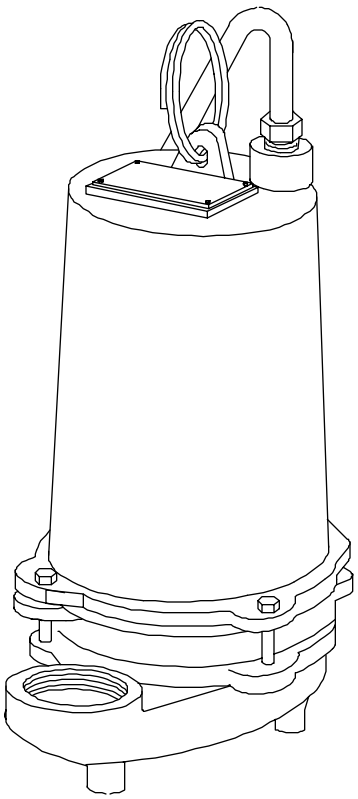
Manual Index

BARNES®

INSTALLATION and OPERATION MANUAL

Submersible Effluent Pump

PumpBiz
1-800-PUMPBIZ



SERIES: EHH
0.4, 0.5 & 1HP, 3450 RPM

IMPORTANT: Read all instructions in this manual before operating pump.
As a result of Crane Pumps & Systems, Inc., constant product improvement program, product changes may occur. As such Crane Pumps & Systems, Inc., reserves the right to change product without prior written notification.

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A Crane Co. Company

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Submersible Wastewater Pump Association SWPA MEMBER

Form No. 088573-Rev. C

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SPECIAL TOOLS and EQUIPMENT:

INSULATION TESTER (MEGGER)
DIELECTRIC TESTER
SEAL TOOL KIT (see parts list)
PRESSURE GAUGE KIT (see parts list)

SAFETY FIRST!
PLEASE READ THIS BEFORE INSTALLING OR OPERATING PUMP.

GENERAL

1. Most accidents can be avoided by using **COMMON SENSE**.
2. Read the operation and maintenance instruction manual supplied with the pump.
3. Do not wear loose clothing that may become entangled in the impeller or other moving parts.
4. Always wear appropriate safety gear, such as safety glasses, when working on the pump or piping.
5. Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.

PUMPS

6. Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.
7. Only qualified personnel should install, operate and repair pump.
8. Keep clear of suction and discharge openings. **DO NOT** insert fingers in pump with power connected.
9. Do not pump hazardous materials (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.
10. Do not block or restrict discharge hose, as discharge hose may whip under pressure.
11. Make sure lifting handles are securely fastened each time before lifting.
12. Do not lift pump by the power cord (if applicable).
13. Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.
14. Secure the pump in its operating position so it can not tip over, fall or slide.
15. Keep hands and feet away from impeller when power is connected.
16. Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.
17. Do not operate pump without guards and safety devices in place.
18. When towing pump behind a vehicle; make sure hitch is properly attached, always attach safety chains.
19. Always replace safety devices that have been removed during service or repair.
20. Operation against a closed discharge valve will cause premature bearing and seal failure on any pump, and on end suction and self priming pump the heat build may cause the generation of steam with resulting dangerous pressures. It is recommended that a high case temperature switch or pressure relief valve be installed on the pump body.

ELECTRICAL

21. To reduce risk of electrical shock, pump must be properly grounded in accordance with the National Electric Code (NEC), or Canadian Electrical Code (CEC) and all applicable state, province and local codes and ordinances.
22. To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing.
23. Any wiring of pumps should be performed by a qualified electrician.
24. Never operate a pump with a power cord that has frayed or brittle insulation.
25. Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.
26. Never handle connected power cords with wet hands.
27. Never operate a pump with a plug-in type power cord without a ground fault circuit interrupter.
28. Do not remove cord and strain relief. Do not connect conduit to pump.
29. To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC or CEC and applicable state or province and local codes. Requirements may vary depending on usage and location. See wiring diagrams in manual.

GAS/DIESEL ENGINE POWER PUMPS & DRIVES ONLY

30. Never operate in an enclosed building or area where exhaust gases can accumulate.
31. Do not breath exhaust fumes when working in the area of the engine. (Exhaust gases are odorless and deadly poison.)
32. Never operate near a building where exhaust gases can seep inside.
33. Never operate in a pit or sump without making provisions for adequate ventilation.
34. Allow exhaust system to cool before touching.
35. Never add fuel to the tank while the engine is running. Stop engine and allow to cool.
36. Do not smoke while refueling the engine.
37. Do not refuel near open flame.
38. Carefully read instruction manuals supplied by engine manufacturer before attempting to assemble, operate or service the engine or any part. The **"WARNING"** statements indicate potentially hazardous conditions for operator or equipment.

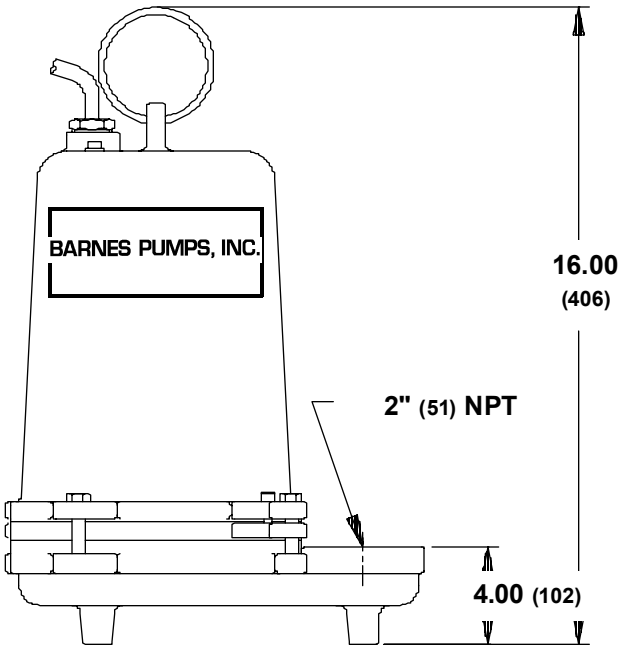
IMPORTANT! Barnes® Pumps, Inc. is not responsible for losses, injury, or death resulting from a failure to observe these safety precautions, misuse or abuse of pumps or equipment.

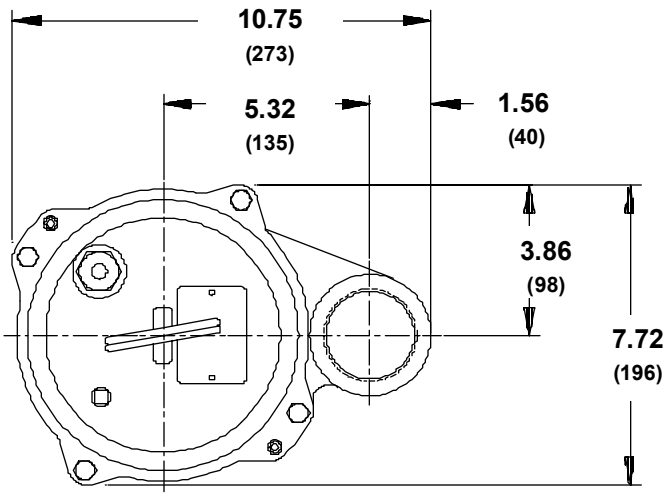
SECTION: A- PUMP SPECIFICATIONS

DISCHARGE:		2" (51mm) NPT, Vertical
LIQUID TEMPERATURE:		104°F (40°C) Continuous.
VOLUTE:		Cast Iron ASTM A-48, Class 30.
MOTOR HOUSING:		Cast Iron ASTM A-48, Class 30.
SEAL PLATE:		Cast Iron ASTM A-48, Class 30.
IMPELLER:		
	Design:	2 Vane, Open, With Pump Out Vanes On Back Side. Dynamically Balanced, ISO G6.3.
	Material:	Cast Iron ASTM A-48, Class 30 for .4 and 1.0HP. 81-3-7-9 Brass Alloy for .5HP
SHAFT:		416 Stainless Steel.
SQUARE RINGS:		Buna-N
HARDWARE:		300 Series Stainless Steel.
PAINT:		Air Dry Enamel.
SEAL:	*Design:*	Single Mechanical, Oil-Filled Reservoir, Secondary Exclusion Seal.
	Material:	Rotating Face - Carbon Stationary Face - Ceramic Elastomer - Buna-N Hardware - 300 Series Stainless

CABLE ENTRY:		15ft. (4.5M) Cord (Plug On 115 Volt), Pressure Grommet For Sealing And Strain Relief.
SPEED:		3450 RPM (Nominal).
UPPER BEARING:		
	Design:	Sleeve
	Lubrication:	Oil
	Load:	Radial
LOWER BEARING:		
	Design:	Single Row, Ball
	Lubrication:	Oil
	Load:	Radial & Thrust
MOTOR:		
	Design:	NEMA L-Single Phase, NEMA B-Three Phase Torque Curve. Completely Oil-Filled, Squirrel Cage Induction.
	Insulation:	Class A.
SINGLE PHASE:		Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.
THREE PHASE:		Dual Voltage 230/460; Requires Overload Protection to be Included in Control Panel.
OPTIONAL EQUIPMENT:		Seal Material, Additional Cable, CSA Listing on 3 phase pumps.

inches (mm)





SECTION B: GENERAL INFORMATION

B-1) To the Purchaser:
Congratulations! You are the owner of one of the finest pumps on the market today. Barnes® Pumps are products engineered and manufactured of high quality components. Over one hundred years of pump building experience along with a continuing quality assurance program combine to produce a pump which will stand up to the toughest applications.

This Barnes Pumps, Inc. manual will provide helpful information concerning installation, maintenance, and proper service guidelines.

B-2) Receiving:
Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. If the manual is removed from the packaging, do not lose or misplace.

B-3) Storage:

Short Term- Barnes Pumps are manufactured for efficient performance following short inoperative periods in storage. For best results, pumps can be retained in storage, as factory assembled, in a dry atmosphere with constant temperatures for up to six (6) months.

Long Term- Any length of time exceeding six (6) months, but not more than twenty-four (24) months. The units should be stored in a temperature controlled area, a roofed over walled enclosure that provides protection from the elements (rain, snow, wind-blown dust, etc.), and whose temperature can be maintained between +40 deg. F and +120 deg. F. (4.4 - 49°C) If extended high humidity is expected to be a problem, all exposed parts should be inspected before storage and all surfaces that have the paint scratched, damaged, or worn should be recoated with a water base, air dry enamel paint. All surfaces should then be sprayed with a rust-inhibiting oil.

Pump should be stored in its original shipping container. On initial start up, rotate impeller by hand to assure seal and impeller rotate freely. If it is required that the pump be installed and tested before the long term storage begins, such installation will be allowed provided:

1.) The pump is not installed under water for more than one (1) month.
2.) Immediately upon satisfactory completion of the test, the pump is removed, thoroughly dried, repacked in the original shipping container, and placed in a temperature controlled storage area.

B-4) Service Centers:
For the location of the nearest Barnes Pumps Service Center, check your Barnes Engineered catalog, your Barnes Pumps, Inc. representative or Barnes Pumps, Inc. Service Department in Piqua, Ohio, telephone (937) 778-8947 or Crane Pumps & Systems Canada, in Brampton, Ontario, (905) 457-6223.

SECTION C: INSTALLATION

C-1) Location:
These pumping units are self-contained and are recommended for use in a sump or basin. The sump or basin shall be vented in accordance with local plumbing codes. This pump is designed to pump effluent or wastewater, nonexplosive and noncorrosive liquids and shall **NOT** be installed in locations classified as hazardous in accordance with the National Electrical Code (NEC), ANSI/NFPA 70 or the Canadian Electrical Code (CEC). Never install the pump in a trench, ditch, or hole with a dirt bottom; the legs will sink into the dirt and the suction will become plugged.

C-1.1) Submergence:
The pump must be operated in the submerged condition. The minimum sump liquid level should never be less than 6 inches above the pump bottom. The recommended level should not drop below the top of the motor housing (see Fig. 1).

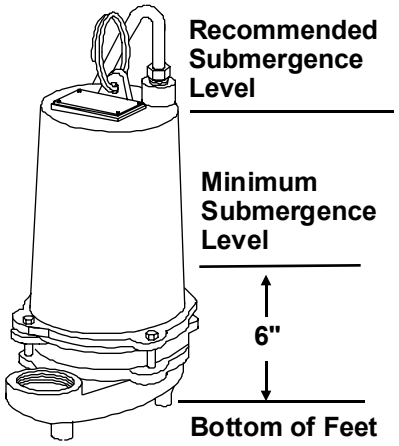


Fig. 1

C-2) Discharge:
Discharge piping should be as short as possible. Both a check valve and a shut-off valve are recommended for each pump being used. The check valve is used to prevent backflow into the sump. Excessive backflow can cause flooding and/or damage to the pump. The shut-off valve is used to stop system flow during pump or check valve servicing.

Barnes Pumps supplies a Stainless Rail Package and also a variety of break away fitting discharge systems designed to allow the submersible wastewater pump to be installed or removed without requiring personnel to enter the wet well. Contact your local Barnes Pumps distributor for complete details.

C-3) Liquid Level Controls

Figure 2 shows a typical installation for any submersible pump using a level control mounted to the discharge piping with a piggy-back plug.

General Comments:

1) Never work in the sump with the power on.

2) Level controls are factory set for a pumping differential of 9 inches. If that is the cycle desired, simply circle the discharge pipe with the pipe mounting strap, feed the end through the worm drive, and tighten with a screwdriver. Be certain that the level control cannot hang up or foul in its swing. Also, make certain the pump impeller is still submerged when the level control is in the "off" mode.

3) If a higher pump differential is needed, grip the cord near the neck of the float, then using the other hand, exert a steady force on the lower edge of the cable clamp. The cable clamp should slide up to the new pivot point. Attach the level control to the discharge hose in the manner described above.

4) Plug the level control plug into the receptacle, then plug the pump into the piggyback plug. One cycle of operation should be observed , so that any potential problems can be corrected.

TYPICAL INSTALLATION WITH WIDE ANGLE LEVEL CONTROL

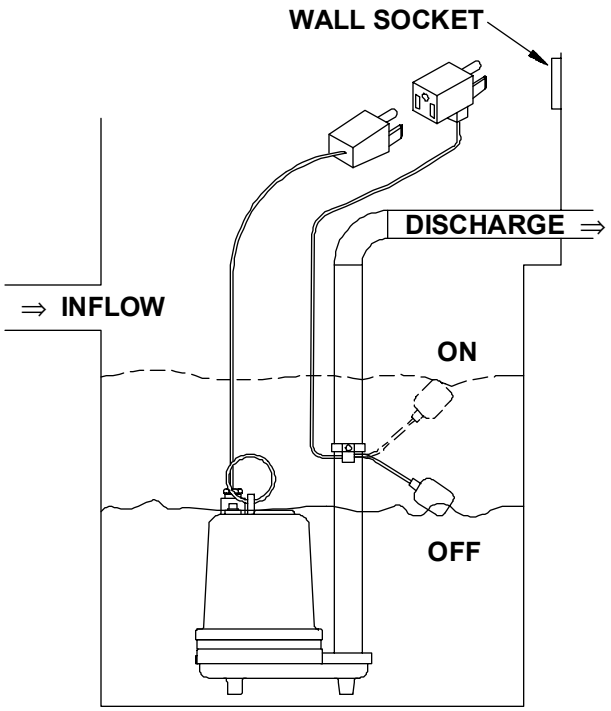


Fig. 2

5) It is recommended that the float should be set to insure that the sump well liquid level never drops below the top of the motor housing or a minimum level of 6" above the pump bottom.

6.) Figure 3 shows a typical connection for pumps with the wide angle float and piggy-back plug. for manual and automatic operations.

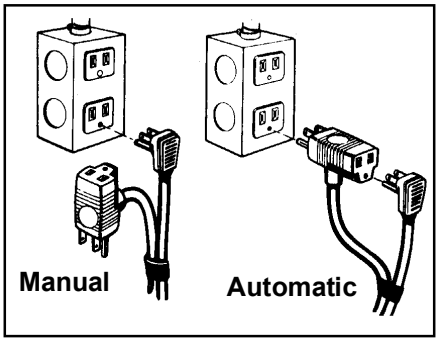


Fig. 3

Automatic- Plug float cord into outlet, then plug pump cord into float cord.

Manual- Plug pump cord directly into outlet.

C-4) Electrical Connections:

⚠ WARNING !

ALL MODEL PUMPS AND CONTROL PANELS MUST BE PROPERLY GROUNDED PER THE NATIONAL ELECTRIC CODEOR CANADIAN ELECTRIC CODE AND STATE, PROVINCEAND LOCAL ELECTRIC CODE. IMPROPER GROUNDING VOIDS WARRANTY.

C-4.1) Power Cable:

The cord assembly mounted to the pump must not be modified in any way except for shortening to a specific application. Any splice between the pump and the control panel must be made in accordance with all applicable electric codes. It is recommended that a junction box, if used, be mounted outside the sump or be of at least NEMA 4 (EEMAC-4) construction if located within the wet well. **DO NOT USE THE POWER CABLE TO LIFT PUMP. NOTE: The white wire is NOT a neutral or ground lead, but a power carrying conductor.**

C-4.2) Overload Protection:

Single Phase - The type of in-winding overload protector used is referred to as an inherent overheating protector and operates on the combined effect of temperature and current. This means that the overload protector will trip out and shut the pump off if the windings become too hot, or the load current passing through them becomes too high. It will then automatically reset and start the pump up after the motor cools to a safe temperature. In the event of an overload, the source of this condition should be determined and rectified immediately. **DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS** !

MODEL NO.	HP	VOLT	PH	RPM (Nom)	NEMA START CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD OD	EMERSON WINDING RESISTANCE MAIN/START	G.E. WINDING RESISTANCE MAIN/START
EHH412L	0.4	115	1	3450	H	11.5	23.0	14/3	SJTOW-A	0.390	1.08 -- 8.02	0.91 -- 13.71
EHH422L	0.4	230	1	3450	M	4.5	17.5	14/3	SJTOW-A	0.600	8.09 -- 8.00	9.24 -- 10.03
EHH432L	0.4	230	3	3450	J	3.0	7.8	14/4	SO	0.600	8.57	8.60
EHH442L	0.4	460	3	3450	J	1.5	3.9	14/4	SO	0.600	34.28	34.40
EHH452L	0.4	575	3	3450	J	1.2	3.1	14/4	SO	0.600	53.47	53.66
EHH512L	0.5	115	1	3450	F	15.0	23.0	14/3	SJTOW-A	0.390	1.08 -- 8.02	0.91 -- 13.71
EHH522L	0.5	230	1	3450	F	7.0	11.5	14/3	SJTOW-A	0.390	8.09 -- 8.00	9.24 -- 10.03
EHH1022L	1.0	230	1	3450	B	8.2	13.8	14/3	SJTOW-A	0.390	3.51 -- 12.07	2.89 -- 15.18
EHH1032L	1.0	230	3	3450	K	5.4	21.2	14/4	SO	0.600	5.32	6.11
EHH1042L	1.0	460	3	3450	K	2.3	10.7	14/4	SO	0.600	21.28	24.44
EHH1052L	1.0	575	3	3450	K	2.8	8.6	14/4	SO	0.600	33.25	38.19

Winding Resistance ± 5%
Pump rated for operation at ± 10% voltage at motor.**CSA Listed Units:**
(**OPTIONAL - CSA** Listed cable for 3 phase models is 14/4 SOW-A, 0.600 O.D.)

If current through the temperature sensor exceeds the values listed, an intermediate control circuit relay must be used to reduce the current or the sensor will not work properly.

TEMPERATURE SENSOR ELECTRICAL RATINGS		
Volts	**Continuous Amperes**	**Inrush Amperes**
110-120	3.00	30.0
220-240	1.50	15.0
440-480	0.75	7.5

C-4.3) Wire Size:
Consult a qualified electrician for proper wire size. See table for electrical information.

SECTION: D START-UP OPERATION

D-1) Check Voltage and Phase:
Before operating pump check to make sure that the voltage and phase information stamped on the pump's identification plate matches the available power.

D-2) Check Pump Rotation:
Before putting pump into service for the first time, the motor rotation must be checked. Improper motor rotation can result in poor pump performance and can damage the motor and/or pump. To check the rotation, suspend the pump freely, momentarily apply power and observe the "kickback". "Kickback" should always be in a counter-clockwise direction as viewed from the top of the pump ("kickback" is always opposite to impeller rotation). "Rotation" and "kickback" direction is noted on the pump motor housing.

D-2.1) Incorrect Rotation for Single-Phase:
In the unlikely event that the rotation is incorrect for a single-phase pump, contact a Barnes Pumps Service Center.

D-2.2) Incorrect Rotation for Three-Phase pumps:
In the event that the rotation is incorrect for a three-phase installation, interchange any two power cable leads at the control box. **DO NOT** change leads in the cable housing in the motor. Recheck the "Kickback" rotation again by momentarily applying power.

D-3) Identification Plate:
Record the numbers off the pump's identification plate onto the START-UP REPORT provided at the end of the manual for future reference.

D-4) Start-Up Report:
Included at the end of this manual are two start-up report sheets. These sheets are to be completed as applicable. Return one copy to Barnes Pumps and store the second in the control panel or with the pump manual if no control panel is used. It is important to record this data at initial start-up since it will be useful to compare to when servicing the pump in the future.

Insulation Test:
Before the pump is put into service, an insulation (megger) test should be performed on it. The ohm values as well as the volts and amps should be recorded on the start-up sheet and stored safely in the control panel or with the pump manual if no control panel is used.

Pump-Down Test:
After the pump has been properly wired and lowered into the basin, sump, or lift station, it is advisable to check the system by filling with liquid and allowing the pump to operate through it's pumping cycle. The time needed to empty the system, or pump-down time, should be recorded on the start-up sheet.

SECTION E: PREVENTATIVE MAINTENANCE

As the motor is oil filled, no lubrication or other maintenance is required, and generally Barnes pumps will give very reliable service and can be expected to operate for years on normal sewage pumping without failure. However, as with any mechanical piece of equipment a preventive maintenance program is recommended and suggested to include the following checks:

1) Inspect motor chamber for oil level and contamination and repair as required per section F-1.
2) Inspect impeller and body for excessive build-up or clogging and repair as required per section F-2.
3) Inspect bearing and replace as required per section F-3.
4) Inspect seal for wear or leakage and repair as required per section F-4

SECTION F: SERVICE AND REPAIR

NOTE: All item numbers ( ) refer to Figures 9 and 10.

⚠ WARNING !

ELECTRICAL POWER TO THE PUMP MOTOR MUST BE DISCONNECTED AND LOCKED OUT TO PREVENT ANY DANGEROUS ELECTRICAL HAZARDS OR PERSONNEL DANGER BEFORE ANY SERVICE WORK IS DONE TO THE PUMP.

⚠ CAUTION:

OPERATING PUMP BUILDS UP HEAT AND PRESSURE; ALLOW TIME FOR PUMP TO COOL TO ROOM TEMPERATURE BEFORE HANDLING OR SERVICING.

F-1) Lubrication:

Anytime the pump is removed from operation and at least every twelve (12) months, the cooling oil in the motor housing (12) must be checked visually for oil level and contamination.

F-1.1) Checking Oil:

To check oil, set unit upright. Remove pipe plug (21). With a flashlight, visually inspect the oil in the motor housing (12) to make sure it is clean, clear and that the oil level is above all internal componentry . If oil appears satisfactory, replace pipe plug. If oil is low or appears contaminated, test oil as per section F-1.2

F-1.2) Testing Oil:

1. Place pump on it's side, remove pipe plug (21) and drain oil into a clean, dry container.
2. Check oil for contamination using an oil tester with a range to 30 kilovolts breakdown.
3. If oil is found to be clean and uncontaminated (measures above 15 KV. breakdown), refill the motor housing as per section F-1.3.
4. If oil is found to be dirty or contaminated (or measures below 15KV. breakdown), then the pump must be carefully inspected for leaks at the shaft seal (3), cord inlet (8), square ring (11), and pipe plug (21) before refilling with oil. To locate the leak, perform a pressure test as per section F-1.4. After leak is repaired, refill with new oil as per section F-1.3.

F-1.3 Replacing Oil in Motor Housing:

Drain all oil from motor housing and dispose of properly. Refill with (see parts list for amount) new cooling oil as per table 1. An air space must remain in the top of the motor housing to compensate for air expansion (see Fig. 10). Set unit upright and fill only until the capacitor, or the motor for 3-phase, as viewed through the fill plug hole is covered. When refilling with oil after servicing the shaft seal (3), a pressure test as per section F-1.4 should be done. If shaft seal was not disturbed during service, then apply pipe sealant and replace the pipe plug (21).

⚠ WARNING !

DO NOT OVERFILL OIL. OVERFILLING OF MOTOR HOUSING WITH OIL CAN CREATE EXCESSIVE AND DANGEROUS HYDRAULIC PRESSURE WHICH CAN DESTROY THE PUMP AND CREATE A HAZARD. OVERFILLING OIL VOIDS WARRANTY.

F-1.4) Pressure Test:

Before checking the pump for leaks around the shaft seal, square ring, and cord inlet, the oil level should be full as described in section F1.3. Apply pipe sealant to the pressure gauge assembly and tighten into fill plug hole (see fig.4). Pressurize motor housing to 10 P.S.I. Use a soap solution around the sealed areas and inspect joints for "air bubbles". If, after five minutes, the pressure is still holding constant, and no "bubbles" are observed, slowly bleed the pressure and remove the gauge assembly. Replace the pipe plug using a sealant. If the pressure does not hold, then the leak must be located.

⚠ CAUTION:

ALWAYS WEAR EYE PROTECTION WHEN WORKING ON PUMPS.

CAUTION:

PRESSURE BUILDS UP EXTREMELY FAST; INCREASE PRESSURE BY "TAPPING" AIR NOZZLE. TOO MUCH PRESSURE WILL DAMAGE SEAL. DO NOT EXCEED 10 P.S.I.

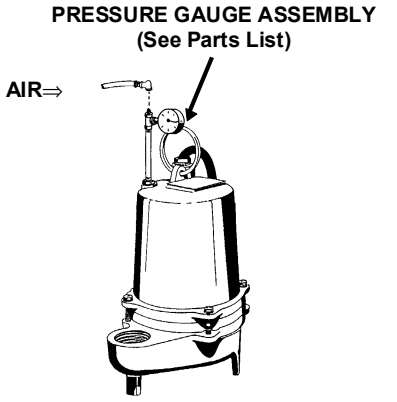


Fig. 4

TABLE 1 - COOLING OIL - Dielectric	
SUPPLIER	**GRADE**
BP	Enerpar SE100
Conoco	Pale Paraffin 22
Mobil	D.T.E. Oil Light
G & G Oil	Circulating 22
Imperial Oil	Voltesso-35
Shell Canada	Transformer-10
Texaco	Diala-Oil-AX

F-2) Impeller and Volute Service:

F-2.1) Disassembly and Inspection:
To clean out body (18), or to replace impeller (15), disconnect power, remove hex bolts (19), and vertically lift motor and seal assembly from body (18). Clean out body if necessary . Clean and examine impeller (15) for pitting or wear and replace if required. Inspect gasket (17) and replace if cut or damaged. If the impeller (15) needs replacing, remove nut (16).The impeller is threaded onto the shaft and to remove, unscrew impeller holding shaft with a large screwdriver. Remove exclusion seal (14) and replace if needed.

F-2.2) Reassembly:
Before installing impeller (15), inspect threads on shaft and impeller to assure that they are clean. Place exclusion seal on shaft with the thin lip towards the motor (see section F-4.3). Screw impeller onto shaft and tighten. Apply a thread-locking compound to shaft threads, thread nut on and torque to 30 ft. lbs. Rotate impeller to check for binding. Position gasket (17) on body and install impeller and motor housing on pump body. Apply thread locking compound to each cap screw, thread into body, and torque to 8 ft.lbs. Check for free rotation of impeller.

F-3) Motor and Bearing Service

F-3.1) Disassembly and Inspection:
Motor - To examine or replace the motor (1) or bearings (4), remove body and impeller as per section F-2.1. Drain oil from motor housing as per section F-1.2. Remove socket head screws (13). Loosen gland nut (8a) and push cord through while lifting motor housing (12) off of seal plate (2). Disconnect motor wires from cord set (8). Pull cord (8) through motor housing and inspect grommet (8c) for deterioration. Remove square ring (11) and inspect for breaks. Loosen motor screws and pull motor (1) straight up and off seal plate (2). Inspect all parts for signs of wear.

Bearings - Disassemble motor as per section F-3.1. Remove snap ring (5) with snap ring pliers and pull motor (1) and lower bearing (4) straight off of seal plate (2). Inspect all parts for signs of wear and replace as needed.

F-3.2) Replacing Bearings:
When replacing bearings, be careful to not damage the rotor or shaft threads. Press the old bearings off the shaft with an arbor press or gear puller. Clean the shaft thoroughly. Apply adhesive compound to shaft and press new bearing on, pushing only on the inner race, until it seats against shoulder of shaft (see fig.9)

IMPORTANT:

ALL PARTS MUST BE CLEAN BEFORE REASSEMBLY.

F-3.3) Reassembly:
Make sure shaft seal (3) is clean and in proper position as per section F-4.2 before reassembling rotor and bearing. Slide lower bearing and rotor shaft squarely into the seal plate (2) until bearing seats on the bottom. Insert snap ring (5) into seal plate with flat edge against outer race of bearing. Place motor stator squarely onto seal plate and tighten motor screws. Install square ring squarely (11) onto seal plate. With cord assembly (8) properly assembled, slip cord through motor housing (see Fig. 5). Connect motor wires to cord set as per figures 5 & 6. Place motor housing squarely onto seal plate while pulling excess cord through hole. Tighten socket head screws (13) into motor housing. Tighten gland nut (8a) against washers (8b) and grommet (8c). Refill with cooling oil as per paragraph F-1.3.

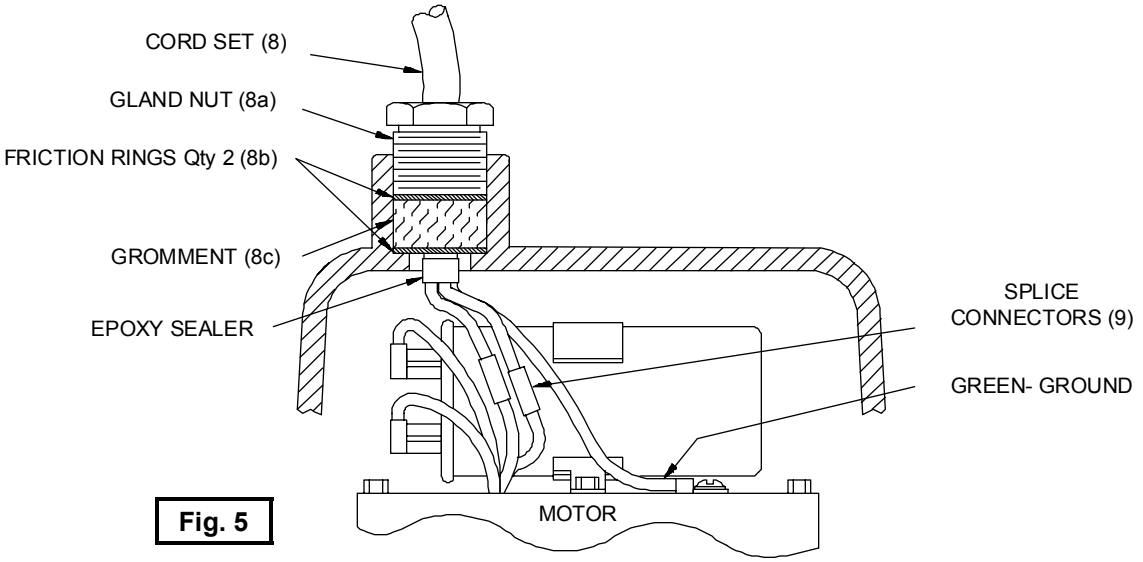
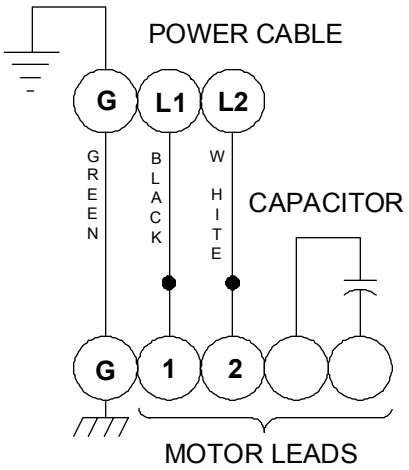
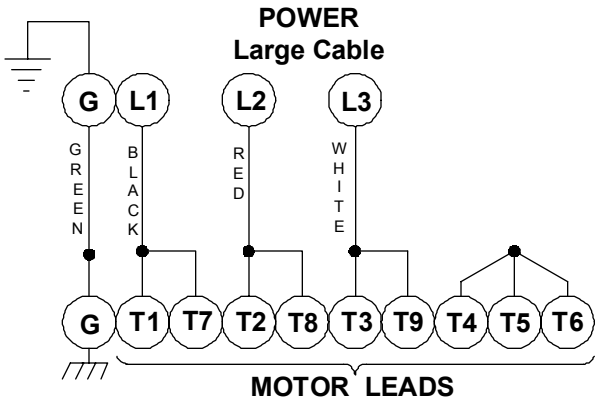


Fig. 5



SINGLE PHASE-115 & 230 VAC

POWER CABLE	MOTOR LEADS
Green (Ground)	Green
Black	Straight Connector
White	Straight Connector
Flag Connector	Capacitor
Flag Connector	Capacitor

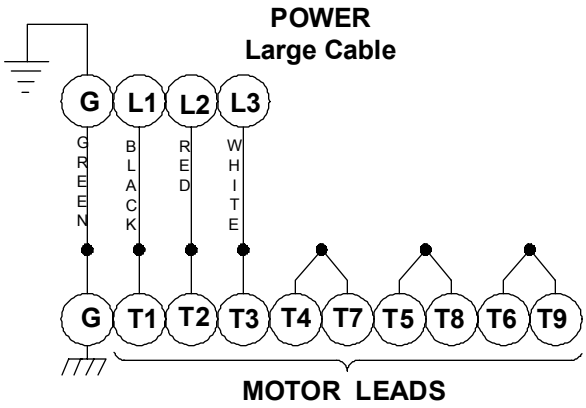


THREE PHASE, 230 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1 & 7
Red	2 & 8
White	3 & 9
	4, 5 & 6 Together

THREE PHASE, 460 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1
Red	2
White	3
	4 & 7 Together
	5 & 8 Together
	6 & 9 Together



THREE PHASE, 575 VOLT AC

Power Cable	Motor Lead Number
Green (Ground)	Green
White	3
Black	1
Red	2

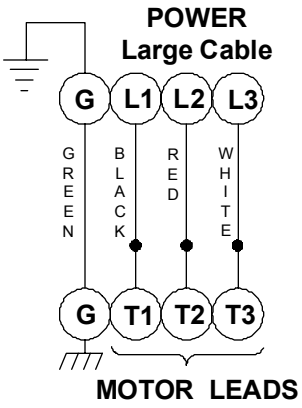


Fig. 6

F-4) Shaft Seal Service

CAUTION:

HANDLE SEAL PARTS WITH EXTREME CARE. DO NOT SCRATCH OR MAR LAPPED SURFACES.

F-4.1) Dissassembly and Inspection:
Disassemble pump motor as per section F-3.1. Inspect seal for signs of wear such as uneven wear pattern on the stationary member or chips and scratches on either sealing face. Do not interchange seal components. Replace entire seal if damage occurs.

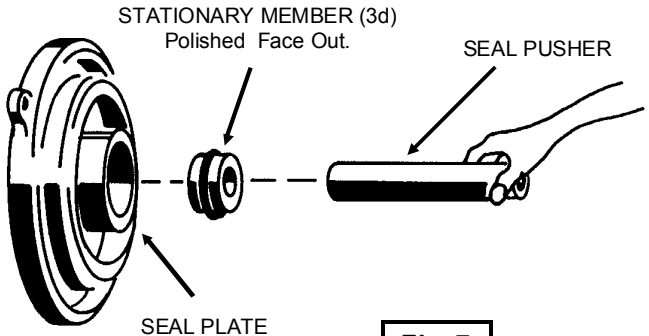


Fig. 7

F-4.2) Replacing Shaft Seal (refer to fig. 7, 8 & 9):
When replacing the shaft seal (3), remove used rotating member (3c), spring (3b), and spring retainer (3a) from motor shaft. Press used stationary member (3d) from the seal plate (2). At reassembly, clean seal cavity thoroughly and apply a light coat of oil. Lightly oil the rubber ring (**DO NOT** use grease) and press the stationary member firmly into the seal plate using a seal pusher (See Parts List- Seal Tool Kit), nothing but pusher to come in contact with seal face (see Fig. 7).
Insert so that the finished surface is up and the grooved surface is against the seal plate. Make sure the stationary member is in straight and that the rubber ring is not out of it's groove.

DO NOT HAMMER ON THE SEAL PUSHER - IT WILL DAMAGE THE SEAL FACE. Place spring retainer and spring onto motor shaft. Lightly oil shaft (**DO NOT** use grease) and inner surface of bellows of rotating member. With finished end away from motor, slide rotating member over bullet and onto shaft until it engages spring (see Fig. 8). Carefully assemble shaft to seal plate as per section F-3.3. It is extremely important to keep seal faces clean during assembly. Dirt particles lodged between these faces will cause the seal to leak. When seal plate is assembled to motor, it will properly align and seat the seal (3) and bearing (4). Follow complete reassembly instructions as per section F-3.3.

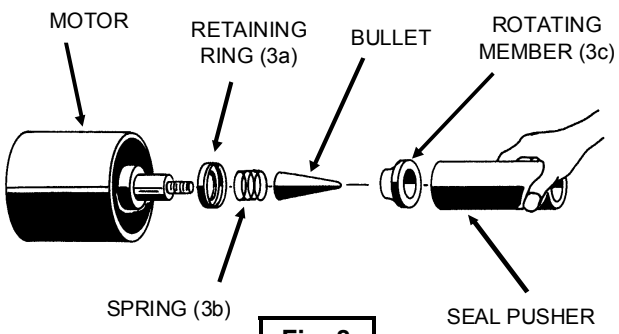


Fig. 8

F-4.3) Replacing Exclusion Seal:
The exclusion seal (14), helps to keep debris away from the shaft seal where it could cause damage. The exclusion seal should be replaced whenever the shaft seal is replaced. To replace the exclusion seal, pull the old seal off the shaft, and slide the new seal on with the thin lip towards the motor. Be sure not to damage the lip of the seal. Finger pressure is all that is needed to install the exclusion seal.

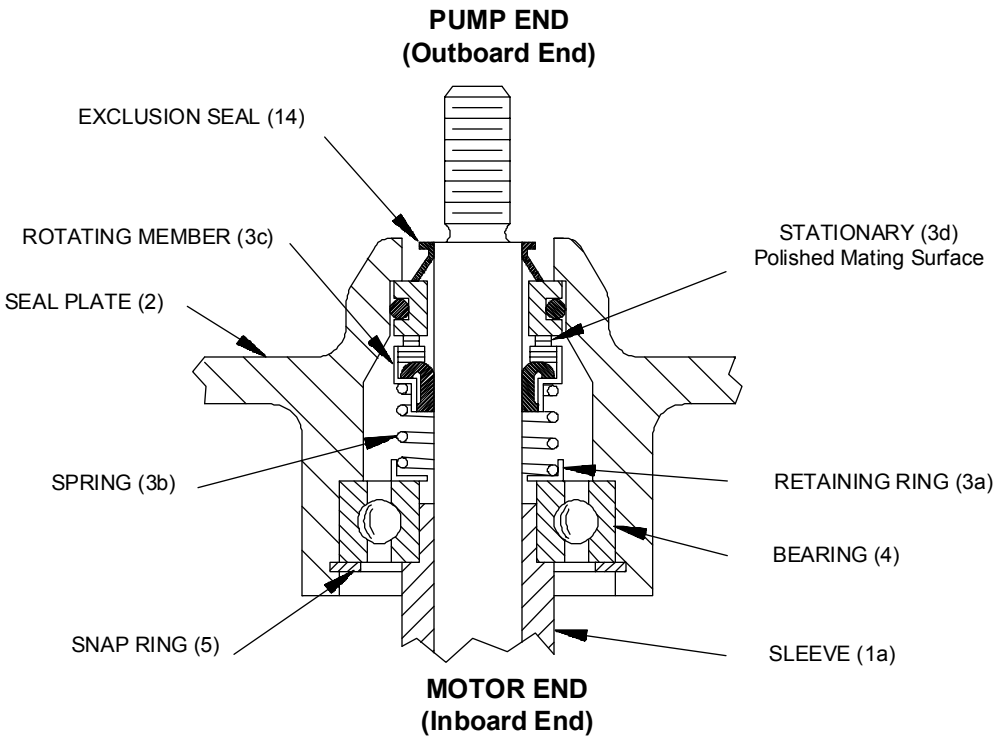


Fig. 9

TROUBLESHOOTING

CAUTION ! Always disconnect the pump from the electrical power source before handling.
If the system fails to operate properly, carefully read instructions and perform maintenance recommendations.
If operating problems persist, the following chart may be of assistance in identifying and correcting them:
MATCH "CAUSE" NUMBER WITH CORRELATING "CORRECTION" NUMBER.

NOTE: Not all problems and correction will apply to each pump model.

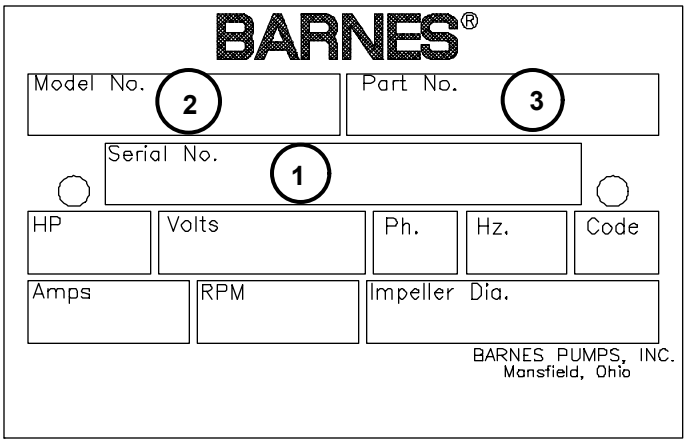
PROBLEM	CAUSE	CORRECTION
Pump will not run.	1. Poor electrical connection, blown fuse, tripped breaker or other interruption of power; improper power supply. 2. Motor or switch inoperative (to isolate cause, go to manual operation of pump). 2a. Float movement restricted. 2b. Switch will not activate pump or is defective. 2c. Defective motor. 3. Insufficient liquid level.	**1.** Check all electrical connections for security. Have electrician measure current in motor leads, if current is within ±20% of locked rotor Amps, impeller is probably locked. If current is 0, overload may be tripped. Remove power, allow pump to cool, then recheck current. **2a.** Reposition pump or clean basin as required to provide adequate clearance for float. **2b.** Disconnect level control. Set ohmmeter for a low range, such as 100 ohms full scale and connect to level control leads. Actuate level control manually and check to see that ohmmeter shows zero ohms for closed switch and full scale for open switch. (Float Switch). **2c.** Check winding insulation (Megger Test) and winding resistance. If check is out side of range, dry and recheck. If still defective, replace per service instructions. **3.** Make sure liquid level is at least equal to suggested turn-on point. **4.** Recheck all sizing calculations to determine proper pump size. **5.** Check discharge line for restrictions, including ice if line passes through or into cold areas. **6.** Remove and examine check valve for proper installation and freedom of operation. **7.** Open valve. **8.** Check impeller for freedom of operation, security and condition. Clean impeller cavity and inlet of any obstruction. **9.** Loosen union slightly to allow trapped air to escape. Verify that turn-off level of switch is set so that impeller cavity is always flooded. Clean vent hole. **10.** Check rotation. If power supply is three phase, reverse any two of three power supply leads to ensure proper impeller rotation. **11.** Repair fixtures as required to eliminate leakage. **12.** Check pump temperature limits & fluid temperature. **13.** Replace portion of discharge pipe with flexible connector. **14.** Turn to automatic position. **15.** Check for leaks around basin inlet and outlets.
Pump will not turn off.	2a. Float movement restricted. 2b. Switch will not activate pump or is defective. 4. Excessive inflow or pump not properly sized for application. 9. Pump may be airlocked. 14. Switch is in "HAND" position.	
Pump hums but doesn't run.	1. Incorrect voltage. 8. Impeller jammed or loose on shaft, worn or damaged, impeller cavity or inlet plugged.	
Pump delivers insufficient capacity.	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 5. Discharge restricted. 6. Check valve stuck closed or installed backwards. 7. Shut-off valve closed. 8. Impeller jammed or loose on shaft, worn or damaged, impeller cavity or inlet plugged. 9. Pump may be airlocked. 10. Pump running backwards.	
Pump cycles too frequently or runs periodically when fixtures are not in use.	6. Check valve stuck closed or installed backwards. 11. Fixtures are leaking. 15. Ground water entering basin.	
Pump shuts off and turns on independent of switch. (trips thermal overload protector). **CAUTION!** Pump may start unexpectedly. Disconnect power supply. **NOTE:** Some pumps **DO NOT** have thermal overload protection on the motor. Check pump specifications to determine.	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 8. Impeller jammed, loose on shaft, worn or damaged, impeller cavity or inlet plugged. 12. Excessive water temperature (internal protection only).	
Pump operates noisily or vibrates excessively.	2c. Worn bearings, motor shaft bent. 8. Debris in impeller cavity or broken impeller. 10. Pump running backwards. 13. Piping attachments to building structure too rigid or too loose.	

SECTION: G REPLACEMENT PARTS

G-1 ORDERING REPLACEMENT PARTS:

When ordering replacement parts, **ALWAYS** furnish the following information:

1. Pump serial number and date code. (Paragraph G-4)
2. Pump model number. (Paragraph G-3)
3. Pump part number. (Paragraph G-2)
4. Part description.
5. Item part number.
6. Quantity required.
7. Shipping instructions.
8. Billing Instructions.



Typical Name Plate

G-2 PART NUMBER:

The part number consists of a six (6) digit number, which appears in the catalog. A one or two letter suffix may follow this number to designate the design configuration. This number is used for ordering and obtaining information.

G-3 MODEL NUMBER:

This designation consists of numbers and letters which represent the discharge size, series, horsepower, motor phase and voltage, speed and pump design. This number is used for ordering and obtaining information.

G-4 SERIAL NUMBER:

The serial number block will consist of a six digit number, which is specific to each pump and may be preceded by a alpha character, which indicates the plant location. This number will also be suffixed with a four digit number, which indicates the date the unit was built (Date Code).
EXAMPLE: A012345 0490.

Reference the six digit portion (Serial Number) of this number when referring to the product.

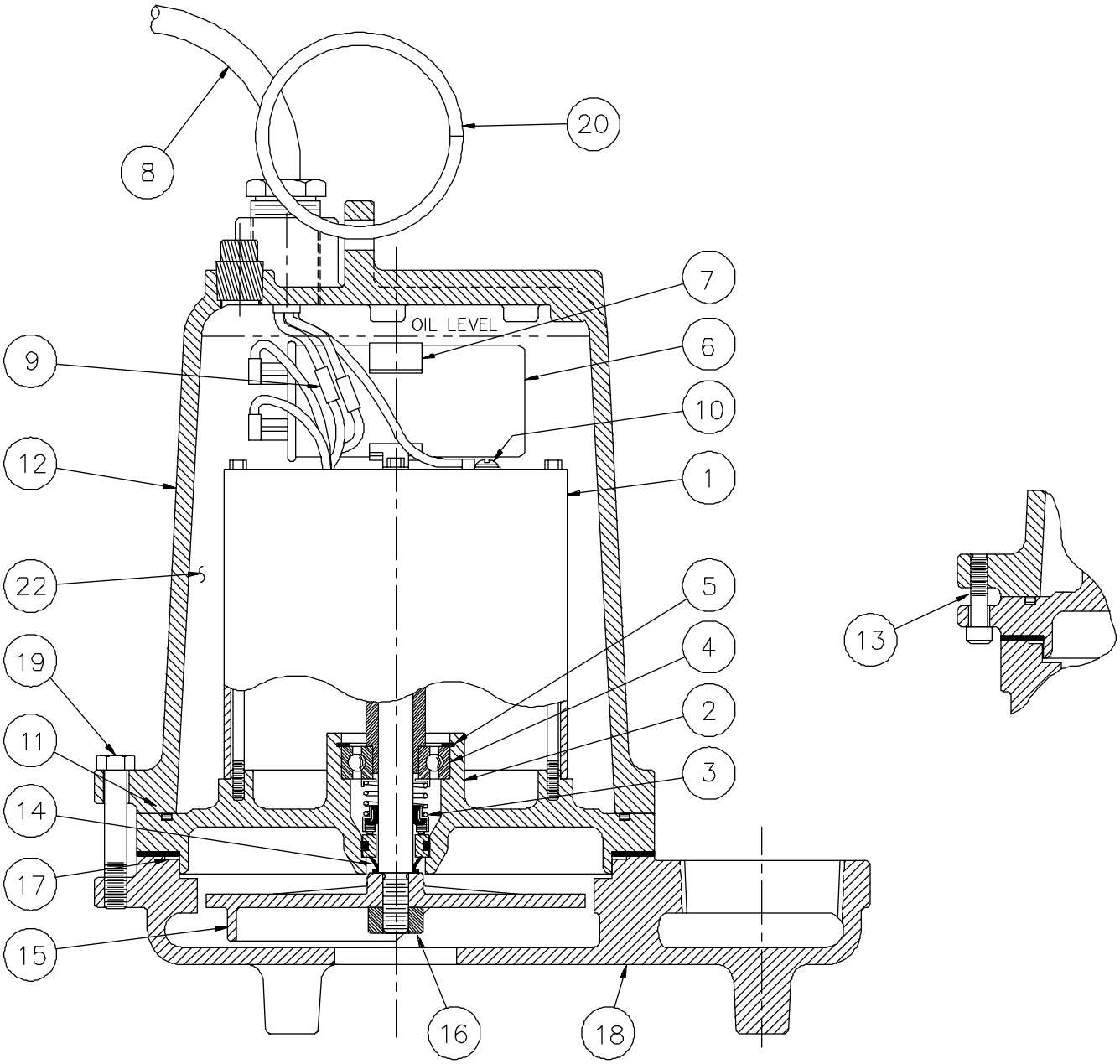


Fig. 10

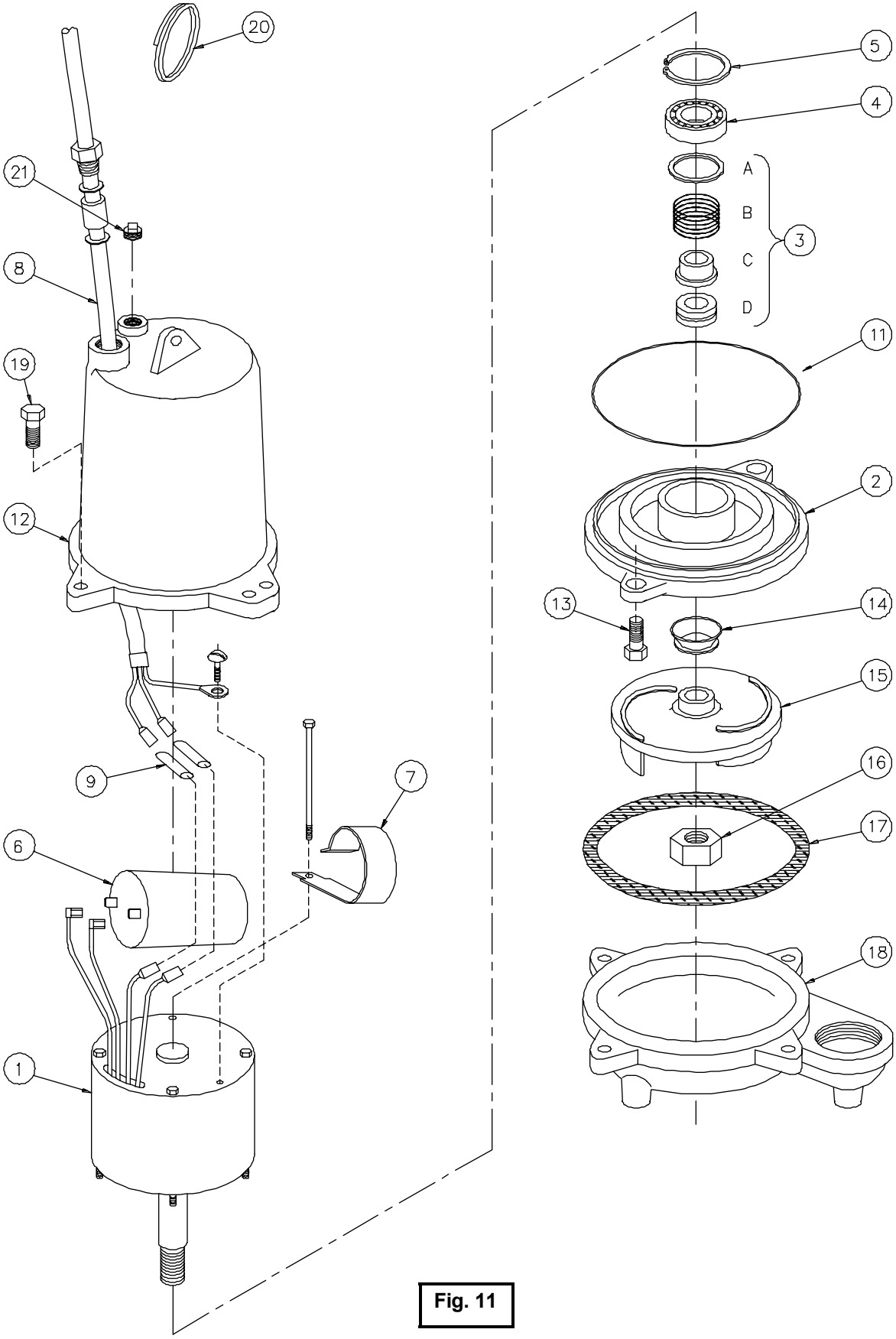


Fig. 11

PARTS KITS

Seal Tool Kit P/N-085344

Pressure Gauge Kit....P/N-085343

PARTS LIST

ITEM	QTY		DESCRIPTION		PART No.
1	1		Motor	EHH412L	068926
				EHH422L	
				EHH432L,442L	067462
				EHH452L	088555
				EHH512L	088521
				EHH522L	088570
				EHH1022L	068928
				EHH1032L, 1042L	071355
				EHH1052L	067463F
2	1		Seal Plate, Cast Iron		093067
3	1		Shaft Seal, **(Standard)**	Carbon/Ceramic/Buna-N	088572
				Tungsten/Tungsten/Buna-N	088572SB
				Carbon/Ni-Resist/Buna-N	088572SC
4	1		Bearing		017414
5	1		Bevel Ring		017415
6	1		Capacitor (Single ph. only, .4 & 1HP)	370V 20MFD	070963
			Capacitor (Single ph. only, .5HP)	370V 25MFD	070965
7	1		Capacitor Bracket		039858
8	1		Power Cable Assembly		**See TABLE 2**
8a	1	*	Gland Nut, 1 Phase	1-16 Stainless	051762
			Gland Nut, 3 Phase	1-16 Stainless	051448
8b	2	*	Friction Ring, 1 Phase		021531
			Friction Ring, 3 Phase		051449
8c	1	*	Grommet, 1 Phase		051764
			Grommet, 3 Phase		051451
9	2		Terminal Connector		026880
10	1		Self Tapping Screw	6-32 x .25" lg Stainless	22-24-6
11	1		Square Ring		095368
12	1		Motor Housing		093068
13	2		Socket Hd. Cap Screw	1/4-20x 1" Stainless	11-32-1
14	1		Exclusion Seal		056789
15	1		Impeller, Cast Iron	5.50" Dia. (1HP)	088557
				5.37" Dia.	088557TA
				5.25" Dia.	088557TB
				5.12" Dia.	088557TC
				5.00" Dia.	088557TD
				4.88" Dia.	088557TE
				4.75" Dia.	088557TF
				4.62" Dia.	088557TG
				4.50" Dia.	088557TH
				4.37" Dia. (.4HP)	088557TJ
				4.25" Dia.	088557TK
15			Impeller, Cast Iron	(.5HP)	088533
16	1		Nut	1/2-20 Stainless	030068
17	1		Gasket		068984
18	1		Volute, **(Standard)**		093070
19	4		Cap Screw	5/16-18 x 1.75" Stainless	1-135-1
20	1		Handle	Stainless	027271
21	1		Pipe Plug	.375 NPT, ZP	085132
22	3 qt.		Oil		029034

*** Included with Item 8**

TABLE 2 - POWER CABLE SETS Item #2				
MODEL/ LENGTH	**EHH412L, EHH422L, EHH512L, EHH1022L**	**EHH432L, EHH442L, EHH452L, EHH1032L, EHH1042L**	**EHH522L**	**(OPTIONAL) 3 PHASE CSA**
15FT. **(STD)**	091563	051545	093291	094882
25 FT.	091563XB	051545XB	093291XB	094882XB
30 FT.	091563XC	051545XC	093291XC	094882XC
40 FT.	091563XE	051545XE	093291XE	094882XE
50 FT.	091563XF	051545XF	093291XF	094882XF
75 FT.	091563XJ	051545XJ	093291XJ	094882XJ
100 FT.	091563XL	051545XL	093291XL	094882XL
125 FT.	091563XP	051545XP	093291XP	094882XP
150 FT.	091563XS	051545XS	093291XS	094882XS
175 FT.	091563XV	051545XV	093291XV	094882XV
200 FT.	091563XY	051545XY	093291XY	094882XY

IMPORTANT !
WARRANTY REGISTRATION

**Your product is covered by the enclosed Warranty.
Complete the Warranty Registration Form and returned to
Crane Pumps & Systems, Inc. Warranty Service Group**

IMPORTANT! If you have a claim under the provision of the warranty, contact your local Crane Pumps & Systems, Inc. Distributor.

RETURNED GOODS

**RETURN OF MERCHANDISE REQUIRES A "RETURNED GOODS AUTHORIZATION".
CONTACT YOUR LOCAL CRANE PUMPS & SYSTEMS, INC. DISTRIBUTOR.**

Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.

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BARNES®

Limited Warranty

We warrant to our immediate customer and to the ultimate consumer that products of our manufacture will be free of defects in material and workmanship under normal use and service for the following time periods, when installed and maintained in accordance with our instructions.

Pump Products: One (1) year from date of installation or (24) twenty-four months from date of shipment, whichever occurs first. Cleaning Products: Twelve (12) months from date of installation or eighteen (18) months from date of shipment, whichever occurs first. As used herein, "the ultimate consumer" is defined as the purchaser who first uses the product after its initial installation or, in the case of product designed for non permanent installation, the first owner who used the product. It is the purchaser's or any sub-vendee's obligation to make known to the ultimate consumer the terms and conditions of this warranty. This warranty gives you specific legal rights, and there may also be other rights which vary from state to state. In the event the product is covered by the Federal Consumer Product Warranties Law (1) the duration of any implied warranties associated with the product by virtue of said law is limited to the same duration as stated herein, (2) this warranty is a LIMITED WARRANTY, and (3) no claims of any nature whatsoever shall be made against us, until the ultimate consumer, his successor, or assigns, notifies us in writing of the defect, and delivers the product and/or defective part(s) freight prepaid to our factory or nearest authorized service station. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply. **THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY AND ALL WARRANTIES WITH RESPECT TO ANY PRODUCT SHALL BE TO REPLACE OR REPAIR AT OUR ELECTION, F.O.B. POINT OF MANUFACTURE OR AUTHORIZED REPAIR STATION, SUCH PRODUCTS AND/OR PARTS AS PROVEN DEFECTIVE. THERE SHALL BE NO FURTHER LIABILITY, WHETHER BASED ON WARRANTY, NEGLIGENCE OR OTHERWISE.** Unless expressly stated otherwise, guarantees in the nature of performance specifications furnished in addition to the foregoing material and workmanship warranties on a product manufactured by us, if any, are subject to laboratory tests corrected for field performance. Any additional guarantees, in the nature of performance specifications must be in writing and such writing must be signed by our authorized representative. Due to inaccuracies in field testing if a conflict arises between the results of field testing conducted by or for user, and laboratory tests corrected for field performance, the latter shall control. Components or accessories supplied by us but manufactured by others are warranted only to the extent of and by the terms and conditions of the original manufacturer's warranty. **RECOMMENDATIONS FOR SPECIAL APPLICATIONS OR THOSE RESULTING FROM SYSTEMS ANALYSES AND EVALUATIONS WE CONDUCT WILL BE BASED ON OUR BEST AVAILABLE EXPERIENCE AND PUBLISHED INDUSTRY INFORMATION. SUCH RECOMMENDATIONS DO NOT CONSTITUTE A WARRANTY OF SATISFACTORY PERFORMANCE AND NO SUCH WARRANTY IS GIVEN.**

This warranty shall not apply when damage is caused by (a) improper installation, (b) improper voltage (c) lightning (d) sand or other abrasive material (e) scale or corrosion build-up due to excessive chemical content. Any modification of the original equipment will also void the warranty. We will not be responsible for loss, damage or labor cost due to interruption of service caused by defective parts. Neither will we accept charges incurred by others without our prior written approval.

This warranty is void if our inspection reveals the product was used in a manner inconsistent with normal industry practice and\or our specific recommendations. The purchaser is responsible for communication of all necessary information regarding the application and use of the product. **UNDER NO CIRCUMSTANCES WILL WE BE RESPONSIBLE FOR ANY OTHER DIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST INCOME, LABOR CHARGES, DELAYS IN PRODUCTION, IDLE PRODUCTION, WHICH DAMAGES ARE CAUSED BY ANY DEFECTS IN MATERIAL AND\OR WORKMANSHIP AND\OR DAMAGE OR DELAYS IN SHIPMENT. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

No rights extended under this warranty shall be assigned to any other person, whether by operation of law or otherwise, without our prior written approval.

CRANE

A Crane Co. Company

PUMPS & SYSTEMS

420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Phone: (937) 778-8947
Fax: (937) 773-7157
www.cranepumps.com

83 West Drive, Brampton
Ontario, Canada L6T 2J6
Phone: (905) 457-6223
Fax: (905) 457-2650

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START-UP REPORT
FOR SUBMERSIBLE PUMPS

This report is designed to insure the customer that customer service and a quality product are the number one priority with Crane Pumps & Systems, Inc. (CP&S). Please answer the following questions completely and as accurately as possible. Mail this form to:

In U.S.A. Send To:
CRANE PUMPS & SYSTEMS, INC.
ATTN: WARRANTY SERVICE GROUP
420 THIRD ST. / P.O. BOX 603
PIQUA, OHIO 45356-0603 U.S.A.

In Canada Send To:
CRANE PUMPS & SYSTEMS, INC.
ATTN: SERVICE MANAGER
83 WEST DRIVE, BRAMPTON
ONTARIO, CANADA L6T 2J6

REPORTS THAT ARE NOT RETURNED CAN DELAY OR VOID WARRANTY.

Pump Owner's Name _____
Address _____
Location of Installation _____
Person in Charge _____ Phone _____
Purchased From (Crane Pumps & Systems Representative/Distributor) _____

Pump Model _____ Serial No. _____
Part Number _____
Voltage _____ Phase _____ Hertz _____ Horespower _____
Rotation: Direction of Impeller Rotation (Use C/W for clockwise, CC/W for counter-clockwise) _____
Method Used to Check Rotation (viewed from bottom) _____
Does Impeller Turn Freely By Hand: YES _____ NO _____

Condition Of Equipment GOOD _____ FAIR _____ POOR _____
Condition Of Cable Jacket GOOD _____ FAIR _____ POOR _____
Resistance of Cable Jacket GOOD _____ FAIR _____ POOR _____
Resistance of Cable and Pump Motor (measured at pump control)
Red-Black _____ Ohms, Red-White _____ Ohms, White-Black _____ Ohms
Resistance Of Ground Circuit Between Control Panel and Outside of Pump _____ Ohms
MEG Ohms Check of Insulation:
Red to Ground _____ White to Ground _____ Black to Ground _____

Condition of Equipment At Start-Up: Dry _____ Wet _____ Muddy _____
Was Equipment Stored: _____ Length of Storage: _____
Describe Station Layout _____

Liquid Being Pumped _____
Debris In Bottom of Station? _____
Was Debris Removed In Your Presence? _____
Are Guide Rails Exactly Vertical? _____
Is BAF Stationary Installed Level? _____

Liquid Level Controls: Model _____
Is Control Installed Away From Turbulence? _____
Operation Check:
Tip Lowest Float (Stop Float), All pumps should remain off.
Tip Second Float (and Stop Float), One pump comes On.
Tip Third Float (and Stop Float), Both pumps on (alarm on simplex).
Tip Fourth Float (and Stop Float), High Level Alarm On (omit on simplex).

If not CP&S level controls, describe type of controls. _____
Does liquid level ever drop below volute top? _____

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CP&S Control Panel Part No. and Brand _____
Number of pumps operated by control panel _____
NOTE: At no time should holes be made in top of control panel, unless proper sealing devices are utilized.
Control Panel Manufactured by Others: _____
Company Name: _____
Model No. _____
Short Circuit Protection _____ Type: _____
Number and Size of Short Circuit Device(s) _____ Amp Rating _____
Overload Type _____ Size _____ Amp Rating _____
Do Protective Devices Comply with pump and motor Amp Rating _____
Are all connections tight? _____
Is the interior of the panel dry? _____

ELECTRICAL READINGS:

Single Phase:

Voltage supply at panel line connection, Pump Off, L1, L2 _____
Voltage supply at panel line connection, Pump On, L1, L2 _____
Amperage: Load connection, Pump On L1 _____ L2 _____

Three Phase:

Voltage supply at panel line connection, Pump Off, L1-L2 _____ L2-L3 _____ L3-L1 _____
Voltage supply at panel line connection, Pump On, L1-L2 _____ L2-L3 _____ L3-L1 _____
Amperage: Load connection, Pump On L1 _____ L2 _____ L3 _____

FINAL CHECK:

Is pump seated on discharge properly? _____ Check for leaks? _____
Does check valves operate properly? _____
Flow; Does station appear to operate at proper rate? _____ Pump down time _____
Noise Level: High _____ Medium _____ Low _____
Comments:

Equipment Difficulties during start-up: _____
_____
_____

MANUALS:

Has operator received pump instructions and parts manual? _____
Has operator received electrical control panel diagram? _____
Has operator been briefed on Warranty? _____
Address of local CP&S Representative/Distributor: _____
I have received the above information (Name of Operator) _____
Name of Company _____
_____ Date _____
I Certify this report to be accurate (Name of Start-Up Person) _____
Employed By: _____ Date _____

Date and Time of Start-Up _____
Present At Start-Up
( ) Engineer: _____ ( ) Operator: _____

( ) Contractor: _____ ( ) Other: _____

To be filled out by factory:

Start - Up form checked by: _____ Date warranty registration mailed: _____

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IMPORTANT !
WARRANTY REGISTRATION
Your product is covered by the enclosed Warranty.
Complete the Warranty Registration Form and returned to
Crane Pumps & Systems, Inc. Warranty Service Group

IMPORTANT! If you have a claim under the provision of the warranty, contact your local Crane Pumps & Systems, Inc. Distributor.

FOLD HERE

**** IMPORTANT ! ****

WARRANTY REGISTRATION

CUSTOMER'S NAME _____ **DATE INSTALLED** _____

ADDRESS _____

CITY _____ **STATE** _____ **ZIP** _____

PHONE # _____ **FAX #** _____

DEALER'S NAME _____

CITY _____ **STATE** _____ **ZIP** _____

MODEL NO. _____ **SERIAL NO.** _____

PART NO. _____ **BRAND:** _____

Manual Index

FOLD HERE AND TAPE, DO NOT STAPLE

PLACE

STAMP

HERE

CRANE PUMPS & SYSTEMS, INC.
WARRANTY SERVICE GROUP
420 THIRD STREET
P.O. BOX 603
PIQUA, OHIO
45356-0603 - U.S.A.