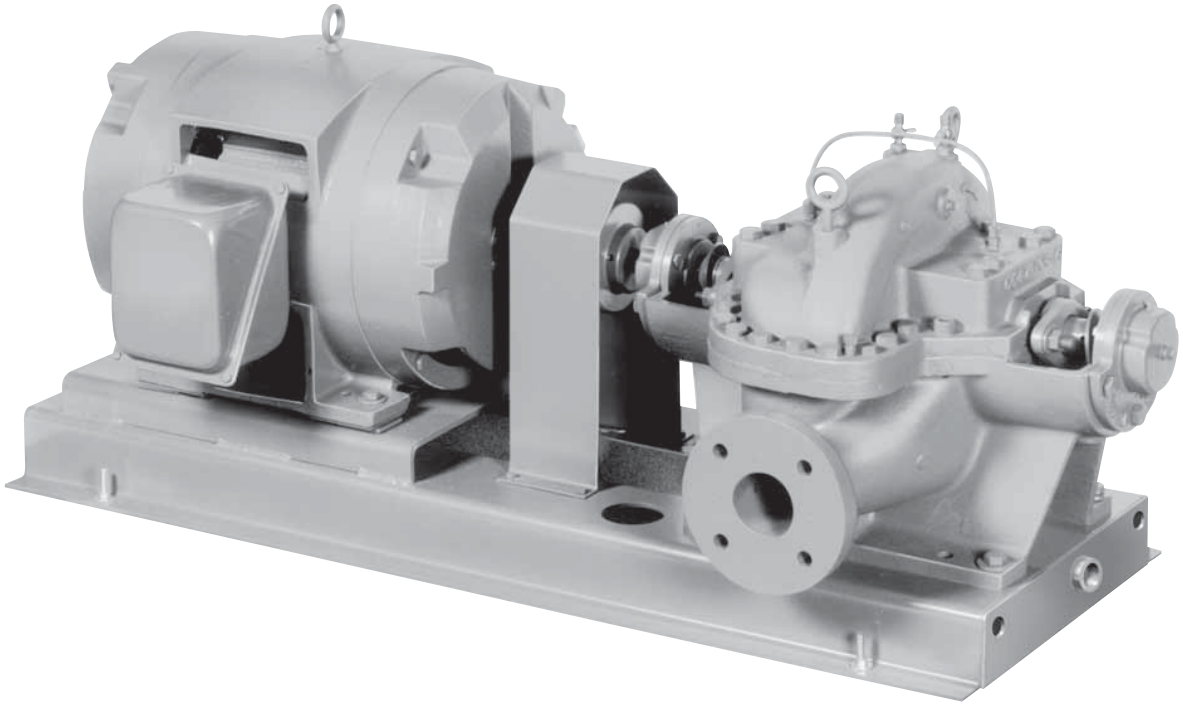
Manual Index

DEMING®

INSTALLATION, OPERATION & MAINTENANCE MANUAL
Horizontal Split Case Centrifugal Pumps

Series: 5260

Multi-Stage



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 reserves the right to change product without prior written notification.

CRANE®

A Crane Co. Company

PUMPS & SYSTEMS

420 Third Street
Piqua, Ohio 45356
Phone: (937) 778-8947
Fax: (937) 773-7157
www.cranepumps.com

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

Form No. 120022-Rev. D

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SAFETY FIRST!

Please Read This Before Installing Or Operating Pump. This information is provided for **SAFETY** and to **PREVENT EQUIPMENT PROBLEMS.** To help recognize this information, observe the following symbols:

IMPORTANT! Warns about hazards that can result in personal injury orIndicates factors concerned with assembly, installation, operation, or maintenance which could result in damage to the machine or equipment if ignored.

CAUTION! Warns about hazards that **can or will cause minor** personal injury or property damage if ignored. Used with symbols below.

WARNING! Warns about hazards that can or will cause serious personal injury, death, or major property damage if ignored. Used with symbols below.

Hazardous fluids can cause fire or explosions, burnes or death could result.

Extremely hot - Severe burnes can occur on contact.

Biohazard can cause serious personal injury.

Hazardous fluids can Hazardous pressure, eruptions or explosions could cause personal injury or property damage.

Rotating machinery Amputation or severe laceration can result.

Hazardous voltage can shock, burn or cause death.

Only qualified personnel should install, operate and repair pump. Any wiring of pumps should be performed by a qualified electrician.

WARNING ! To reduce risk of electrical shock, pumps and control panels must be properly grounded in accordance with the National Electric Code (NEC) or the Canadian Electrical Code (CEC) and all applicable state, province, local codes and ordinances. Improper grounding voids warranty.

WARNING! To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing. Lock out power and tag.

WARNING! 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.

CAUTION ! Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.

WARNING ! Do not pump hazardous materials (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.

WARNING ! Do not wear loose clothing that may become entangled in moving parts.

WARNING ! Keep clear of suction and discharge openings. **DO NOT** insert fingers in pump with power connected.

Always wear eye protection when working on pumps.

Make sure lifting handles are securely fastened each time before lifting. **DO NOT** operate pump without safety devices in place. Always replace safety devices that have been removed during service or repair. Secure the pump in its operating position so it can not tip over, fall or slide.

DO NOT exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.

WARNING ! 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.

WARNING! 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.

Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Lead is known to cause cancer and birth defects or other reproductive harm. 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.

Crane Pumps & Systems, 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.

A - GENERAL INFORMATION

TO THE PURCHASER:
Congratulations! You are the owner of one of the finest pumps on the market today. These pumps are products engineered and manufactured of high quality components. With 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.

Check local codes and requirements before installation. Servicing should be performed by knowledgeable pump service contractors or authorized service stations.

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 crating, do not lose or misplace.

STORAGE:
Short Term - Pumps are manufactured for efficient performance following long 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. Pump should be stored in its original shipping container and before initial start up, rotate impeller by hand to assure seal and impeller rotate freely.

SERVICE CENTERS:
For the location of the nearest Deming Service Center, check your Deming representative or Crane Pumps & Systems Service Department in Piqua, Ohio, telephone (937) 778-8947 or Crane Pumps & Systems Canada, Inc., Bramton, Ontario, (905) 457-6223.

B - INSTALLATION

1. LOCATION
The pump should be installed as near the source of liquid as possible with a minimum of piping on the suction side of the pump. The discharge piping should be as direct as possible with a minimum of fittings to lower friction loss.

The unit should be installed with adequate head room and a maximum area for inspection and service. The installation should be dry, well ventilated, and protected against moisture and flooding.

2. FOUNDATION
The pump foundation should be sufficiently substantial to form a level, rigid support for the combined weight of the pump and driver and maintain alignment of the installed unit. Foundation bolts, of the proper size, should be imbedded in the concrete. A pipe sleeve, about 2½" diameters larger than the bolt, should be used to allow for final positioning of the bolts. See Figure 1.

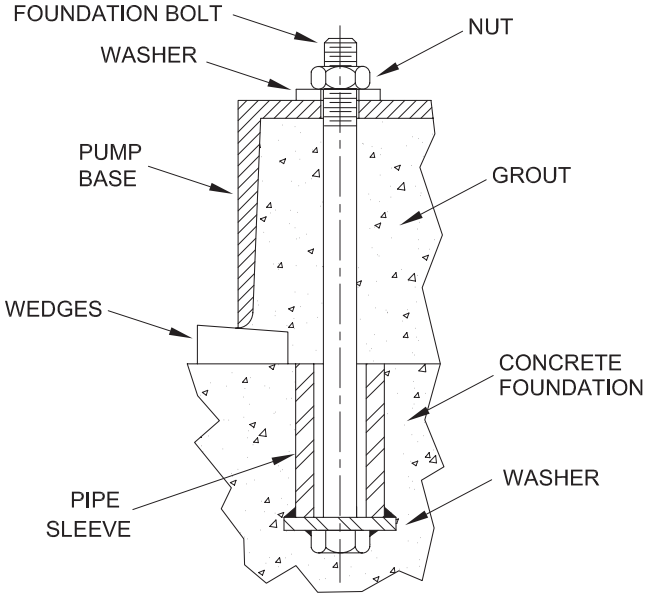


Figure 1. Foundation Bolt Location and Anchorage

3. MOUNTING:
Pumps and drivers that are received from the factory with both machines mounted on a common base plate, were accurately aligned before shipment. All baseplates are flexible to some extent and, therefore, must not be relied upon to maintain the factory alignment. Preliminary alignment is necessary after the complete unit has been leveled on the foundation, and again, after the unit is piped, and rechecked periodically as outlined in the following paragraphs.

Position unit on foundation and level the base plate, using rectangular metal blocks and shims, or wedges having a small taper. A gap of 3/4" to 1½" should be allowed between the base plate and foundation for grouting.

Adjust the metal supports or wedges until the shafts of the pump and driver are level. Check the coupling faces, as well as the suction and discharge flanges of the pump for horizontal or vertical position by means of a level. Correct the positions, if necessary, by adjusting the supports or wedges under the base plate, as required.

4. FLEXIBLE COUPLING ALIGNMENT

A flexible coupling should not be used to compensate for misalignment of the pump and driver shafts. The purpose of the flexible coupling is to compensate for temperature changes and to permit end movement of the shafts without interference with each other, while transmitting power from the driver to the pump.

CAUTION! - Remove and lock out power to driver.

FACTORY ALIGNMENT

Pump and drivers that are received from the factory with both machines mounted on a common baseplate, were accurately aligned before shipment. All baseplates are flexible to some extent and, therefore, must not be relied upon to maintain the factory alignment. Preliminary alignment is necessary after the complete unit has been leveled on the foundation and again, after the unit is piped, and rechecked periodically as outlined in the following paragraphs.

FIELD ALIGNMENT

The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved toward the pump. The necessary tools for checking the alignment of a flexible coupling are a straight edge and a taper gauge or a set of feeler gauges.

NOTE: In most cases where extreme **accuracy** is necessary, a dial indicator may be used to align coupling. Angular alignment check is made by inserting a taper gauge or feelers between the coupling faces at 90-degree intervals around the coupling. The unit will be in angular alignment when the coupling faces are exactly the same distance apart at all points. (See Figure 2).

Parallel alignment check is made by placing a straight edge across both coupling rims at the top, bottom and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling rim at all positions. Allowance may be necessary for temperature changes and for coupling halves that are not of the same outside diameter. Care must be taken to have the straight edge parallel to the axis of the shafts. Correction for Angular and Parallel Misalignment is made by adjusting the shims under the driver. After each change, it is necessary to recheck the alignment of the coupling halves, as adjustment in one direction may disturb adjustments already made in another direction.

The permissible amount of coupling misalignment will vary with the type of pump and driver, but should be limited to approximately .002 inches per inch of shaft diameter when final adjustment is made. When the units are lined up cold, it is necessary to make allowance for the vertical rise of the driver caused by heating when in operation. When the preliminary alignment has been completed the foundation, bolts should be tightened evenly, but not too firmly.

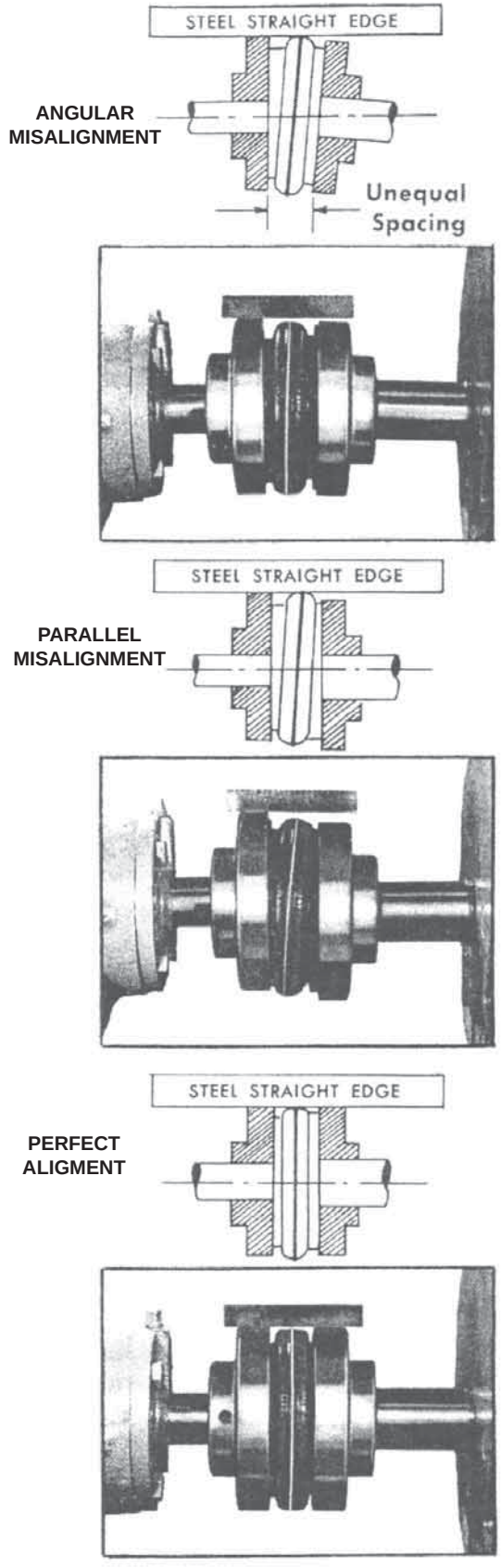


Figure 2

WARNING - Coupling guards must be used to avoid serious injury to operating personnel.

5. GROUTING

Grouting compensates for unevenness in the foundation and prevents vibration and shifting after mounting is complete. Build a form around the base plate to contain the grout, and sprinkle area with water to obtain a good bond. The base should be completely filled with a good quality, non-shrinking grout. The usual mixture for grouting is one part Portland cement and two parts sand with sufficient water to flow freely. It is also desirable to grout the leveling pieces, shims or wedges in place. Foundation bolts should be fully tightened when grout has hardened, usually about 48 hours after pouring.

6. PIPING

The pump suction and discharge connections are not intended to indicate the required suction and discharge pipe sizes. The pipe diameter must be selected according to the requirements of the pumping system and recommended friction losses for the liquid being pumped.

Usually, it is advisable to increase the size of both the suction and discharge pipes at the pump nozzles to have minimum acceptable friction loss, suction pipe should never be smaller in diameter than the pump suction nozzle. When suction pipe is of larger diameter than the pump suction nozzle, an eccentric reducer is required to eliminate possible air or vapor pockets at the pump suction inlet.

Both suction and discharge pipes must be supported independently near the pump, so that when piping is connected to the pump, no strain will be transmitted to the pump. Piping should be arranged with as few bends as possible, and, preferably, with long radius elbow whenever possible.

Where vibration noises must be kept to a minimum a flexible connection is recommended on both the suction and discharge lines. This will eliminate any sound being telegraphed through the pipe system.

NOTE: Flexible connector should have limiting bolts to contain hydraulic forces.

SUCTION PIPING

A horizontal suction line must have a gradual rise to the pump. Any high point in the suction pipe can become filled with air and prevent proper operation of the pump and may cause loss of prime. The pipe and fittings must be free of all air leaks.

Any valves or fittings should located at a distance equal to 5 to 10 times the diameter of the suction pipe from the pump suction nozzle. If an elbow must be installed at the pump suction, it should be installed in a vertical position to reduce unequal flow into the pump, which may cause cavitation in the pump (See Figure 3).

There is always uneven flow in an elbow when it is installed in any position other than a vertical position. This unequal flow allows more water to enter one side of the impeller than enters the other side causing a reduction in capacity and efficiency. This condition may also cause cavitation which would be characterized by noisy operation and shorter pump life.

An eccentric rather than straight reducer and gate vale with stem horizontal rather than vertical should be installed in suction piping. (See Figure 3).

NOTE: A gate valve in the suction piping should not be used as a throttling device, as this may cause the liquid to overheat during operation.

DISCHARGE PIPING

A silent type check valve and a gate valve should be installed in the discharge line. The check valve, placed between the pump and the gate valve, is to protect the pump against pressure surges and to prevent water running back through the pump in case of failure of the driver. The gate valve is used in priming, starting and when shutting down the pump. This is especially important when the pump is operated against a high static head.
if increasers are used on the discharge side increase the size of discharge piping, they should be placed between the check valve and pump.

7. WIRING

For electric motor drives, connect power supply to conform with national and local codes. Line voltage and wire capacity must match the ratings stamped on the motor nameplate.

8. ROTATION

Before starting the pump, check the required direction of rotation of the pump. The proper direction is indicated by a direction arrow on the pump casing. Separate the coupling halves, then start motor to see that it rotates in the direction required by the pump. If it does not, reverse any two main leads of the 3-phase wiring to the motor. The coupling halves can be reconnected and the pump primed for starting.

C - OPERATION

1. PRIMING

Install pet cocks on top of casing as shown.

CAUTION: Before starting the pump, the casing and suction line must be filled with liquid. The pump must not be run until it is completely filled with liquid, because of danger of injuring some of the parts of the pump which depend upon liquid for lubrication. Wearing rings will not seize when the pump is filled with liquid but are very liable to do so when the pump is run dry.

Priming By Suction Pressure

When operating with suction pressure (flooded suction), priming may be accomplished by bleeding all the air out of the pump by opening the petcock located at the top of the upper casing or at the top seal gland.

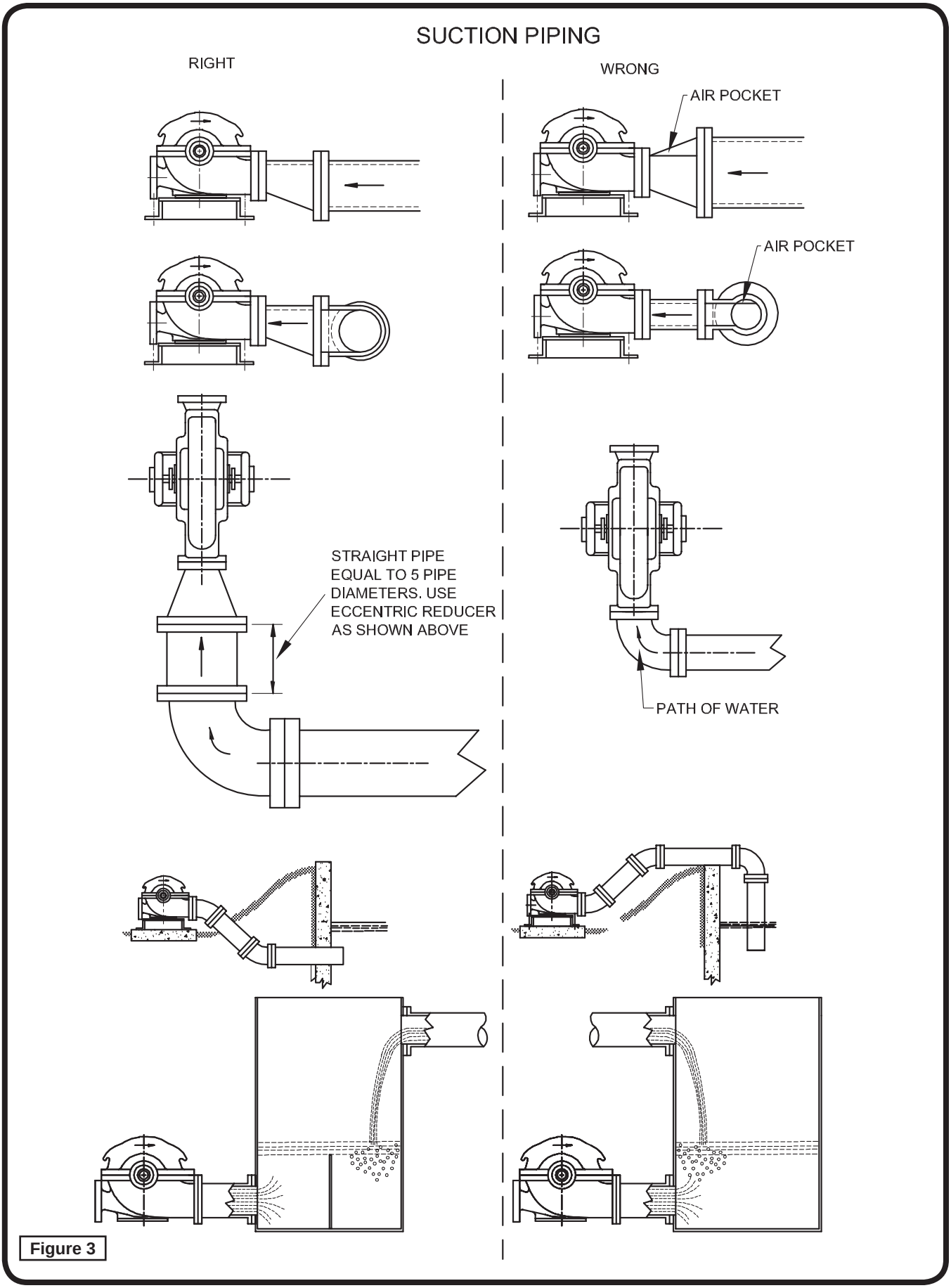

SUCTION PIPING
RIGHT
WRONG
AIR POCKET
AIR POCKET
STRAIGHT PIPE
EQUAL TO 5 PIPE
DIAMETERS. USE
ECCENTRIC REDUCER
AS SHOWN ABOVE
PATH OF WATER

Figure 3

A pump operating under a suction lift may be primed by any of the following methods, as may be best suited to the conditions. The discharge valve should be closed during priming operation.

Priming by Ejector or Exhauster

This method is used when steam, high pressure water, or compressed air is available.

1. Attach an air ejector to the highest point in the pump casing. This will remove the air from the pump and suction line.

2. As soon as the ejector waste pipe throws water continuously, the pump may be started. After starting, a steady stream of water from the waste pipe indicates the pump is primed. If this stream of water is not obtained, the pump must be stopped at once and the process of priming repeated. A foot valve is unnecessary when this kind of device is used.

3. Open the discharge valve slowly and close off the ejector.

Priming With Foot Valve

When it is not practicable to prime by ejector or exhauster, the pump may be primed by the use of a foot valve. The foot valve will prevent liquid running out through the suction inlet and the pump can be completely filled with liquid from some outside source. Pet cocks on the top of the pump should be opened during filling to allow the air to escape. A tight foot valve will keep the pump constantly primed so that the pump may be used for automatic operation. The valve must be inspected frequently, however, to see that it does not develop leaks and thus allow the pump to be started dry.

Priming by Vacuum Pump

When neither of the above methods of priming are practical, the pump may be primed by the use of a vacuum pump to exhaust the air from the pump casing and suction line. A wet vacuum pump is preferable, as it will not be injured if water enters it. When a dry vacuum pump is used, the installation must be such as to prevent liquid being taken into the air pump. The vacuum pump manufacturer's instructions should be followed.

2. STARTING THE PUMP

Position of Discharge Valve on Starting

A high or medium head centrifugal pump, when primed and operated at full speed with the discharge gate valve closed, requires much less power than when operated at its rated capacity and head with the discharge gate valve open. For this reason it is usually advantageous to have the discharge gate valve closed when the pump is being started. The pump must not be throttled by the use of a valve in the suction line.

WARNING! - Operating the pump with a closed discharge valve can result in excessive heat build-up and should be limited to the shortest practical duration. Operating the pump at close to shut-off head usually places greater bending strains on the shaft than at operating points near the best efficiency.

The following important items should be checked as pump is started and placed in operation.

a. Pump and driver securely bolted
b. Coupling properly aligned
c. Piping complete
d. Correct pump rotation
e. Pump shaft turns freely
f. Discharge valve closed
g. Suction valve open (if used)
h. Coupling Guard installed
i. Pump fully primed
j. Pump and driver properly lubricated
k. Seal water valve (if used) open

Only after these items have been checked should the pump be started.

3. INITIAL ADJUSTMENTS

Open discharge valve as soon as operating speed has been reached. After the pump has been started the packing box glands should be tightened to eliminate excessive liquid loss. (Applies only to pumps having packed stuffing boxes.) Packing should not be pressed too tight, as this may result in burning the packing and scoring the shaft or shaft sleeve. The best adjustment will allow the liquid to drip slowly from the packing box gland. This will permit proper lubrication of the shaft and dissipate generated heat.

As soon as the pump and driver have reached the normal operating temperature, the unit should be shut down for final coupling alignment. This should be done by following the instructions found in Section B, Part 4.

After the unit has been running for about one week, the coupling halves should be given a final check for misalignment caused by pipe strains or temperature strains. If the alignment is correct, both pump and driver may be dowelled to the baseplate if desired.

D. MAINTENANCE

1. LUBRICATION

Grease Lubricated Pump

Pump bearings are properly lubricated with grease at the factory before shipment. Periods of subsequent lubrication depend on local conditions, loads, speeds, hours of operation and temperature.

Periodic inspection of bearing lubrication should be made and additional grease added as needed. At this time the plug in the bottom of the bearing cover should be removed and the bearing flushed with clean grease. A Chevron SRI-2 or Shell Dolium "R" grease is recommended for most installations. Do not overgrease as this causes high bearing temperatures and shortens bearing life. The pump should be run a short time to eject any excess grease and the plug then replaced in the bearing cover.

2. PACKING BOX

The packing glands should be adjusted occasionally to insure proper packing lubrication. A slow dripping through the gland is recommended for good lubrication and long packing and shaft sleeve life.

When installing new rings of packing, clean packing box and inspect parts for any damage. If the shaft sleeve is worn or grooved, it should be replaced. New packing will not do an adequate sealing job on a worn shaft sleeve.

Insert two new rings of packing in front of lantern ring. Stagger joints to minimize leakage.

Tamp each ring in place. Replace lantern ring. Add two rings of packing behind lantern ring. Replace gland and bolts, rotate shaft and tighten gland securely. Loosen the gland and add the final ring of packing. Be sure lantern ring is positioned to receive lubrication through orifice. Tighten nuts securely to seat packing and rotate shaft. After rotating several turns, loosen nuts to finger tight for starting.

3. DISASSEMBLY

The following procedure is for complete disassembly of the pump. If complete disassembly is not necessary, use only those steps which apply.

1. Shut off and lock put power to motor.
2. If hot liquids are being pumped, care should be taken so personal injury is not incurred during disassembly.
3. Totally depressurized pump and associated piping by closing suction and discharge valves, to isolate pump from system. Slowly open vent cock and then remove drain plug from casing.
4. Remove all relief cooling, flush lines from pump.
5. Remove coupling guard
6. Loosen coupling set screws. Move coupling hubs back and remove coupling sleeve.
7. Remove seal cap bolts by alternating the loosening of the bolts. Exercise care to not cock the seal cap, which could chip or crack the carbon seal face. (Pack pumps remove packing gland).
8. Remove case rollpins. (Used to align upper and lower halves).
9. Using some type of overhead lifting device, (a frame, come a long chain fall, etc) hook onto the two eyebolts or lifting lugs on top half of casing.
10. Remove bolts holding casing halves together. Turn jackscrews in to separate the casing halves.
11. Set top half out of the way on a piece of cardboard or wood, taking care not to scratch gasket surface.
12. Place casing gasket, as well as all other gaskets in water to keep them from drying out and shrinking
13. Check seal setting (distance from machined surface at the end of the stuffing box area to the seal collar). This will need to be known to reset collar in the proper position, if disassembly requires removal of collar. (See Chart “Construction Details”).
14. Using overhead lifting device, hook onto rotating assembly with nylon straps or rope, to not scratch shaft. Remove bolts holding bearing housing to pump casing. Remove rotating assembly from casing.
15. Mark impeller on coupling side , so if required to remove from shaft, it will be reassembled correctly.
16. Remove coupling hub from pump shaft (may require use of a gear or wheel puller). Remove coupling key. (This is inboard side).
17. Remove three capscrews holding bearing cap and bearing housing together. Remove bearing housing (tap off using rubber hammer). Using a gear or wheel puller, pull bearing off of shaft.
18. Remove bearing cap and water deflector (rubber slinger) from shaft.
19. Loosen set screws in sleeve lock nuts, using a spanner wrench. Remove (when used).
20. Remove seal cap. (Stationary seal seat is pressed in).
21. Remove rotating seal assembly. (Packing and packing bushing on pack pumps).
22. Slide shaft sleeve off
23. Remove both impellers and interstage diaphragm, impeller key and casing rings.
24. Remove three capscrews holding bearing cap and bearing housing together (outboard). Remove bearing housing (Tap off using rubber housing).
25. Remove retaining ring (bearing snap ring).
26. Remove bearing (outboard) using gear or wheel puller.
27. Remove thrust collar. (Remove bearing cap before thrust collar on verticals).
28. Repeat Steps 20 through 25.

4. REASSEMBLY

The following procedure is for the complete assembly of the pump. This procedure must be followed for satisfactory operation. If pump is not completely disassembled, use only the steps that are applicable.

1. Install both impellers and interstage diaphragm, with gasket between impellers. Make sure impeller is installed on shaft the same way it came off, per mark put on it during disassembly. (Double check vane curvature as indicated as shown in Figure 4.

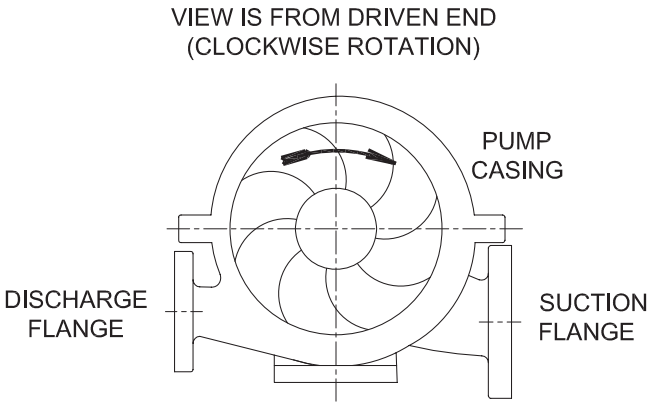


Figure 4

2. Install shaft sleeves. Be sure good hub gaskets are in place on sleeves, to seal between sleeve and impeller. If sleeves have internal o-rings, be sure they are good. Make sure there are not sharp edges or corners to cut o-rings. Line up slots on sleeves with impeller key. If pack pump, install stuffing box bushing. On mechanical seals, install stuffing box bushing.
3. Clean and polish smooth the sleeves, making sure there are no sharp edges or corners to cut the seal's rubber parts. If seal collars were removed or being replaced, slide into place.
4. Inspect face of seal washer, if scratched or chipped, replace. Clean inside of rubber bellows of seal assembly. (Anti-freeze can be used as a lubrication for installation of seal). Oil inside of seal bellows and sleeves, with a mixture of 1/3 part STP and 2/3 part 10W oil. This allows seal assembly to be easily pushed into position. Be sure the sealing washer is in the proper position. The notches on the outside edge of the sealing washer must mate with the lugs in the retainer.
5. Slip spring retainer and spring over shaft or sleeve and up against seal collar. Then slide the seal bellows assembly over the sleeve, compressing spring against seal collar, and seating spring against bellows assembly. Gently release pressure. The mechanical seal is a precision product, and great care must be taken to avoid damage.
6. Inspect face of stationary seat. If grooved, replace by removing old seal and cleaning seal cap. Oil outer seal ring and push new seat into the seal cap cavity, so the lapped surface side of seal seat will mate with seal washer or rotating element taking care not to marr seal surface. It must be seated firmly and squarely.
7. Put casing rings on impeller
8. Put seal cap gaskets and seal caps into place.
9. Put 2 to 3 wraps of Teflon sealing tape on shaft threads and start shaft sleeve locknuts when use.
10. Slide deflectors (rubber water slinger) onto shaft
11. Put on outboard bearing cap
12. Put on thrust collar.
13. Clean and check, or replace bearing. Hand pack with a Lithium base grease
14. Put bearing on by only applying pressure to the inner race. Care must be taken not to damage seat, by wrapping a clean rag or paper towel around shaft between seal cap and seal rotating element.
15. Install retaining ring (bearing snap ring), make sure it is seated in grove shaft.
16. Clean all the old grease out of the bearing housing. Check grease for saponification, which is usually caused by infiltration of moisture, and noticed by the whitish color of the grease. Also check for carbonizing of grease which results from heat caused by overgreasing. Put bearing housing on and bolt up to bearing cap.
17. Put on inboard bearing cap.
18. Repeat Steps 13, 14 and 16.
19. Install pump coupling hub and key
20. If new casing half gaskets are to be installed, place them onto lower half and trim to fix. ***CAUTION: Do Not cut gasket at end of stuffing box in the seal cap area.***
21. Place rotating assembly into lower case, making sure to fit holes in case wear rings on roll pins in lower case half. (Keep seal cap gaskets next to seal cap, to not tear them. Watch that seal collars or packing bushings are in stuffing box).
22. Bolt outboard bearing housing to lower casing half
23. Bolt inboard bearing housing to lower casing half
24. Center impeller up in volute of lower casing half
25. Tighten shaft sleeve nuts and tighten setscrew in sleeve nuts
26. If seal collars were removed or need resetting, rotate them 30° before tightening set screws. Set them using the dimensions from Step 15 or Disassembly Instructions. NOTE: Seal collar face (Surface next to seal spring) must be perpendicular to the shaft while rotating shaft.
27. Pack pumps thread and tighten gland studs into casing. Place one ring of packing into stuffing box. On successive rings of packing, stagger the packing joints 120° to prevent excessive leakage through the packing box. Under suction lift conditions, or when external flushing is required, the pump should be fitted with lantern rings. Care must be taken to locate these under the flushing port drilled in casing. Each ring of packing should be slid into place when being installed until stuffing box is full.
28. Place casing half gaskets in place. When installing new gaskets a small amount of grease evenly applied to casing surface will help hold gasket in place.
29. Put upper casing half (make sure seal caps and seal cap gaskets will clear upper casing and that jack screws in upper half have been backed off) into place, taken care to install as to not slide gasket. Check casing half gaskets at stuffing box and seal cap area. Check for binding by rotating shaft.
30. Drive in case rollpins (to align upper and lower halves) check for binding by rotating shaft.
31. Bolt casing halves together by tightening all bolts until snug. To insure an equal clamping force, tightening should be done in a sequence of steps. First start with 50% of the full torque value, following a "criss-cross" pattern. For instance, start at twelve o'clock, then six o'clock, then nine o'clock, three, o'clock, eleven, five, eight, two and so on. After the initial tightening of 50% torque the bolts 70%, then 100% to achieve the required clamping force. Follow the "criss-cross" pattern in each sequence. After the initial tightening has been done, the bolts should be retightened as often as necessary to make up for the loss of clamping force that occurs as the gaskets compress. With the torque calculated properly, using the correct torquing sequence, the seal against leakage will be assured. Check for binding by rotating shaft. (Torque requirements).

32. Trim the casing half gaskets flush with casing at end of stuffing box using a putty knife, file, etc.
33. **Mechanical seal pumps:** Remove rag or towel from between seal cap and rotating element of seal that was placed here in Step 15. Slide seal element into place, check to be sure seal faces are clean, and that the sealing washer is properly positioned in retainer. Push seal cap and seal cap gasket in evenly far enough to install seal cap bolts and washers. Care must be taken to turn both bolts equally to prevent cocking the seal cap and chipping or cracking the carbon sealing washer. Check to make sure gasket is in proper position. Note that these bolts only need to be tight enough to compress gasket to seal.
34. **Pack Pumps:** Install the gland halves (Note: These are in sets and marked as such and cannot be mixed. The one with the hole goes on bottom), gland washers and nuts. Tighten nuts down finger tight. Be sure the gland has entered the box at least 1/8". If the packing will not compress to allow this, remove one ring of packing. The breaking-in period of the packing is more important in the satisfactory performance of a stuffing box. When the pump is returned to service, additional care must be given the packing box to insure proper packing life. It is necessary to allow 60 to 100 drops leakage per minute through the packing for lubrication purposes. If the flow rate is other than this, the gland nuts should be loosened or tightened one flat (1/16 turn) at a time to acquire the correct leakage (both nuts must be turned equally to prevent cocking the gland) allow at least ten minutes between adjustment for the leakage rate to stabilize. When in doubt, choose the greater leakage rate, since overly tightened packing will ruin the packing as well as the sleeve.
35. Install relief cooling, abrasive separator, flush lines, vent cock, drain plug and other fittings that were removed during disassembly.
36. Open vent cock to evacuate air. Slowly open suction valve, when air has evacuated close vent cock and fully open suction valve. Open discharge valve to its original position. Check for leaks and turn rotating assembly. Never start a pump until all air and vapor has been evacuated. Without fluid around it, the mechanical seal may be ruined within a few seconds of operation. It is possible that the mechanical seals may drip the first few minutes to an hour of operation.
39. Install coupling sleeve, adjust and align coupling. Refer to alignment procedure section.
40. Install coupling guard
41. Turn power to pump on. Start and run pump

TORQUE REQUIREMENTS	
SIZE	**FOOT-POUNDS**
3/8-16	21.7
1/2-13	43.5
5/8-11	86.0
3/4-10	152.0
7/8-9	222.0
1-8	307.0

FOOTNOTE: The rotating assembly can be adjusted by loosening the three bolts that holds the bearing housing to lower case half on one end or the other, or both. Lift up on bearing housing and snug bottom bolt, then using a rubber hammer, lightly tap housing while turning shaft. Repeat until best position is found, then tighten all bolts.

5. DOUBLE-WEAR RING IMPELLERS:

Remove - Wear rings are pressed and bolted on and must be removed with puller or by drilling through the width of the wear ring and removing with a chisel after the wear ring locking screws are removed. Wear ring locking screws can be removed by center punching and drilling out using a 7/32" drill.

Install - Install wear rings onto impeller hubs. Drill through each wear ring and impeller hub in two places 180° apart, using a number 7 drill, tap holes with 1/4-20UNC tap stopping 1 or 2 threads short of tapping through. Thread screws into tapped holes until tight or flush with inside of impeller hub. Cut screws off flush with outside diameter of wear ring and file smooth any burrs or protrusions.

6. CHANGE ROTATION:

Follow disassembly instructions Steps 1 thru 24. Turn both impellers and interstage diaphragm around and slide back onto shaft. The mark put on impeller in Step 16 should be opposite the coupling (driver) end of shaft. Follow reassembly instruction Steps 1 thru 10, Steps 17 thru 39.

There is only one correct way for impeller to go in casing. If pump is mounted on base, unbolt and turn casing around 180°.

7. SEAL REPLACEMENT (Inboard):

Follow disassembly instructions Steps 1 thru 4, remove flush line to seal cap only, 5, 6 remove three motor mounting bolts and turn motor enough to allow for coupling removal, 7, 16 thru 21.

Follow reassembly instructions Steps 5, 6, 7, 9, 10. 16, 17, 22, 28, 32, 34, 35, put motor back into place, 36 & 27.

8. SEAL REPLACEMENT (Outboard):

Follow disassembly instructions Steps 1, 2, 3, remove flush line to seal cap, 7, 25 thru 28, then 18 thru 21.

Follow reassembly instructions Steps 5, 6, 7 thru 15, 21, 32, 34, 35.

9. SHAFT SEAL - TYPE 1 INSTALLATION

Remove top half of the casing. After determining size and type of pump from name plate, find setting location of seal collar, either X, Y, or Z, from Table 1. If the seal collar needs resetting, rotate it 30° before tightening set screws.

IMPORTANT ! - DO NOT ATTEMPT TO REINSTALL ANY USED PARTS OF THE SEAL, EXCEPT THE SPRING AND COLLAR.

TABLE 1			
PUMP	**SHAFT GROUP**	**Fig. 5A with SHAFT SLEEVE "Y"**	**Fig. 5B BALANCED SEAL "Z"**
3 x 1-1/2 x 10	1-1/8	1-1/2	1-7/8
3 x 2 x 10			
4 x 3 x 10	1-3/8	1-1/2	2

This shaft seal is a precision product. Treat it with care. In handling, do not let the carbon sealing washer or ceramic floating seat drop or fall. Take particular care not to scatch the lapped faces on the sealing washer and floating seat.

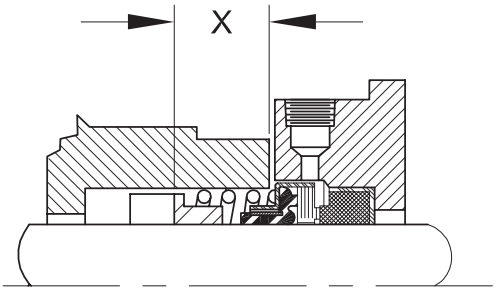


Figure 5A

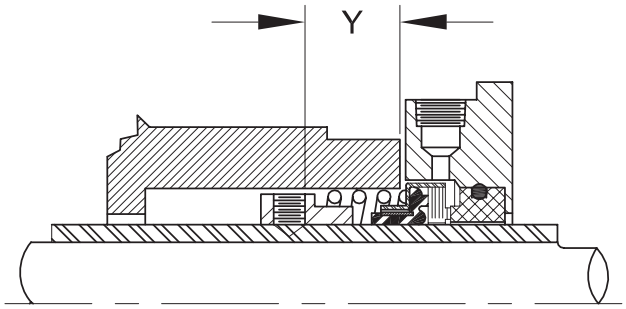


Figure 5B

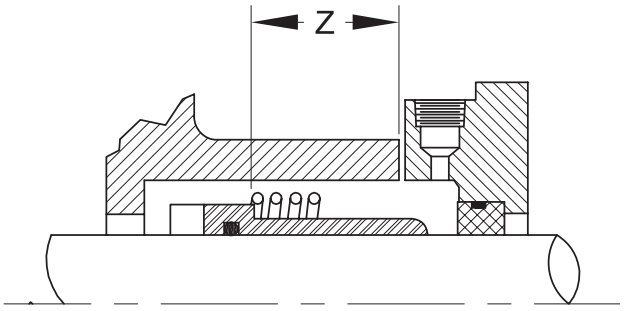


Figure 5C

INSTALL WASHER AND BELLOWS ASSEMBLY

Be sure the sleeve (or shaft) is clean and polished smooth before installing new part.

Oil sleeve (or shaft) and the thimble with light oil, to allow the washer and bellows assembly to be easily pushed into position.

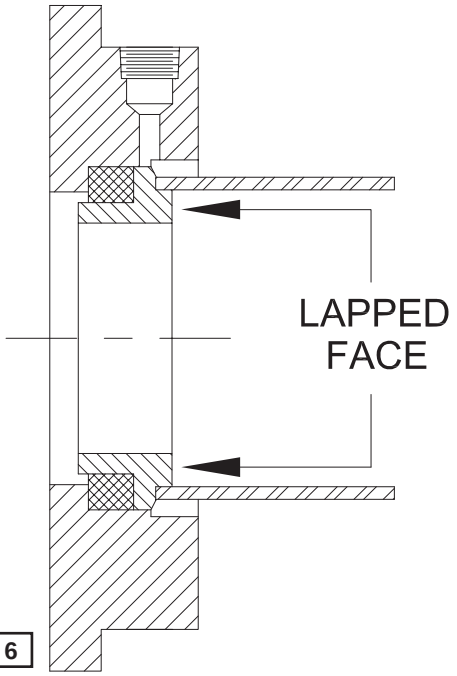


Figure 6

E - LOCATING TROUBLE

1. No Liquid Delivered
   a. Pump not primed - See Priming
   b. Speed too low - Check motor speed and nameplate
   c. Discharge head too high
   d. Suction lift too high
   e. Impeller completely plugged
   f. Wrong direction of rotation - Check wiring
   g. NPSHA may be too low - pump cavitates check total NPSHR
   h. Suction or discharge valves closed
   i. Impeller installed backwards

2. Not Enough Liquid Delivered
   a. Air leaks in suction piping
   b. Speed to low - Check motor speed
   c. Discharge head higher than anticipated. Check discharge valve/system requirements
   d. Suction lift too high
   e. Impeller partially plugged
   f. Wrong direction of rotation
   g. Not enough suction head for hot liquid
   h. NPSHA may be too low - pump cavitates
   i. Mechanical defects
      1. Impeller damage
      2. Wear rings worn
   j. Air entrainment
   k. Flow meter improperly calibrated
   l. Impeller installed backwards

3. Not Enough Pressure
   a. Speed too low - Check motor speed
   b. Air or gas in liquid
   c. Incorrect impeller diameter - Check system requirements
   d. Obstruction in pump or piping
   e. Air leaks in suction piping
   f. Specific gravity lower than specified - May require larger pump impeller
   g. Defective pressure gauge
   h. Mechanical defects
      1. Impeller damaged
      2. Wear rings worn

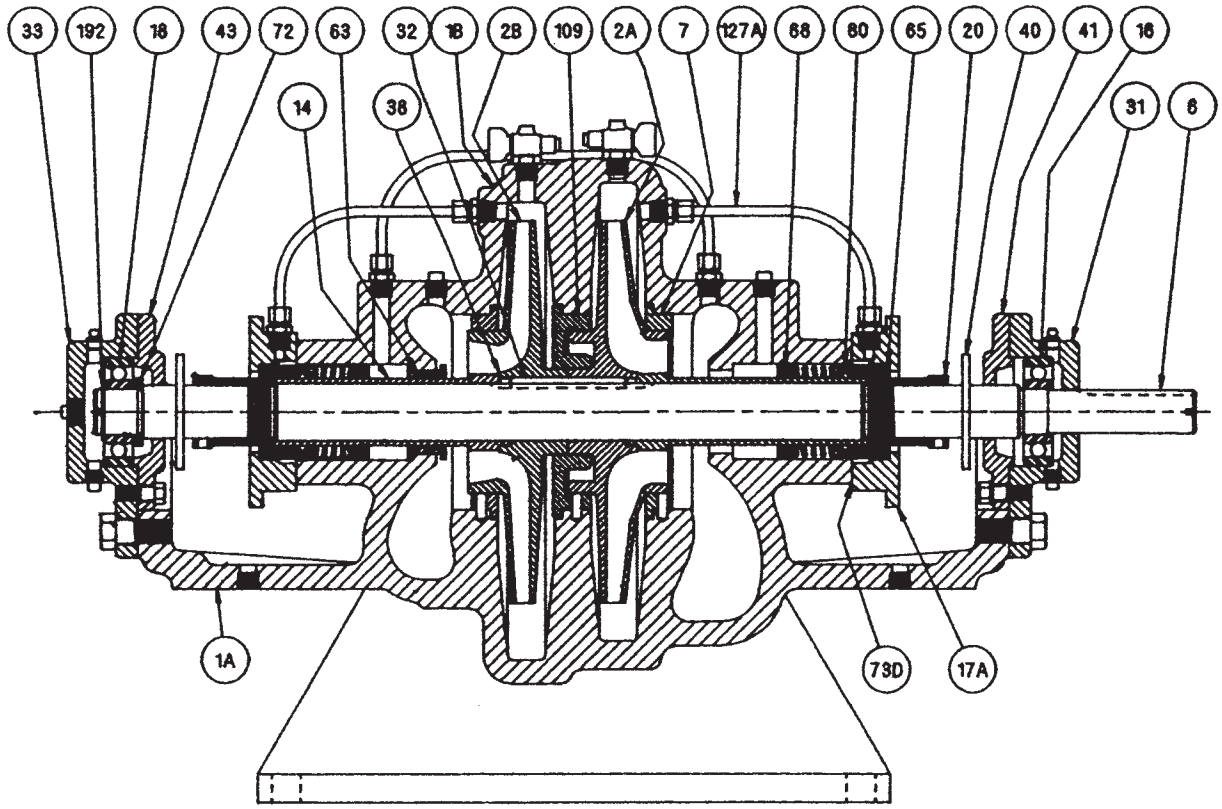
4. Pump Works For A While Then Quits
   a. Air leaks in suction piping
   b. Obstruction in pump or piping
   c. Suction lift too high
   d. Air or gas in liquid
   e. Incomplete priming - See Priming
   f. Air leak due to defective shaft packing
   g. Air leak through stuffing box when operating with high vacuum or high suction lift. Install recirculation piping or pressurize from outside liquid source.

5. Pump Takes Too Much Power
   a. Speed too high - Compare Pump and motor nameplates
   b. Head lower than rating - pumps too much liquid. Check system requirements
   c. Liquid specific gravity or viscosity greater than expected. Requires large motor.
   d. Pump and driver misalignment - Check casing for pipe strain. Support piping and realign unit
   e. Wrong direction of rotation
   f. Electrical defects - Check power supply and motor
   g. Impeller oversized for system requirements
   h. Partial freezing or thickening of liquid when pumped. Check liquid characteristics.
   i. Mechanical defects
      1. Bent pump shaft.
      2. Impeller binds in casing - Check impeller adjustment
      3. Stuffing box packing too tight. See Packing

6. Excessive Pump Vibration
   a. Cavitation at pump suction due to insufficient NPSHA. Alter installation to reduce NPSHR
   b. Impeller out of balance - Check mechanical (static) balance
   c. Pump and motor misalignment
   d. Obstruction in pump impeller
   e. Pump shaft bent
   f. Worn pump bearings
   g. Impeller imbalance due to wear or corrosion
   h. Motor imbalance
   i. Base plate loose on foundation or insufficient strength to support the load

7. Pump and/or Motor Noise
   a. Pump and motor misalignment
   b. Pump cavitation
   c. Base plate loose or not grouted
   d. Pump bearings worn
   e. Motor bearings worn or fan rubs housing
   f. Foreign matter in pump
   g. Broken shaft
   h. Liquid velocity in pump or valves due to greater liquid flow than anticipated.
   i. Pump impeller imbalance due to wear.

FIG. 5260 SERIES TWO-STAGE
with MECHANICAL SHAFT SEALS



ITEM No.	DESCRIPTION
+1A	Lower Half Casing
+1B	Upper Half Casing
*2A	Impeller (1st Stage)
*2B	Impeller (2nd Stage)
6	Pump Shaft
*7	Casing Ring
±*8	Impeller Ring (Not Shown)
*14	Shaft Sleeve
*16	Ball Bearing (inboard)
17A	Seal Cap
*18	Ball Bearing (outboard)
20	Shaft Sleeve Nut
31	Bearing Housing (inboard)
*32	Impeller Key
33	Bearing Housing (outboard)
38	Shaft Sleeve Gasket
40	Deflector (Liquid)

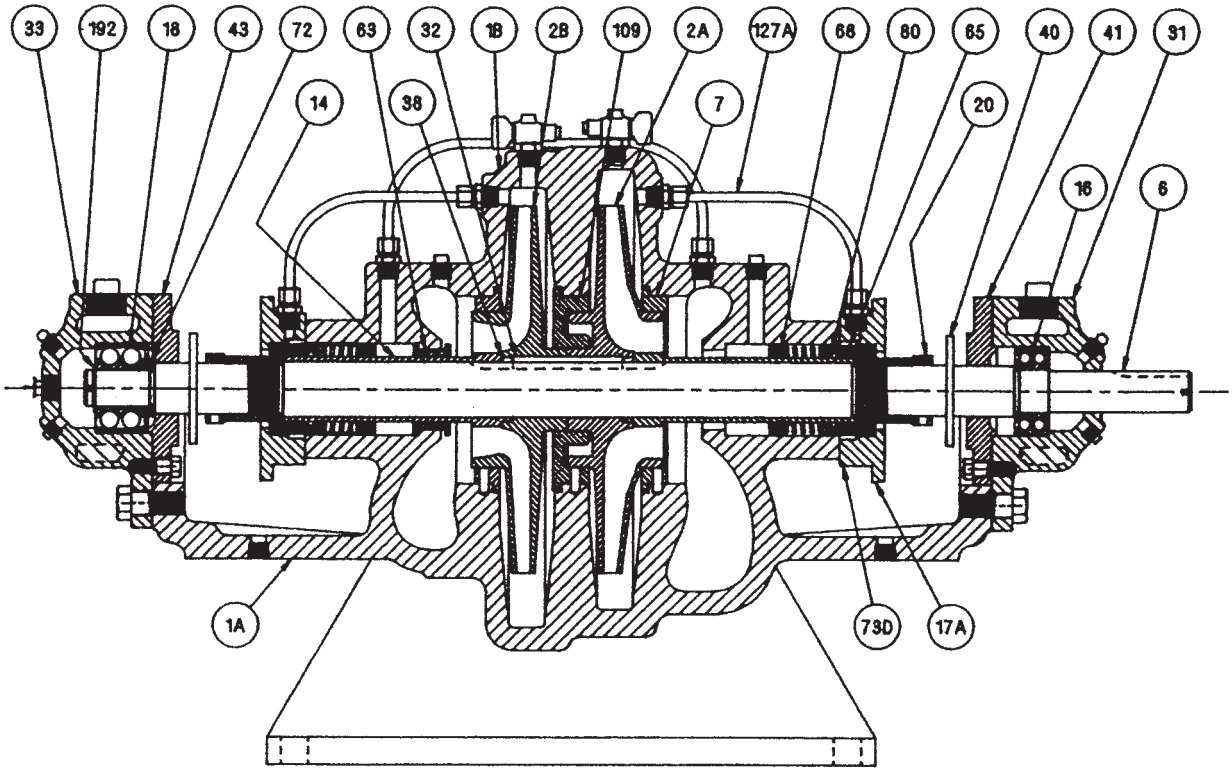
ITEM No.	DESCRIPTION
41	Bearing Cap (inboard)
43	Bearing Cap (outboard)
63	Stuffing Box Bushing
+*65	Mechanical Shaft Seal (Stationary Element)
68	Seal Collar
72	Thrust Collar
*73	Casing Gasket - Suction Side (Not Shown)
*73A	Casing Gasket - Discharge Side (Not Shown)
*73D	Gasket (Seal Cap)
+*80	Mechanical Shaft Seal (Rotating Element)
*109	Interstage Diaphragm
127A	Seal Piping
192	Retaining Ring (Bearing)

(+) Furnished ONLY in pairs as complete unit

(*) For domestic service recommend spare parts

(±) Double Wearing Rings furnished as special equipment only

FIG. 5260 SERIES TWO-STAGE
with MECHANICAL SHAFT SEALS & WATER-JACKETED BEARINGS



ITEM No.	DESCRIPTION
+1A	Lower Half Casing
+1B	Upper Half Casing
*2A	Impeller (1st Stage)
*2B	Impeller (2nd Stage)
6	Pump Shaft
*7	Casing Ring
±*8	Impeller Ring (Not Shown)
*14	Shaft Sleeve
*16	Ball Bearing (inboard)
17A	Seal Cap
*18	Ball Bearing (outboard)
20	Shaft Sleeve Nut
31	Bearing Housing, Water Jacketed (inboard)
*32	Impeller Key
33	Bearing Housing, Water Jacketed (outboard)
*38	Shaft Sleeve Gasket

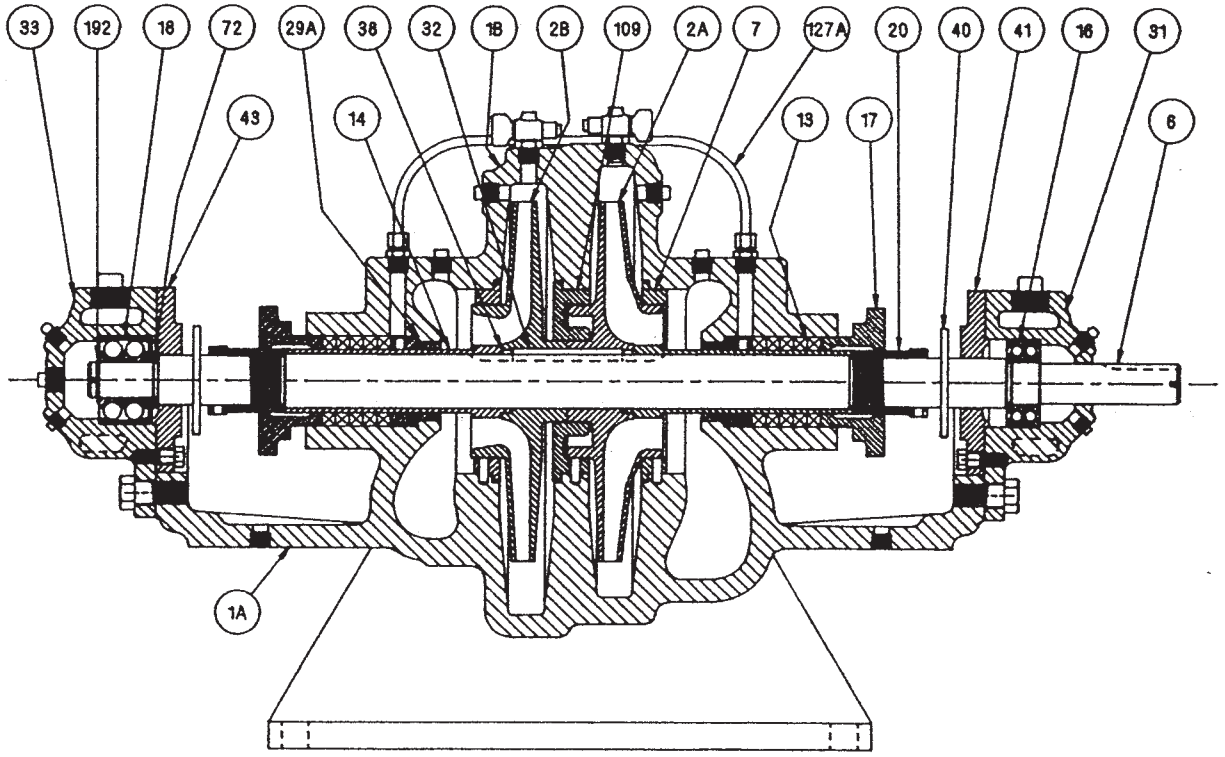
ITEM No.	DESCRIPTION
40	Deflector (Liquid)
41	Bearing Cap (inboard)
43	Bearing Cap (outboard)
63	Stuffing Box Bushing
+*65	Mechanical Shaft Seal (Stationary Element)
68	Seal Collar
72	Thrust Collar
*73	Casing Gasket - Suction Side (Not Shown)
*73A	Casing Gasket - Discharge Side (Not Shown)
*73D	Gasket (Seal Cap)
+*80	Mechanical Shaft Seal (Rotating Element)
127A	Seal Piping
192	Retaining Ring (Bearing)

(+) Furnished ONLY in pairs as complete unit

(*) For domestic service recommend spare parts

(±) Double Wearing Rings furnished as special equipment only

FIG. 5260 SERIES TWO-STAGE
with PACKED STUFFING BOX & WATER-JACKETED BEARINGS



ITEM No.	DESCRIPTION
+1A	Lower Half Casing
+1B	Upper Half Casing
*2A	Impeller (1st Stage)
*2B	Impeller (2nd Stage)
6	Pump Shaft
*7	Casing Ring
±*8	Impeller Ring (Not Shown)
*14	Shaft Sleeve
*16	Ball Bearing (inboard)
17	Seal Cap
*18	Ball Bearing (outboard)
20	Shaft Sleeve Nut
29A	Seal Cage
31	Bearing Housing (inboard)
*32	Impeller Key
33	Bearing Housing (outboard)
38	Shaft Sleeve Gasket

ITEM No.	DESCRIPTION
40	Deflector (Liquid)
41	Bearing Cap (inboard)
43	Bearing Cap (outboard)
72	Thrust Collar
*73	Casing Gasket - Suction Side (Not Shown)
*73A	Casing Gasket - Discharge Side (Not Shown)
127A	Seal Piping
192	Retaining Ring (Bearing)

(+) Furnished ONLY in pairs as complete unit

(*) For domestic service recommend spare parts

(±) Double Wearing Rings furnished as special equipment only

FIG. 5260 - CONSTRUCTION DETAILS

	3 x 1-1/2 x 10	3 x 2 x 10	4 x 3 x 10
1. Shaft Diameters			
At Coupling	1.125”	1.125”	1.375”
At Radial Bearing	1.181”	1.181”	1.378”
Under Shaft Sleeve	1.500”	1.500”	1.625”
At Impeller	1.500”	1.500”	1.625”
At Thrust Bearing (Std)	1.181”	1.181”	1.378”
At Thrust Bearing (Water Cooled)	0.984”	0.984”	1.181”
2. Ball Bearings			
Standard Thrust	MRC 306 S	MRC 306 S	MRC 307 S
Radial	MRC 306 S	MRC 306 S	MRC 307 S
Water Cooled Thrust 2 Req.	SKF 7305 BYG	SKF 7305 BYG	SKF 7306 BYG
Radial	MRC 5206	MRC 5206	MRC 5207
3. Packing Box - First Stage			
No. of Rings (with Seal Cage)	5.000”	5.000”	5.000”
Size Packing (Sq)	0.375”	0.375”	0.375”
Depth of Box	3.062”	3.062”	3.062”
Bore of Box	2.500”	2.500”	2.812”
Dia. of Sleeve	1.750”	1.750”	2.000”
Width of Seal Cage	0.750”	0.750”	0.750”
4. Packing Box - Second Stage			
No. of Rings (with Bleedoff Bushing)	5.000”	5.000”	5.000”
Size Packing (Sq.)	0.375”	0.375”	0.375”
Depth of Bore	3.062”	3.062”	3.062”
Bore of Box	2.500”	2.500”	2.812”
Dia. Sleeve	1.750”	1.750”	2.000”
Width of Bleed off Bushing	0.750”	0.750”	0.750”
5. Mechanical Seal			
Crane Type 1 (Unbalanced) (225°F. MAX.)	1-3/4	1-3/4	2
6. Bearing Spacing	23.868	23.868	24.822
7. Shaft Overhang	4.250	4.250	4.625
8. Key Sizes			
At Coupling	1/4 sq. x 2-5/8	1/4 sq. x 2-5/8	5/16 sq. x 2-3/4
At Impellers	5/16 sq. x 3-1/2	5/16 sq. x 3-1/2	5/16 sq. x 4-1/8
9. Wearing Rings			
Ring I.D.	3.762”	4.262”	5.104”
Interstage Diaphragm	3.762”	4.262”	5.103”
Ave. Dia. Clearance	0.013”	0.013”	0.013”

BARNES® BARNES® PRESSURE PS SYSTEMS CROWN

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Limited 24 Month Warranty

Crane Pumps & Systems warrants that products of our manufacture will be free of defects in material and workmanship under normal use and service for twenty-four (24) months after manufacture date, when installed and maintained in accordance with our instructions.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. **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) excessive 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 TRAVEL EXPENSES, RENTED EQUIPMENT, OUTSIDE CONTRACTOR FEES, UNAUTHORIZED REPAIR SHOP EXPENSES, 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.

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420 Third Street
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Phone: (937) 778-8947
Fax: (937) 773-7157
www.cranepumps.com

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

IMPORTANT!
WARRANTY REGISTRATION

Your product is covered by the enclosed Warranty.
To complete the Warranty Registration Form go to:

http://www.cranepumps.com/ProductRegistration/

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.

CRANE PUMPS & SYSTEMS

A Crane Co. Company

START-UP REPORT

General Information

Pump Owner's Name: _____

Address: _____

Location of Installation: _____

Contact Person: _____ Phone: _____

Purchased From: _____

Nameplate Data

Pump Model #: _____ Serial #: _____

Part #: _____ Impeller Diameter: _____

Voltage: _____ Phase: _____ Ø Hertz: _____ Horsepower: _____

Full Load Amps: _____ Service Factor Amps: _____

Motor Manufacturer: _____

Controls

Control panel manufacturer: _____

Model/Part number: _____

Number of pumps operated by control panel: _____

Short circuit protection? YES___ NO___ Type: _____

Number and size of short circuit device(s): _____ Amp rating: _____

Overload Type: _____ Size: _____ Amp rating: _____

Do protection devices comply with pump and motor Amp rating? YES___ NO___

Are all electrical and panel entry connections tight? YES___ NO___

Is the interior of the panel dry? YES___ NO___

Liquid level Control Brand and Model: _____

Pre-Startup

All Pumps

Type of equipment: NEW___ REBUILT___ USED___

Condition of equipment at Start-Up: DRY___ WET___ MUDDY___

Was Equipment Stored? YES___ NO___ Length of Storage: _____

Liquid being pumped: _____ Liquid Temperature: _____

Supply Voltage/Phase/Frequency matches nameplate? YES___ NO___

Shaft turns freely? YES___ NO___

Direction of rotation verified for 3Ø motors? YES___ NO___

Debris in piping or wet well? YES___ NO___

Debris removed in your presence? YES___ NO___

Pump case/wet well filled with liquid before startup? YES___ NO___

Is piping properly supported? YES___ NO___

Non-Submersible Pumps

Is base plate properly installed / grouted? YES___ NO___ N/A___

Coupling Alignment Verified per I&O Manual? YES___ NO___ N/A___

Grease Cup/Oil Reservoir Level checked? YES___ NO___ N/A___

Submersible Pumps

Resistance of cable and pump motor (measured at pump control):

Red-Black:_____Ohms(Ω) Red-White:_____Ohms(Ω) White-Black:_____Ohms(Ω)

Resistance of Ground Circuit between Control Panel and outside of pump:_____Ohms(Ω)

MEG Ohms check of insulation:

Red to Ground: _____ White to Ground: _____ Black to Ground: _____

Operational Checks

Is there noise or vibration present? YES___ NO___ Source of noise/vibration: _____

Does check valve operate properly? YES___ NO___ N/A___

Is system free of leaks? YES___ NO___ Leaks at: _____

Does system appear to operate at design flow rate? YES___ NO___

Nominal Voltage: _____ Phase: 1Ø 3Ø (select one)

Voltage Reading at panel connection, Pump OFF: L1, L2 _____ L2, L3 _____ L1, L3 _____

Voltage Reading at panel connection, Pump ON: L1, L2 _____ L2, L3 _____ L1, L3 _____

Amperage Draw, Pump ON: L1 _____ L2 _____ L3 _____

Submersible Pumps

Are BAF and guide rails level / plumb? YES___ NO___

Is pump seated on discharge properly? YES___ NO___

Are level controls installed away from turbulence? YES___ NO___

Is level control operating properly? YES___ NO___

Is pump fully submerged during operation? YES___ NO___

Follow up/Corrective Action Required

YES___ NO___

Additional Comments:

_____

_____

_____

_____

_____

_____

_____

Startup performed by: _____ Date: _____

Present at Start-Up

( ) Engineer: _____ ( ) Operator: _____

( ) Contactor:_____ ( ) Other:_____

All parties should retain a copy of this report for future trouble shooting/reference

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420 Third Street
Piqua, Ohio 45356
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

Notes