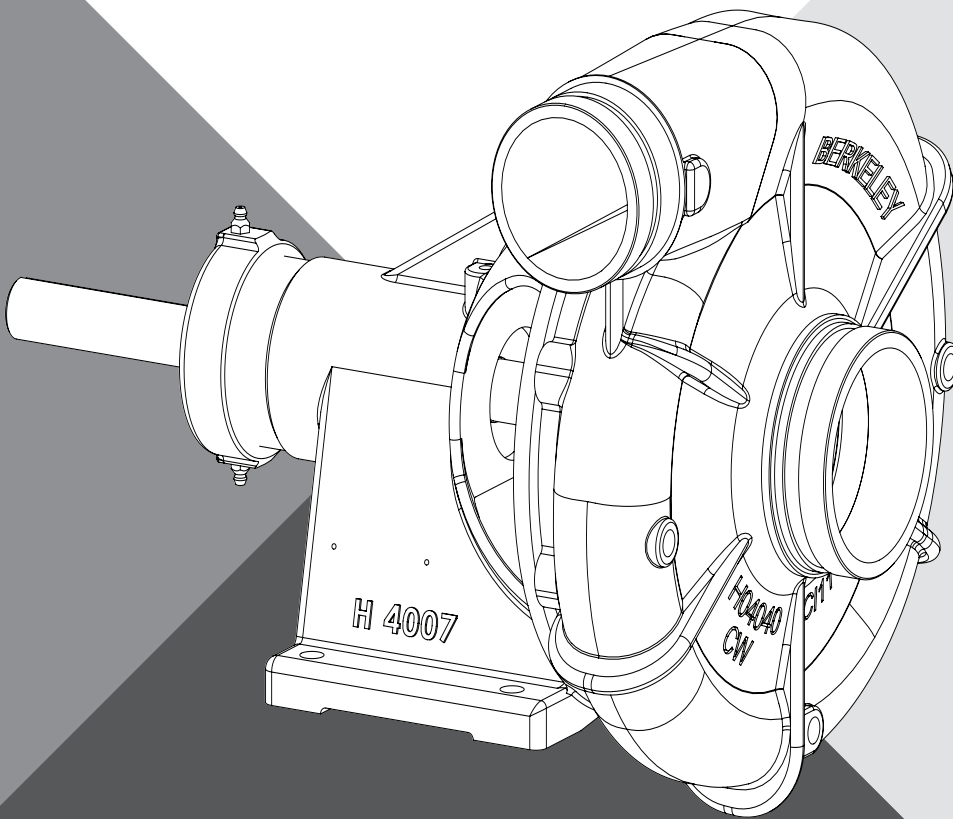




FRAME MOUNTED CENTRIFUGAL PUMP

DIRECT COUPLING DRIVE / BELT DRIVEN



INSTALLATION & OPERATION MANUAL

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MOTOR / PUMP LIFTING SAFETY

⚠ WARNING Heavy Weight Crushing Hazard. NEVER walk or reach under a suspended pump.

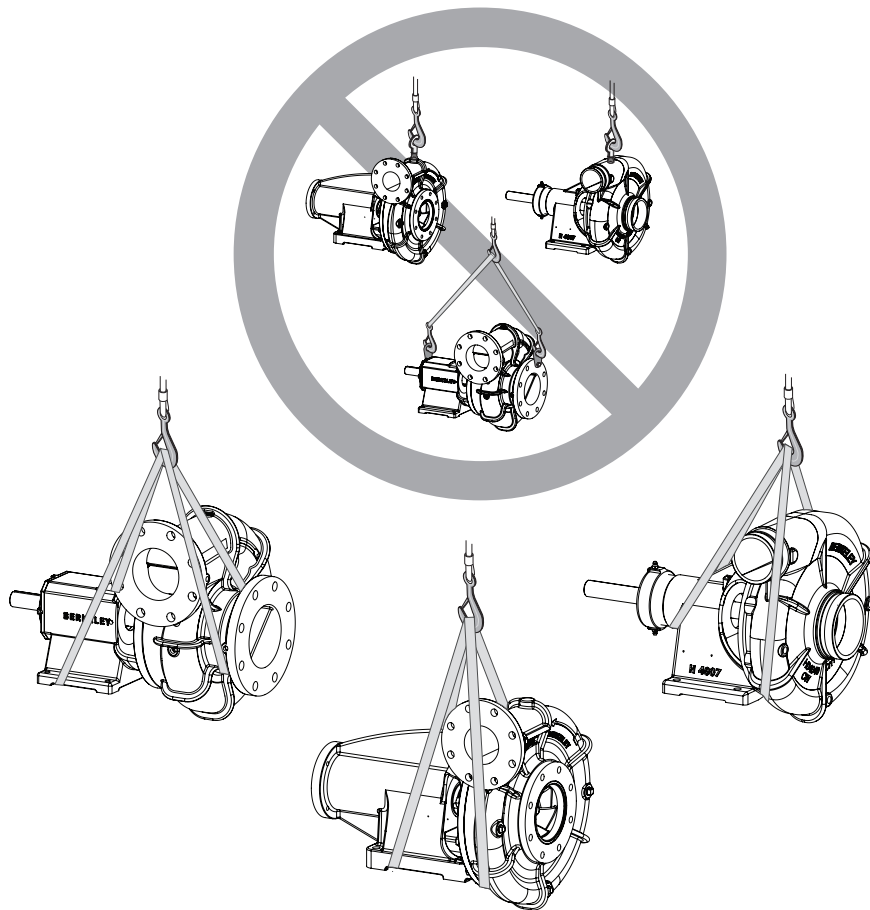
DO NOT screw or thread on any kind of eye bolt or hook to any part of the pump's casing or bracket and attempt to lift the pump or complete pump assembly. DO NOT attempt to lift the pump or complete pump assembly using a single lift point or single chain / strap.

The crane or hoist must have a capacity in excess of the combined weight of the pump or complete pump assembly.

Use a minimum of two chains or straps to lift motor/pump assembly. Each chain or strap must have a capacity in excess of the combined weight of the pump or complete pump assembly.


Wrap the first chain or strap under the pump's bracket, and the second chain or strap under the pump's casing.


Raise pump assembly slowly to ensure that the chains or straps will not slip when put under tension. Balance pump or complete pump assembly with chains or straps to maintain proper weight distribution. If not balanced, release tension on the chains or straps and readjust.





SAFETY INSTRUCTIONS

SAFETY SYMBOLS

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


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

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


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

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

CALIFORNIA PROPOSITION 65 WARNING

 **WARNING** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

GENERAL SAFETY


- ◆ Carefully read and follow all safety instructions in this manual and on the unit itself.
- ◆  **CAUTION** Do not touch an operating motor. Modern motors can operate at high temperatures. To avoid burns when servicing pump, allow it to cool for 20 minutes after shutdown before handling.
- ◆ Do not allow pump, piping, or any other system component containing water to freeze. Freezing may damage system, leading to injury or flooding. Allowing pump or system components to freeze will void warranty.
- ◆ Pump approved liquids only with this pump.

- ◆ Keep work area clean, uncluttered and properly lighted; store properly all unused tools and equipment.
- ◆ Follow all applicable local and state codes and regulations.
- ◆ Keep safety labels in good condition, replacing any missing or damaged labels.
- ◆ **DO NOT** run the pump dry. Dry running can overheat the pump, (causing burns to anyone handling it) and will void the warranty.
- ◆ Wear safety glasses at all times when working on pumps.
- ◆ Keep work area clean, uncluttered and properly lighted. Store all unused tools and equipment.

ELECTRICAL SAFETY

 **DANGER HAZARDOUS VOLTAGE. CAN SHOCK, BURN, OR KILL.**

When installing, operating, or servicing this pump, follow the safety instructions listed below.

- ◆  **DANGER ELECTROCUTION HAZARD:** First disconnect all electrical power before attempting service. For your safety, the installation and operation instructions must be followed to minimize the risk of electric shock, property damage or personal injury.
- ◆ **ALL** wiring should be done by a qualified electrician and must meet National Electrical Code and local codes.
- ◆ **DO NOT** allow the plug on the end of the electrical cord to be submerged.
- ◆ **DO NOT** use extension cords. They are a fire hazard and can reduce voltage sufficiently to prevent pumping and/or damage motor.
- ◆ **DO NOT** handle or service the pump while it is connected to the power supply.

GENERAL INFORMATION

LOCATION

Locate the pump as near to the water source as practical. Make the suction pipe run short and straight with as few pipe fittings as possible to keep total friction loss to a minimum. Install pump in a clean, dry and well drained location if possible and protect against moisture and adverse weather conditions. Pump should be located on a level, hard surface to prevent shifting or tipping. Locate to be readily accessible for inspection and maintenance. Careful attention should be taken to assure that Net Positive Suction Head Available (NPSHA) exceeds Net Positive Suction Head Required (NPSHR) by the pump or reduced performance and severe pump damage may result.

Figure 1 illustrates where these terms (NPSHA / NPSHR) come from, and how to determine if the pumping conditions at which you want to operate meet the proper criteria. When in doubt, consult your nearest Berkeley Professional Dealer. If pump site is 1000 feet above sea level, subtract 1.2 feet from the NPSHA equation and an additional 1.2 feet for each additional 1000 feet of elevation.

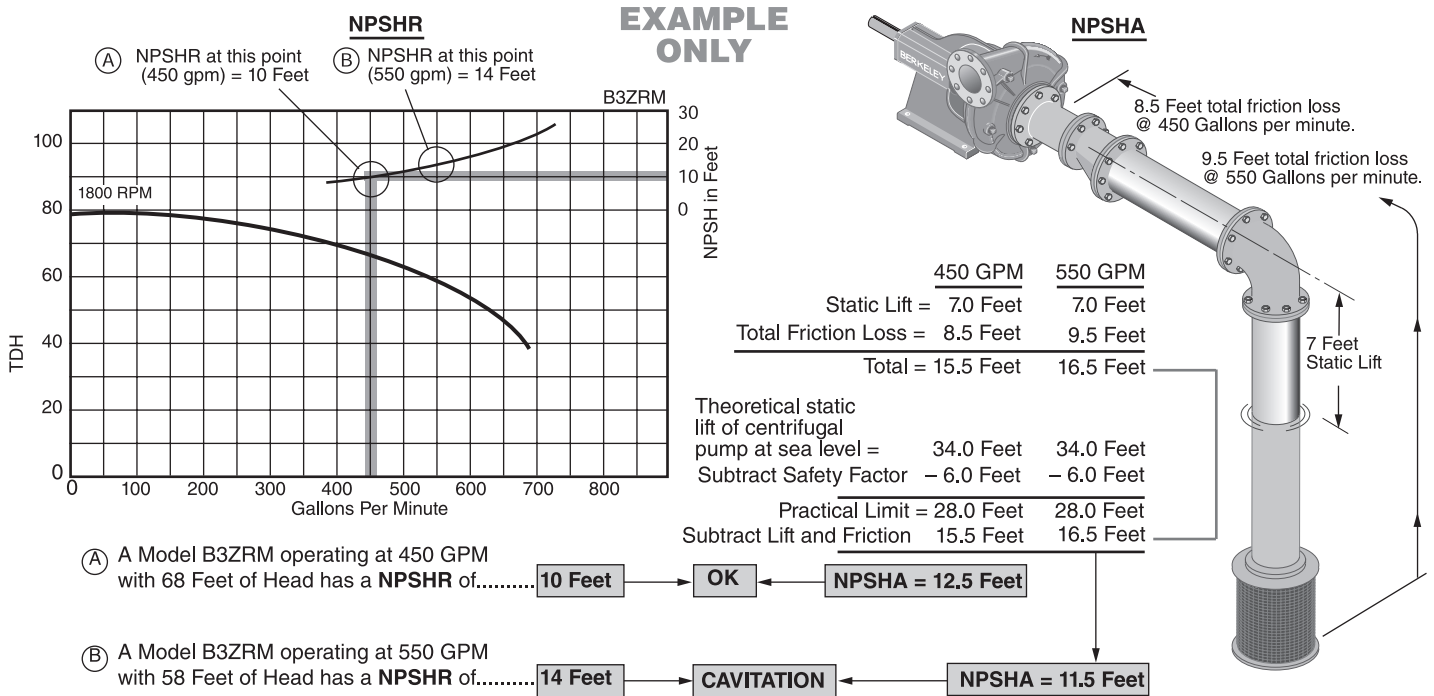


FIGURE 1

INSTALLATION

FOUNDATION

⚠ WARNING Heavy weights; risk of crushing toes or feet. Use care and proper lifting equipment when handling pump for installation. Size and weight of some units will require hoists for safe handling.

Pump should be set on a concrete foundation which is sufficiently substantial to absorb vibration and which provides a permanent and rigid support.

When properly positioned, the unit will be level, and the suction and discharge openings of the pump will be aligned with system piping.

See Figure 2 for reference.

PIPING

System piping should be at least one commercial pipe size larger than pump connections and flow velocity should not exceed eight (8) feet per second. Suction and discharge pipes must be naturally aligned with pump connections.

NOTICE: Misalignment of piping with pump case or excessive pipe strain can cause distortion of pump components resulting in rubbing, breakage and reduced pump life.

Insure that piping is supported in a manner that prevents the exertion of force on pump connections. This can be checked by the following procedure. With the pump shut down, remove pipe flange bolts. If the mating flanges come apart or shift, misalignment is present and causing pressure on the connections. Adjust pipe supports until flanges mate without any force. This procedure can be done throughout piping system.

SUCTION PIPING

Refer to illustrations in the Suction Connection section for recommended and not recommended practices in suction connections.

DISCHARGE PIPING

Refer to illustrations in the Discharge Connection section for recommended and not recommended practices in discharge connections.

ELECTRICAL CONNECTION: IF ELECTRIC MOTOR USED

NOTICE: All wiring should be done by a qualified electrician.

⚠ WARNING Hazardous voltage. Can shock, burn, or cause death. Disconnect power to pump before servicing.

Check voltage and phase stamped on pump motor nameplate before making wiring connections to electrical system. Be sure they agree with your electric current supply. They **MUST** be the same. If in doubt, check with your local power company.

Refer to illustration in the Electric Motor section for minimum recommended pumping panel components that help safeguard your pump during operation.

INSTALLATION

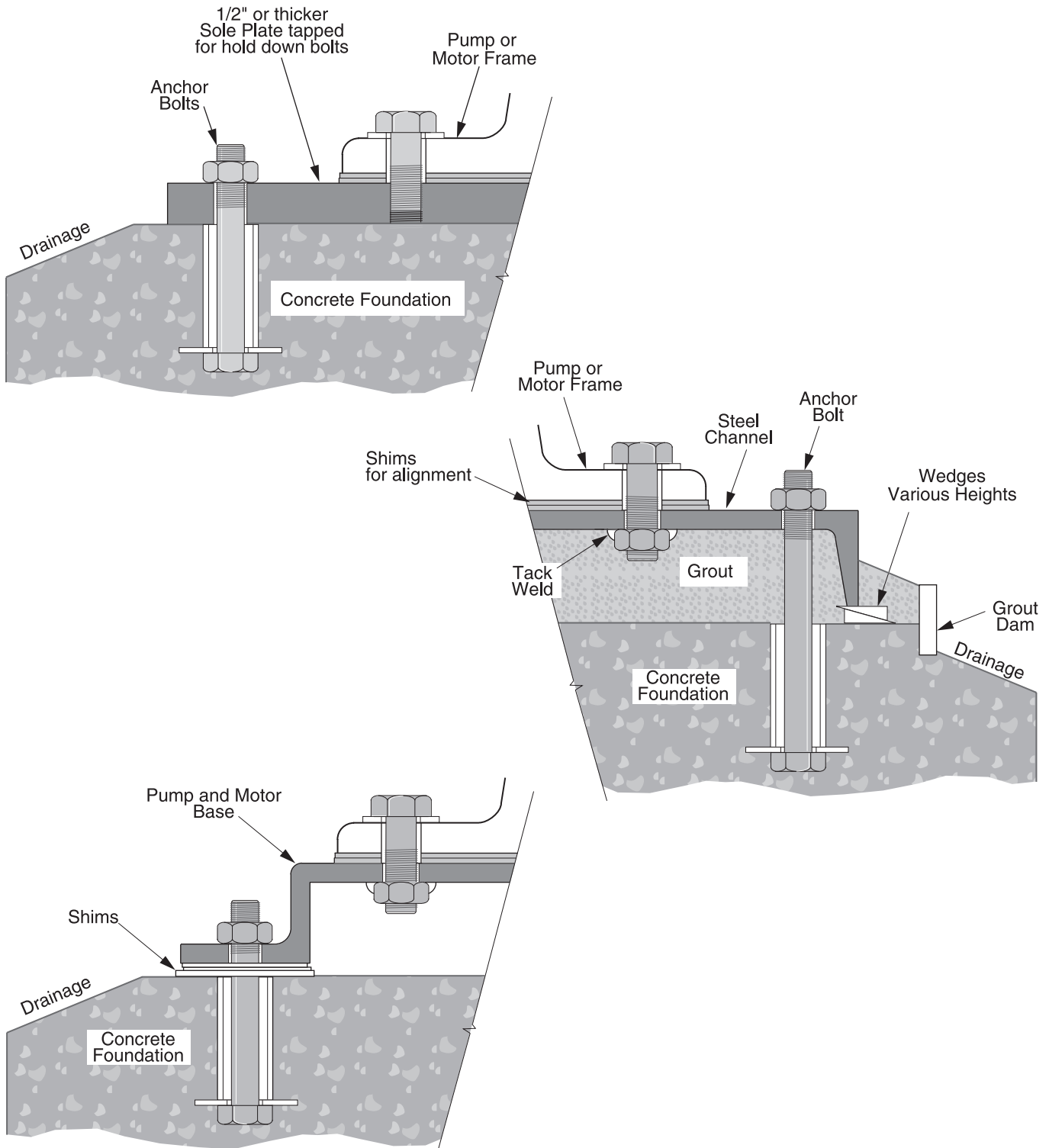


FIGURE 2: FOUNDATION

INSTALLATION

DIRECT COUPLING DRIVE

⚠ WARNING Rotating shaft can catch and trap clothing or body. Coupling guard must **ALWAYS** be in place when pump is running. Coupling guard shown in phantom for pictorial clarity.

PUMP AND MOTOR SHAFT ALIGNMENT

A flexible coupling (except for double universal joint shaft) will not compensate for misalignment. After the pump unit is fastened on the foundation, it is necessary to see that the shafts of the pump and motor are properly aligned.

Each motor and pump foot should be shimmed to avoid shifting or soft foot.

COURSE ALIGNMENT

1. By moving the entire unit, bring suction and discharge openings of the pump into alignment with the system piping. Pipes should align without force with the pump (see Installation Section).
2. Bring the pump and motor shaft into approximate alignment by shifting or shimming the motor. Use a straight edge to check alignment of the shafts.
3. Use calipers, or a wedge thickness gauge to check the distance between coupling halves. The distance between halves should be equal at 90 degree intervals around the coupling, and the shafts should be concentric when checked with a straight edge.

FINE ALIGNMENT

1. Angular and parallel misalignment of the coupling may be corrected simultaneously. Maintain a separation between coupling halves, per manufacturer's specifications, to avoid preloading of pump and motor bearings.
2. Check and account for indicator sag.
3. Clamp dial indicators to the pump and motor shaft as shown above.
4. Start with angular alignment and finish check with parallel alignment.
5. Rotate both the shaft and coupling together by hand. Note the total indicated run-out shown on indicator "A". The maximum allowable angular misalignment is 1 degree. Limits of reading on indicator "A" at various distances from shaft centerline are shown in table below.
6. Continue to rotate both shafts by hand and note the run-out shown on indicator "B". The maximum allowable total indicated run-out is .005 inches. Should either angular or parallel misalignment exceed the value shown, shift or shim the motor until misalignment is within the allowable limits shown. Do not move pump unless absolutely necessary. When shimming, be sure that all feet on the pump and motor are equally supported to avoid strains on the castings when the hold down bolts are tightened.

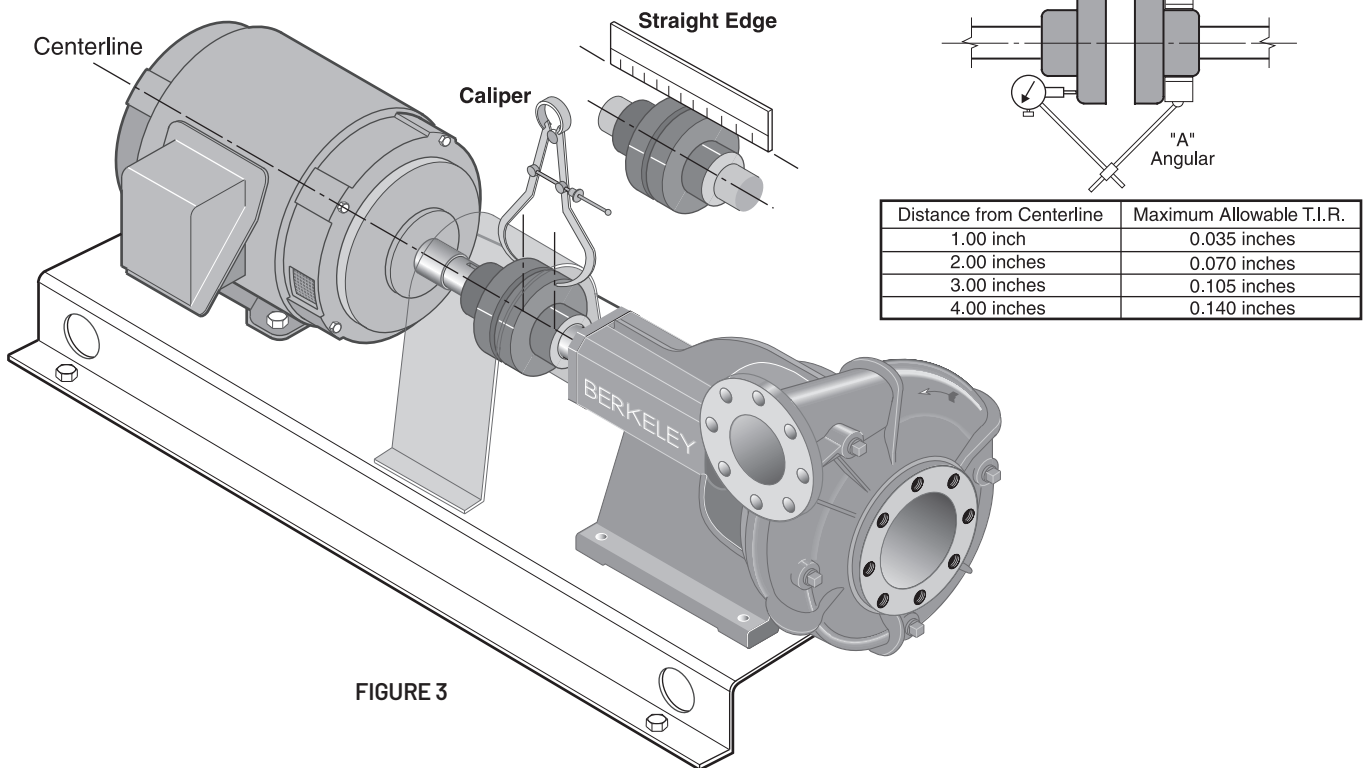


FIGURE 3

INSTALLATION

BELT DRIVE

⚠ WARNING Rotating shaft can catch and trap clothing or body. Coupling guard must **ALWAYS** be in place when pump is running. Coupling guard shown in phantom for pictorial clarity.

ALIGNMENT

Drive belt can catch and trap clothing or body. Belt guard must ALWAYS be in place when pump is running. Belt guard is not shown for pictorial clarity.

Drive and pump shaft centerlines (A) must be parallel as shown. Belt centerlines (B) must be straight as shown.

When installing belts, move the driver toward the pump to allow belts to be placed on pulley. Then, move the driver away from pump to obtain proper belt tension as described below.

TENSION

Multiple belt spans must be equal tension in all belts. Proper belt tension varies with the size of belt being used, however a general rule is:

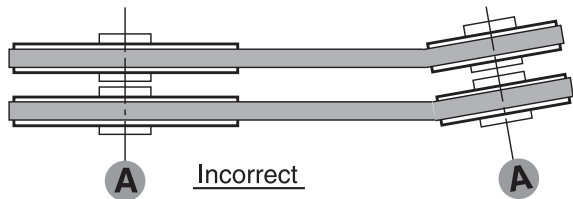
Belts are properly tensioned when one belt can be depressed one belt thickness at the center of the span when pressing with thumb.

Another method is that a properly tensioned belt can be rotated (twisted) one-quarter revolution at the center of span.

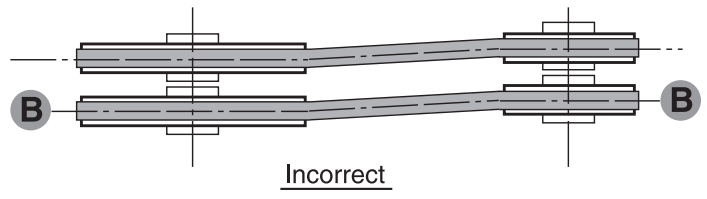
NOTICE: Belts must be tight enough to prevent slipping during operation. Loose belts result in early belt failure and reduced performance. However, excessive tightness of belts will result in overheating of the belts and excessive bearing load in the pump and driver.

Most v-belts will stretch slightly after initial installation. After a short period of operation, re-check belt tension and adjust as necessary.

INSTALLATION



A Incorrect **A**
Centerline - A of each shaft and pulley must be parallel for proper alignment.



B Incorrect **B**
Centerline - B represents center of belt and pulley. This centerline must be straight for proper alignment.

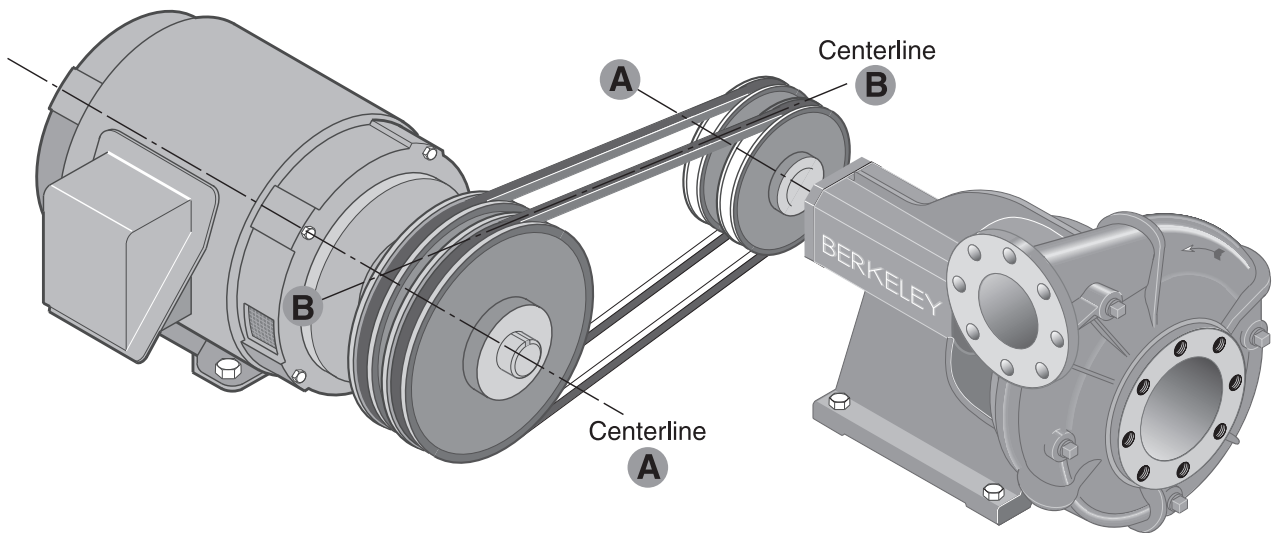


FIGURE 4

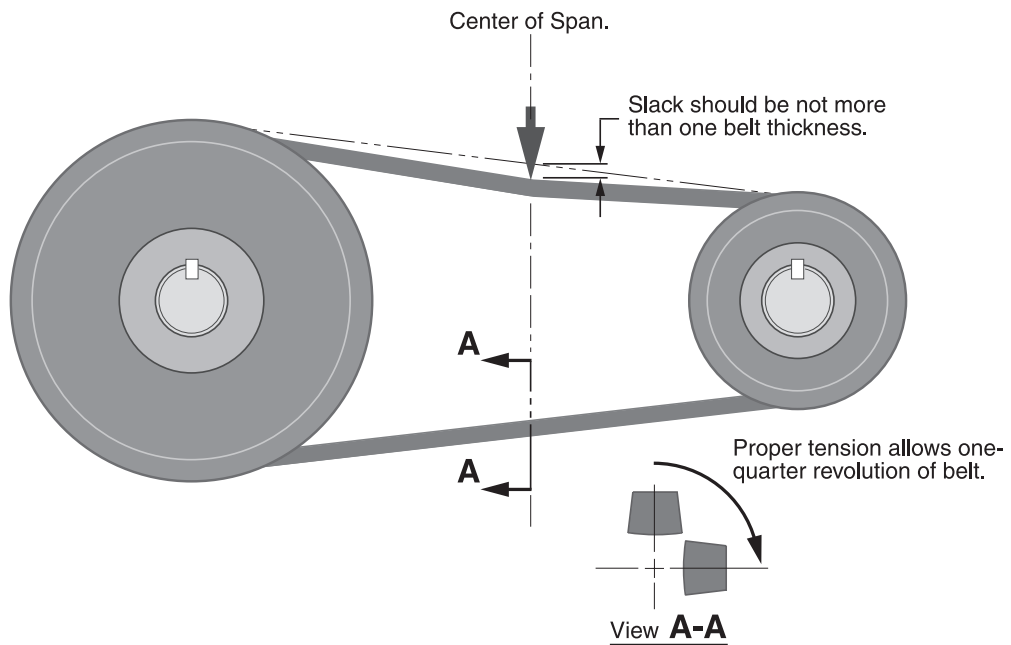
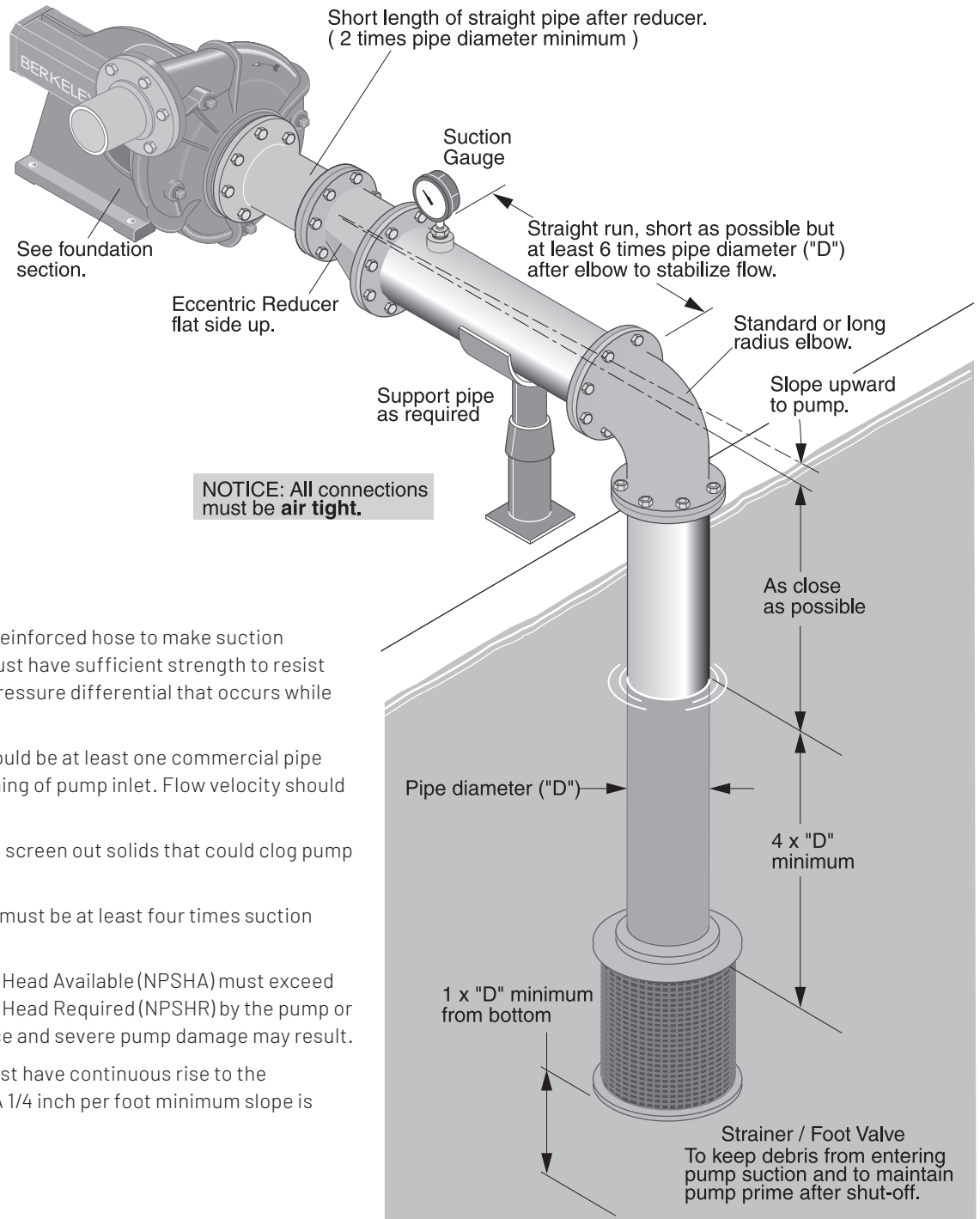


FIGURE 5

INSTALLATION

SUCTION CONNECTION - RECOMMENDED METHOD

Pump driven by remote power source, direct coupling or pulley/belt connection.



NOTICE: All connections must be air tight.

1. Use pipe, tubing, or reinforced hose to make suction connection. Hose must have sufficient strength to resist collapse under the pressure differential that occurs while pump is running.
2. Suction pipe size should be at least one commercial pipe size larger than opening of pump inlet. Flow velocity should not exceed 8 ft./sec.
3. Suction screen must screen out solids that could clog pump impeller.
4. Suction screen area must be at least four times suction pipe area.
5. Net Positive Suction Head Available (NPSHA) must exceed Net Positive Suction Head Required (NPSHR) by the pump or reduced performance and severe pump damage may result.
6. All suction piping must have continuous rise to the pump suction inlet. A 1/4 inch per foot minimum slope is recommended.

FIGURE 6

INSTALLATION

SUCTION CONNECTION - NOT RECOMMENDED METHOD

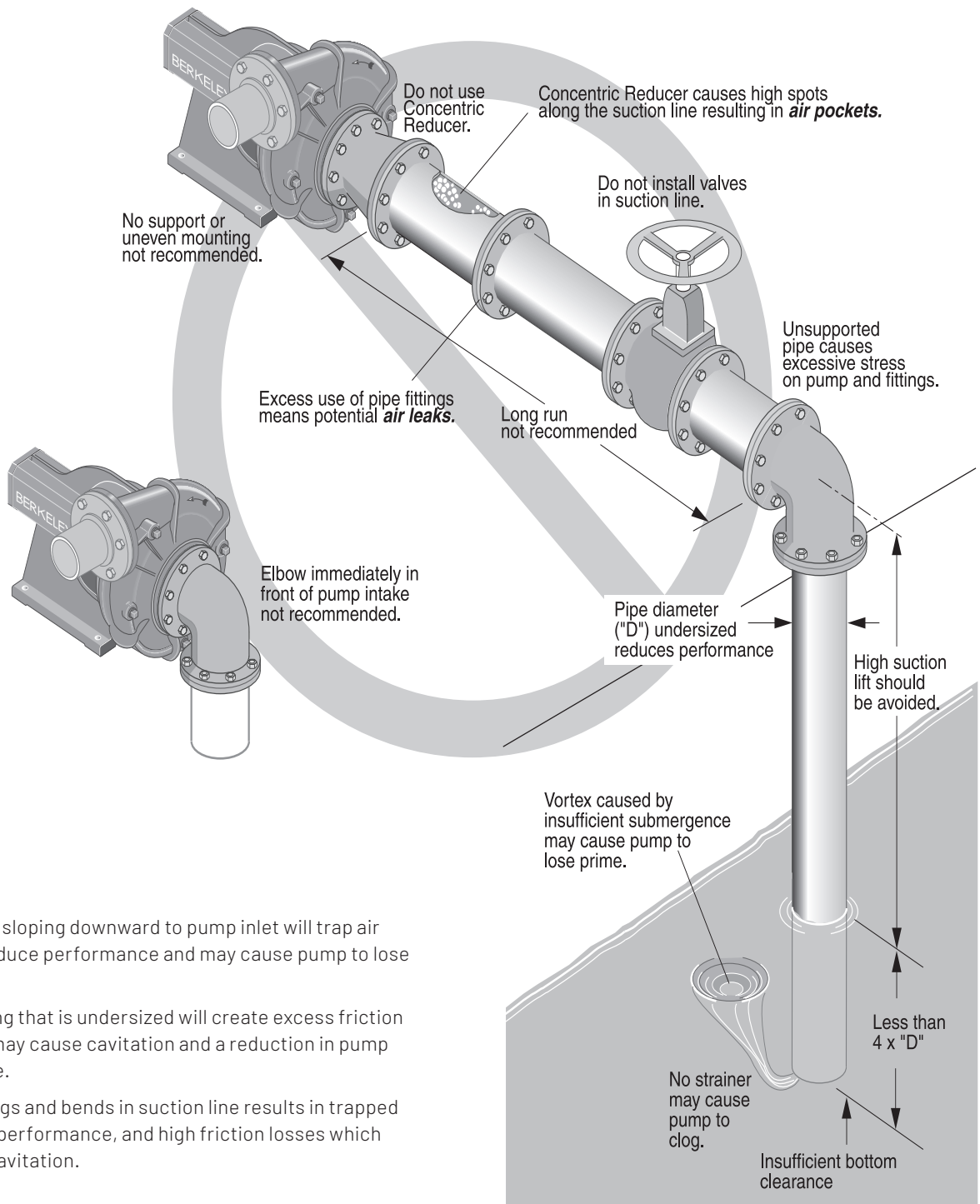


FIGURE 7

1. Suction pipe sloping downward to pump inlet will trap air which will reduce performance and may cause pump to lose prime.
2. Suction piping that is undersized will create excess friction losses that may cause cavitation and a reduction in pump performance.
3. Excess fittings and bends in suction line results in trapped air, reduced performance, and high friction losses which may cause cavitation.

INSTALLATION

SUCTION CONNECTION WHEN FLOODED SUCTION EXISTS - RECOMMENDED METHOD

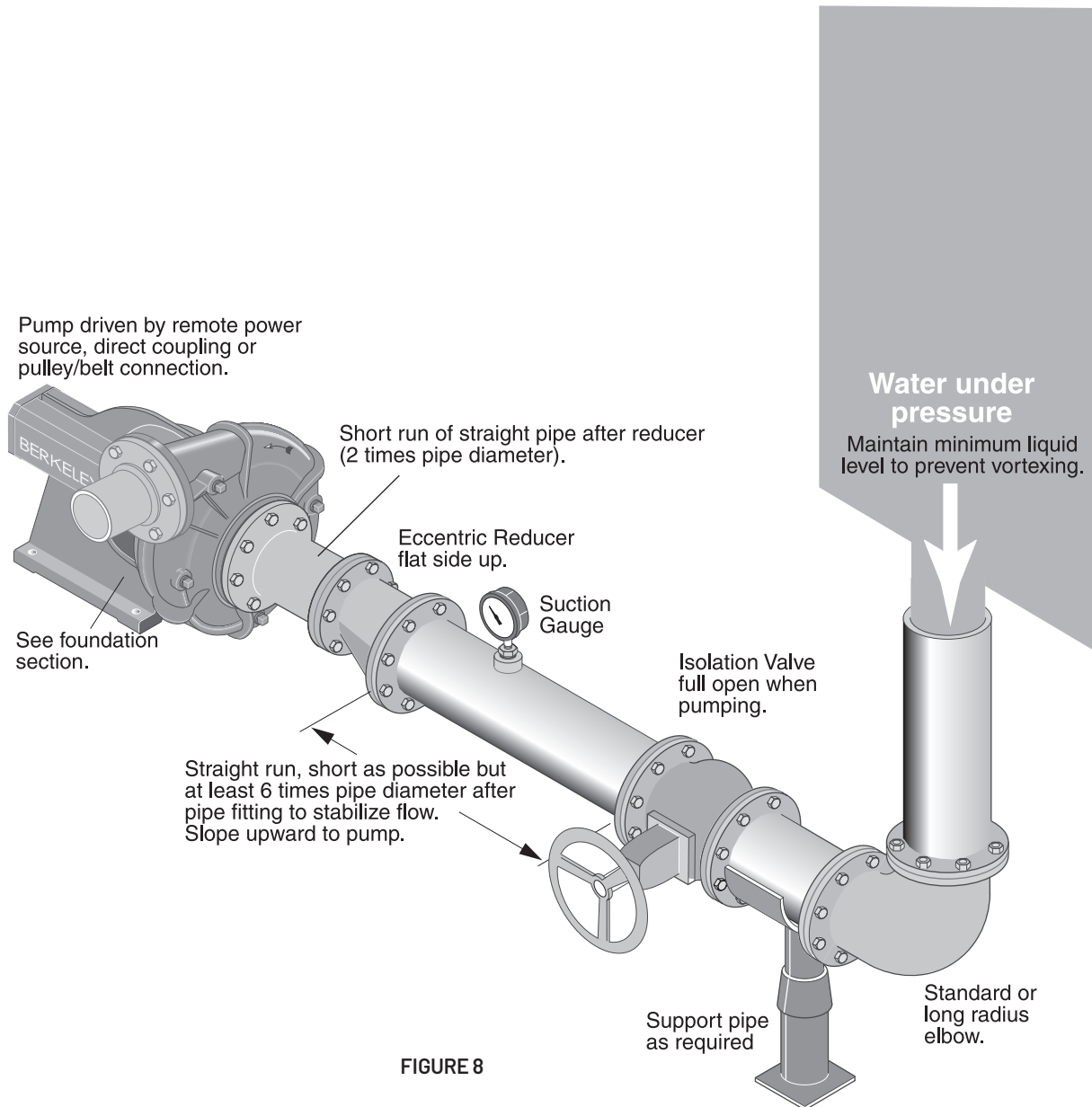


FIGURE 8

RECOMMENDED:

- ◆ Use pipe, tubing, or reinforced hose to make suction connection. Hose must have sufficient strength to resist collapse under the atmospheric pressure differential that may occur while pump is running.
- ◆ It is important, even with a flooded suction condition, that proper pipe fittings are used so water is delivered to impeller eye with a smooth flow and consistent velocity.
- ◆ Suction pipe size should be at least one commercial pipe size larger than opening of pipe inlet. Flow velocity should not exceed 8 ft./sec.
- ◆ An isolation valve is used in a pressurized suction pipe to permit servicing pump.
- ◆ Piping run and connection fittings should be properly aligned and independently supported to reduce strain on pump case.
- ◆ If solids are present, a strainer should be used to protect the pump.

INSTALLATION

SUCTION CONNECTION WHEN FLOODED SUCTION EXISTS - NOT RECOMMENDED METHOD

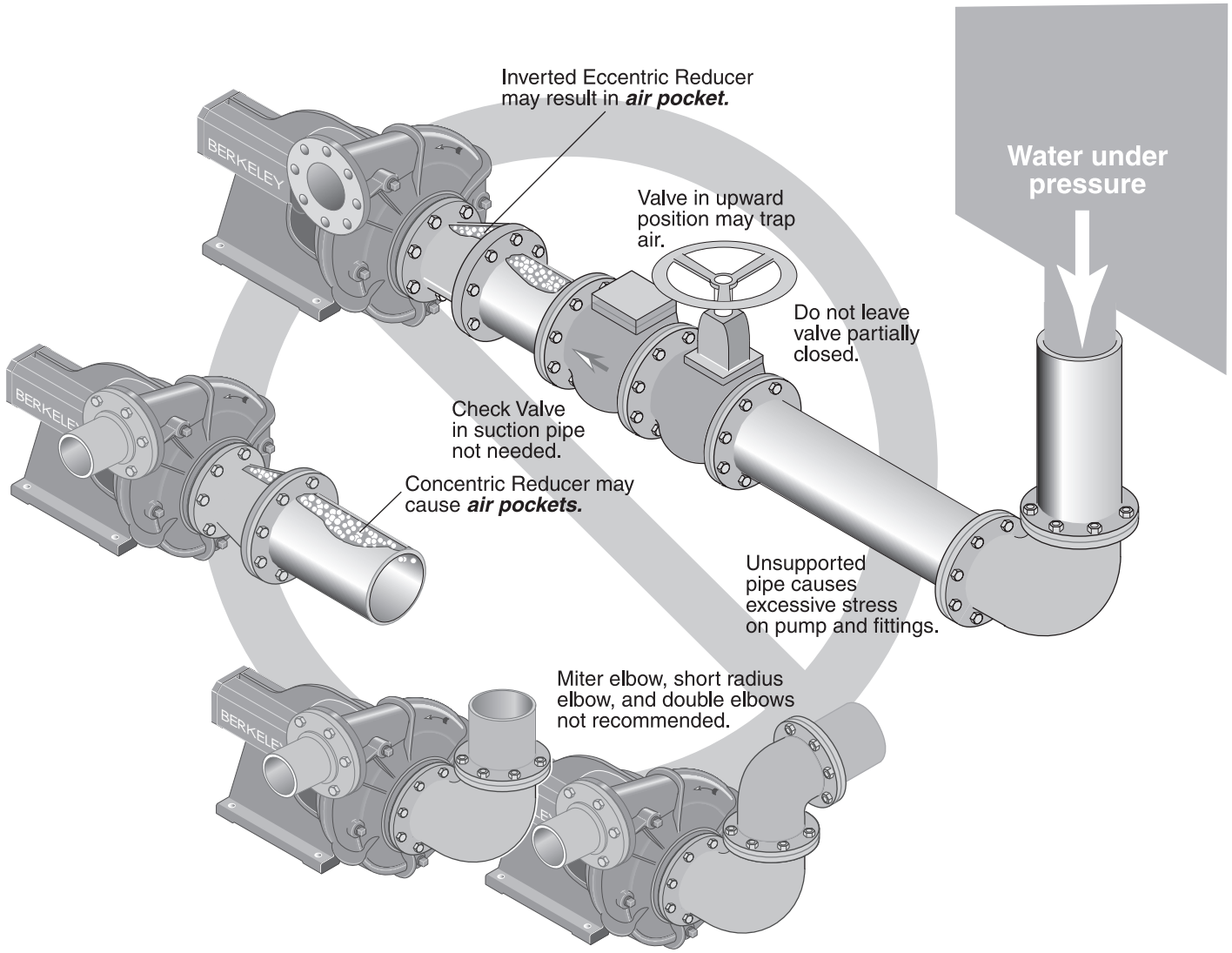


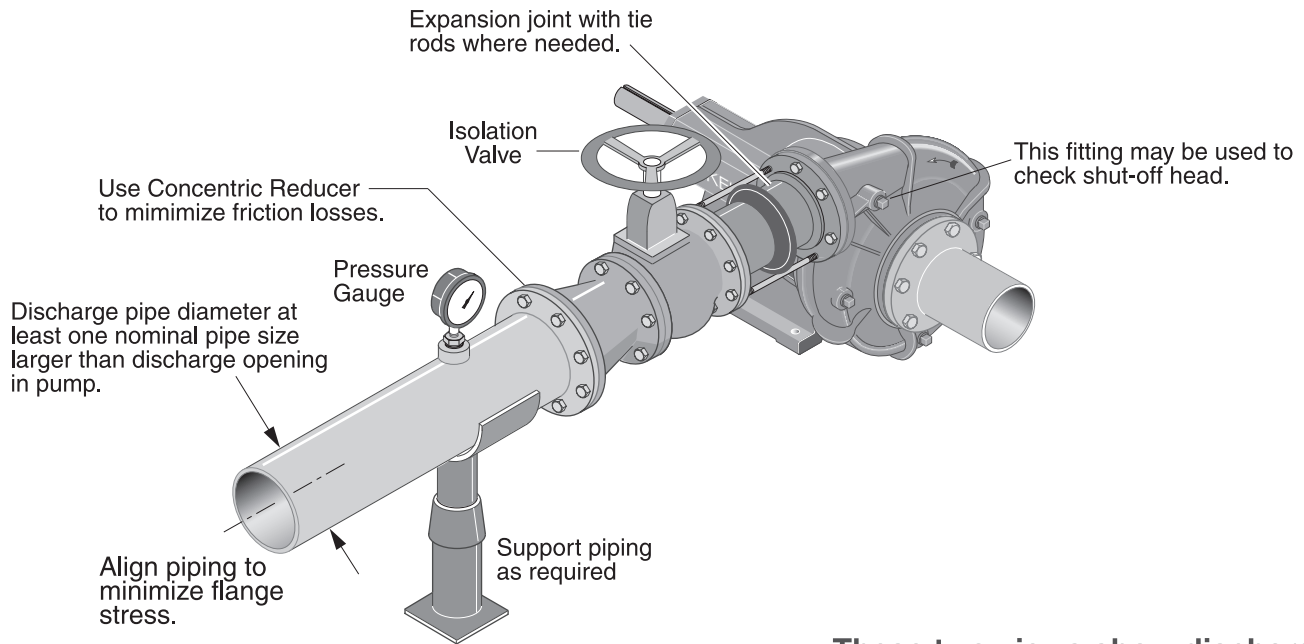
FIGURE 9

NOT RECOMMENDED:

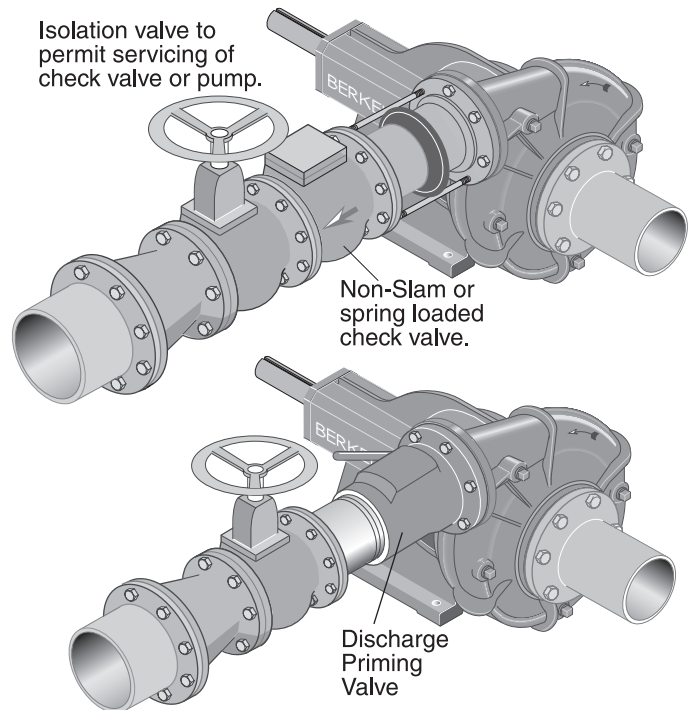
- ◆ Suction piping that is undersized will create excess friction losses that may cause cavitation and a reduction in pump performance.
- ◆ Excess fittings and bends in suction line result in trapped air, reduced performance, and high friction losses which may cause cavitation.
- ◆ If check valve is required for back flow prevention, locate on the discharge side of pump.

INSTALLATION

DISCHARGE CONNECTION - RECOMMENDED METHOD



These two views show discharge fittings typical of pump with suction lift.



RECOMMENDED:

- ◆ Use pipe, tubing, or reinforced hose to make suction
- ◆ Use pipe, tubing or reinforced hose to make discharge connection. Material selected must have sufficient strength for operating pressures.
- ◆ Discharge pipe should be sized so that flow velocity is below 8 feet per second.
- ◆ Use ONLY non-slammng check valves to prevent hydraulic shock (water hammer).
- ◆ Use gate, ball, or butterfly valve for isolation. Valve should be full open during operation.
- ◆ Maintain proper pipe size throughout discharge system, using as few elbows and tees as possible to keep friction loss to a minimum.
- ◆ Install pressure gauge after reducer as shown to check operating pressure or shut-off head.

FIGURE 10

INSTALLATION

DISCHARGE CONNECTION - NOT RECOMMENDED METHOD

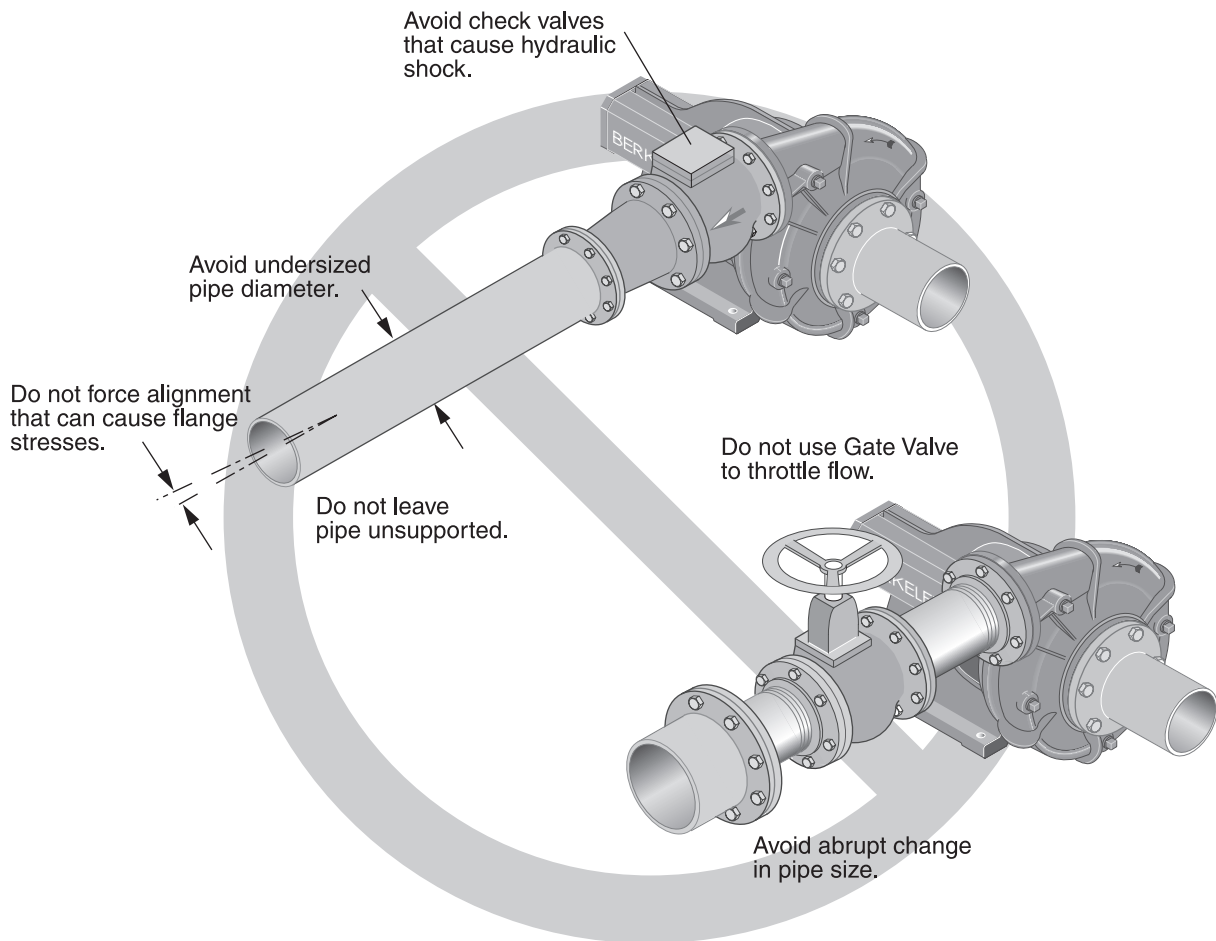


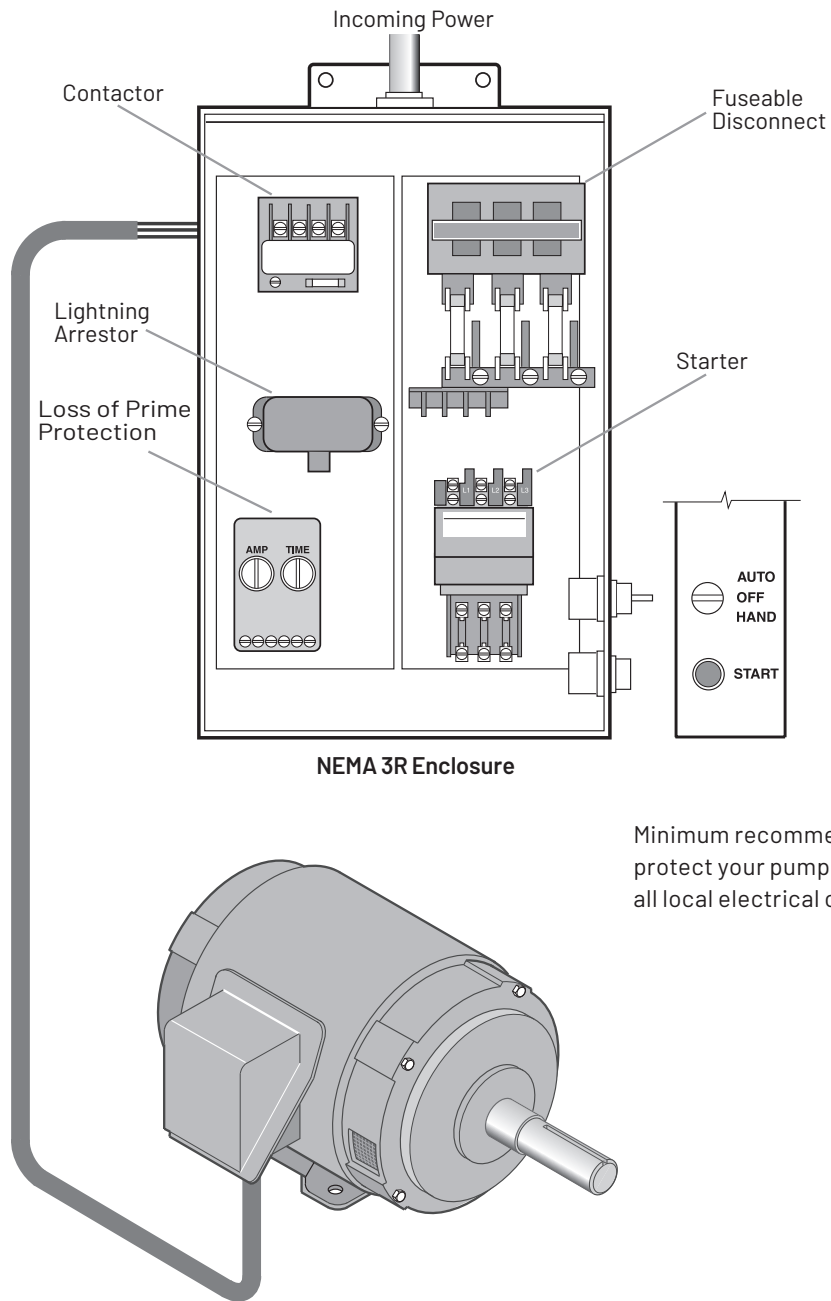
FIGURE 11

NOT RECOMMENDED:

- ◆ Avoid excess friction loss caused by numerous fittings, insufficient pipe diameter, and sharp turns in pipe run.
- ◆ Swing type check valves can permit build-up of reverse velocity before closing causing hydraulic shock or “water hammer.”

INSTALLATION

IF ELECTRIC MOTOR IS USED:



Minimum recommended components to protect your pump during operation. Check all local electrical codes prior to installation.

FIGURE 12: Electrical Motor

OPERATION

CHECK ROTATION

Before pump is put into operation, rotational direction must be checked to assure proper performance of pump.

⚠ WARNING Hazardous voltage. Can shock, burn, or cause death. Disconnect power to pump before servicing.

Do not attempt any wiring changes without first disconnecting power to pump.

PRIMING

Pump priming is the displacement of air with water in the pump and suction piping. Pump MUST BE completely filled with water when operating.

Refer to Figure 14 for instruction on the following conditions:

1. Suction lift with priming pump (water source below pump).
2. Suction lift with foot valve (water source below pump).
3. Flooded suction (water source above pump, or incoming water pressure is greater than atmospheric pressure).

SPECIAL CASE - HYDRAULIC BALANCED PUMPS:

Hydraulic balanced pumps operate with a very low positive pressure across the stuffing box, permitting a much looser fit of the packing rings around the shaft sleeve to control the loss of water from the pump through the stuffing box. Because of the looser fit of the packing rings, air can be more easily drawn into the pump through the stuffing box when priming the pump with an air evacuation type primer.

A grease fitting, aligned with the lantern ring in the packing set, is provided to grease-seal the stuffing box and minimize air leakage during priming.

If pump cannot be primed due to air leakage through stuffing box, DO NOT tighten packing. Instead, pump NLGI No. 4 Water Pump Grease into lantern ring until back pressure occurs forcing grease into the lantern ring, grease-sealing the stuffing box. After priming, when unit is put into operation, the grease will be flushed out through the packing by the water flowing outward through the stuffing box.

Proceed with normal adjustment of the packing as described in Packing instructions under Maintenance section. Note that the grease seal only is used for control of air leaking during priming, and that only the packing gland is used to control flow of water through the stuffing box during normal operation.

When necessary to replenish the grease supply use an NLGI no. 4 Water Pump Grease.

STARTING

Never run pump dry. Running pump without water will overheat pump and damage internal parts. Always make sure pump is primed prior to start-up.

Refer to Maintenance section if pump has packing for adjustment prior to start-up.

1. Prime pump by one of the above procedures.
2. Set discharge valve to minimum flow.
3. Turn on power to pump.
4. Slowly open discharge valve until desired flow rate is achieved.
5. Place the "Hand-Off-Auto" selector switch in the "Auto" position.
6. The pump will be started automatically when the pilot device signals the motor starter.

STOPPING

Pump will stop automatically when the pilot device de-energizes the motor starter.

Turn the "Hand-Off-Auto" selector switch to "Off" position if you want to stop the pump while it is running.

If hydraulic shock occurs, the check valve closure rate may need adjustment or additional controls may be needed.

OPERATION

DETERMINE PUMP ROTATION

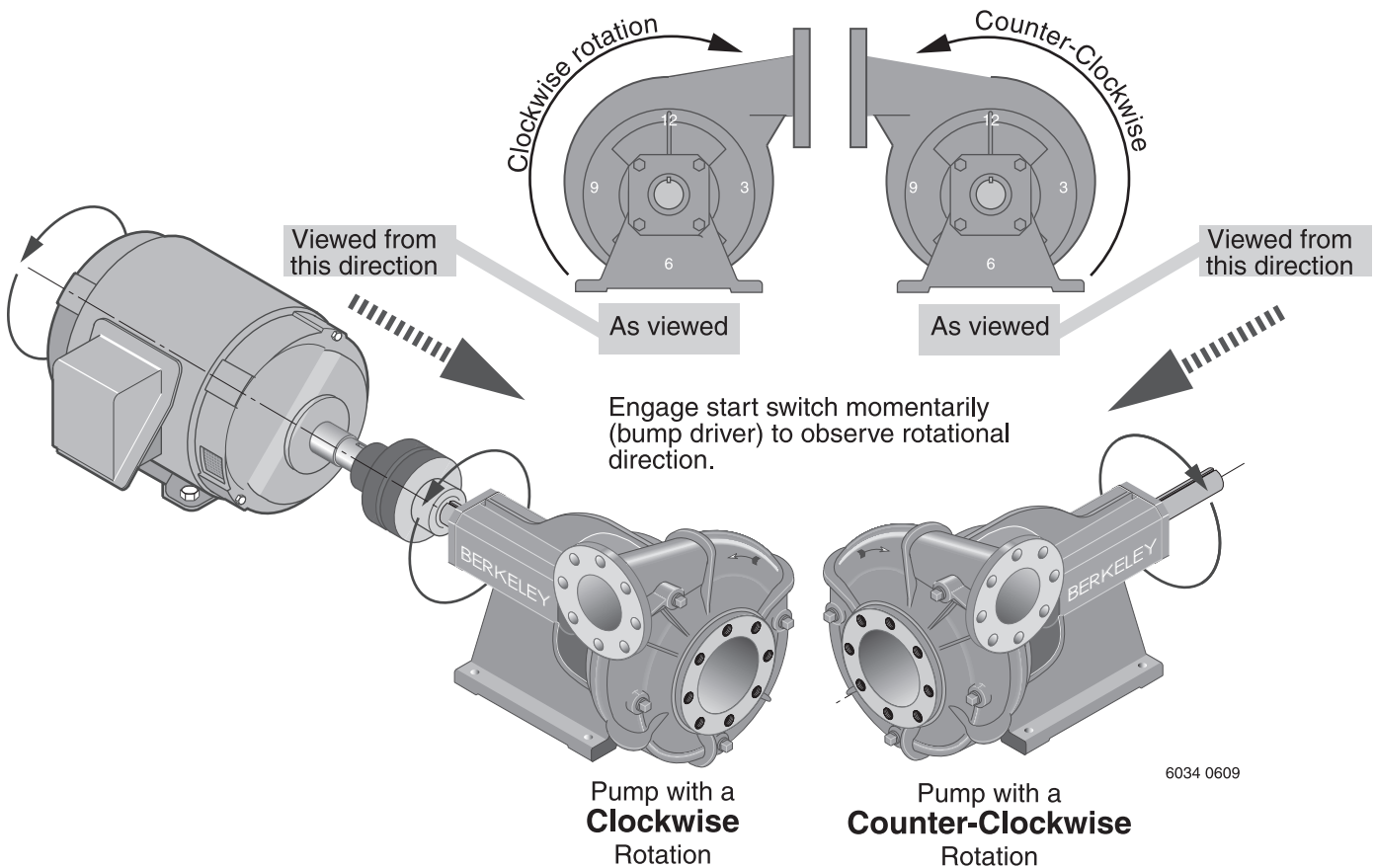


FIGURE 13

ELECTRIC MOTORS

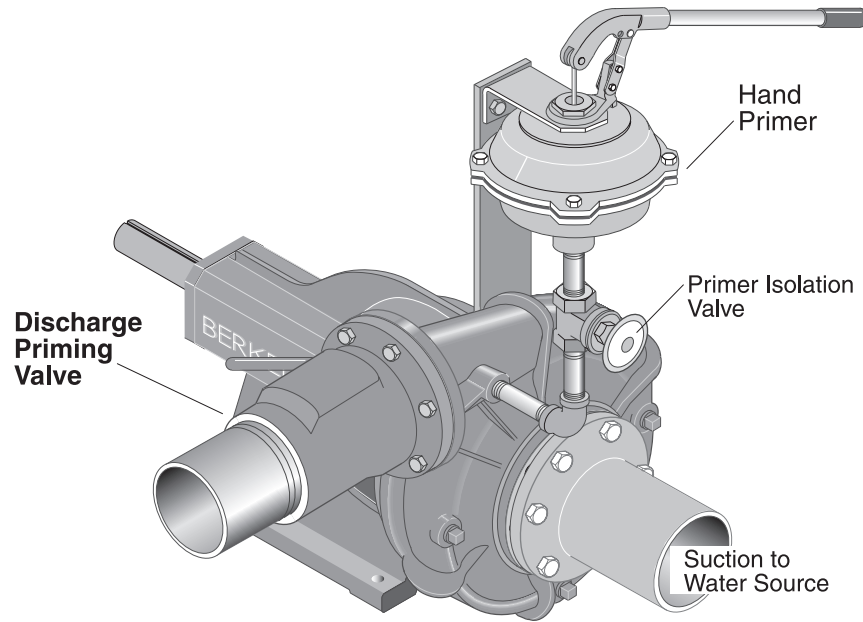
- ◆ **Single Phase:** Refer to wiring information on the motor plate to obtain proper rotation.
- ◆ **Three Phase:** If pump runs backwards, reverse any two leads coming off incoming power (L1, L2, L3) until proper rotation is obtained. Reverse L1 and L2, or L2 and L3, or L1 and L3. Swing type check valves can permit build-up of reverse velocity before closing causing hydraulic shock or "water hammer."
- ◆ Pump running backward - Centrifugal pumps will still pump liquids, however, GPM and head will be a fraction of the published performance.

ENGINE DRIVEN

- ◆ If engine is used for pump driver, check with engine instruction and operation manual or engine manufacturer to determine how rotation is defined, then use above illustration for proper connection.

OPERATION

PUMP PRIMING



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FIGURE 14

INSTALLATIONS WITH FLOODED SUCTION MOTORS

1. Open air vent (or pipe plug) in the highest tapped opening in pump case.
2. Open inlet isolation valve, allowing water to fill the pump completely and force all air out through vent.
3. Rotate shaft slowly allowing any air trapped in impeller to escape.
4. Close vent opening when water without air emerges.

INSTALLATIONS WITH SUCTION LIFT AND FOOT VALVE

1. Close air tight valve on discharge.
2. Remove pipe plug from highest opening on pump case.
3. Completely fill pump and suction piping with water.
4. Rotate shaft slowly allowing any air trapped in impeller to escape.
5. When all air has been forced out of pump, replace pipe plug. Use pipe joint compound on plug threads and tighten as necessary to prevent leakage.

INSTALLATIONS WITH SUCTION LIFT AND PRIMING PUMP

1. Close air tight valve.
2. Hand primer operation:
 - ◆ Open hand primer isolation valve.
 - ◆ Work handle of hand primer up and down to evacuate air from the suction line. Refer to primer owner's manual for proper procedure.
 - ◆ When water flows freely from primer, close hand primer isolation valve. Pump case should now be filled with water.
3. Immediately start pump.
4. Slowly open discharge valve (if used) until desired flow is achieved. Discharge Priming Valve will open automatically.

MAINTENANCE

LUBRICATION

LIQUID END of pump requires no lubrication. Wear rings, packing rings, and models using a mechanical shaft seal, are lubricated by the liquid being pumped. Do not run dry!

BEARING FRAME - Add approximately 2 ounces of a lithium-based NGLI No. 2 extra pressure ball bearing grease to each bearing during quarterly inspection. Excess grease will cause bearings to run hot.

The following are factory approved brands of grease for use with Berkeley Pumps:

- ◆ Shell Oil 's Alvania EP2,
- ◆ Mobil Oil's Mobilith AW2,
- ◆ Exxon's Ronex MP,
- ◆ Atlantic Richfield's Litholine EP2,
- ◆ Amoco Amolith EP2.

Grease fitting in packing area is for priming only. See Priming in the Operations section for instruction.

ELECTRIC MOTOR: Refer to motor manufacturer's operating manual for complete instruction.

GAS/DIESEL ENGINE: Refer to engine manufacturer's operating manual for complete instruction.

PERFORMANCE CHECK

Periodically check the output of the pump. If performance is noticeably reduced, refer to Troubleshooting Chart.

OBSERVATIONAL MAINTENANCE

When the pump and system operation have been stabilized, verify that pump unit is operating properly. Observe the following:

VIBRATION : All rotating machines can be expected to produce some vibration, however, excessive vibration can reduce the life of the unit. If the vibration seems excessive, discontinue operation, determine cause of the excessive vibration, and correct.

NOISE: When the unit is operating under load, listen closely for unusual sounds that might indicate that the unit is in distress. Determine the cause and correct.

OPERATING TEMPERATURE: During operation, heat is dissipated from the pump and the driver. After a short period of time, the surface of the pump bracket will be quite warm (as high as 150°F), which is normal.

If the surface temperature of the pump bracket or driver is excessive, discontinue operation, determine cause of the excessive temperature rise, and correct. Bearings will run

hotter for a brief run-in period after packing which is normal. However, worn bearings will cause excessive temperatures and need to be replaced. The pump unit is cooled by the water flowing through it, and will normally be at the temperature of the water being pumped.

STUFFING BOX: After a short period of operation, verify that the stuffing box area and gland are not hot. If heating is detected, loosen the gland nuts evenly until water is just running out of stuffing box in a DROPLET form (approximately 40-60 drops per minute). Water must not be streaming or spraying out. Verify cool operation periodically. Adjust gland nuts **EVENLY** as necessary for lubrication and cooling of the packing. If packing has been tightened to the limit of the packing gland travel, additional packing is necessary.

PACKING

Starting new pump. Before starting pump for the first time, loosen gland nuts and re-tighten finger tight. Proceed with pump startup procedure. Allow packing to leak liberally for a few moments. Then tighten gland nuts one complete turn each until leakage is reduced to 40 to 60 drops per minute.

REPACKING

Refer to Figures 15 and 16.

MECHANICAL SEAL

Adjustment or maintenance is normally not required. The seal is enclosed within the pump and is self adjusting. Seal is cooled and lubricated by the liquid being pumped. Consult factory for proper replacement procedure.

PUMP PROTECTION COLD WEATHER/WET WEATHER INSTALLATIONS

SYSTEM DRAINS: Provide drain valves to empty system, including pump case, to prevent freezing damage.

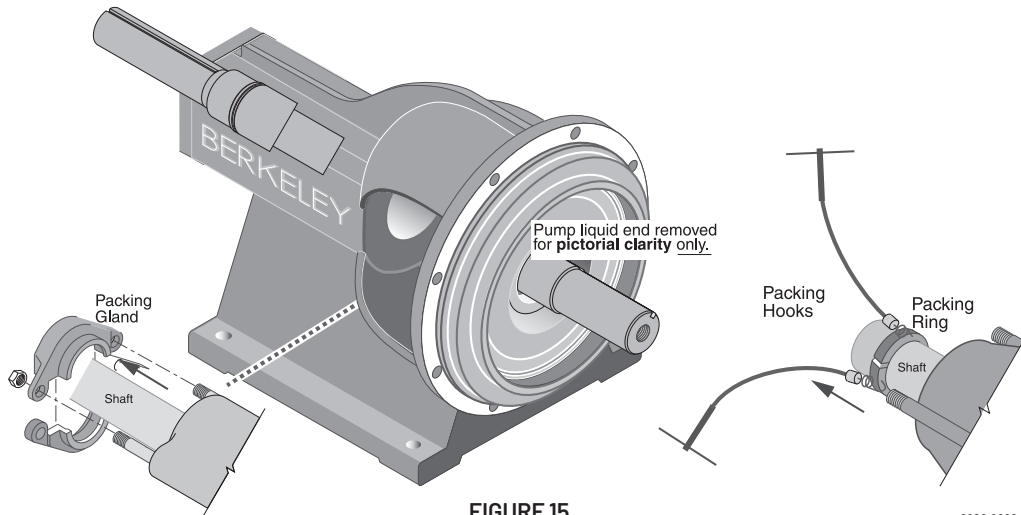
SHELTER: If possible, provide shelter for unit to protect from weather. Allow adequate space around pump unit for service. When effectively sheltered, a small amount of heat will keep temperature above freezing. Provide adequate ventilation for unit when running. For severe weather problems, where other shelter is not practical, a totally enclosed fan-cooled enclosure can be considered for electric motors.

CONDENSATION: When the temperature of metal parts is below dew point and the surrounding air is moist, water will condense on the metal surfaces and can cause corrosion damage. In severe situations, a space heater can be considered to warm the unit.

MAINTENANCE

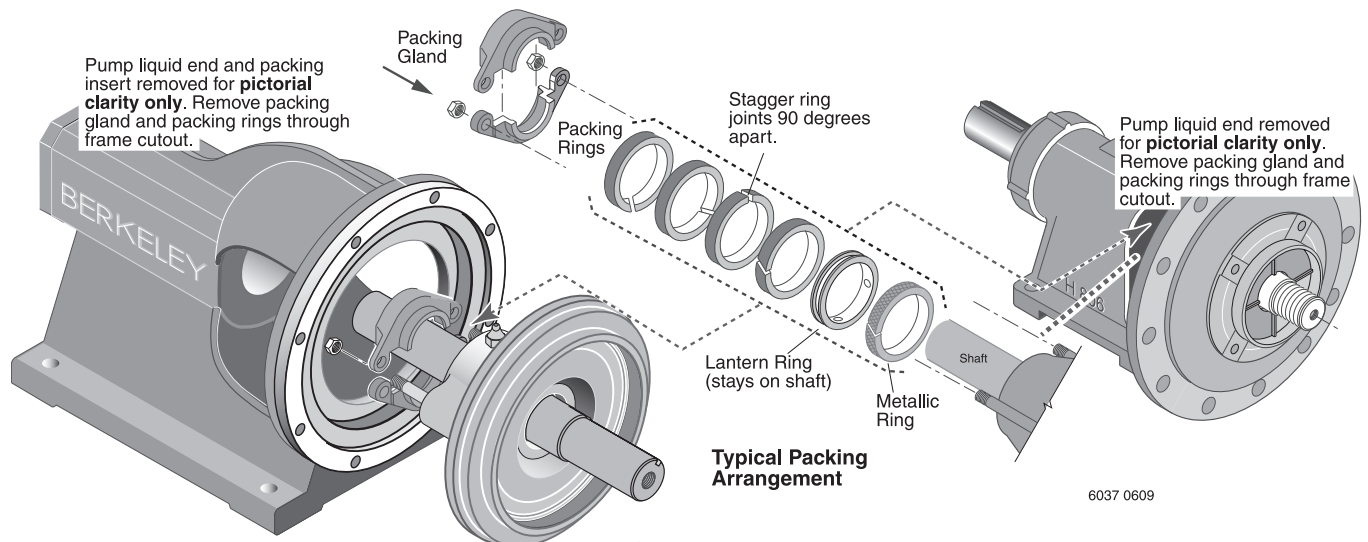
PACKING RING REPLACEMENT - REMOVAL

- ◆ Unfasten hardware holding packing gland in place and slide back on shaft to expose packing rings. A split packing gland with threaded studs is shown.
- ◆ Remove packing rings from stuffing box using two commercially available packing hooks as shown.
- ◆ Slide lantern ring (if used) back to expose any remaining rings, including metallic. Remove them in the same manner.



PACKING RING REPLACEMENT - INSTALL NEW RINGS

- ◆ Clean shaft sleeve and packing gland.
- ◆ Inspect shaft sleeve for wear, replace if needed.
- ◆ Install new packing rings in stuffing box by placing over shaft sleeve and pushing them in as far as they will go.
- ◆ Rotate ring joint 90 degrees when installing each ring as shown.
- ◆ Slide packing gland into position (gland must enter stuffing box bore) then gently and evenly tighten nuts to force rings into place and seat (do not over tighten). Loosen nuts again to hand tight.
- ◆ Start primed pump and allow packing to leak liberally. While pump is running, evenly tighten gland nuts one complete turn at a time until leakage is reduced to droplet form (40 to 60 drops per minute).



MAINTENANCE

IMPELLER REPLACEMENT

1. Remove the volute, the old gasket(s), and the o-ring(s). Discard the gaskets and o-rings.
2. Check the clearance between the impeller hub and the volute wear ring. If it is more than .020" on a side, replace the wear ring. NOTE: Certain models, such as the B4EY, have a suction cover which is removed first to gain access to the impeller. On these models, remove the access cover, then remove the impeller (see below), and then remove the seal from the volute.

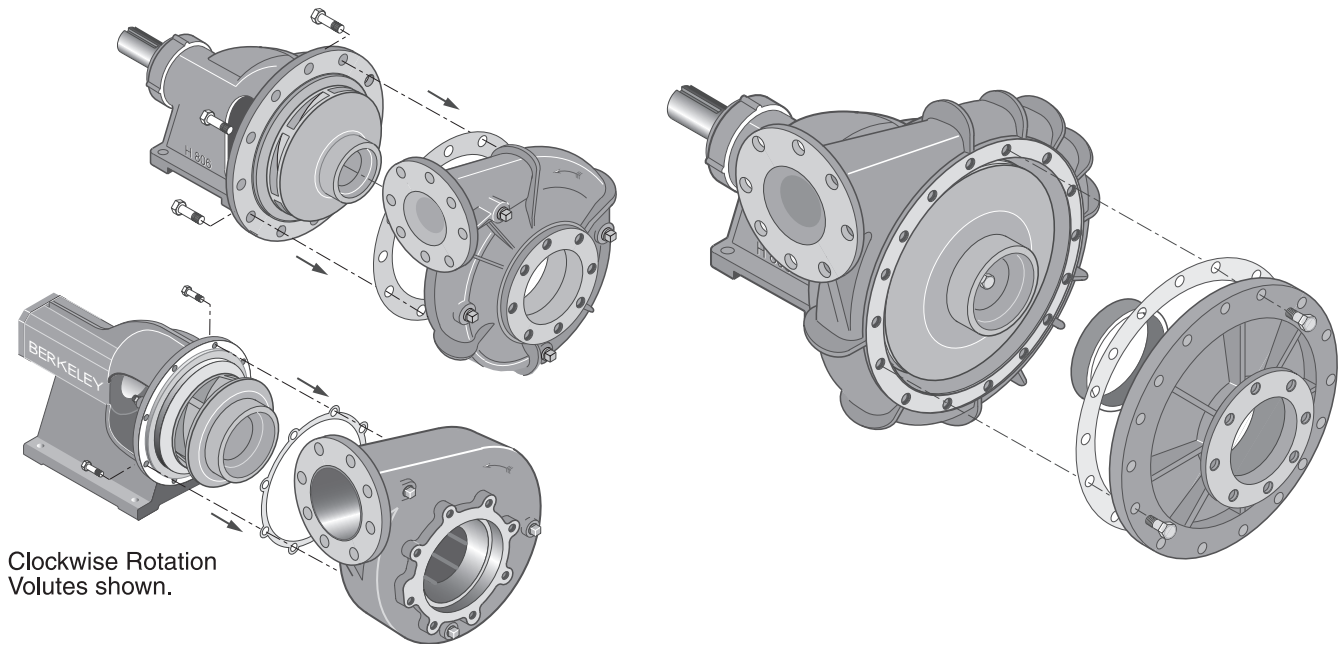


FIGURE 18

3. Remove the impeller. Pull keyed impellers off the shaft with a standard gear puller against the end of the shaft and pulling on the impeller. Place the puller's fingers against the back of the vanes in the impeller. Pulling on the impeller's unsupported front or back shroud could easily break the impeller. Never pull on the supported front or back shroud.
4. Unscrew threaded impellers. Pumps with clockwise rotation as viewed from the shaft (engine) end have a right-hand threaded impeller. Pumps with counterclockwise rotation as viewed from the shaft (engine) end have a left-hand threaded impeller. The impeller cap screw is always right-hand thread.

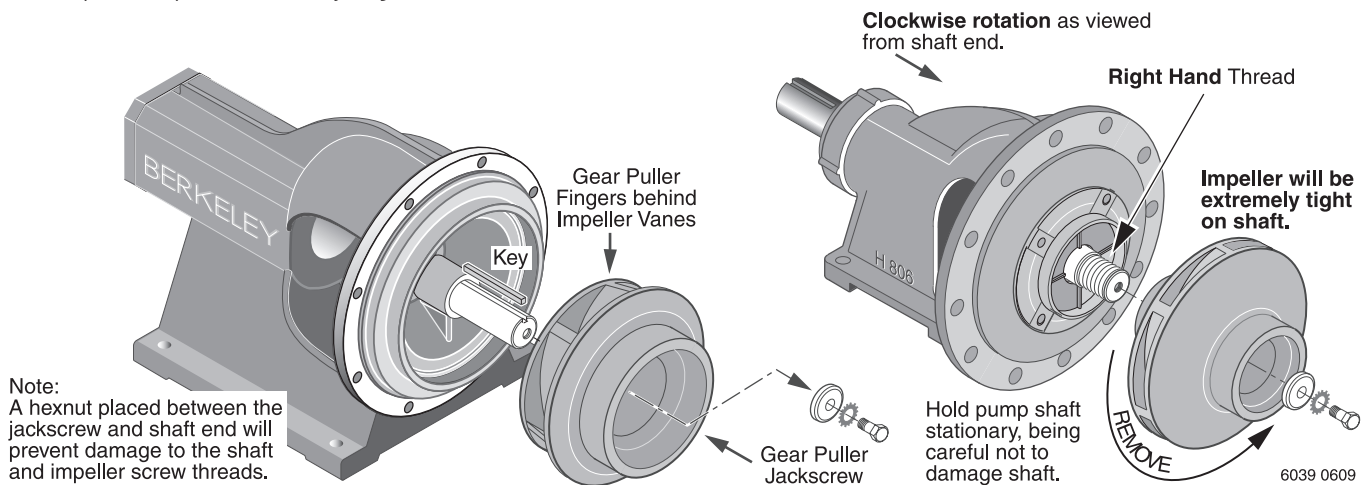


FIGURE 19

MAINTENANCE

SHAFT MAINTENANCE/REPLACEMENT

1. If your pump has a bolted in balance ring, remove it; if it has a pressed in balance ring, leave it in place unless there isn't room to get the seal out past it. If it doesn't have a balance ring, go to Step 4.

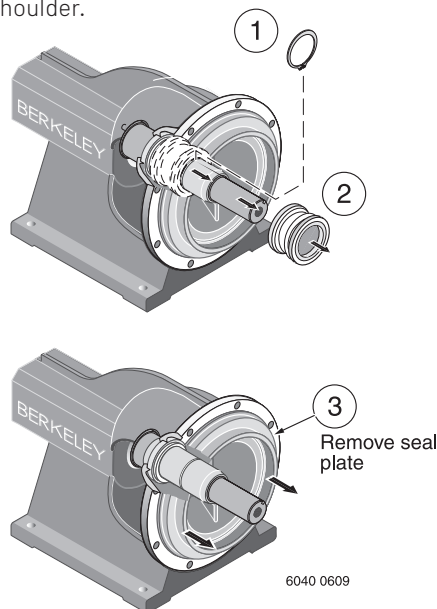
Check the clearance between the balance ring and the impeller hub. If it is more than .020" on a side, replace the balance ring.

2. Remove the seal retaining ring and pull the rotating part of the seal off the shaft.
3. For model **B4EYRMBM(S) and similar pumps**: See the special instructions section on this page.

4. For **Z Series**: Pull the seal plate out until it clears the shaft, bringing the stationary part of the seal out with it. Tap the seal out of the seal plate and clean the seal cavity.

For **Other Pumps**: Pull the stationary part of the seal out of the cavity and clean the cavity.

5. Install the new stationary seal in the seal cavity. Apply a small amount of mineral oil to the o-ring or cup seat of the stationary seal.
6. Use the cardboard washer (supplied) and a piece of pipe as a press; press the stationary seal into place. Do not damage the seal face!
7. Reinstall the seal plate (if used) now. Cover all shaft threads with tape to protect the seal during installation.
8. Apply a small amount of mineral oil to the inside diameter of the rubber ring in the rotating seal and to the outside of the shaft sleeve.
9. Slide the seal plate over the shaft now, taking care to avoid damage to the stationary part of the shaft seal as it goes over the shaft shoulder.



10. After lubricating the rotating part of the seal, slide it onto the shaft and sleeve until it seats against the stationary (ceramic) part.
11. Compress the seal spring on the shaft sleeve and reinstall the seal retaining ring (if used).
12. Reinstall the balance ring (if used).
13. Slide or thread the impeller onto the shaft until it seats solidly against the shaft shoulder, then install a new impeller screw with its associated hardware.
14. Replace the volute. Use new gasket(s) and o-ring(s). Complete.

FOR B4EYRMBM(S) AND SIMILAR PUMPS (SEE GRAPHIC).

- ◆ After Step 3, you will need to remove the outer bearing cap and slide the shaft assembly back out of the bracket.
- ◆ Remove the seal retainer and tap out the stationary seal.
- ◆ Clean the seal retainer and shaft (don't scratch the shaft!)
- ◆ Apply a small amount of mineral oil to the o-ring or cup seat of the stationary seal, to the inside diameter of the rubber ring in the rotating seal, and to the outside of the shaft sleeve.
- ◆ Use the cardboard washer (supplied) and a piece of pipe to press the stationary seal into place.
- ◆ Inspect the oil seal and replace it if necessary.
- ◆ Repack the bearings and reinstall the shaft in the bracket. When the end of the shaft comes through the front bearing bore in the bracket, slip the slinger and seal retainer over the end of the shaft. BE SURE you don't damage the seal face on the shaft shoulder!
- ◆ Reinstall the outer bearing cap with a new gasket and proceed back to Step 7.

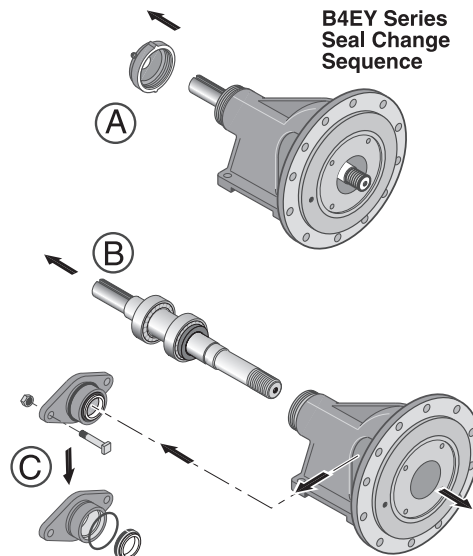


FIGURE 20

MAINTENANCE

SHAFT MAINTENANCE/REPLACEMENT

Shaft assembly of bearing frame pumps should be periodically (annually minimum) torn down for inspection of worn parts, leaning, and re-greasing. Most importantly to check shaft sleeve and bearings for pitting.

Replace worn components as necessary. Parts may be ordered separately as required, or for some models, shaft kits are available that are completely assembled and ready for installation.

1. Remove volute to expose impeller. Certain models such as the B4EY, are constructed with a suction cover which is removed first to access impeller.
2. Peel off old volute gasket (or o-ring) and discard.

PUMP DISASSEMBLY

3. Remove packing gland and packing arrangement as described in Packing Ring Replacement section.
4. Remove pump volute and impeller as described in the Impeller Replacement and Shaft Replacement sections.
5. Remove outer bearing cap and slide shaft assembly from bearing bracket.
6. Clean and inspect all components

SHAFT INSTALLATION

1. Thoroughly steam clean or solvent wash the bearing cavity of bracket to remove old grease and dirt. Check surface of

bracket for cracks, extreme corrosion, or other defects.

2. Pack bearings with a lithium-based NLGI No. 2 extra pressure ball bearing grease. Force enough grease into each bearing to fill internal space between the races.
3. Coat the bearing bores of bracket with oil.
4. Orient shaft assembly in the direction shown above. Slide shaft and bearing assembly into bearing bracket. Do not force them!
5. When end of pump shaft comes through inside opening of bearing cavity, place oil seal, water slinger, and lantern ring over end of shaft.
6. If packing gland or seal retainer is not of the split variety, place it over the shaft at this time as well.
7. Slide shaft on through stuffing box until the first bearing makes contact with the bracket.
8. Carefully align bearing with the bearing bore and press or tap bearing assembly into place. Do not use excessive force.
9. Be sure bearing bores and bracket area are clean and free of contamination or early bearing failure may occur.
10. Reinstall outer bearing cap and oil seal.
11. Rotate pump by hand, 10-12 rotations.
12. Reassemble pump parts and reinstall unit to piping system.
13. Refer to Installation section in this manual for correct procedure.

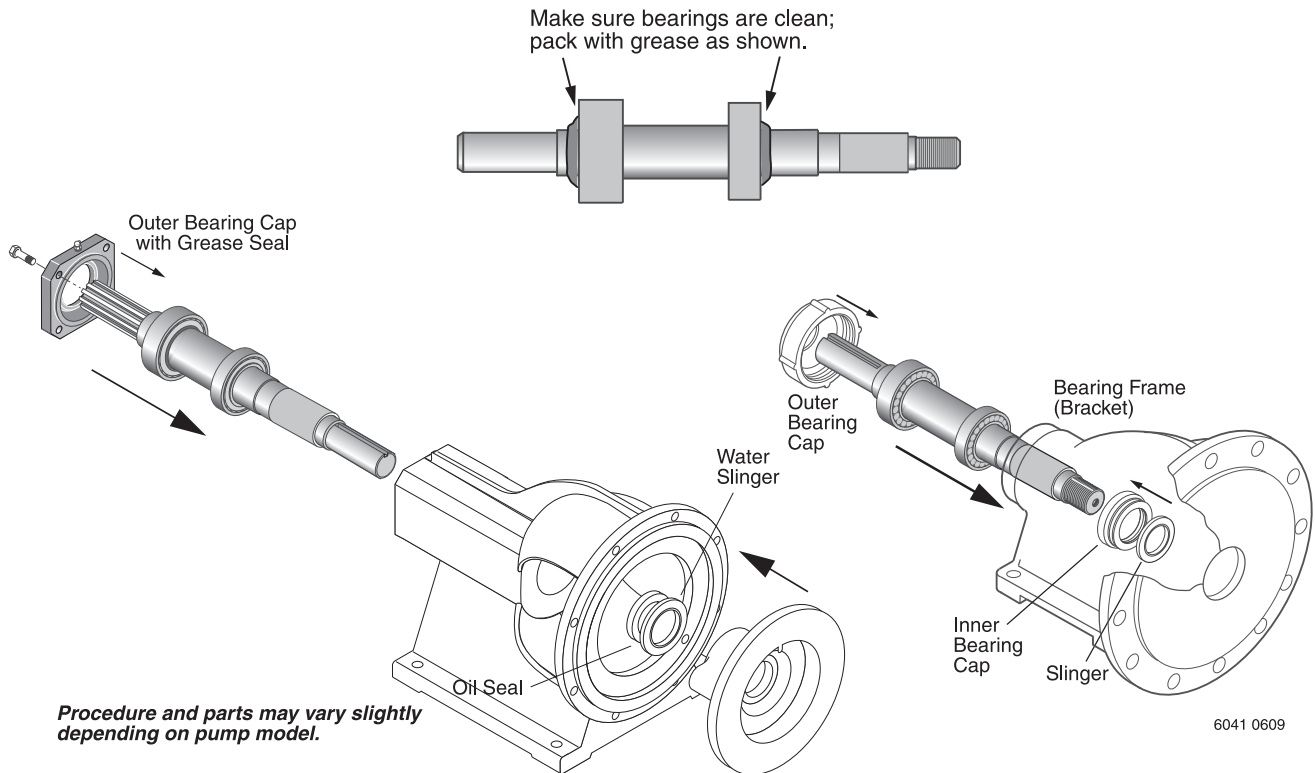


FIGURE 21

MAINTENANCE

GENERAL PUMP CARE

A well maintained pumping system will extend the life of the unit and will require fewer repairs. This means less down time which can be very critical when a constant delivery of water is required.

ROUTINE MAINTENANCE

A routine maintenance and inspection schedule should be set up on a weekly, quarterly, and annual basis with records kept of these actions. For weekly checks see observational maintenance instructions in Maintenance section. For quarterly and annual maintenance, refer to check list on the following page. Copy page as necessary for continual usage.

RECOMMENDED SPARE PARTS

It is recommended that the following spare parts be kept on-site as a minimum back-up to service your pump and reduce down-time. Check your model/style against parts breakdown drawing on Page 25 when selecting spares.

- ◆ Mechanical Shaft Seal
- ◆ Packing Set and Packing Hooks
- ◆ Shaft Sleeve(s)
- ◆ All Gaskets and O-Rings Required for One Pump
- ◆ Impeller Wear Ring
- ◆ Retaining Rings

If having a pump non-operational has severe consequences, a back-up pump should be considered. Otherwise, a back-up impeller, volute case, bearings and shaft, would be prudent.

WINTERIZING

If pump is to be out of service for an extended period of time, such as the winter months, the following storage procedures should be followed.

- ◆ Remove exterior dirt and grime or any substance that may trap moisture. Exposed metal is subject to oxidation, prime and repaint if necessary. If this is not possible, coat with grease or heavy oil.
- ◆ Flush suction and discharge lines. Check for leaks at this time and replace any worn gaskets.
- ◆ Remove lowest plug in pump and drain pump casing and suction and discharge lines.
- ◆ Lubricate bearings.
- ◆ If possible, keep unit clean and dry during storage period to guard against corrosion.
- ◆ Seal all open ports to keep out foreign objects such as insects, rodents, dust and dirt.
- ◆ Rotate driver shaft periodically to prevent freeze-up of internal components.
- ◆ Shelter unit from elements if possible.
- ◆ Work oil into impeller wear ring by dripping oil into the gap while rotating by hand.

SPRING START -UP

- ◆ Inject sufficient grease into the bearings to displace old grease.
- ◆ Visual inspection.
- ◆ Rotate by hand, if any binding occurs, disassemble and inspect.

MAINTENANCE

ROUTINE INSPECTION CHECKLIST

I. QUARTERLY INSPECTION

- ◆ Inspect all system piping connections for leakage or possible misalignment.
- ◆ Check pump foundation for soundness and see that all hold-down bolts are secure.
- ◆ Complete any lubrication requirements as dictated by pump and driver owner's manual.
- ◆ Inspect packing or mechanical seal for possible replacement. Examine shaft sleeve, if present, for wear and replace if necessary.
- ◆ Inspect pumping plant panel for signs of wear (replace pitted contactors, etc., as needed).
- ◆ Check pump and motor bearings from signs of wear. Repack or replace as necessary.
- ◆ Check alignment of couplings and/or pulleys and belt tension if applicable.

II. QUARTERLY INSPECTION

- ◆ Inspect all system piping connections for leakage or possible misalignment.
- ◆ Check pump foundation for soundness and see that all hold-down bolts are secure.
- ◆ Complete any lubrication requirements as dictated by pump and driver owner's manual.
- ◆ Inspect packing or mechanical seal for possible replacement. Examine shaft sleeve, if present, for wear and replace if necessary.
- ◆ Inspect pumping plant panel for signs of wear (replace pitted contactors, etc., as needed).
- ◆ Check pump and motor bearings from signs of wear. Repack or replace as necessary.
- ◆ Check alignment of couplings and/or pulleys and belt tension if applicable.

NOTES:

III. QUARTERLY INSPECTION

- ◆ Inspect all system piping connections for leakage or possible misalignment.
- ◆ Check pump foundation for soundness and see that all hold-down bolts are secure.
- ◆ Complete any lubrication requirements as dictated by pump and driver owner's manual.
- ◆ Inspect packing or mechanical seal for possible replacement. Examine shaft sleeve, if present, for wear and replace if necessary.
- ◆ Inspect pumping plant panel for signs of wear (replace pitted contactors, etc., as needed).
- ◆ Check pump and motor bearings from signs of wear. Repack or replace as necessary.
- ◆ Check alignment of couplings and/or pulleys and belt tension if applicable.

IV. QUARTERLY INSPECTION

- ◆ Inspect all system piping connections for leakage or possible misalignment.
- ◆ Check pump foundation for soundness and see that all hold-down bolts are secure.
- ◆ Complete any lubrication requirements as dictated by pump and driver owner's manual.
- ◆ Inspect packing or mechanical seal for possible replacement. Examine shaft sleeve, if present, for wear and replace if necessary.
- ◆ Inspect pumping plant panel for signs of wear (replace pitted contactors, etc., as needed).
- ◆ Check pump and motor bearings from signs of wear. Repack or replace as necessary.
- ◆ Check alignment of couplings and/or pulleys and belt tension if applicable.

ANNUAL INSPECTION

- ◆ Inspect pump and entire pumping system for signs of wear.
- ◆ Inspect system valves, screens, etc.
- ◆ If electric motor is used, check windings for degradation, rewind if necessary.
- ◆ Check pump impeller eye for clearance.
- ◆ Inspect impeller, volute case, and seal chamber for signs of excessive wear or corrosion.

PUMP NOMENCLATURE

ORDERING REPLACEMENT PARTS

Locate the Berkeley nameplate on the pump, plate is normally on the bearing bracket. Information found on this plate is shown below. To be sure of receiving correct parts, provide all nameplate data when ordering.

The BM (Bill of Material) number is most important. Write your nameplate information on the blank nameplate below for future reference as nameplates can become worn or lost.

Illustration on the following page show typical components used in the assembly of bearing frame mounted centrifugal pumps. Refer to this drawing when ordering any replacement parts.

MODEL B3TPMS	S.N. OR DATE G100894
IMPELLER DIA. 6-1/8"	B.M. B54598

SAMPLE ONLY

MODEL	S.N. OR DATE
IMPELLER DIA.	B.M.

RECORD NAMEPLATE DATA HERE

PUMP NOMENCLATURE

PARTS BREAKDOWN

- ◆ Drawing is representative of a typical bearing frame pump, parts on some models may vary slightly.
- ◆ Frame mount pumps equipped with a mechanical seal use the same standard components as the packing style except as shown in supplemental view.

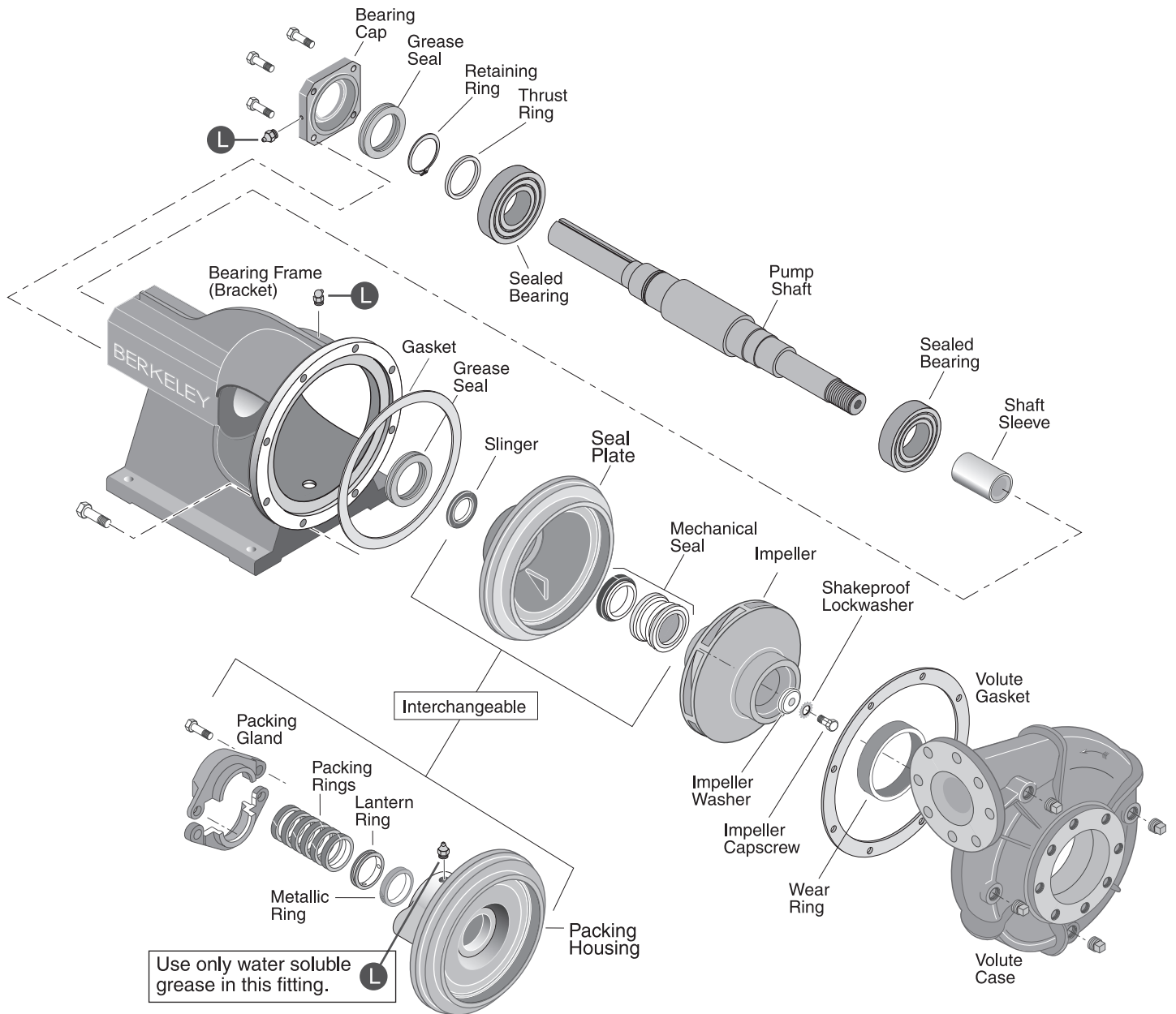


FIGURE 22

INSTALLATION

PARTS BREAKDOWN

- ◆ Drawing is representative of a typical bearing frame pump, parts on some models may vary slightly.
- ◆ Frame mount pumps equipped with a mechanical seal use the same standard components as the packing style except as shown in supplemental view.

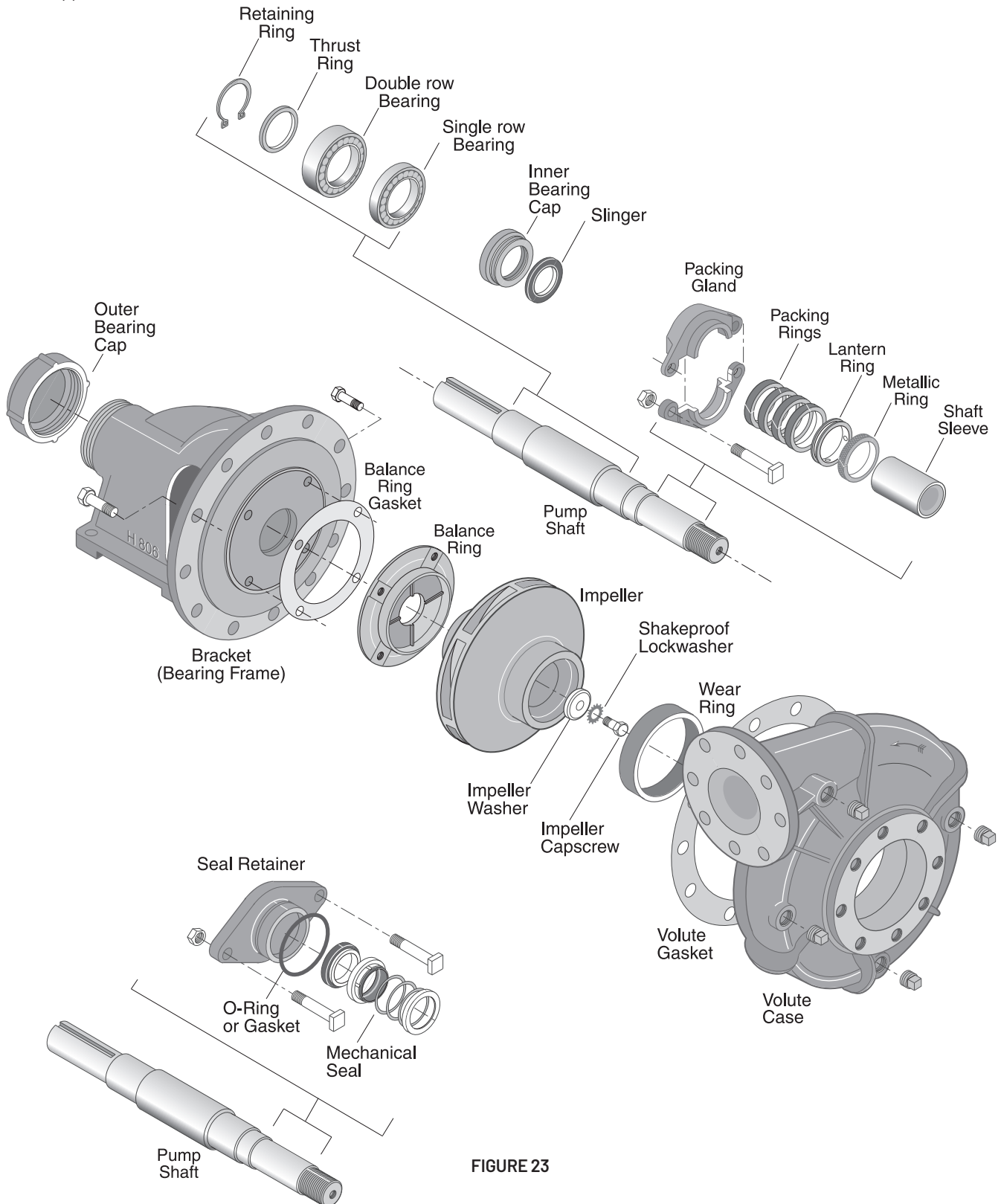


FIGURE 23

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE																	
	GROUP I ELECTRICAL									GROUP II MECHANICAL					GROUP III SYSTEM			
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	A	B	C
Pump runs, but no water delivered										X		X					X	X
Not enough water delivered			X	X				X		X	X		X				X	X
Not enough pressure			X	X				X		X	X		X				X	X
Excessive vibration								X		X	X			X			X	X
Abnormal noise										X	X	X		X	X		X	X
Pump stops	X	X	X	X	X	X	X	X										
Overheating		X	X	X				X			X		X	X	X			X

CAUSE	CORRECTIVE ACTION
I. ELECTRICAL	
A. No voltage in power system	Check phase-to-phase on line side of starter contactor. Check circuit breaker or fuses.
B. No voltage on one phase (Three Phase Units)	Check phase voltage on line side of starter contactor. Isolate open circuit (circuit breaker, fuse, broken connections, etc.)
C. Low voltage at motor	Running voltage across each leg of motor must be $\pm 10\%$ of nominal voltage shown on nameplate.
D. Motor leads improperly grouped for voltage	Refer to lead grouping diagram on motor nameplate.
E. Control failure	Check control device, starter contactor, H-O-A selector switch, etc., for malfunction.
F. Thermal overload switch open	Check phase-to-phase on line side of starter contactor.
G. Installation failure	Check motor or windings to ground with megohmmeter.
H. Open windings	Check leg-to-leg with ohmmeter.
I. Frequency variation	Check frequency of power system. Must be less than 5% variation from motor nameplate rating.
II. MECHANICAL	
A. Flow through pump completely or partially obstructed	Locate and remove obstruction. Refer to Repair Instructions for disassembly.
B. Wrong direction of rotation	Reverse rotation of three phase motor by interchanging any two leads. See manufacturer's instructions for reversing single phase motor.
C. Pump not primed	Reprime. Inspect suction system for air leaks.
D. Internal leakage	Check impeller for wear of controlled clearances (See Repair Instructions).
E. Loose parts	Inspect. Repair.
F. Stuffing box not properly adjusted	Adjust gland.
III. SYSTEM	
A. Pressure required by system at design flow rate exceeds pressure rating of pump	Compare pump pressure and flow rate against pump characteristic curve. Check for closed or partially closed valve in discharge piping system. Reduce system pressure requirement. Increase pressure capability of pump.
B. Obstruction in suction piping	Locate and remove obstruction.
C. Pressure rating of pump exceeds pressure requirement of system at design flow rate	Compare pump pressure and flow rate against pump characteristic curve. Inspect discharge piping system for breaks, leaks, open by-pass valves, etc. If necessary, reduce flow rate by partially closing discharge valve.

TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE														
	GROUP I ENGINE						GROUP II MECHANICAL						GROUP III SYSTEM		
	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C
Pump runs, but no water delivered	X						X		X				X	X	
Not enough water delivered	X				X		X	X		X			X	X	
Not enough pressure	X				X		X	X		X			X	X	
Excessive vibration			X	X	X		X	X			X			X	X
Abnormal noise			X	X	X		X	X	X		X	X		X	X
Pump stops		X		X	X	X									
Overheating		X	X	X	X			X		X	X	X			X

CAUSE	CORRECTIVE ACTION
I. ENGINE	
A. Speed too low	Refer to engine manufacturer's manual.
B. Rotating and/or reciprocating parts drag	Refer to engine manufacturer's manual.
C. Speed too high	Refer to pump and engine power curves. Adjust.
D. Loose or broken parts	Refer to engine manufacturer's manual.
E. Improper adjustment	Check fuel and ignition systems. Adjust per engine manufacturer's manual.
F. Fuel supply	Check fuel supply, fuel pump, filters, etc.
II. MECHANICAL	
A. Flow through pump completely or partially obstructed	Locate and remove obstruction. Refer to Repair Instructions for disassembly.
B. Wrong direction of rotation	Reverse rotation of three phase motor by interchanging any two leads. See manufacturer's instructions for reversing single phase motor.
C. Pump not primed	Reprime. Inspect suction system for air leaks.
D. Internal leakage	Check impeller for wear of controlled clearances (See Repair Instructions).
E. Loose parts	Inspect. Repair.
F. Stuffing box not properly adjusted	Adjust gland.
III. SYSTEM	
A. Pressure required by system at design flow rate exceeds pressure rating of pump	Compare pump pressure and flow rate against pump characteristic curve. Check for closed or partially closed valve in discharge piping system. Reduce system pressure requirement. Increase pressure capability of pump.
B. Obstruction in suction piping	Locate and remove obstruction.
C. Pressure rating of pump exceeds pressure requirement of system at design flow rate	Compare pump pressure and flow rate against pump characteristic curve. Inspect discharge piping system for breaks, leaks, open by-pass valves, etc. If necessary, reduce flow rate by partially closing discharge valve.

Warranty

Pentair BERKELEY® warrants to the original consumer purchaser ("Purchaser" or "You") of the products listed in the table below, that they will be free from defects in material and workmanship for the Warranty Period shown in the table below.

Product	Warranty Period
Water Systems:	
Water Systems Products – jet pumps, small centrifugal pumps, submersible pumps and related accessories	<i>whichever occurs first:</i> 12 months from date of original installation, or 18 months from date of manufacture
Pentair Pro-Source® Composite Tanks	5 years from date of original installation
Pentair Pro-Source Steel Pressure Tanks	5 years from date of original installation
Pentair Pro-Source Epoxy-Lined Tanks	3 years from date of original installation
Agricultural/Commercial:	
Centrifugals – close-coupled motor drive, frame mount, SAE mount, engine drive, VMS, SSCX, SSHM	12 months from date of original installation, or 24 months from date of manufacture
Submersible Turbines, 6" diameter and larger	12 months from date of original installation, or 24 months from date of manufacture

Our warranty will not apply to any product that, in our sole judgement, has been subject to negligence, misapplication, improper installation, or improper maintenance. Examples that may result in denial of a warranty claim (this list is not all inclusive):

- Damage caused by careless handling, improper repackaging, or shipping.
- Damage due to misapplication, misuse, abuse, or failure to operate equipment as specified in the owner's manual.
- Damage caused by failure to install products as specified in the owner's manual.
- Damage due to unauthorized product modifications or failure to use Pentair original replacement parts.
- Damage caused by negligence, or failure to properly maintain products as specified in the owner's manual.
- Damage caused by water freezing inside the product.
- Accidental damage, fire, acts of God, or other circumstances outside the control of Pentair.

Without limiting the foregoing, operating a three phase motor with single phase power through a phase converter will void the warranty. Note also that three phase motors must be protected by three-leg, ambient compensated, extra-quick trip overload relays of the recommended size or the warranty is void.

All impeller diameters specified in the BEC2 pump sizing program have been tested and determined to not exceed the service factor of the specified motor. Oversized impeller diameters can be requested, however, use of an oversized impeller will void any warranty claims.

Your only remedy, and BERKELEY's only duty under this warranty, is that BERKELEY repair or replace defective products (at BERKELEY's choice). THE REMEDIES DESCRIBED HERE ARE YOUR SOLE AND EXCLUSIVE REMEDIES AND OUR ENTIRE LIABILITY FOR ANY BREACH OF THIS WARRANTY.

You must pay all labor and shipping charges associated with the warranty and must request warranty service through the installing dealer as soon as a problem is discovered. No request for service will be accepted if received after the Warranty Period has expired. This warranty is not transferable.

BERKELEY'S LIABILITY SHALL UNDER NO CIRCUMSTANCES EXCEED THE ACTUAL AMOUNT PAID BY YOU FOR THE PRODUCT AT ISSUE. BERKELEY SHALL NOT, UNDER ANY CIRCUMSTANCES, BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE, OR CONTINGENT DAMAGES OR LOSSES WHATSOEVER, WHETHER DIRECT OR INDIRECT. THE FOREGOING WARRANTY IS EXCLUSIVE. EXCEPT FOR THE WARRANTY SET FORTH HEREIN, BERKELEY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING, BUT NOT TO ANY WARRANTIES OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

THE FOREGOING WARRANTIES SHALL NOT EXTEND BEYOND THE DURATION PROVIDED HEREIN. Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on the duration of an implied warranty, so the above limitations or exclusions may not apply to You. This warranty gives You specific legal rights and You may also have other rights which vary from state to state.

This Warranty is effective July 14, 2020 and replaces all undated warranties and warranties dated before July 14, 2020.

BERKELEY

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