side of a movable disc that separates the chamber into two sections. As water enters, it moves the disc (nutates), forcing a known volume of water out of the meter from the opposite side of the disc. The process repeats as the sections refill and empty in turn. The nutating action of the disc is coupled magnetically to the register to indicate the volume of water that passes through the meter. The large capacity measuring chamber requires fewer nutations of the disc for each gallon measured, which helps to limit wear, extend the life of the meter, and reduce pressure loss.

MAINTENANCE: The Hersey Series 400 IIS Water Meters are designed and manufactured to provide long service life with virtually no maintenance required.

CONNECTIONS: Supplied with external straight pipe threads (NPSM) per ANSI B1.20.1.



Materials and Specifications

- **MODEL NUMBER** 430IIS, 442IIS, 452IIS
- **SIZES** 5/8"x1/2", 5/8"x3/4", 3/4"x3/4", 3/4"x1" and 1"x1"
- **STANDARDS** Manufactured and tested to meet or exceed all applicable parts of ANSI/AWWA C700 Standard. EnviroBrass options meet requirements of NSF Standard 61.
- **SERVICE** cold water measurement with flow in only one direction
- **OPERATING FLOW RANGE** See Chart on page 1.2
- **ACCURACY** See Chart on page 1.2
- **PRESSURE LOSS** See Chart on page 1.2
- **MAXIMUM WORKING PRESSURE** 150 PSI
- **TEMPERATURE RANGE** 33F to 100F Water Temperature
- **MEASURING ELEMENT** Nutating Disc
- **DISC NUTATIONS (per Gallon)** 430IIS: 49.6,
442IIS: 22.4, 452IIS: 11.7
- **REGISTER TYPE** Straight reading, permanently sealed, magnetic drive with low flow indicator. Remote reading units optional.
- **METER CONNECTIONS** 1/2", 3/4", 1"
external (NPSM) straight pipe threads per ANSI B1.20.1
- **MATERIALS** Meter case - bronze UNSC84400; Bottom cover - cast iron ASTM A126 CL. B; Chamber top/bottom - thermoplastic; Nutating disc - thermoplastic; Disc pin - stainless steel; Thrust roller - thermoplastic; Wear plate - stainless steel; Coupling - Ceramic magnet; Strainer - thermoplastic; Coupling shaft - stainless steel ANSI B18; Bottom cover bolts - stainless steel ANSI B18; Register box and lid - thermoplastic.
- **OPTIONS** Meter case - EnviroBrass® UNSC89520
Bottom cover - bronze UNSC84400 or thermoplastic;
Register box and lid - bronze UNSC85700; AMR Reading Systems

400 Series IIS

Magnetic Drive Positive Displacement Disc Meters
 Sizes 5/8", 3/4" and 1"

Meter Registration

Meter Size	Initial Dial*	Capacity	Initial Dial*	Capacity
5/8"	10 Gallons	10 Million	1 Cubic Feet	1 Million
3/4"	10 Gallons	10 Million	1 Cubic Feet	1 Million
1"	10 Gallons	10 Million	1 Cubic Feet	1 Million

*Registration equal to one full revolution of the sweep hand.

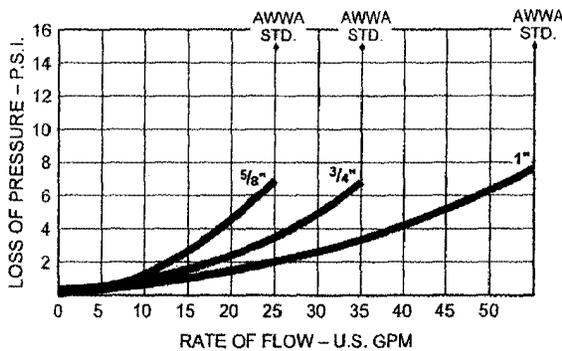
Flow Characteristics

Meter Size	Typical Low Flow (95% Minimum)	Typical Operating Range (100% ± 1.5%)	Maximum Continuous Operation
5/8"	1/4 GPM	1/2 to 25 GPM	15 GPM
3/4"	1/2 GPM	3/4 to 35 GPM	25 GPM
1"	3/4 GPM	2 to 50 GPM	35

Performance

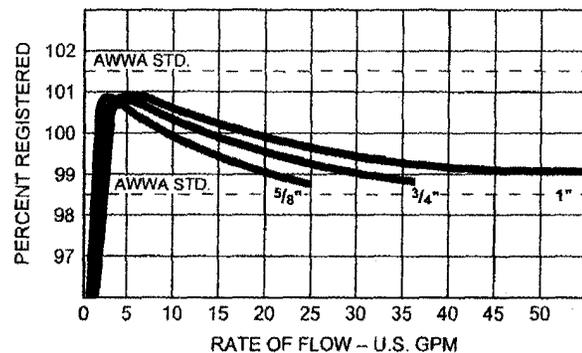
HEAD LOSS - 5/8", 3/4" AND 1"

(Figure 1)



ACCURACY - 5/8", 3/4", AND 1"

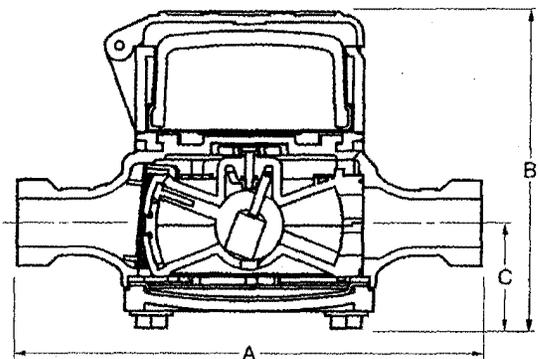
(Figure 2)



NOTE: Performance curves are typical only and NOT a guarantee of performance.

Dimensions and weights

Meter Size	5/8"	3/4"	3/4" Short	3/4" x 1"	1"
Ends External (NPSM) straight pipe threads					
Model	430	442	442	442	452
Dimension					
A	7-1/2"	9"	7-1/2"	9"	10-3/4"
B	4-15/16"	5-11/16"	5-11/16"	5-11/16"	6-5/8"
C	1-5/8"	1-15/16"	1-15/16"	1-15/16"	2-1/8"
Width	4.25"	6.39"	6.39"	6.39"	7.22"
inlet and outlet	1/2" or 3/4"	3/4"	3/4"	1"	1"
Net weight	4-1/2	8-1/2	8	9	11



Note: Weights are in pounds and are approximate.

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS



SPECIFICATIONS

Dimensions: 4-3/4" dia. x 2-3/16" deep.

Weight: 1 lb. 2 oz. (510 g)

Finished: Baked dark gray enamel.

Connections: 1/8" female NPT high and low pressure taps, duplicated, one pair side and one pair back.

Accuracy: Plus or minus 2% of full scale, at 70°F (21.1°C). (Model 2000-0, 3%; 2000-00, 4%).

Pressure Rating: 15 PSI (1.03 bar)

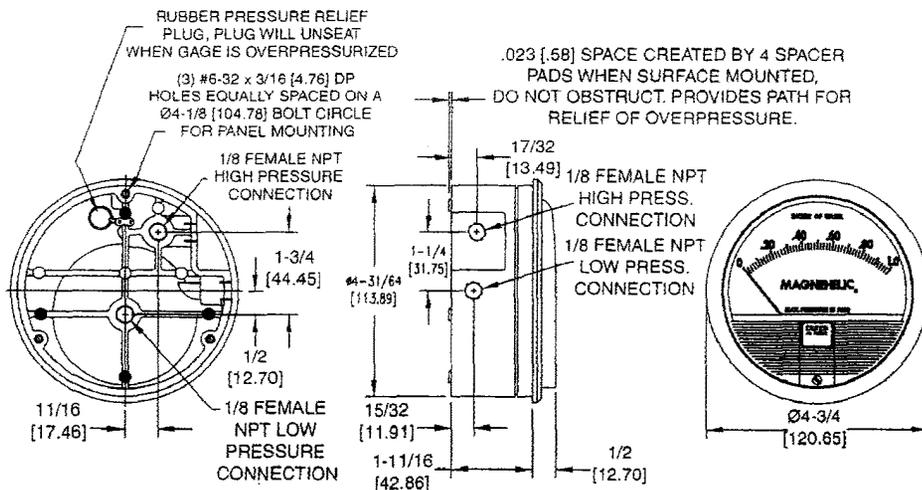
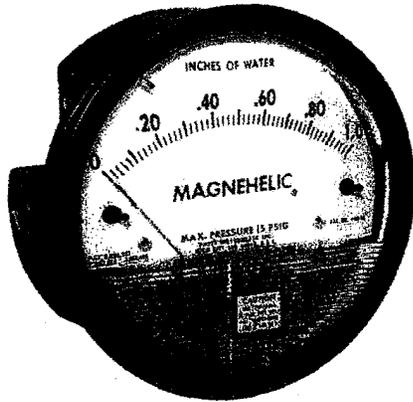
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).

Standard gage accessories include two 1/8" male NPT plugs for duplicate pressure taps, two 1/8" male NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



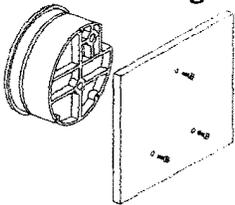
MAGNEHELIC® INSTALLATION

Overpressure Protection: Standard Magnehelic gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Newer models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when overpressure reaches approximately 25 psig. To provide a free path for pressure relief, there are four spacer pads which maintain .023" clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

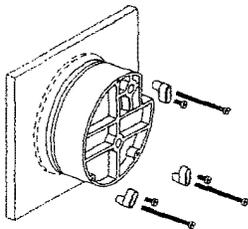
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4"-2" pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warranty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

Trouble Shooting Tips:

- Gage won't indicate or is sluggish.
1. Duplicate pressure port not plugged.
 2. Diaphragm ruptured due to overpressure.
 3. Fittings or sensing lines blocked, pinched, or leaking.
 4. Cover loose or "O" ring damaged, missing.
 5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
 6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.
- Pointer stuck-gage can't be zeroed.
1. Scale touching pointer.
 2. Spring/magnet assembly shifted and touching helix.
3. Metallic particles clinging to magnet and interfering with helix movement.
 4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

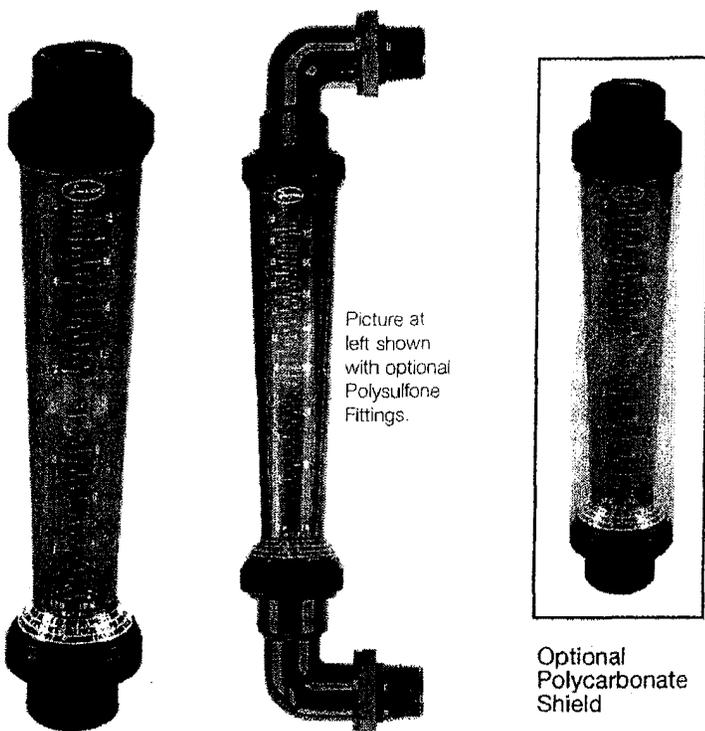
We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

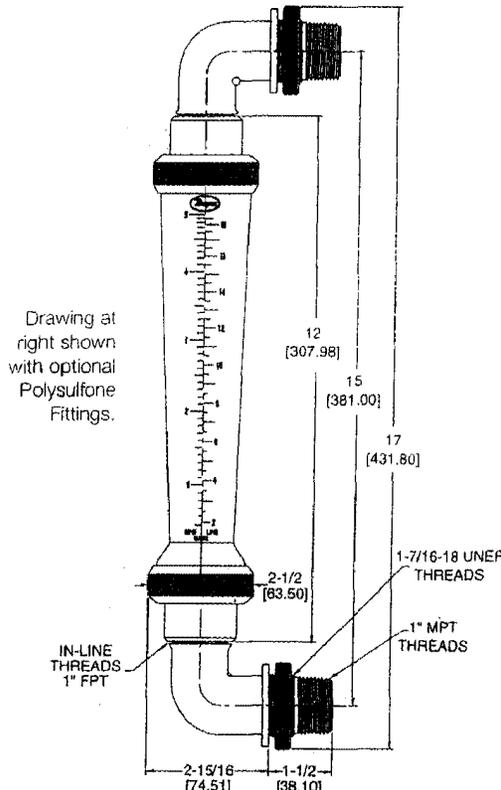


Specifications - Installation and Operating Instructions



Picture at left shown with optional Polysulfone Fittings.

Optional Polycarbonate Shield



Drawing at right shown with optional Polysulfone Fittings.

The Series UV In-Line Polysulfone Flowmeter measures the flow of water, air, and other compatible media at temperatures up to 212°F (100°C) and pressures up to 150 psi (10.34 bar). This flowmeter's highly corrosion-resistant materials suit it ideally for use with de-ionized water and ultra-pure applications, including food processing, medical equipment and reverse osmosis water systems.

INSTALLATION

- 1. Select an indoor (only) location that is free from excess vibration, within the specified temperature limits, and away from direct sunlight. (Polysulfone is adversely affected by ultra-violet light.)
2. Remove hollow plastic shipping tube from inside flow body.
3. Handle carefully. Hand-tighten aluminum ring. O-Rings will seal if hand tightened only. Do not overtighten the adapters and fittings.
4. Install the flowmeter in an exact vertical plane, one that is in proper alignment with the existing plumbing. Use wall or other structural supports at the top and bottom of the unit. Do not allow the instrument to support the weight of pipes or tubing.
5. Use Teflon® tape thread sealant. Do not use pipe dope compounds, which can craze and crack the polysulfone housing. Hand tighten system pipe fitting to adaptor fitting. If additional torque is needed to seal pipe joint, use strap wrench on adaptor fitting. Maximum torque is 22 Foot - Pounds.

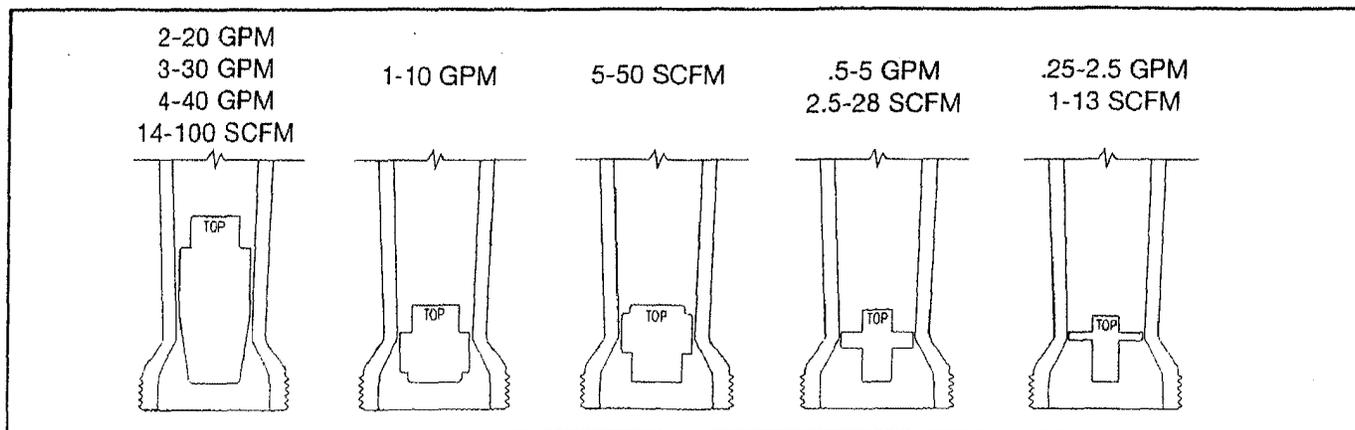
6. If using solvent-based glues like PVC cement, in the piping system, do so with the meter's body removed until glue has cured, then purge the system before re-installing. Do not solder brass fittings with the body installed, because the heat generated to solder the brass fittings will damage the flowmeter.

CAUTION: Ball valves and solenoid valves can have a "water cannon" effect on opening, creating pressure that exceeds the warranted ratings and will damage the flowmeter.

SPECIFICATIONS

- Service: Compatible liquids.
Wetted Materials: Polysulfone body, Viton® O-Rings and Virgin PTFE float.
Temperature Limits: 35 to 212°F (2 to 100°C); 35 to 130°F (2 to 54°C) for PVC Fitting Option.
Pressure Limit: 150 psi (10.34 bar).
Accuracy: ±2% Full Scale @ 70°F +/- 2 F (21.1°C) and 14.7 psia (In line connection rating only).
Repeatability: +/-1% full scale @ 70+/-2°F (21.1°C) and 14.7 psia (In line connection rating only).
Process Connections: 1" female NPT. Optional 90° Polysulfone Elbow - 1" male NPT.
Scale Length: 6" (152.40) - 7" (177.80), depending on model.
Fitting Torque: Maximum 22 ft - lb.
Weight: 1 lb (457 g) (for 20 GPM range).

Teflon, Viton-Reg. TM E.I. du Pont de Nemours & Co.



OPERATION AND MAINTENANCE

Once installed, the Series UV In-Line Polysulfone Flowmeter is self-operating and requires no maintenance other than an occasional cleaning with mild soap and a bottle brush. For this purpose, the unit has been designed so that its body can be removed quickly and easily while leaving all fittings intact.

When removing float for cleaning, note the floats "up" position. The float is a precision part and must be reassembled without adverse treatment, i.e. dropping, denting, and surface abrasion.

The standard technique for reading a Variable Area Flowmeter is to locate the highest point of greatest diameter on the float, and then align that with the theoretical center of the scale graduation. In the event that the float is not aligned with a grad, an extrapolation of the float location must be made by the operator as to its location between the two closest grads. The following are some sample floats shown with reference to the proper location to read the float.



Variable Area Flowmeters used for gases are typically labeled with the prefix "S" or "N", which represents "Standard" for English units or "Normal" for metric units. Use of this prefix designates that the flowmeter is calibrated to operate at a specific set of conditions, and deviation from those standard conditions will require correc-

tion for the calibration to be valid. In practice, the reading taken from the flowmeter scale must be corrected back to standard conditions to be used with the scale units. The correct location to measure the actual pressure and temperature is at the exit of the flowmeter, except under vacuum applications where they should be measured at the flowmeter inlet. The equation to correct for nonstandard operating conditions is as follows:

$$Q_2 = Q_1 \times \sqrt{\frac{P_1 \times T_2}{P_2 \times T_1}}$$

Where: Q_1 = Actual or Observed Flowmeter Reading
 Q_2 = Standard Flow Corrected for Pressure and Temperature

P_1 = Actual Pressure (14.7 psia + Gage Pressure)
 P_2 = Standard Pressure (14.7 psia, which is 0 psig)
 T_1 = Actual Temperature (460 R + Temp °F)
 T_2 = Standard Temperature (530 R, which is 70°F)

Example: A flowmeter with a scale of 10-100 SCFH Air. The float is sitting at the 60 grad on the flowmeter scale. Actual Pressure is measured at the exit of the meter as 5 psig. Actual Temperature is measured at the exit of the meter as 85°F.

$$Q_2 = 60.0 \times \sqrt{\frac{(14.7 + 5) \times 530}{14.7 \times (460 + 85)}}$$

$Q_2 = 68.5$ SCFH Air

Models and Ranges					
Model Number	Range	Medium	Body	Fitting Material	Float
UV-0112	0.25-2.5 GPM (1-9.5 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-1112	0.5-5.0 GPM (2-19 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-2112	1.0-10.0 GPM (4-38 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-3112	2.0-20.00 GPM (8-76 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-4112	3.0-30.00 GPM (12-112 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-5112	4.0-40.00 GPM (20-150 LPM)	Water	Polysulfone	Polysulfone	Virgin PTFE
UV-A112	1-13 SCFM (30-370 LPM)	Air	Polysulfone	Polysulfone	Virgin PTFE
UV-B112	2.5-28 SCFM (70-780 LPM)	Air	Polysulfone	Polysulfone	Virgin PTFE
UV-C112	5-50 SCFM (70-1400 LPM)	Air	Polysulfone	Polysulfone	Virgin PTFE
UV-D112	14-100 SCFM (400-2800 LPM)	Air	Polysulfone	Polysulfone	Virgin PTFE

Models 12" to 24" Heavy-Duty Exhaust Fans

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. Fan impellers should be rotated at each inspection by hand ten to fifteen revolutions to redistribute the motor and bearing lubricant.

If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. The most critical items are pulleys, shafts and bearing locking collars. At the first sign of rusting on any of the above parts, remove the original rust preventive coating with petroleum solvent and clean lint-free cloths. Polish any remaining rust from surfaces with crocus cloth or fine emery paper and oil. **IMPORTANT:** Do not destroy the continuity of the surfaces. Wipe clean with lint-free cloths and recoat surfaces evenly and thoroughly with Tectly 506 (Ashland Oil Company) or equal. For hard to reach internal surfaces or for occasional use, consider using Tectly 511M Rust Preventive or WD40 or equal.

Removing from Storage. As fans are removed from storage to be installed in their final location, they should be protected and maintained in similar fashion, until the fan equipment goes into operation.

Installation

1. The unit should be securely mounted in a rigid framework.
2. Connect power to motor, using an approved wiring method.
3. Install any auxiliary components.
4. Before activating the fan, double-check to ensure that there are no obstructions (framing, stud, shutter, etc.) which would interfere with proper fan operation.

▲ CAUTION *This fan has rotating parts. Exercise applicable safety precautions during its handling, assembly, operation and maintenance. Disconnect power before handling, assembling, operating or maintaining. If disconnect means is out of sight, lock it in the open position to prevent unexpected starts.*

▲ WARNING *Do not use in hazardous environments where the fan's electrical system could provide ignition to combustible or flammable materials, unless the unit is specifically built for hazardous environments.*

▲ CAUTION *Guards must be installed when the fan is within reach of personnel or within seven (7) feet (2.134m) of working level or when deemed advisable for safety.*

▲ CAUTION *Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.*

▲ WARNING *Check the voltage at the fan to see if it corresponds with the motor nameplate. High or low voltage can seriously damage the motor. Extra care should be taken when wiring two speed motors since improper connections will damage the motor and void the motor warranty.*

Apply power momentarily and compare the rotation of the impeller with the directional arrow on fan.

▲ WARNING *Operation in the wrong direction will deliver air but will overload the motor to the extent of blowing fuses and seriously damaging the motor. In the case of three phase motors, the direction can be changed by interchanging any two of the*

three motor leads. In the case of single phase motors, the reversing instructions will appear on the wiring diagram in the motor wiring compartment.

General Safety Information

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) in the United States.
2. Motor must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system by using a separate ground wire connected to the bare metal of the motor frame, or other suitable means.
3. Always disconnect power source before working on or near a motor or its connected load. If the power disconnect point is out-of-sight, lock it in the open position and tag to prevent unexpected application of power.
4. All moving parts should be guarded.
5. Be careful when touching the exterior of an operating motor - it may be hot enough to be painful or cause injury. With modern motors this condition is normal if rated at normal load and voltage - modern motors are built to operate at higher temperatures.
6. Make certain that the power source conforms to the requirements of your equipment.
7. Wiping or cleaning rags and other flammable waste materials must be placed in a tightly closed metal container and disposed of later in the proper fashion.
8. When cleaning electrical or electronic equipment, always use an approved cleaning agent such as dry cleaning solvent.

Maintenance

1. Periodically clean the propeller and motor of any excessive accumulation of dirt.

Dayton® 12" to 24" Heavy-Duty Exhaust Fans

Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the fan orifice.

▲ CAUTION *Do not lift by the fan hood.*

Fans with special coatings or paints must be protected in handling to prevent damage.

Storage. Fans are protected against damage during shipment. If they cannot be installed and put into operation immediately upon receipt, certain precautions are necessary to prevent deterioration during storage. Responsibility for integrity of fans and accessories during storage must be assumed by the user. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user, who shall make his own decision as to whether to use any or all of them.

Indoor Storage. The ideal storage environment for fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained at between 70°F and 105°F (wide temperature swings may cause condensation and "sweating" of metal parts). Windows should be covered to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points and maintain the atmosphere at 40% relative humidity, or lower.

It may be necessary to use desiccant or a portable dehumidifier to remove moisture from the air in the storage enclosure.

Thermostatically controlled portable heaters (vented to outdoors) may be required to maintain even temperatures inside the enclosure.

▲ CAUTION *Provide fire extinguishers, fire alarms, or emergency response communication to protect building and equipment*

against fire damage. Be sure that building and storage practices meet all local, state and federal fire and safety codes.

The following fans or accessories must be stored indoors, in a clean dry atmosphere:

- a. Propeller wall fans not in wall housings.
- b. Any fan protected by a cardboard carton.
- c. Motors dismantled from fans.
- d. Spare wheels or propellers.
- e. Belts, sheaves, bushings and other parts when not mounted on fan.
- f. Boxes, bags or cartons of hardware.
- g. Curbs
- h. Shutters

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. Allow cold parts to reach room temperature to avoid "sweating" of metal parts. Open boxes or cartons. Remove any accumulated moisture; if necessary use portable electric heaters to dry parts and packages. Leave coverings loose to permit air circulation and to permit periodic inspection.

Rotate impeller by hand to distribute bearing grease over the entire bearing surfaces.

Store at least 3 1/2" above the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Provide aisles between parts and along all walls to permit air circulation and space for inspection.

Outdoor Storage. Fans designed for outdoor use may be stored outdoors, if absolutely necessary. The storage area should be reasonably level and drained or ditched to prevent accumulation of water. Fencing and lighting for security are desirable.

Roads or aisles for portable cranes and hauling equipment are needed. Consider the use of drift fencing to minimize accumulation of blowing snow or dirt.

The following fans may be stored outdoors, if dry indoor storage space is not available:

- a. Fans intended for outdoor use that are crated in wood.
- b. Wall fans installed in wall housings.

All fans must be supported on wooden blocks or timbers above water or normal snow levels. Provide enough blocking to prevent settling into soft ground. Fans should be set in place using the directional arrow markings on the crate as a guide.

Locate pieces far enough apart to permit air circulation, sunlight, and space for periodic inspection. Place all parts on their supports so that rain water will run off, or to minimize water accumulation.

IMPORTANT: Do not cover parts with plastic film or tarps — these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan impellers should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance

During Storage. Inspect fans and accessories at least once per month, while in storage. Log results of inspection and maintenance performed. A typical log entry should include the following:

- a. Date
- b. Inspector's Name
- c. Name of Fan
- d. Location
- e. Condition of Paint or Coating
- f. Is moisture present?
- g. Is dirt accumulated?
- h. Corrective steps taken?

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® 12" to 24" Heavy-Duty Exhaust Fans

Description

NOTE: Manufacturer assumes no obligation or liability on account of any unauthorized recommendations, opinions, or advice as to the choice, installation or use of products.

Dayton heavy duty exhaust fans have wire intake guards that comply with OSHA ½" max. opening requirements and baked-on charcoal grey metallic polyester finish to resist corrosion. All units are supplied with aluminum propeller with a corrosion resistant spider. Fans are powered by a 115V, 60 Hz., totally enclosed motor. Shipped completely assembled.

Certified Rating for Air and Sound



Dayton Electric Mfg. Company certifies that the ventilators shown hereon are licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 comply with the requirements of the AMCA Certified Ratings Program.

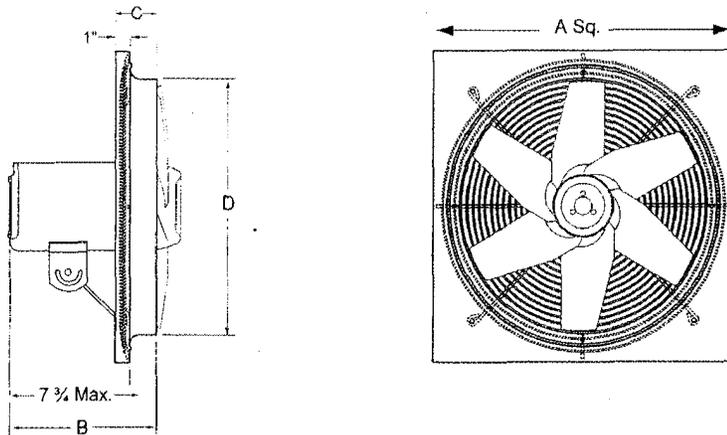


Figure 1 - Dimensions

Model	Propeller Dia.	A. Sq.	B	C	D
4YC81F	12"	16"	10 7/8"	2 1/2"	12 3/8"
4C163F	16	20	10 1/4	2 3/4	16 1/16
4C164F	18	22	10 1/8	2 15/16	18 1/16
4C367F	20	22	10 3/8	3 1/16	20 1/2
4C127F	20	24	10 3/8	3 1/16	20 1/2
4C165F	20	24	10 3/4	3 3/16	20 1/2
4C059F	24	28	10 3/4	3 3/8	24 3/8
4C167F	24	28	11 1/4	3 3/8	24 3/8

Unpacking

Receiving and Inspection. Immediately upon receipt of shipment, carefully inspect for damage and/or shortage. Turn the impeller by hand to see that it turns freely and does not bind. If any damage and/or shortage is detected or suspected, the carrier must be notified to conduct an inspection. The customer should not accept shipment without a notation on the delivery receipt indicating items not delivered or the apparent extent of damage.

When shipment is opened and damage is found which was not evident externally (concealed damage), it is mandatory that the customer request an immediate inspection by the carrier. Report any damage to the carrier within 15 days. Failure to report damage within the above time limit could result in rejection of claim.

Handling. When handling fans and their accessories, always use equipment and methods that will not cause damage. To avoid damage fans should be lifted using slings and padding or spreaders.

CAUTION Always make sure that all lifting and handling equipment and techniques conform to current safety standards.

Dayton® 12" to 24" Heavy-Duty Exhaust Fans

LIMITED WARRANTY

WARRANTY AND DISCLAIMER: Dayton® extends this limited warranty by the manufacturer to the original purchaser and warrants that Dayton® products shall be free from original defects in workmanship and materials for one year from date of shipment, provided same have been properly handled, stored, installed, serviced, maintained and operated. This warranty shall not apply to products which have been altered or repaired in any way so as to affect performance or reliability, nor which have been improperly installed or subjected to misuse, negligence, or accident, or incorrectly used in combination with other substances. The Purchaser assumes all risks and liability for results of use of all products.

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.

Dayton® is not responsible for the cost of removal of the defective product or part, damages due to removal, or any expenses incurred in shipping the product or part to or from Dayton®, or the installation of the repaired or replaced product or part.

The warranties set forth above do not apply to any components, accessories, parts or attachments manufactured by other manufacturers; such being subject to the manufacturer's warranty, if any. To the extent not prohibited by the manufacturer's warranty, Dayton® shall pass through to Purchaser such manufacturer's warranty.

DAYTON®'S WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND WAIVED. THIS WARRANTY CONSTITUTES DAYTON®'S SOLE AND EXCLUSIVE WARRANTY FOR DEFECTIVE GOODS AND PURCHASER'S SOLE AND EXCLUSIVE REMEDY FOR DEFECTIVE PRODUCTS.

No employee, agent, dealer, or other person is authorized to give any warranties on behalf of Dayton® or to assume for Dayton® any other liability in connection with any of its products except in writing and signed by an officer of Dayton®.

TECHNICAL ADVICE AND RECOMMENDATIONS, DISCLAIMER: Notwithstanding any past practice or dealings or any custom of the trade, sales shall not include the furnishing of technical advice or assistance or system design.

Dayton® assumes no obligation or liability on account of any unauthorized recommendations, opinions or advice as to the choice, installation or use of products.

LIMITATION OF LIABILITY The cumulative liability of Dayton® to the Purchaser and any other persons for all claims in any way relating to or arising out of the products, including, but not limited to, any cause of action sounding in contract, tort, or strict liability, shall not exceed the total amount of the purchase price paid for those products which are the subject of any such claim. This limitation of liability is intended to apply without regard to whether other provisions of this agreement have been breached or have proven ineffective even if Dayton® has been advised of the possibility of such claims or demands. In no event shall Dayton® be liable to the Purchaser or any other person for any loss of profits or any incidental, special, exemplary, or consequential damages for any claims or demands brought by the Purchaser or such other persons.

INDEMNITY Dayton®'s maximum liability to Purchaser and to any end user is as set forth above. Dayton® makes no warranty to anyone for any products not manufactured by Dayton® and shall have no liability for any use or installation of any products (whether manufactured by Dayton® or other manufacturers) not specifically authorized by this sale. Purchaser acknowledges various warnings by Dayton® regarding the products and its installation and use. If Dayton® incurs any claims, lawsuits, settlements, or expenses (including attorney fees) for any loss, injury, death or property damage including, but not limited to, claims arising out of the Purchaser's or any end user's installation or use of the products, the Purchaser shall indemnify and hold Dayton® harmless.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 U.S.A.

Dayton® 12" to 24" Heavy-Duty Exhaust Fans

- Under normal usage, no spare parts are recommended for one year of operation. Motor bearings are prelubricated. Consult information printed on motor for lubrication instructions.

▲ CAUTION *Before proceeding, make sure electrical service to the fan is locked in the "OFF" position.*

▲ WARNING *Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.*

Set Screw Tightening Schedule

- Before initial operation of the fan, tighten set screws according to the procedure outlined below.
- After 500 operating hours or three months, whichever comes first, tighten set screws to the full recommended torque.
- At least once a year, tighten set screws to the full recommended torque.

Procedure for Tightening Set Screws in Bearings and Hubs

One Set Screw Application

Using a torque wrench, tighten the set screw to the torque recommended in Table 1.

Two Set Screw Application

- Using a torque wrench, tighten one set screw to half of the torque recommended in Table 1.
- Tighten the second set screw to the full recommended torque.
- Tighten the first set screw to the full recommended torque.

Variable Frequency Drives and Motors

There are occasions when a Variable Frequency Drive (VFD) will cause poor motor performance and possible damage. To avoid these problems, the manufacturer recommends the following:

- Select compatible motor and VFD converter; if possible, the motor and the converter should be from the same manufacturer or at least the converter selected should be recommended by the motor manufacturer.
- A motor shaft grounding system should be used to prevent motor bearing damage from eddy currents.

NOTE: The manufacturer will not honor motor warranty claims if the customer fails to follow these recommendations.

Table 1. Recommended Tightening Torque for Set Screws

Set Screw Diameter	Torque (in-lbs)
#10	35
1/4	80
5/16	126
3/8	240
7/16	384
1/2	744
9/16	1080
5/8	1500
3/4	2580
7/8	3600
1	5400

For Repair Parts, call 1-800-323-0620

24 hours a day - 365 days a year

Please provide following information:

- Model number
- Serial number (if any)
- Part descriptions 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.

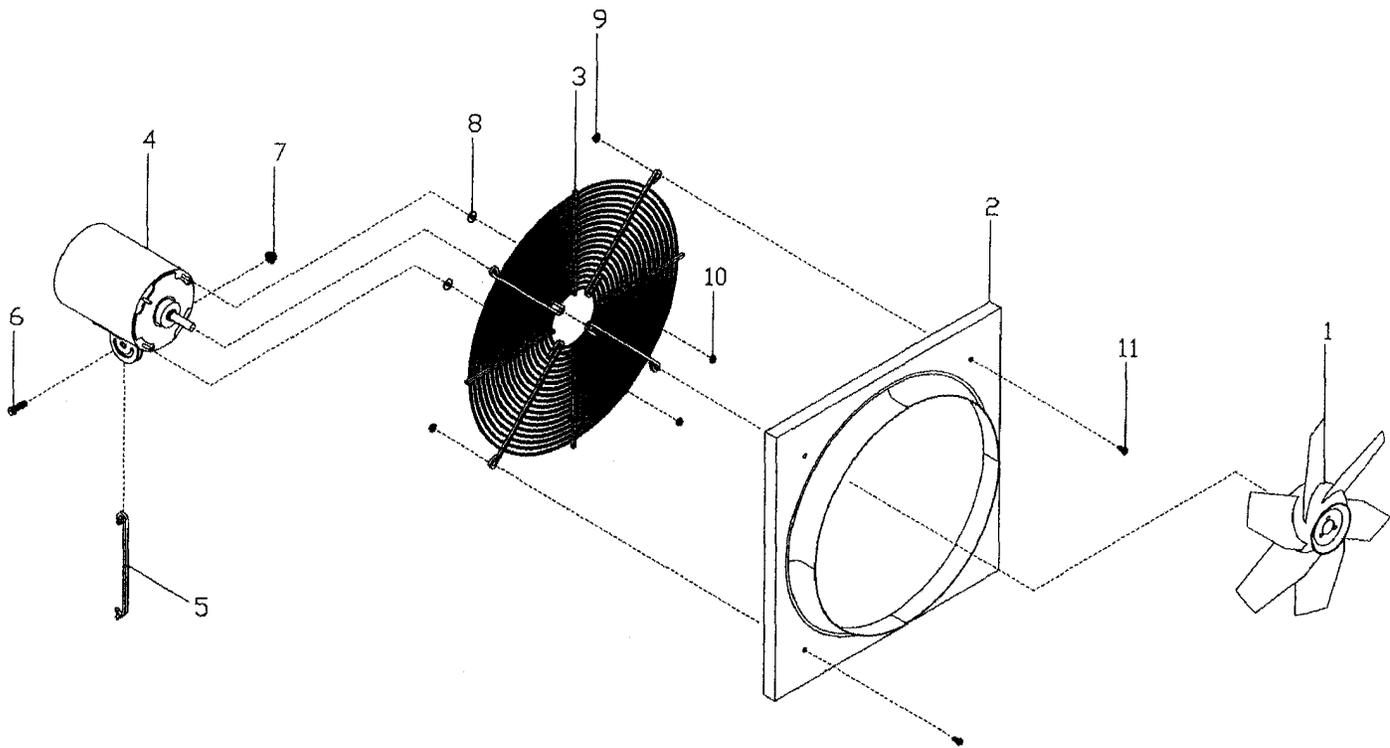


Figure 2 - Repair Parts Illustration

Ref. No.	Description	Part Numbers for Models								Qty.
		4YC81F	4C163F	4C164F	4C367F	4C127F	4C165F	4C059F	4C167F	
1	Prop	506524	506525	506526	506527	506528	506529	506530	506531	1
2	Orifice	506000	506001	506002	506003	506003	506003	506004	506004	1
3	Guard	993814	993815	993818	993819	993819	993819	993821	993821	1
4	Motor	994208G	994207G	994207G	994207G	994209G	994223G	994209G	994223G	1
5	Motor Support Strut	993813	993810	993810	993810	993810	993810	993811	993811	1
6	Hex Bolt	*	*	*	*	*	*	*	*	1
7	Washed Nut	*	*	*	*	*	*	*	*	1
8	Washer	*	*	*	*	*	*	*	*	4
9	Washed Nut	*	*	*	*	*	*	*	*	4
10	Washed Nut	*	*	*	*	*	*	*	*	4
11	Hex Bolt	*	*	*	*	*	*	*	*	4

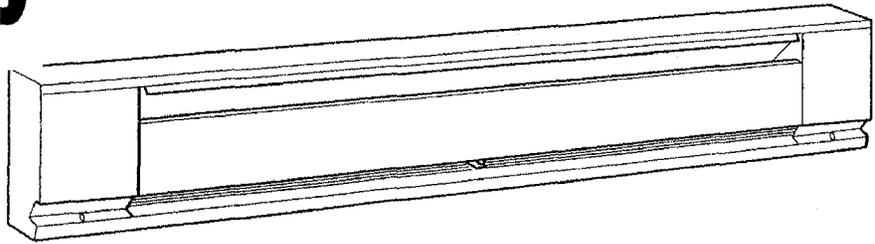
(*Standard hardware item available locally.



Marley
Engineered Products
An **SPX** Company



File #E37116



Electric Baseboard Heaters

1800, 2500, C1800 & C2500 Series

Installation & Maintenance Instructions

Dear Owner,

Congratulations! Thank you for purchasing this new heater manufactured by a division of Marley Engineered Products. You have made a wise investment selecting the highest quality product in the heating industry. Please carefully read the installation and maintenance instructions shown in this manual. You should enjoy years of efficient heating comfort with this product from Marley Engineered Products... the industry's leader in design, manufacturing, quality and service.

*... The Employees of
Marley Engineered Products*



WARNING

Read Carefully - This Instruction Sheet contains vital information for the proper installation, use, and efficient operation of the heater. Carefully read the manual before installation, operation, or cleaning of the heater. Failure to adhere to the instructions could result in fire, electric shock, death, serious personal injury, or property damage. Save these instructions and review frequently for continuing safe operation and instructing future users.

1. Keep all electrical cords, foam filled articles, drapes, bedding, and other household furnishings away from contact with heater. It is recommended all items be kept a minimum of six (6") inches (152mm) from heater.
2. Do not install baseboard heater below electrical convenience receptacles (outlets).
3. Do not install baseboard heater against vinyl wallpaper, paperboard or low density fiberboard surface. Do not install vinyl drapes or vinyl blinds above heater.
4. Do not recess heater in wall.
5. The installation must comply with applicable Local and National Electrical Codes and utility requirements.
6. Do not remove or by-pass thermal cutout.
7. To reduce the risk of fire, do not store or use gasoline or other flammable vapors and liquids in the vicinity of the heater.
8. Personal injury or death could result from electric shock. Disconnect all power to heater at main panel before attempting to install or service this heater.
9. Supply voltage must be the same as heater voltage. Check heater nameplate and supply voltage before energizing.
10. When using RSA Transformer Relay Accessory, supply wiring must be suitable for 90°C.

Heater Ampere Rating.

Residential Model No.	Commercial Model No.	120 Volt	208 Volt	240 Volt	277 Volt	347 Volt	600 Volt
2512 *	-	3.3	-	-	-	-	-
25126 *	C25126 *	4.2	-	-	-	-	-
2513 *	C2513 *	6.3	-	-	-	-	-
2514 *	C2514 *	8.3	-	-	-	-	-
2515 *	C2515 *	10.4	-	-	-	-	-
2516 *	C2516 *	12.5	-	-	-	-	-
2502 *	-	-	1.9	-	-	-	-
25026 *	C25026 *	-	2.4	-	-	-	-
2503 *	C2503 *	-	3.6	-	-	-	-
2504 *	C2504 *	-	4.8	-	-	-	-
2505 *	C2505 *	-	6.0	-	-	-	-
2506 *	C2506 *	-	7.2	-	-	-	-
2507 *	C2507 *	-	9.6	-	-	-	-
2508 *	C2508 *	-	8.4	-	-	-	-
25008 *	C25008 *	-	12.0	-	-	-	-
2542 *	-	-	1.4	1.7	-	-	-
25426 *	C25426 *	-	1.8	2.1	-	-	-
2543 *	C2543 *	-	2.7	3.1	-	-	-
2544 *	C2544 *	-	3.6	4.2	-	-	-
2545 *	C2545 *	-	4.5	5.2	-	-	-
2546 *	C2546 *	-	5.4	6.3	-	-	-
2547 *	C2547 *	-	6.3	7.3	-	-	-
2548 *	C2548 *	-	7.2	8.3	-	-	-
25408 *	C25408 *	-	8.7	10.4	-	-	-
2572 *	-	-	1.1	1.2	1.4	-	-
25726 *	C25726 *	-	1.4	1.6	1.8	-	-
2573 *	C2573 *	-	2.0	2.4	2.7	-	-
2574 *	C2574 *	-	2.7	3.1	3.6	-	-
2575 *	C2575 *	-	3.4	3.9	4.5	-	-
2576 *	C2576 *	-	4.1	4.7	5.4	-	-
2577 *	C2577 *	-	4.7	5.5	6.3	-	-
2578 *	C2578 *	-	5.4	6.3	7.2	-	-
25708 *	C25708 *	-	6.8	7.5	9.0	-	-
25326 *	C25326 *	-	-	-	-	1.4	-
2533 *	C2533 *	-	-	-	-	2.2	-
2534 *	C2534 *	-	-	-	-	2.9	-
2535 *	C2535 *	-	-	-	-	3.6	-
2536 *	C2536 *	-	-	-	-	4.3	-
2537 *	C2537 *	-	-	-	-	5.0	-
2538 *	C2538 *	-	-	-	-	5.8	-
25308 *	C25308 *	-	-	-	-	7.2	-
2530 *	C2530 *	-	-	-	-	7.2	-
2564 *	C2564 *	-	-	-	-	-	1.7
2565 *	C2565 *	-	-	-	-	-	2.1
2566 *	C2566 *	-	-	-	-	-	2.5
2567 *	C2567 *	-	-	-	-	-	2.9
2568 *	C2568 *	-	-	-	-	-	3.3
25608 *	C25608 *	-	-	-	-	-	4.2
2560 *	C2560 *	-	-	-	-	-	4.2

Followed by WC or NWC suffix

Total Amps	Minimum AWG. Wire Size (Copper)	Circuit Breaker or Fuse Size
0 thru 12	#14	15 amp
12.1 thru 16	#12	20 amp
16.1 thru 24	#10	30 amp

NET VOLUMES OF WIRING COMPARTMENT		
DESCRIPTION	CUBIC INCHES	CUBIC CENTIMETERS
Heater Only (Each Wiring Compartment)	14.96	241
Heater W/SP Thermostat	11.18	180
Heater W/DP Thermostat	11.18	180
Heater W/Heat-Cool Switch Receptacle	9.51	153
Heater W/Duplex Receptacle	11.18	180
Heater W/DP Disconnect Switch	11.18	180
Heater W/Power Relay	10.76	174
Heater W/Transformer Relay	2.93	47

This Heater is designed to provide years of efficient, trouble free operation as a primary or supplementary heat source for residential and commercial applications. Baseboard heaters must be thermostatically controlled for efficient, safe operation. A thermostat is not provided with this heater. However, a single or double

pole thermostat accessory is available for installation into this heater at your place of purchase, or the heater may be connected to any suitable wall mounted thermostat that will meet the electrical load requirements. Installation or use of this product in any manner not described herein will void the warranty and could result in injury, damage to property, or permanent damage to heater.

UNPACKING HEATER

Check heater to make sure it has not been damaged in shipping. Do not install or attempt to operate the heater if damaged. Return to place of purchase or file claim with freight carrier.

NOTICE TO OWNERS

Certain fabrics discolor in time from indirect sunlight and normal room temperature - mostly organic and synthetic material. They will discolor more rapidly when exposed to direct sunlight and warm currents. Hang drapes to provide minimum of 2 in. (51mm) air space between heater front and nearest drape fold as shown in Example 1 Figure 1, or 6 in. (153mm) airspace between top of heater and bottom of drapes as shown in Example 2, Figure 1. Allow minimum clearance of 1 in. (26mm) from drapes to ceiling and to top of floor covering to permit air circulation as shown in Example 1, Figure 1.

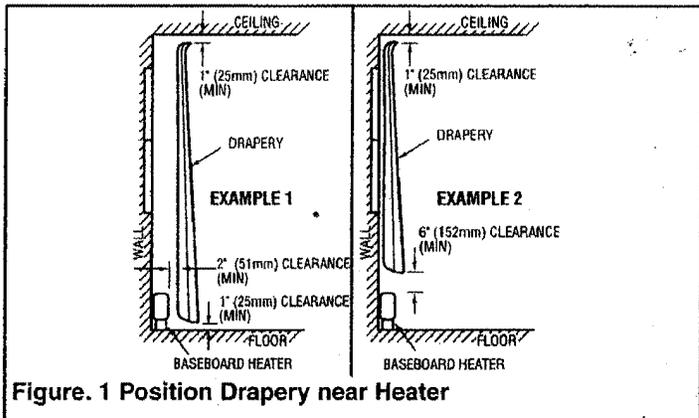


Figure. 1 Position Drapery near Heater

INSTALLATION

FLOORS & CARPETING:

Heaters may be mounted directly on any floor surface, including carpeting. Where wall-to-wall carpets are installed after the baseboard installation, the carpeting can be run up to the front and around the heater body, providing it does not obstruct air flow. (Maximum 3/4" (19mm) thick).

1. Remove wiring compartment cover at end of heater where power supply cable is to enter. Determine desired mounting location (Figure 2), position heater to wall as intended and mark wall (or floor) at location where power supply is to enter heater.

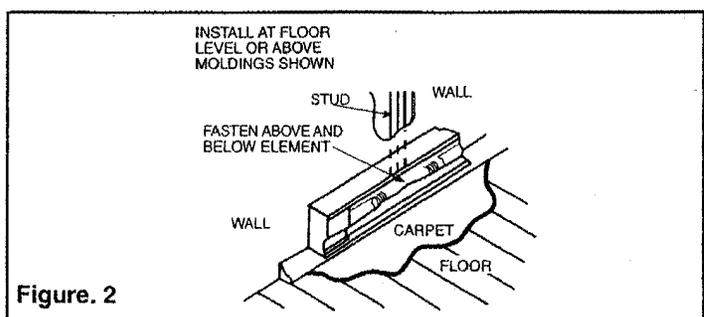


Figure. 2

NOTE: Make sure the caution label with the word "TOP" is at the top of the heater. For most efficient operation locate heaters along outside wall under windows. Position heater so it can be secured to wall stud. Power cable must enter heater through one of the knockouts provided in wiring compartment. See Figure 3.

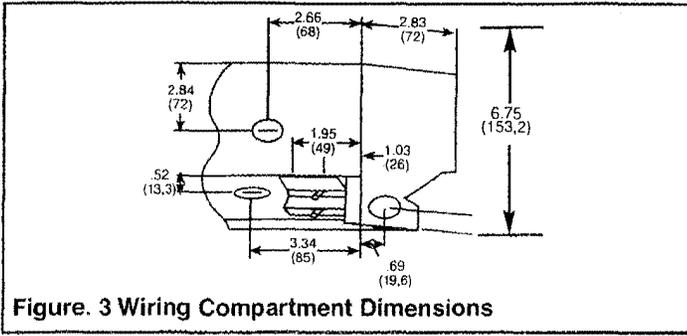


Figure 3 Wiring Compartment Dimensions

2. Drill hole in wall (or floor) at desired location for power supply entry. Install power supply wiring to heater and thermostat location as determined by thermostat option selected. Allow approximately 10 to 12in(254mm to 305mm) of wire at heater for connections.
3. If any other Marley accessories are to be used with this heater, refer to installation instructions provided with the accessory for proper installation and wiring.
4. Wireway Cover - Commercial Baseboard Only
 - a. The wireway cover is a factory installed feature of Marley commercial baseboard heaters. Two cables or four individual conductors plus two ground wires may be routed through the wireway. Refer to page 2 for maximum current loads.
 - b. To gain access to wireway, lay heater face down and remove two screws as shown in Figure 4. Remove the knockouts in the channel areas of both terminal boxes.
 - c. Insert the plastic bushings from the parts kit (in wiring compartment) in the knockout holes.
 - d. Wire heater according to Figure 5. Reattach the wireway cover using the two screws.
5. Loosen screw in built-in cable clamp or remove desired knockout from heater wiring compartment (Figures 3 and 4). Install power cable into wiring compartment allowing at least 6in(153mm) of cable for connection to heater. To install two power cables using the built-in cable clamp, bend tab covering second hole up and back to rear wall of wiring compartment. If built-in cable clamp is not used, install approved cable connector (not included) in desired knockout.
6. Position heater to wall (use cross stamped perforations as a guide, see Figure 4) and secure through the top row of predrilled mounting holes using at least two fasteners, one at each end of the heater. If the unit is mounted above the floor to allow carpet installation under the heater, two additional mounting holes are supplied at each end below the element. This will allow you to screw into the sill plate if the unit does not span across two wall studs.

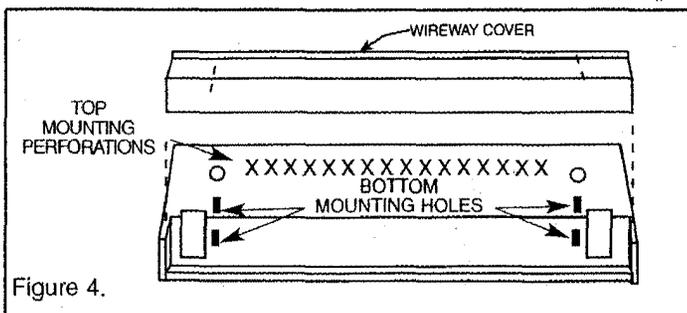


Figure 4.

! **CAUTION** !

When using bottom mounting holes, (to prevent a possible shock or fire hazard,) make sure you do not drive the screws through or damage the power supply wire.

7. Connect the supply cable grounding wire to the bare copper pigtail in wiring compartment.
8. After making sure the electrical power coming to the heater is turned off at main switch panel follow the desired wiring diagram, as shown in Figure 5, to connect the power supply to the heater using approved wire nuts.

! **WARNING**

To prevent a possible fire, make sure all wire connections are tight.

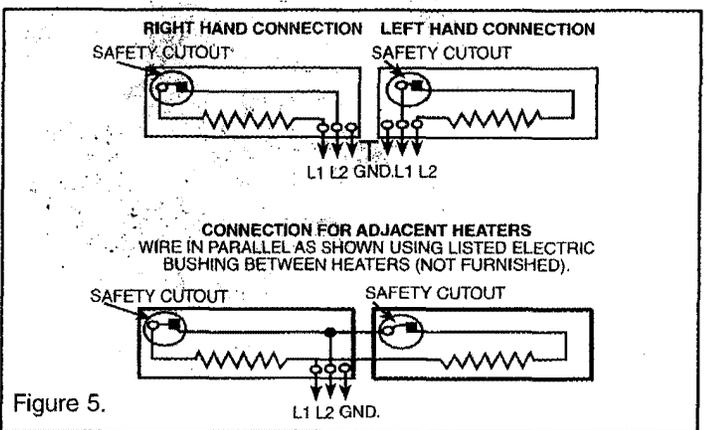


Figure 5.

- NOTE:** When accessories are installed, use wiring diagram supplied with the accessory.
9. If front cover was removed, reinstall by hooking the top edge on the support bracket(s). Then push down to latch onto the support bracket(s).
 10. Replace wiring compartment cover.
 11. Follow instructions accompanying thermostat for installation and wiring thermostat. See Figure 6 for typical thermostat wiring diagrams.

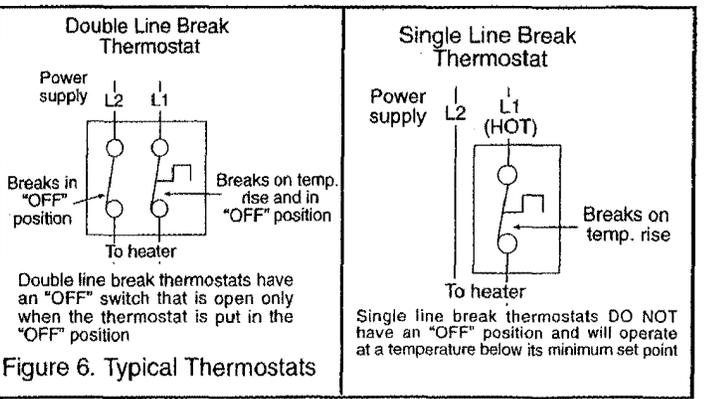


Figure 6. Typical Thermostats

OPERATION

1. After the baseboard system has been completely installed, all thermostats should be turned to LOW or NO HEAT. Then turn on breakers. Wait 3 to 5 minutes and check to see that none of the heaters are operating. If operating, disconnect power and check wiring. If none are operating then turn thermostats to highest position and wait 3 to 5 minutes. Check to see that all heater(s) are operating. Should any not be operating, disconnect power and check wiring.
2. Allow entire system to operate steadily for 1/2 hour. This should remove oily residue from manufacturing. (Some smoking may occur).
3. Select the setting for comfort on all thermostats.

CLEANING

Because of the convection heating principle which depends on air circulation through the finned element, dust will collect between the fins. The heater should be cleaned regularly for maximum efficiency. Before cleaning be sure the heater is off and the element is cool. A vacuum cleaner with a brush attachment may be used for cleaning. The finish of the heater may be cleaned with a slightly damp rag if desired.

PAINTING

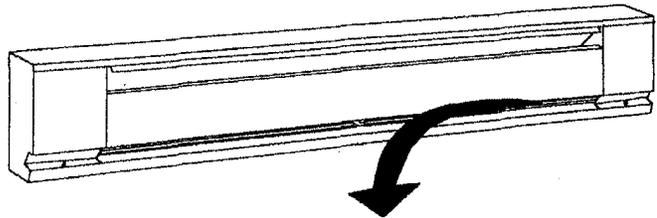
Painting of this baseboard is not necessary unless to match room decor. To paint, first rough up the exterior with steel wool. Paint only the exterior of the cabinet. Do not allow paint on the element and high limit capillary tube. Use a high quality enamel paint.

HOW TO ORDER REPAIR PARTS

In order to obtain any needed repair or replacement parts, warranty service or technical information, please contact Marley Engineered Products Service Center toll-free by calling 1-800-642-HEAT.

When ordering repair parts, always give the information listed as follows:

1. The Part Number
2. The Model Number
3. The Part Description
4. Date of Manufacture



NAMEPLATE

MODEL NO. **C2570WC** DATE CODE **1294**

VOLTS AC **60HZ** WATTS **AMPS**

277/240/208 **2500/1900/1450**

9.1/8.0/7.0



54E1 LISTED
BASEBOARD HEATER

MARLEY ENGINEERED PRODUCTS
BENNETTSVILLE, SC 29512

PATENT PENDING
4104-2109-265

LIMITED WARRANTY

All products manufactured by Marley Engineered Products are warranted against defects in workmanship and materials for one year from date of installation, except heating elements which are warranted against defects in workmanship and materials for ten years from date of installation. This warranty does not apply to damage from accident, misuse, or alteration; nor where the connected voltage is more than 5% above the nameplate voltage; nor to equipment improperly installed or wired or maintained in violation of the product's installation instructions. All claims for warranty work must be accompanied by proof of the date of installation.

The customer shall be responsible for all costs incurred in the removal or reinstallation of products, including labor costs, and shipping costs incurred to return products to Marley Engineered Products Service Center. Within the limitations of this warranty, inoperative units should be returned to the nearest Marley authorized service center or the Marley Engineered Products Service Center, and we will repair or replace, at our option, at no charge to you with return freight paid by Marley. It is agreed that such repair or replacement is the exclusive remedy available from Marley Engineered Products.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESAID EXPRESSED WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS AGREEMENT. MARLEY ENGINEERED PRODUCTS SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES ARISING WITH RESPECT TO THE PRODUCT, WHETHER BASED UPON NEGLIGENCE, TORT, STRICT LIABILITY, OR CONTRACT.

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

For the address of your nearest authorized service center, contact Marley Engineered Products in Bennettsville, SC, at 1-800-642-4328. Merchandise returned to the factory must be accompanied by a return authorization and service identification tag, both available from Marley Engineered Products. When requesting return authorization, include all catalog numbers shown on the products.



Marley
Engineered Products

An **SPX** Company

470 Beauty Spot Rd. East
Bennettsville, SC 29512 USA

ECR

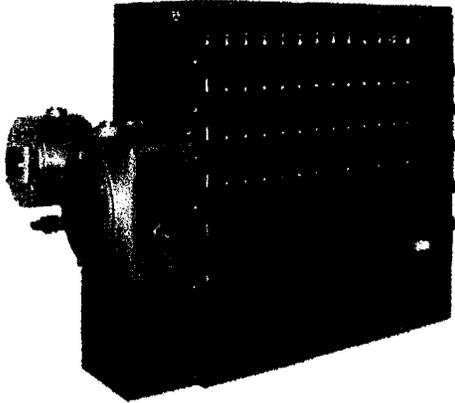
35194

3-02

4

HAZARDOUS LOCATION FAN FORCED UNIT HEATER

FOR CLASS I, GROUP C & D, DIVISION 1 & 2 AND CLASS II, GROUPS E, F & G, DIVISIONS 1 & 2.

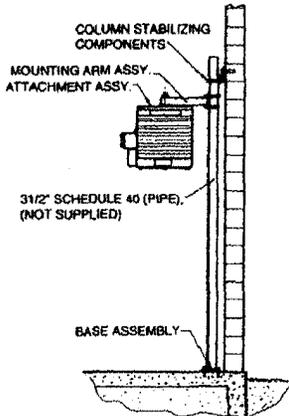


Designed for rugged industrial applications in hazardous locations where the possibility of explosion or fire exists due to the presence of certain flammable gases, vapors, powdered metals or dust.

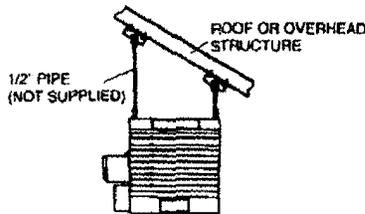
- Permanently sealed, liquid to air, finned tube heat exchanger core.
- Ethylene Glycol to water mixture uses a heat transfer fluid in the heater core, providing -49° F. (-45° C) freeze damage protection.
- Manual Reset capillary type high limit provides high temperature regulation and is rated for 6,000 cycles of service.
- 24v transformer and contactor.
- Pressure relief valve with cintered metal mesh flame arrestor.
- 14 ga. steel cabinet with epoxy powder coated finish contains heater core, motor, and fan assembly.
- Narrow gap safety fan guard shields all moving parts.
- Adjustable louvers allow directional control of air flow.
- Box lugs furnished for field connections within an approved enclosure.
- Units can not be operated in room ambients exceeding 104° F (40° C).



Unit shown with optional disconnect, thermostat and pilot light



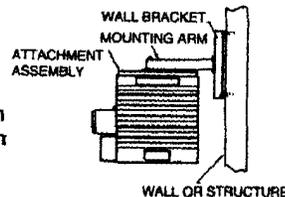
HLPM
Pipe Mounting Kit
Particularly useful in buildings with insufficient strength to use other types of mounts. Requires 3 1/2" pipe (4" O.D. - not supplied).



HLHM
Hanging Mounting Kit
Simple and economical if adequate overhead structure exists. Requires 1/2" pipe, cut and threaded (not supplied).

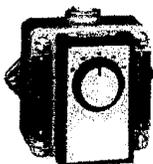
OPTIONAL MOUNTING BRACKET KITS			
UPC	MODEL	USE WITH HEATERS	WT. (LBS.)
686334			
734288	HLPM37	3.0 kW - 7.5 kW	37
734295	HLPM1015	10.0 kW	38
734301	HLPM1525	15.0 kW - 25.0 kW	40
734318	HLHM	ALL	5
734325	HLWM37	3.0 kW - 7.5 kW	27
734332	HLWM10	10.0 kW	28
734349	HLWM1525	15.0 kW - 25.0 kW	29

HLWM
Wall Mounting Kit
Ideal for use in buildings that have substantial walls. Arm can also be bolted directly to structural steel.



FACTORY INSTALLED ACCESSORIES

SUFFIX	DESCRIPTION
T	In-Built single pole thermostat 50° - 90° F
120	Control transformer w/ primary fusing (Delete 24 suffix - add 120)
208	208/240V Control available on 208/240V units (Delete 24 suffix and add 208 OR 240)
240	
D	Disconnect Switch
P	Pilot Light



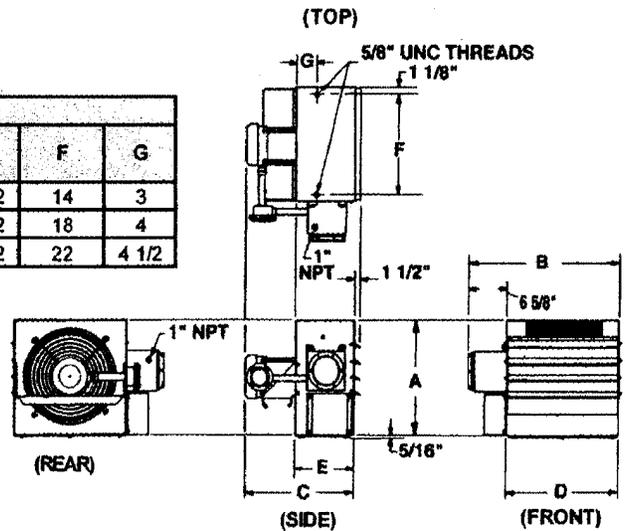
HAZARDOUS LOCATION WALL THERMOSTAT			
UPC	MODEL NUMBER	DESCRIPTION	WT. (LBS.)
686334			
538107	EPETD8S	Single Pole	5
538077	EPETD8D	Double Pole	5

Dimensions: Height 5 5/8", Width 6 3/8", Depth 4 1/2"
 Range: 50° - 90° F
 Motor Rating: 1 1/2 HP @ 250V (full load)
Heater Loading
 Rating: 22A @ 125-277VAC; 125VA @ 24VAC
 Rated: Class I Group C & D, Class II Group E, F, G
 Thermostat is not rated for use in Group B environments.

HAZARDOUS LOCATION FAN FORCED UNIT HEATER

UPC 686334	MODEL	KW	BTU's	VOLTS	PH	AMPS	Control Voltage	Temp Rise °F	Air Throw	CFM	Recom'd Mounting Ht.	WT.
734356	HLA 12-208160-3.0-24	3	10250	208	1	16.3	24	16.5			8'	167 lb.
734004	HLA 12-208360-3.0-24			208	3	9.8						
734011	HLA 12-240160-3.0-24			240	1	14.8						
734028	HLA 12-240360-3.0-24			240	3	8.6						
734035	HLA 12-480360-3.0-24			480	3	4.3						
734042	HLA 12-600360-3.0-24			600	3	3.5						
734363	HLA 12-208160-5.0-24	5	17100	208	1	26		27.6	24'	580	8'	167 lb.
734059	HLA 12-208360-5.0-24			208	3	15.4						
734066	HLA 12-240160-5.0-24			240	1	23.1						
734073	HLA 12-240360-5.0-24			240	3	13.4						
734080	HLA 12-480360-5.0-24			480	3	6.7						
734097	HLA 12-600360-5.0-24			600	3	5.4						
734370	HLA 12-208160-7.5-24	7.5	25600	208	1	38		41.4			8'	167 lb.
734103	HLA 12-208360-7.5-24			208	3	22.3						
734110	HLA 12-240160-7.5-24			240	1	33.6						
734127	HLA 12-240360-7.5-24			240	3	19.4						
734134	HLA 12-480360-7.5-24			480	3	9.7						
734141	HLA 12-600360-7.5-24			600	3	7.8						
734158	HLA 16-208360-10.0-24	10	34150	208	3	29.3		21.7	40'	1500	10'	193 lb.
734165	HLA 16-240160-10.0-24			240	1	44						
734172	HLA 16-240360-10.0-24			240	3	25.5						
734189	HLA 16-480360-10.0-24			480	3	12.7						
734196	HLA 16-600360-10.0-24			600	3	10.2						
734202	HLA 20-208360-15.0-24	15	51200	208	3	43.5		19.2			13'	193 lb.
734219	HLA 20-240360-15.0-24			240	3	38.1						
734226	HLA 20-480360-15.0-24			480	3	19						
734233	HLA 20-600360-15.0-24			600	3	15.2						
734240	HLA 20-480360-20.0-24	20	68300	480	3	25.1	26.2	43'	2450	13'	225 lb.	
734257	HLA 20-600360-20.0-24			600	3	20						
734264	HLA 20-480360-25.0-24			480	3	31.1						
734271	HLA 20-600360-25.0-24	25	85400	600	3	24.9	32.8			13'	225 lb.	

PHYSICAL DIMENSIONS								
MODEL	A	B	C		D	E	F	G
			3 ph.	1 ph.				
HLA 12	17 3/4	22 3/8	19 3/4	20 5/8	16 1/4	10 1/2	14	3
HLA 16	20 3/4	26 3/8	20 3/4	21 5/8	20 1/4	11 1/2	18	4
HLA 20	24 3/4	30 3/8	22 1/2	N/A	24 1/4	12 1/2	22	4 1/2



McMaster Carr #
Model - 1799-K16



COOK

Propeller Wall

Propeller Wall Fans

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

This publication contains the installation, operation and maintenance procedures for standard units of the *Propeller Wall* and *X.Stream- Propeller Wall Fans*.

- APD
- SPB
- EWBSM
- SWDS
- XLW/XMW/XLWS/XMWS
- XLP/XMP/XLPS/XMPS
- XLWHS/XMWHS
- XLWH/XMWH
- XLPH/XMPH
- APB
- AWBS/AWBE
- SPD
- EWB
- EWD
- EPB
- EPD
- SWD
- XLPHS/XMPHS

Carefully read this publication prior to any installation or maintenance procedure.

Loren Cook catalog, *Propeller Wall* and *X.Stream*, provides additional information describing the equipment, fan performance, available accessories and specification data.

For additional safety information, refer to AMCA publication 410-96, *Safety Practices for Users and Installers of Industrial and Commercial Fans*.

All of the publications listed above can be obtained from Loren Cook Company by phoning 417.869.6474, extension 166; by FAX at 417.832.9431; or by e-mail at info@loren-cook.com.

For information and instructions on special equipment, contact Loren Cook Company at 417.869.6474.

Receiving and Inspection

Carefully inspect the fan and accessories for any damage and shortage immediately upon receipt of the fan.

- Turn the propeller by hand to ensure it turns freely and does not bind.
- Record on the *Delivery Receipt* any visible sign of damage.

Handling

Lift propeller wall fans by attachment to the power assembly or by the shipping carton. Never lift by the shaft, motor or housing.

Storage

If the fan is stored for any length of time prior to installation, coat the shaft with grease or a rust preventative compound. Store it in its original shipping crate and protect it from dust, debris and the weather.

Rotate the wheel several revolutions every three to five days to keep a coating of grease on all internal bearing parts.

WARNING

This unit has rotating parts. Safety precautions should be exercised at all times during installation, operation, and maintenance. ALWAYS disconnect power prior to working on fan.

size than fans mounted in wall collars or wall housings. For specific dimensions, refer to the submittal drawing for the specific fan type.

Motor Installation

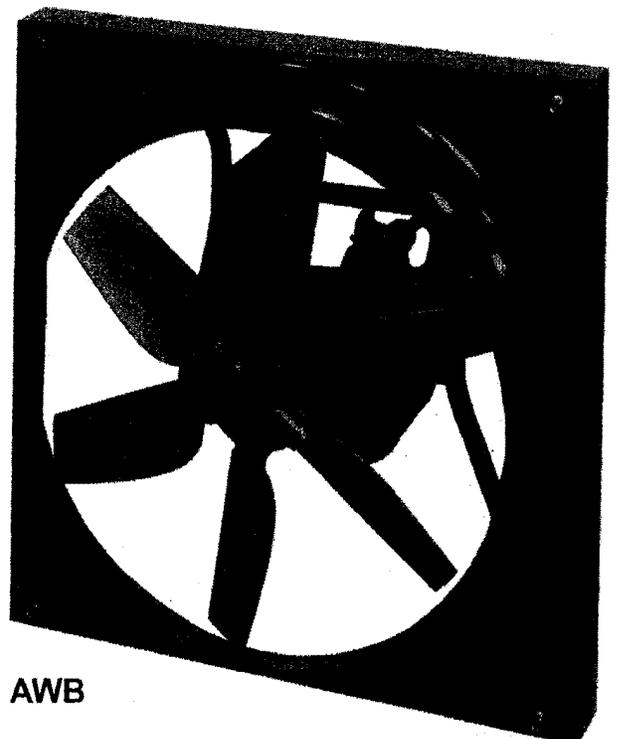
To prevent damage to the fan during shipping, motors 5 HP and larger, and extremely heavy motors (cast iron or severe duty) are shipped loose and must be field mounted by bolting the motor on the motor mounting plate in the existing slots.

The motor should be mounted in order that the motor plate is between the fan shaft and the motor shaft.

- a. Remove the motor plate mounting bolts and motor plate.
- b. Remove the motor mounting bolts from the motor plate.
- c. Mount the motor to the motor plate aligning the appropriate holes.
- d. Place the motor plate on the power assembly and reinstall the mounting bolts.

Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.



AWB

Installation

Fans mounted to a wall require a different wall opening

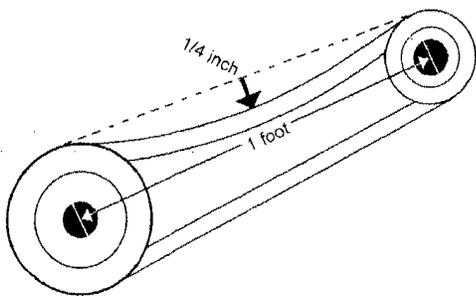


Figure 1

Belt and Pulley Installation

Belt tension is determined by the sound of the belts when the fan is first started. The belts will produce a loud squeal, which dissipates after the fan is operating at full capacity. If belt tension is too tight or too loose, lost efficiency and damage can occur.

Do not change the pulley pitch diameter to change tension. The change will result in a different fan speed.

- Loosen the motor plate adjustment nuts on motor base and move motor plate in order that the belts can easily slip into the grooves on the pulleys. Never pry, roll, or force the belts over the rim of the pulley.
- Adjust the motor plate until proper tension is reached. For proper tension, a deflection of approximately 1/4" per foot of center distance should be obtained by firmly pressing the belt. Refer to Figure 1.
- Lock the motor plate adjustment nuts in place.
- Ensure pulleys are properly aligned. Refer to Figure 2.

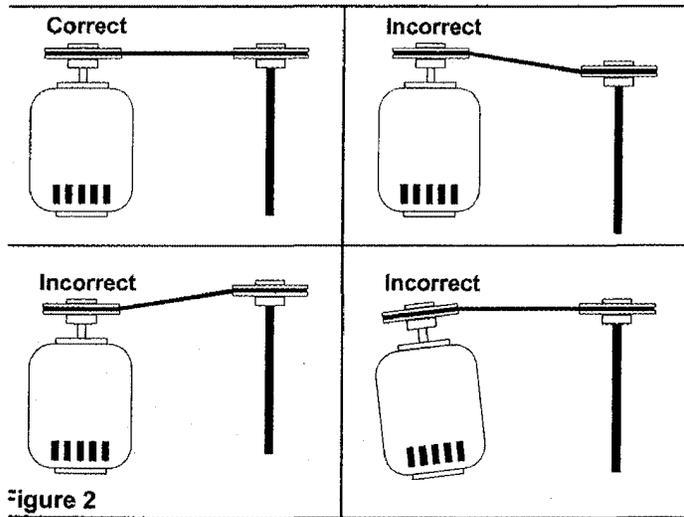


Figure 2

Pulley Alignment

Pulley alignment is adjusted by loosening the motor pulley setscrew and by moving the motor pulley on the motor shaft by moving the entire motor along the motor mounting racket.

Figure 2 illustrates correct and incorrect pulley alignment. The recommended method of inspecting the pulley alignment is shown in Figure 3. With the shorter leg of a carpenter's square or other straight edge lying along the case of the motor, adjust the position of the motor pulley (or the motor) until the longer leg of the square is parallel to the belt.

Final Installation

Insert the fan into the wall opening and secure with lag screws, anchor bolts, or other suitable fasteners.

Always mount belt drive wall fans in order that the motor base is below the fan shaft.

Wiring Installation

All wiring should be in accordance with local ordinances and the National Electrical Code, NFPA 70. Ensure the power supply (voltage, frequency, and current carrying capacity of wires) is in accordance with the motor nameplate. Refer to the *Wiring Diagrams*, next page.

Lock off all power sources before unit is wired to power source.

Leave enough slack in the wiring to allow for motor movement when adjusting belt tension. Some fractional motors have to be removed in order to make the connection with the terminal box at the end of the motor.

Personal Safety

Disconnect switches are recommended. Place the disconnect switch near the fan in order that the power can be swiftly cut off in case of an emergency, and in order that maintenance personnel are provided complete control of the power source.

Follow the wiring diagram in the disconnect switch and the wiring diagram provided with the motor. Correctly label the circuit on the main power box and always identify a closed switch to promote safety (i.e., red tape over a closed switch).

Wall Fans

- Extend wires to the fan.
- Prevent excess wire from entering the shaft and propeller area by restraining the excess wire to a point outside the base.

Wall Fans with Wire Guard

- Remove end panel from the wire guard to gain access to the motor.
- Extend wires through a side panel of the wire guard to gain access to the motor.
- Prevent excess wire from entering the shaft and propeller area by restraining the excess wire to a point outside the base.

Wall Fans with Wall Housing

- Remove end guard from the wall housing.
- Drill a hole through either side panel at a convenient location and pull the wires through. Do not pull wires through wire guard at the back panel.
- Restrain the incoming wire at the side panel to prevent excess wire from entering the shaft and propeller area.

Shutter Installation

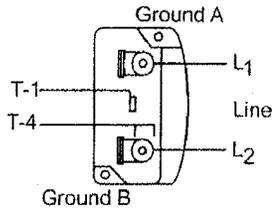
If your fan is supplied with a shutter, follow the direction below. If your fan is not supplied with a shutter, proceed to *Final Installation Steps*.

To ensure long-life, make a weather-proof seal by using a good quality silicon caulking under the shutter flange.

- Place the shutter into the wall opening.
- Mount the shutter to the supporting surface using Num-

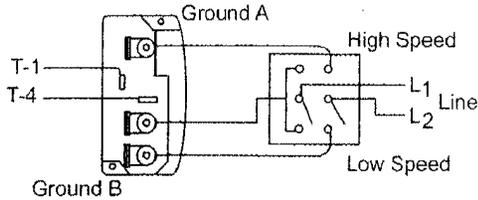
Wiring Diagrams

Single Speed, Single Phase Motor



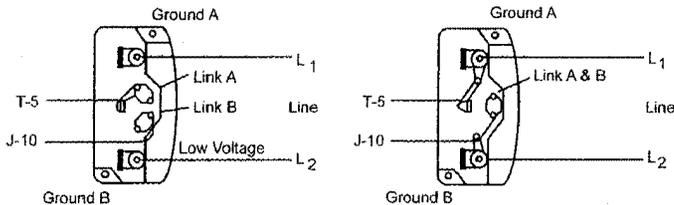
When ground is required, attach to ground A or B with no. 6 thread forming screw. To reverse, interchange T-1 and T-4.

2 Speed, 2 Winding, Single Phase Motor



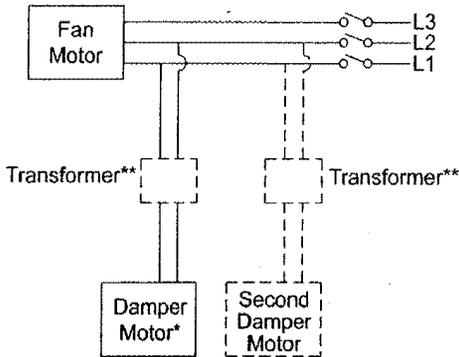
When ground required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-1 and T-4 leads.

Single Speed, Single Phase, Dual Voltage



When ground required, attach to ground A or B with No. 6 thread forming screw. To reverse, interchange T-5 and J-10 leads.

Typical Damper Motor Schematic



- Mount the shutter to the supporting surface using Number 12 sheet metal screws on six inch centers around the perimeter.
- Manually operate the shutter to ensure the blades move freely.

Typical Installation

Refer to page 5.

Final Installation Steps

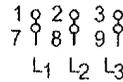
- Inspect fasteners and setscrews, particularly fan mounting and bearing fasteners, and tighten according to the recommended torque shown in the table on page 4, *Recommended Torque for Setscrews/Bolts*.
- Inspect for correct voltage with voltmeter.
- Ensure all accessories are installed.
- Test the fan to be sure the rotation is the same as indicated by the arrow marked **Rotation**.

Wiring Diagrams

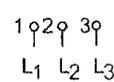
3 Phase, 9 Lead Motor

3 Phase, 9 Lead Motor Y-Connection

Low Voltage
208/230 Volts

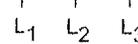


High Voltage
460 Volts

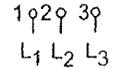


3 Phase, 9 Lead Motor Delta-Connection

Low Voltage
208/230 Volts

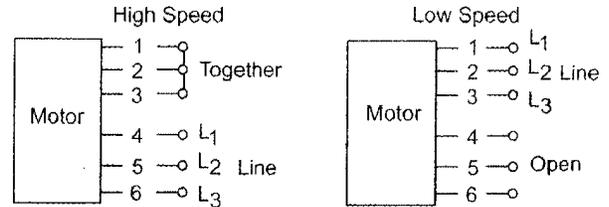


High Voltage
460 Volts



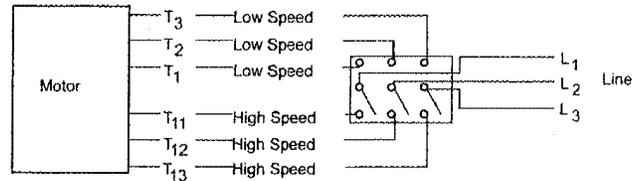
To reverse, interchange any 2 line leads.

2 Speed, 1 Winding, 3 Phase Motor



To reverse, interchange any 2 line leads. Motors require magnetic control.

2 Speed, 2 Winding, 3 Phase



To reverse: High Speed-interchange leads T₁₁ and T₁₂. Low Speed-interchange leads T₁ and T₂. Both Speeds-interchange any 2 line leads.

For 3 phase, damper motor voltage should be the same between L₁ and L₂. For single phase application, disregard L₃. *Damper motors may be available in 115, 230 and 460 volt models. The damper motor nameplate voltage should be verified prior to connection. **A transformer may be provided in some installations to correct the damper motor voltage to the specified voltage.

Do not allow the fan to run in the wrong direction. This will overheat the motor and cause serious damage. For 3-phase motors, if the fan is running in the wrong direction, check the control switch. It is possible to interchange two leads at this location so that the fan is operating in the correct direction.

Operation

Pre-Start Checks

- Lock out all the primary and secondary power sources.
- Inspect fasteners and setscrews, particularly those used for mounting the unit, and tighten if necessary.
- Inspect belt tension and pulley alignment. (Remember, if belt tension is correct, a loud squeal occurs as the fan increases to full power.)
- Inspect motor wiring.
- Ensure the belt touches only the pulleys.
- Rotate the prop to ensure it does not rub against the venturi.

- g. Ensure fan and ductwork are clean and free of debris.
- h. Test the fan to ensure the rotation of the propeller is the same as indicated by the rotation label.
- i. Close and secure all access doors.
- j. Restore power to unit.

Start Up

Turn the fan on. In variable speed units, set the fan to its lowest speed. Inspect for the following:

- Direction of rotation.
- Excessive vibration.
- Unusual noise.
- Bearing noise.
- Improper belt alignment or tension (listen for a continuous squealing noise).
- Improper motor amperage or voltage.

If a problem is discovered, immediately shut off the fan. Lock out all electrical power and check for the cause of the trouble. Refer to *Troubleshooting*, page 7.

Recommended Torque for Setscrews/Bolts (IN/LB.)

Setscrews				Hold Down Bolts	
Size	Key Hex Across Flats	Recommended Torque Inch-lbs.		Size	Wrench Torque (inch-lbs)
		Min.	Max.		
No.10	3/32"	28	33	3/8"-16	240
1/4"	1/8"	66	80	1/2"-13	600
5/16"	5/32"	126	156	5/8"-11	1200
3/8"	3/16"	228	275	3/4"-10	2100
7/16"	7/32"	348	384	7/8"-9	2040
1/2"	1/4"	504	600	1"-8	3000
5/8"	5/16"	1104	1200	1-1/8"-7	4200
3/4"	3/8"	1440	1800	1-1/4"-7	6000

Inspection

Inspection of the fan should be conducted at the first **30 minute, 8 hour and 24 hour** intervals of satisfactory operation. During the inspections, stop the fan and inspect as per directions below.

30 Minute Interval

Inspect bolts, setscrews, and motor mounting bolts. Adjust and tighten as necessary.

8 Hour Interval

Inspect belt alignment and tension. Adjust and tighten as necessary.

24 Hour Interval

Inspect belt tension. Adjust and tighten as necessary.

Maintenance

Establish a schedule for inspecting all parts of the fan. The frequency of inspection depends on the operating conditions and location of the fan.

Inspect fans exhausting corrosive or contaminated air within the first month of operation. Fans exhausting contaminated air (airborne abrasives) should be inspected every three months. Clean the propeller and air inlets if material build-up is excessive. Excessive build-up can cause imbalance and failure of the propeller.

Regular inspections are recommended for fans exhausting non-contaminated air.

It is recommended the following inspections be conducted twice per year.

- Inspect bolts and setscrews for tightness. Tighten as necessary.

- Inspect belt wear and alignment. Replace worn belts with new belts and adjust alignment as needed. See *Belt and Pulley Installation*, on page 2.
- Bearings should be inspected as recommended in the *Conditions Chart*, below.
- Inspect for cleanliness. Clean exterior surfaces only. Removing dust and grease on motor housing assures proper motor cooling.

Lubricants

Loren Cook Company uses petroleum lubricant in a lithium base conforming to NLGI grade 2 consistency. Other grades of grease should not be used unless the bearings and lines have been flushed clean. If another grade of grease is used, it should be lithium-based.

A NLGI grade 2 grease is a light viscosity, low-torque, rust-inhibiting lubricant that is water resistant. Its temperature range is from -30°F to +200°F and capable of intermittent highs of +250°F.

Motor Bearings

Motor bearings are pre-lubricated and sealed. Under normal conditions they will not require further maintenance for a period of ten years. However, it is advisable to have your maintenance department remove and disassemble the motor, and lubricate the bearings after three years of operation in excessive heat and or in a contaminated airstream consisting of airborne abrasives.

Conditions Chart

RPM	Temperature	Fan Status	Greasing Interval
Up to 100	Up to 120°F	Clean	6 to 12 months
Up to 500	Up to 150°F	Clean	2 to 6 months
Up to 1000	Up to 210°F	Clean	2 weeks to 2 months
Up to 1500	Over 210°F	Clean	Weekly
Any Speed	Up to 150°F	Dirty	1 week to 1 month
Any Speed	Over 150°F	Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Very Dirty	Daily to 2 weeks
Any Speed	Any Temperature	Extreme Conditions	Daily to 2 weeks

Fan Bearings

Greasable fan bearings are lubricated through a grease connector and should be lubricated by the schedule, *Conditions Chart*, on page 4.

For best results, lubricate the bearing while the fan is rotating. Slowly pump grease into the bearing until a slight bead forms around the bearing seals. Excessive grease can burst seals thus reduce bearing life.

In the event the bearing cannot be seen, use no more than three injections with a hand-operated grease gun.

Motor Services

Should the motor prove defective within a one-year period, contact your local Loren Cook representative or your nearest authorized electric motor service representative.

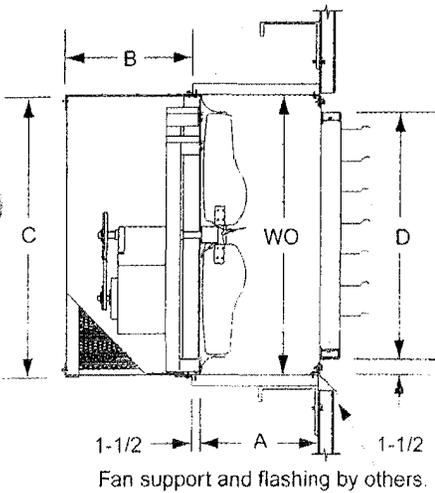
Changing Shaft Speed

All belt driven Propeller Wall fans with motors up to and including 5HP are equipped with variable pitch pulleys. To change the fan speed, perform the following:

- a. Loosen setscrew on driver (motor) pulley and remove key, if equipped.

Exhaust wall fan with OSHA wire guard and shutter

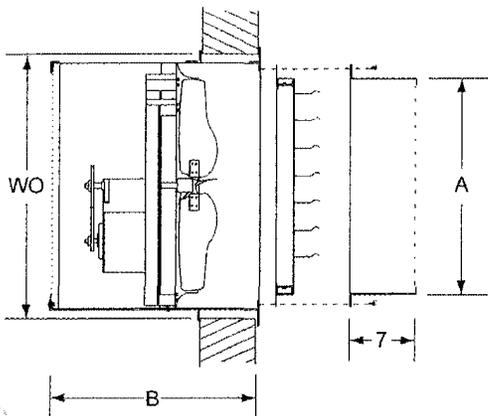
Illustrated is the typical installation of an exhaust wall fan with an OSHA wire guard and shutter in a steel structure with corrugated siding. The installer will provide a sleeve of suitable material to support the fan at a correct distance from the shutter (minimum distance is the "A" dimension).



AWB, AWD, SWD	XLW, XLWH, XMW, XMWH	EWB, EWD	A	B	C	D	E	WO	
								Std. Fan	Wire Gd.
8	-	-	11	13	12-3/4	10	1	12-1/2	13-1/4
10-12	-	-	12	13	16-3/4	14	1	16-7/16	17-1/4
14-16	-	-	12	13	20-3/4	18	1	20-7/16	21-1/4
18-20	-	-	13	12	24-3/4	22	1	24-7/16	25-1/4
-	20	-	13	21	24-3/4	22	1	24-7/16	25-1/4
24	-	-	15	21	30-3/4	27	1-1/2	30-7/16	31-1/4
-	24	-	15	13	30-3/4	27	1-1/2	30-7/16	31-1/4
30	30	24	16	21	36-3/4	33	1-1/2	36-7/16	37-1/4
36	36	30	16	21	42-3/4	39	1-1/2	42-7/16	43-1/4
42	42	36	17	26	48-7/8	45	1-1/2	48-7/16	49-1/4
48	48	42	17	26	54-7/8	51	1-1/2	54-7/16	55-5/16
-	54	48	17	28	60-7/8	57	1-1/2	60-7/16	61-5/16
-	60	54	17	28	66-7/8	63	1-1/2	66-7/16	67-1/2
-	-	60	17	28	72-7/8	69	1-1/2	72-7/16	73-1/2
-	-	72	17	31	84-7/8	81	1-1/2	84-7/16	85-1/2

Exhaust Pac-Fan with shutter guard

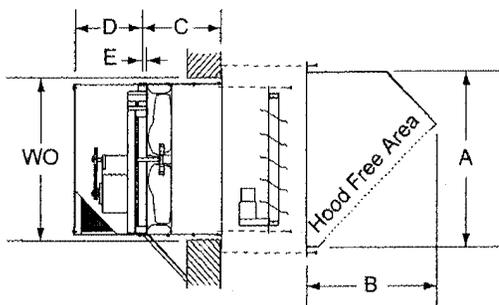
Illustrated is the typical installation of an exhaust PAC-Fan in a masonry wall with a shutter guard. The installer provides suitable fasteners (Hex bolts or Lag screws) to support the fan. It is recommended that 5/16" minimum bolts on 6" to 10" centers be used on the perimeter of the housing. Mounting flange should be caulked to exterior of the wall. Fans with motors in excess of 80 lbs. should be additionally supported by hanging rods or supports placed underneath the fan.



APB, APD, SPD	XLPH, XMP, XMPH	EPB, EPD	A	B- Direct	B-Belt	WO
8	-	-	10-5/8	13-5/8	-	13-1/4
10-12	-	-	14-5/8	17-5/8	-	17-1/4
14-16	-	-	18-5/8	20	-	21-1/4
18-20	20	-	22-5/8	22	34-1/4	25-1/4
24	24	-	27-7/8	23	34-1/4	31-1/4
30	30	24	33-7/8	24-3/8	37-7/8	37-1/4
36	36	30	39-7/8	28-3/8	39-3/8	43-1/4
42	42	36	45-7/8	33-5/8	40-5/8	49-1/4
48	48	42	51-7/8	39-5/8	50-5/8	55-5/16
-	54	48	57-7/8	40-1/8	47-3/4	61-5/16
-	60	54	63-7/8	44-3/4	47-3/4	67-1/2
-	-	60	69-7/8	-	47-3/4	73-1/2
-	-	72	81-7/8	-	50-3/4	85-1/2

Supply wall fan with wall collar, OSHA wire guard, motorized supply shutter and weather hood

Illustrated is the typical installation of a supply wall fan in a masonry wall with a wall collar, OSHA wire guard, motorized supply shutter and weather hood. The installer provides suitable fasteners to support the fan. Fasteners should be placed on 6" to 10 centers on the perimeter of the wall collar. Wall collar should be caulked to the exterior of the wall. The weather hood should be securely fastened and sealed to the wall. Fans with motors in excess of 80 lbs. should be additionally supported by hanging rods or supports placed underneath the fan.



AWB, AWD, SWD	XLW, XLWH, XMW, XMWH	EWB, EWD	A	B	C	D	E	WO
8	-	-	18	16	12	13	1	13-1/4
10-12	-	-	22	18-3/4	14-3/8	13	1	17-1/4
14-16	-	-	26	21-3/4	15-3/8	13	1	21-1/4
18-20	-	-	30	24-1/2	17-5/8	13	1	25-1/4
-	20	-	30	24-1/2	17-5/8	21	1	25-1/4
24	-	-	30	24-1/2	17-5/8	13	1-1/2	31-1/4
-	24	-	34	27-1/4	18-3/4	21	1-1/2	31-1/4
30	30	24	40	31-1/2	18-3/4	21	1-1/2	37-1/4
36	36	30	46	35-3/4	19-1/2	21	1-1/2	43-1/4
42	42	36	52	40	19-1/2	26	1-1/2	49-1/4
48	48	42	58	44-1/4	19-3/4	26	1-1/2	55-5/16
-	54	48	64	48-1/2	19-3/4	28	1-1/2	61-5/16
-	60	54	70	52-3/4	19-3/4	28	1-1/2	67-1/2
-	-	60	76	57	19-3/4	28	1-1/2	73-1/2
-	-	72	88	67-1/2	19-3/4	31	1-1/2	85-1/2

Changing Shaft Speed continued

- b. Turn the pulley rim to open or close the groove facing. If the pulley has multiple grooves, all must be adjusted to the same width.
- c. After adjustment, inspect for proper belt tension.

Speed Reduction

Open the pulley in order that the belt rides deeper in the groove (smaller pitch diameter).

Speed Increase

Close the pulley in order that the belt rides higher in the groove (larger pitch diameter). Ensure that the RPM limits of the fan and the horsepower limits of the motor are maintained.

Pulley and Belt Replacement

Maximum RPM

SWD Size	Maximum RPM	EWB Size	Maximum RPM	AWB Size	Maximum RPM
8	1690	24	1675	24	1510
10	1550	30	1370	30	1145
12	1615	36	1310	36	990
14	1130	42	1175	42	905
16	1115	48	1215	48	900
18	1095	54	960	-	-
20	1075	60	890	-	-
24	1050	72	700	-	-

Maximum RPM

APB Size	Maximum RPM	XLP/XLPS Size	Maximum RPM	XLPH/XLPHS Size	Maximum RPM
24	1005	20	1280	-	-
30	800	24	1012	24	1110
36	645	30	666	30	930
42	660	36	566	36	714
48	605	42	424	42	610
-	-	48	356	48	512
-	-	54	316	54	472
-	-	60	260	60	446

Maximum RPM

XMP/XMPS Size	Maximum RPM	XMPH/XMPHS Size	Maximum RPM	XLW/XLWS Size	Maximum RPM
20	1280	-	-	20	1276
24	1276	24	1410	24	1018
30	830	30	1172	30	674
36	680	36	838	36	570
42	498	42	716	42	422
48	414	48	596	48	356
54	346	54	516	54	320
60	318	60	474	60	256

Maximum RPM

XLWH/XLWHS Size	Maximum RPM	XMW/XMWHS Size	Maximum RPM	XMWH/XMWHHS Size	Maximum RPM
-	-	20	1462	-	-
24	1126	24	1272	24	1400
30	932	30	860	30	1184
36	720	36	672	36	864
42	610	42	498	42	718
48	516	48	416	48	600
54	478	54	350	54	522
60	438	60	320	60	476

- a. Clean the motor and fan shafts.
- b. Loosen the motor plate mounting bolts to relieve the belt tension. Remove the belt.
- c. Loosen the pulley setscrews and remove the pulleys from the shaft.

If excessive force is required to remove the pulleys, a three-jaw puller can be used. This tool, however, can easily warp a pulley. If the puller is used, inspect the trueness of the pulley after it is removed from the shaft. The pulley will need replacement if it is more than 0.020

inch out of true.

- d. Clean the bores of the pulleys and place a light coat of oil on the bores.
- e. Remove grease, rust and burrs from the shaft.
- f. Place fan pulley on the fan shaft and the motor pulley on the motor shaft. Damage to the pulleys can occur when excessive force is used in placing the pulleys on their respective shafts.
- g. After the pulleys have been correctly placed back onto their shafts, tighten the pulley setscrews.
- h. Install the belts on the pulleys. Align and adjust the belts to the proper tension as described in *Belt and Pulley Installation*, page 2.

Bearing Replacement

The fan bearings are pillow block ball bearings.

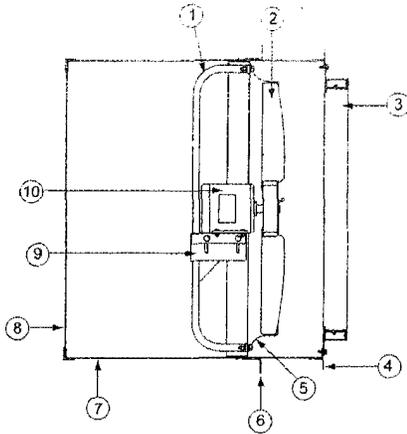
- a. Mark the position of the shaft in reference to both the bearing races and the propeller and pulley. Make a note of the clearance between the propeller and the frame.
- b. Remove the pulley.
- c. Remove the propeller from the shaft. A two-jaw puller may be needed to remove the propeller from the shaft.
- d. Remove the bearing hold-down bolts. Remove the shaft and the bearings as one unit.
- e. Remove the anti-corrosion coating from the shaft with a suitable degreaser.
- f. Remove the bearing from the shaft using a bearing puller. If a bearing puller is not available, remove the bearing by using a wood block and hammer. An emery cloth or file may be needed to remove imperfections in the shaft left by the setscrews.
- g. Clean the shaft and bearing bore thoroughly.
- h. Place the bearings into position ensuring they are not on a worn section of the shaft. Tapping the inner ring face with a soft driver may be required. Do not hammer on the housing.
- i. The outer ring of the bearing is spherical and swivels in the housing to compensate for misalignment. Slightly tighten the hold down bolts.
- j. Align the setscrews on the bearings and tighten one setscrew on each bearing.
- k. Rotate the shaft to allow the bearing outer rings to find the center of free movement.
- l. Install the propeller on the shaft and adjust the bearing position to center the propeller in the opening.
- m. Tighten the hold-down bolts to the proper torque. Refer to the *Torque Chart*, page 4.
- n. Turn the shaft by hand. Resistance should be the same as it was before the hold-down bolts were fully tightened.
- o. Tighten the bearing setscrews to the specified torque.
- p. Install the pulley and adjust the belt tension.

After 24 hours of continuous operation, tighten the setscrews to the appropriate torque. This assures the full locking of the inner race to the shaft. Ensure the socket key or driver is in good condition with no rounded corners. The key should be fully engaged in the setscrew and held squarely to prevent the rounding out of the setscrew socket when applying maximum torque.

Troubleshooting

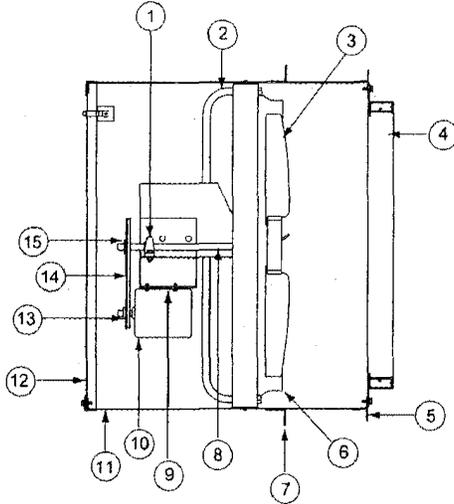
Problem and Potential Cause	
Low Capacity or Pressure <ul style="list-style-type: none"> •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Poor fan inlet conditions. There should be a straight clear duct at the inlet. •Improper propeller alignment. 	Overheated Motor <ul style="list-style-type: none"> •Motor improperly wired. •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Cooling air diverted or blocked.
Excessive Vibration and Noise <ul style="list-style-type: none"> •Damaged or unbalanced propeller. •Belts too loose; worn or oily belts. •Speed too high. •Incorrect direction of rotation. Make sure the fan rotates in same direction as the arrows on the motor or belt drive assembly. •Bearings need lubrication or replacement. •Fan surge. 	Overheated Bearings <ul style="list-style-type: none"> •Improper bearing lubrication •Excessive belt tension.

APD Parts List



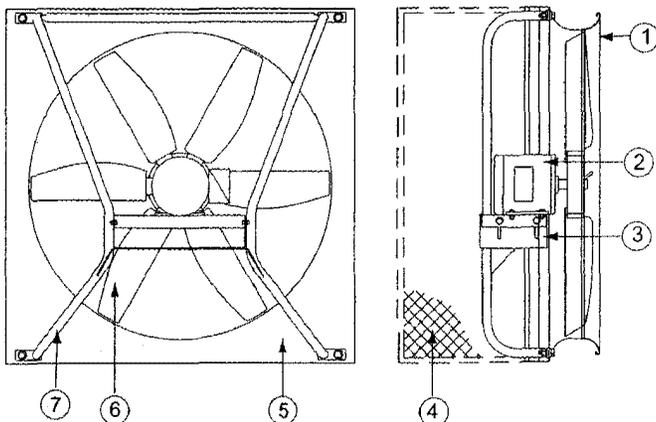
Parts No.	Description		
	APD Sizes 16-36	APD Sizes 16-36	
1	Power Assembly	6	Anchor Angles (2)
2	Propeller	7	Fan Box Panel (4)
3	Shutter Assembly	8	End Wire Guard
4	Mounting Collar Angles (4)	9	Motor Plate
5	Wall Base	10	Motor

APB Parts List



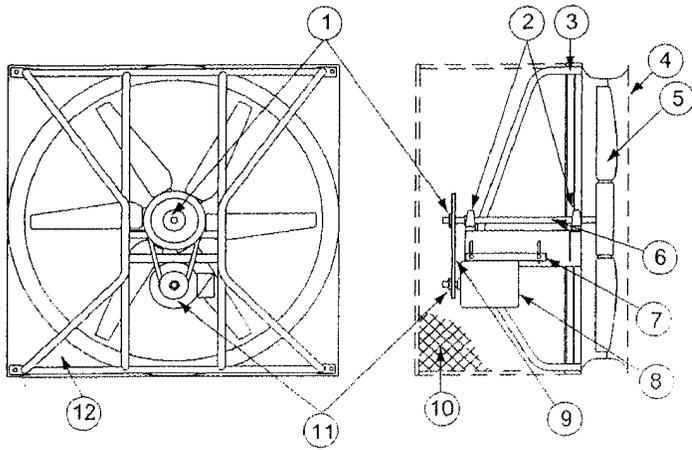
Parts No.	Description		
	APB Sizes 24-48	APB Sizes 24-48	
1	Bearings (2)	9	Motor Plate
2	Power Assembly	10	Motor
3	Propeller	11	Fan Box Panel (4)
4	Shutter Assembly	12	End Wire Guard
5	Mounting Collar Angles (4)	13	Driver Sheave
6	Wall Base	14	Belt Set
7	Anchor Angles (2)	15	Driven Sheave
8	Shaft		

AWDS and AWDE Parts List



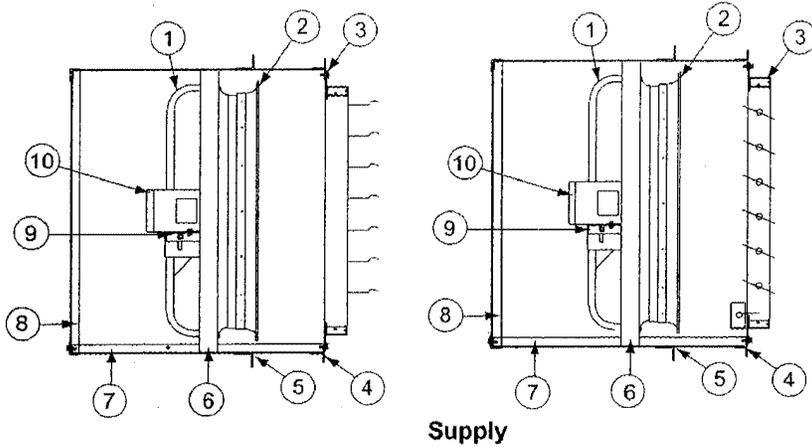
Parts No.	Description	
	AWDS	AWDE
1	Supply Venturi	—
2	Motor	Motor
3	Motor Plate	Motor Plate
4	Optional Wire Guard	Birdscreen
5	Wall Base	Wall Base
6	Cast Aluminum Propeller	Cast Aluminum Propeller
7	Power Assembly	Power Assembly

AWBS and AWBE Parts List



Part No.	Description	
	AWBS	AWBE
1	Driven Sheave	Driven Sheave
2	Bearings (2)	Bearings (2)
3	Power Assembly	Power Assembly
4	Supply Venturi	—
5	Propeller	Propeller
6	Shaft	Shaft
7	Motor Plate	Motor Plate
8	Motor	Motor
9	Belt Set	Belt Set
10	Optional Wire Guard	Birdscreen
11	Driver Sheave	Driver Sheave
12	Wall Base	Wall Base

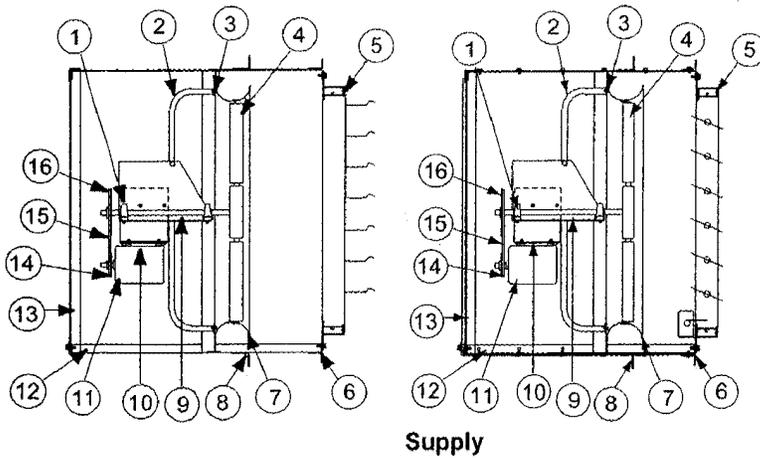
EPD Parts List



Supply

Part No.	Description	
	EPD	
1	Power Assembly	
2	Supplemental Venturi	
3	Shutter Assembly	
4	Mounting Collar Angles (4)	
5	Anchor Angles (2)	
6	Wall Base	
7	Fan Box Panel (4)	
8	End Wire Guard	
9	Motor Plate	
10	Motor	
11	Wall Base	
	Propeller (Not Shown)	

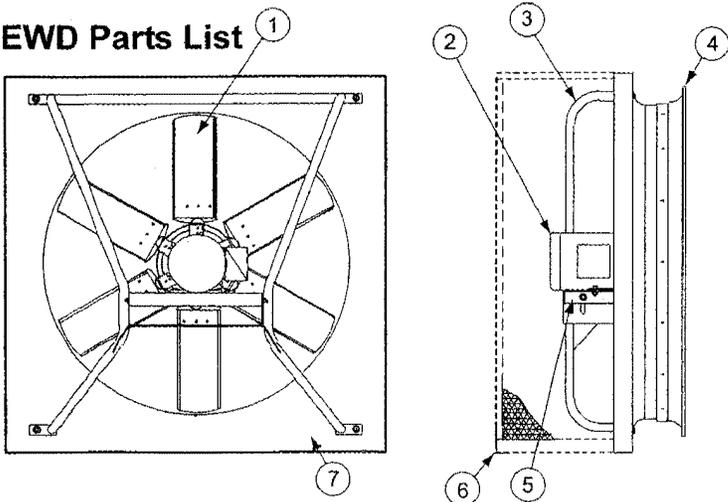
EPB Parts List



Supply

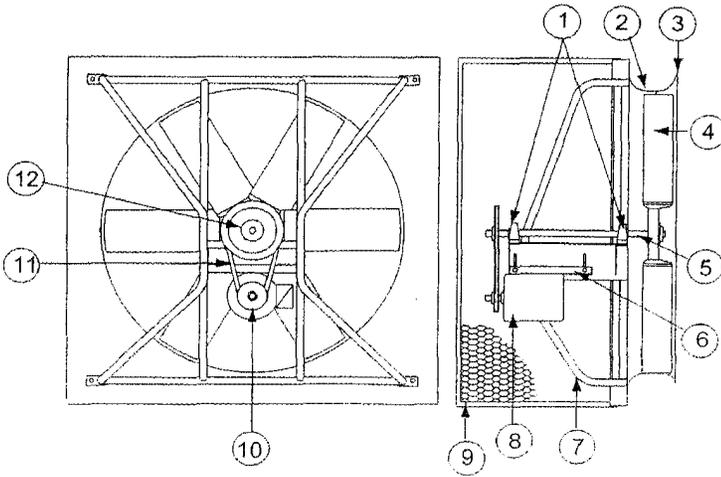
Part No.	Description	
	EPB	
1	Bearings (2)	
2	Power Assembly	
3	Wall Base	
4	Propeller	
5	Shutter Assembly	
6	Mounting Collar Angles (4)	
7	Supplemental Venturi	
8	Anchor Angles (2)	
9	Shaft	
10	Motor Plate	
11	Motor	
12	Fan Box Panel (4)	
13	End Wire Guard	
14	Driver Sheave	
15	Belt Set	
16	Driven Sheave	

EWD Parts List



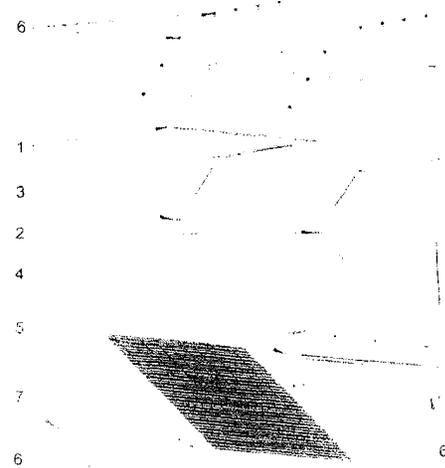
Part No.	Description	
	EWD	
1	Propeller	
2	Motor	
3	Power Assembly	
4	Supplemental Venturi	
5	Motor Plate	
6	Optional Wire Guard	
7	Wall Base	

EWB Parts List



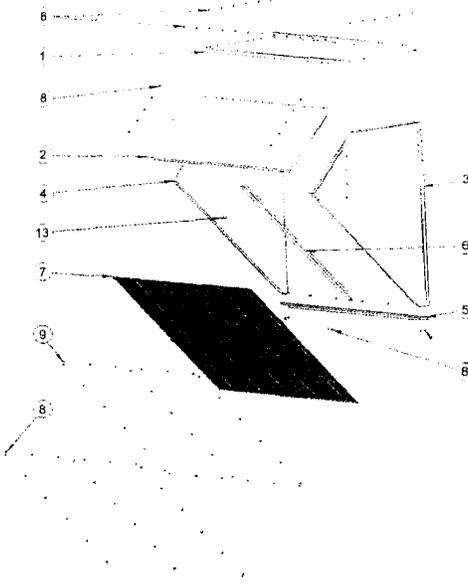
Part No.	Description
EWB	
1	Bearings (2)
2	Wall Base
3	Supply Venturi
4	Steel Propeller
5	Shaft
6	Motor Plate
7	Power Assembly
8	Motor
9	Optional Wire Guard
10	Driver Sheave
11	Belt Set
12	Driven Sheave

8-30 Wall Propeller Weather Hood Parts List



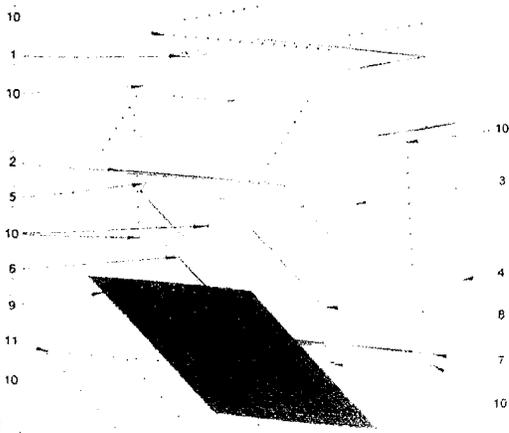
Part No.	Description
8-30 Wall Prop	
1	Top Panel
2	Right Side Panel
3	Left Side Panel
4	Bottom Panel
5	1/2" Mesh Galvanized Bird Screen
6	1/4" X 1/2" Speed Screw
7	5/16 SAE Steel Washer

36-60 Wall Propeller Weather Hood Parts List



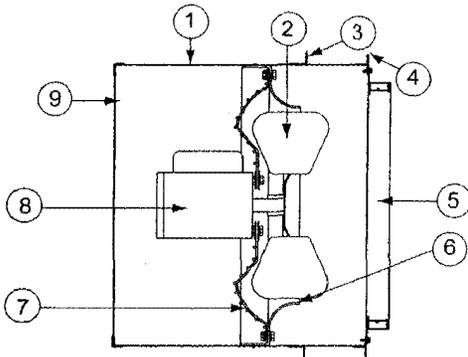
Part No.	Description
36-60 Wall Prop	
1	Top Panel, Piece 1
2	Top Panel, Piece 2
3	Right Side Panel
4	Left Side Panel
5	Bottom Panel
6	Bird Screen Support
7	1/2" Mesh Galvanized Bird Screen
8	1/4" X 1/2" Speed Screw
9	5/16 SAE Steel Washer

72 EWB Weather Hood Parts List



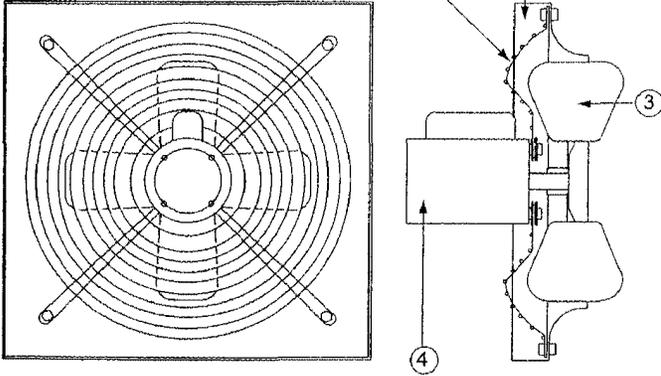
Part No.	Description
	72 EWB
1	Top Panel, Piece 1
2	Top Panel, Piece 2
3	Right Side Panel Tip
4	Right Side Panel
5	Left Side Panel Tip
6	Left Side Panel
7	Bottom Panel
8	Bird Screen Support
9	1/2" Mesh Galvanized Bird Screen
10	1/4" X 1/2" Speed Screw
11	5/16 SAE Steel Washer

SPD Parts List



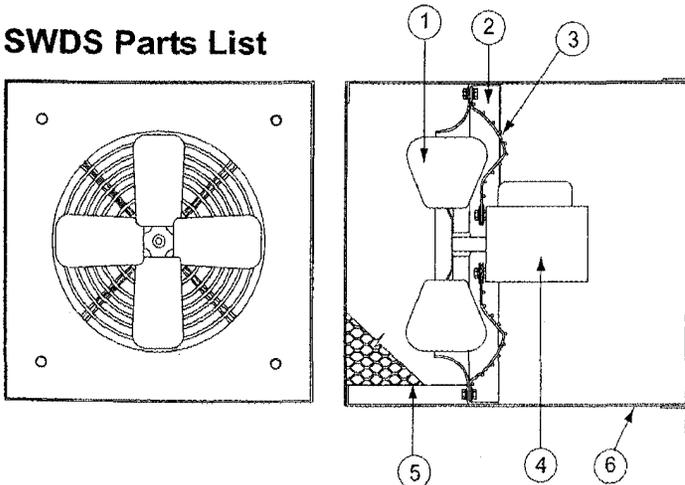
Part No.	Description
	SPD
1	Fan Box Panel (4)
2	Stamped Aluminum Propeller
3	Anchor Angle (4)
4	Mounting Collar Angle (2)
5	Automatic Louver
6	Wall Base
7	Mounting Grille
8	Motor
9	Mesh Guard

SWD Parts List



Part No.	Description
	SWD
1	Wire Guard
2	Wall Base
3	Stamped Aluminum Propeller
4	Motor

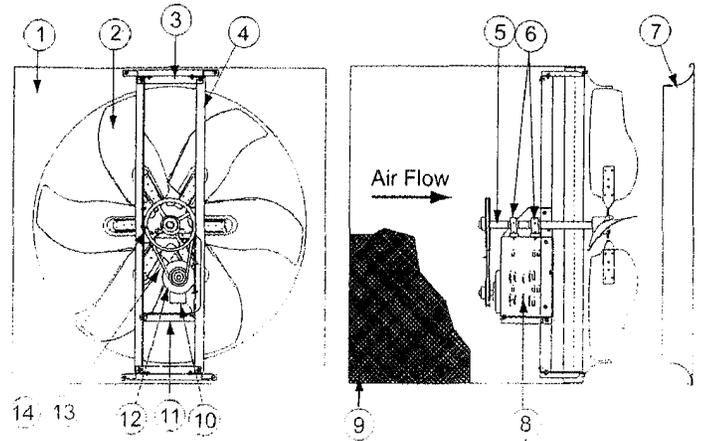
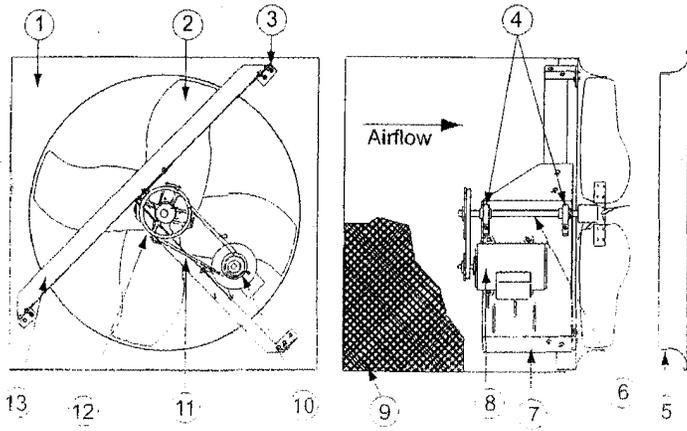
SWDS Parts List



Part No.	Description
	SWDS
1	Stamped Aluminum Propeller
2	Wall Base
3	Wire Guard
4	Motor
5	End Wire Guard
6	Wall Collar

XLW, XMW, XLWS, XMWS 20 - 36 Parts List

XLW, XMW, XLWS, XMWS 42 - 60 Parts List

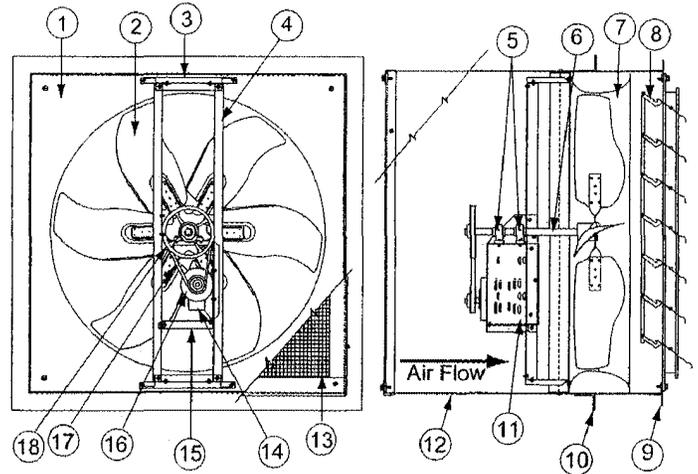
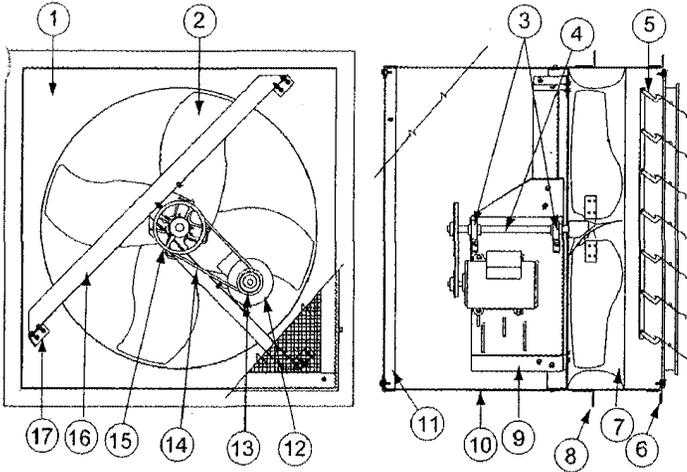


Part No.	Description	Part No.	Description
1	Wall Venturi Base	8	Motor
2	Prop Assembly	9	Optional Wire Guard
3	Power Assembly Foot (3)	10	Drive Sheave
4	Bearings (2)	11	Belt Set
5	Inlet Venturi (Supply only)	12	Driven Sheave
6	Fan Shaft	13	Power Assembly Rail
7	Motor/Bearing Plate		

Part No.	Description	Part No.	Description
1	Wall Venturi Base	8	Motor/Bearing Plate
2	Prop Assembly	9	Optional Wire Guard
3	Power Assembly Foot (2)	10	Motor
4	Power Assembly Rail (2)	11	Motor Plate Brace
5	Fan Shaft	12	Drive Sheave
6	Bearings (2)	13	Belt Set
7	Inlet Venturi (Supply Only)	14	Driven Sheave

XLP, XMP, XLPS, XMPS 20 -36 Parts List

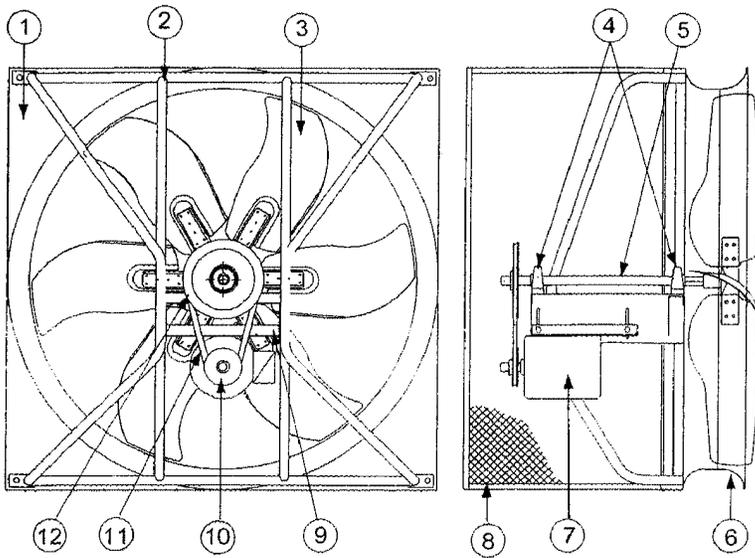
XLP, XMP, XLPS, XMPS 42 - 60 Parts List



Part No.	Description	Part No.	Description
1	Wall Venturi Base	9	Motor/Bearing Plate
2	Prop Assembly	10	Housing Wrapper Panel (4)
3	Bearings (2)	11	End Safety Guard
4	Fan Shaft	12	Motor
5	Exhaust Shutter (Exhaust Only) Supply Shutter (Supply Only)	13	Drive Sheave
		14	Belt Set
6	Mounting Collar Angle (4)	15	Driven Sheave
7	Inlet Venturi (Supply Only)	16	Power Assembly Rail
8	Wall Mounting Angle (2)	17	Power Assembly Foot (3)

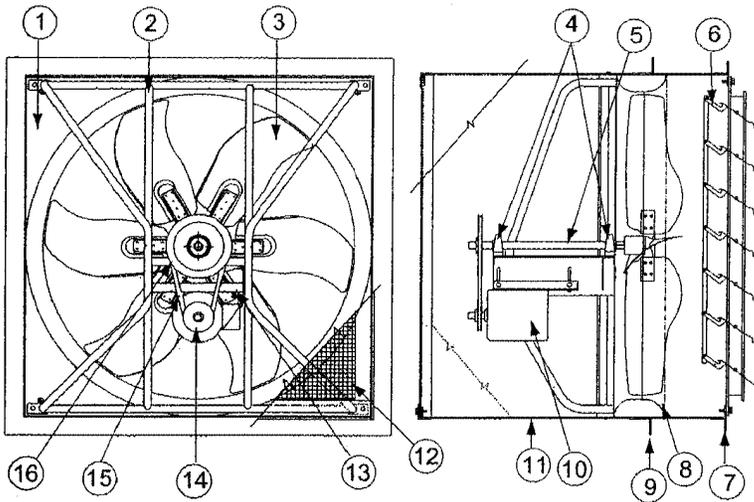
Part No.	Description	Part No.	Description
1	Wall Venturi Base	10	Wall Mounting Angle (2)
2	Prop Assembly	11	Motor/Bearing Plate
3	Power Assembly Foot (2)	12	Housing Wrapper Panel (4)
4	Power Assembly Rail (2)	13	End Safety Guard
5	Bearings (2)	14	Motor
6	Fan Shaft	15	Motor Plate Brace
7	Inlet Venturi (Supply Only)	16	Drive Sheave
8	Exhaust Shutter (Exhaust Only) Supply Shutter (Supply Only)	17	Belt Set
		18	Driven Sheave
9	Mounting Collar Angle (4)		

XLWHS, XMWHS, XLWH, XMWH 24 - 60 Parts List



Part No.	Description	Part No.	Description
1	Wall Venturi Base	7	Motor
2	Power Assembly	8	Optional Wire Guard
3	Prop Assembly	9	Motor Plate
4	Bearings (2)	10	Drive Sheave
5	Fan Shaft	11	Belt Set
6	Inlet Venturi (Supply Only)	12	Driven Sheave

XLPH, XMPH, XLPHS, XMPHS 24 - 60 Parts List



Part No.	Description	Part No.	Description
1	Wall Venturi Base	9	Wall Mounting Angle (2)
2	Power Assembly	10	Motor
3	Prop Assembly	11	Housing Wrapper Panel
4	Bearings	12	End Safety Guard
5	Fan Shaft	13	Motor Plate
6	Exhaust Shutter (Exhaust Only)	14	Drive Sheave
	Supply Shutter (Supply Only)	15	Belt Set
7	Mounting Collar Angle (4)	16	Driven Sheave
8	Inlet Venturi (Supply Only)		

Limited Warranty

Loren Cook Company warrants that your Loren Cook fan was manufactured free of defects in materials and workmanship, to the extent stated herein. For a period of one (1) year after date of shipment, we will replace any parts found to be defective without charge, except for shipping costs which will be paid by you. This warranty is granted only to the original purchaser placing the fan in service. This warranty is void if the fan or any part thereof has been altered or modified from its original design or has been abused, misused, damaged or is in worn condition or if the fan has been used other than for the uses described in the company manual. This warranty does not cover defects resulting from normal wear and tear. To make a warranty claim, notify Loren Cook Company, General Offices, 2015 East Dale Street, Springfield, Missouri 65803-4637, explaining in writing, in detail, your complaint and referring to the specific model and serial numbers of your fan. Upon receipt by Loren Cook Company of your written complaint, you will be notified, within thirty (30) days of our receipt of your complaint, in writing, as to the manner in which your claim will be handled. If you are entitled to warranty relief, a warranty adjustment will be completed within sixty (60) business days of the receipt of your written complaint by Loren Cook Company. This warranty gives only the original purchaser placing the fan in service specifically the right. You may have other legal rights which vary from state to state.

LOREN COOK COMPANY

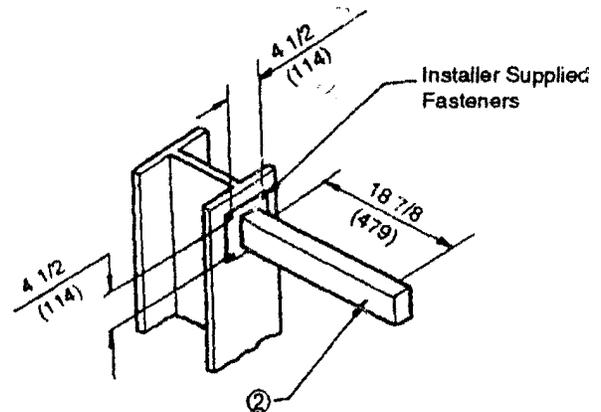
Corporate Offices: 2015 E. Dale Street Springfield, MO 65803 417.869.6474
lorencook.com

BASIC MOUNTING KIT INSTALLATION

Note: Dimensions are in inches (mm)

STEP 1

Fasten the ARM ASSEMBLY ② to a surface or structure that will support the heater's weight using the installer supplied fastening method.

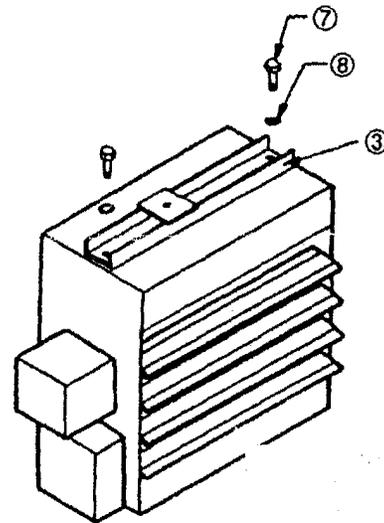


STEP 2

Bolt ATTACHMENT ASSEMBLY ③ to the heater using 5/8 UNC x 1 1/4 bolts and lock washers.

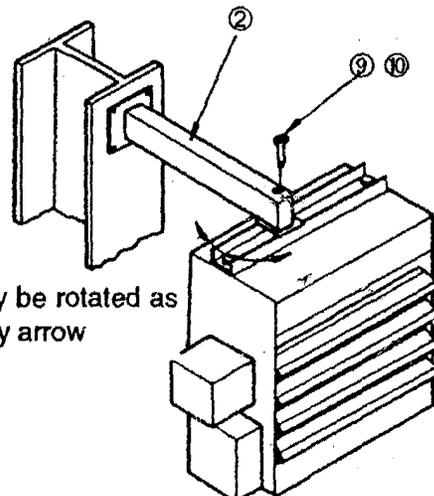
NOTES:

- 1) HL Series electric heaters use an ATTACHMENT ASSEMBLY ③ with an offset threaded hole. The ATTACHMENT ASSEMBLY ③ must be placed with the threaded hole closest to the control box side of heater.



STEP 3

Lift heater into place and fasten it to the ARM ASSEMBLY ② using a 5/8 UNC x 4 1/2 bolt. This step will require more than one person due to the weight of the heater. Refer to the heater installation manual for weight.



Heater may be rotated as indicated by arrow

BASIC MOUNTING KIT/WALL MOUNTING KIT INSTRUCTION SHEET

NOTE: Check that your heater model number corresponds to the model number shown on the mounting kit carton.

WARNING: IF INSTALLED ON A STRUCTURE THAT IS TO BE TRANSPORTED, PROVIDE ADDITIONAL TEMPORARY SUPPORT FOR THE HEATER DURING TRANSIT.

THE SUSPENDED WEIGHT ON THE ARM ASSEMBLY SHOULD NOT EXCEED 250 LB (114KG.)

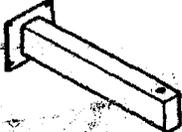
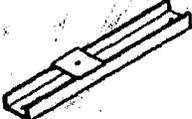
REFER TO HEATER INSTALLATION MANUAL FOR MOUNTING SPECIFICATIONS AND CONDITIONS.

INSTALLER REQUIRED TO SUPPLY:

A method to fasten the two Z Sections ① to the supporting wall. This kit required at least four (4) 3/8" diameter, grade 5 bolts. However, any method providing the same or greater strength may be used.

A method to fasten the ARM ASSEMBLY ② to the supporting structure. Four (4) 3/8" diameter, grade 5 bolts are suggested, however, any method providing the same or greater strength may be used.

CONTENTS:

<u>Item</u>	<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>	
①	51666-001	2	Z SECTION, SUPPORT	
②	62036-002	1	ARM ASSEMBLY, MOUNTING	
③	62037-001 HLA 12 62037-002 HLA 16 62037-003 HLA 20	1	ATTACHMENT, ASSEMBLY	
④	93480-004	4	3/8 UNC Nut	
⑤	1766	4	3/8 UNC x 1 Bolt	
⑥	43567-001	4	3/8 Lock Washer	
⑦	43566-002	2	5/8 UNC x 1 1/4 Bolt	
⑧	43567-002	2	5/8 Lock Washer	
⑨	43566-001	1	5/8 UNC x 4 1/2 Bolt	
⑩	43625-003	1	5/8 Flat Washer	

Krystil Klear Filtration[®]



The one-stop source for all your industrial liquid filtration needs!

Standard Duty Products | Medium Duty Products | About Us | Industry Applications | Contact Us | Technical Assistance | Brochures

Standard Duty Product Navigation

- **Liquid Bag**
 - Model 44 Single Liquid Bag Housing
 - Model 66 Single Liquid Bag Housing
 - Model 88 Single Liquid Bag Housing
 - Model 88, 100 PSI Liquid Bag Housing
 - Model T88, 150 PSI Liquid Bag Housing
 - OEM, 100 PSI Liquid Bag Housing
 - Multi-Round Liquid Bag Housing
 - Duplex Liquid Flow Housings
 - Diversa-Flow Liquid Bag Housings
 - Model 882 Twin Capacity Liquid Bag Housing
 - Strainer Baskets
 - Liquid Filter Bags
- + Liquid Cartridge
- + Inline Strainer
- + Fuel/Hydraulic

Model 66 Single Liquid Bag Housing

Features and Options

Housing Operation

Vessel Construction

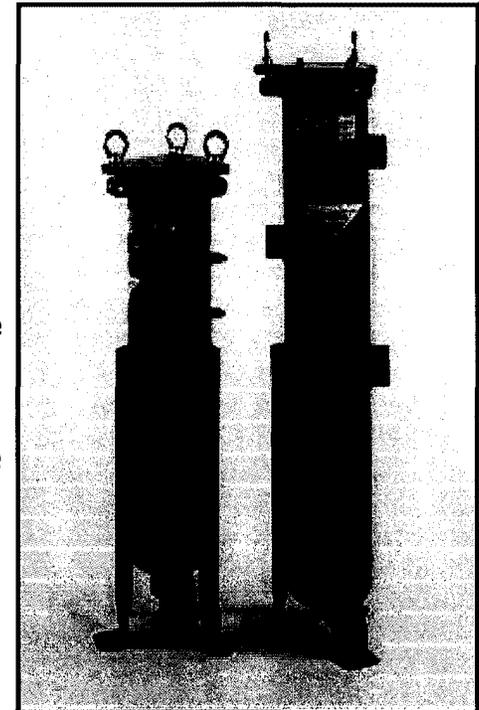
Specifications

Build a Part Number

Schematics and Dimensions

SPECIFICATIONS

Housing lid has a 3-bolt swing closure with a vent port. Connections are (___) inch (NPT)(FLG) with a (side inlet and bottom outlet)(side inlet and side outlet)(side inlet and 90 degree bottom outlet). Housing is supplied with two differential pressure ports to measure the differential pressure across the filter bag. A two-part epoxy finish is applied on the carbon steel vessels to maximize the life of the housing; stainless steel vessels are supplied with a satin finish. Basket material is constructed of 316 stainless steel with 9/64" perforations to act as a strainer or to accept a #8 or #9 size liquid bag. Basket seals onto a Viton o-ring in the basket support. Adjustable tripod leg assembly is supplied with housing. Vessels are rated at a 150 pounds per square inch design.



Contact a Sales Representative About this Product

Basket Data for Model 66 with flow rates to 100 gpm

Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)
18	5	2.0	350
30	5	3.4	630

Krystil Klear Products

| Liquid Bag Housings | Liquid Cartridge Housings | Inline Strainer Housings | Fuel / Hydraulic Housings |



The one-stop source for all your industrial liquid filtration needs!

Standard Duty Products | Medium Duty Products | About Us | Industry Applications | Contact Us | Technical Assistance | Brochures

Standard Duty Product Navigation

- **Liquid Bag**
 - Model 44 Single Liquid Bag Housing
 - Model 66 Single Liquid Bag Housing
 - Model 88 Single Liquid Bag Housing
 - Model 88, 100 PSI Liquid Bag Housing
 - Model T88, 150 PSI Liquid Bag Housing
 - OEM, 100 PSI Liquid Bag Housing
 - Multi-Round Liquid Bag Housing
 - Duplex Liquid Flow Housings
 - Diversa-Flow Liquid Bag Housings
 - Model 882 Twin Capacity Liquid Bag Housing
 - Strainer Baskets
 - Liquid Filter Bags

- + Liquid Cartridge
- + Inline Strainer
- + Fuel/Hydraulic

Model 66 Single Liquid Bag Housing

Features and Options Housing Operation Vessel Construction

Specifications Build a Part Number Schematics and Dimensions

- [Dimensions](#)
- [Schematics](#)

Dimensions

All dimensions are approximate...

66-18

Pipe Size	A	B	C	D	E	F	G	H	I	J	K
1	4.0	5.4	25.3	26.8	7.0	25.2	26.0	5.0	26.0	1.5	.75 90# skid wt.
1.25	4.2	5.6	25.3	26.8	7.0	25.2	26.3	5.0	26.3	1.0	
1.50	4.2	5.6	25.3	26.8	7.0	25.2	26.7	5.0	26.4	2.0	
2	4.3	5.7	25.3	26.9	7.0	25.2	27.4	5.0	26.6	2.3	
3	4.3	6.0	25.3	27.4	7.0	25.2	28.6	5.0	27.2	3.1	

Contact a Sales Representative
About this Product

66-30

Pipe Size	A	B	C	D	E	F	G	H	I	J	K
1	4.0	5.4	35.2	36.8	7.0	35.3	36.1	5.0	36.0	1.5	.75 115# skid wt.
1.25	4.2	5.6	35.2	36.8	7.0	35.3	36.4	5.0	36.3	1.8	
1.50	4.2	5.6	35.2	36.8	7.0	35.3	36.8	5.0	36.4	2.0	
2	4.3	5.7	35.2	36.9	7.0	35.3	37.4	5.0	36.6	2.3	
3	4.3	6.0	35.2	37.4	7.0	35.3	38.6	5.0	37.2	3.1	

Adjustable support legs have 9.25" bolt circle and a 16" height adjustment.

Schematics

If your browser has been configured with Javascript enabled, then a separate window should have been opened to display the schematics in a convenient, easy-to-view fashion. If your browser does not support Javascript, or if Javascript has not been enabled, then the schematic will not be displayed. If you do not see the schematic displayed now, you may [click here](#) to

view it embedded on this page, or you may configure your browser with Javascript enabled. Consult your browser documentation for further information about enabling Javascript.

Krystil Klear Products

| [Liquid Bag Housings](#) | [Liquid Cartridge Housings](#) | [Inline Strainer Housings](#) | [Fuel / Hydraulic Housings](#) |

© 1998, 2003 Krystil Klear Filtration