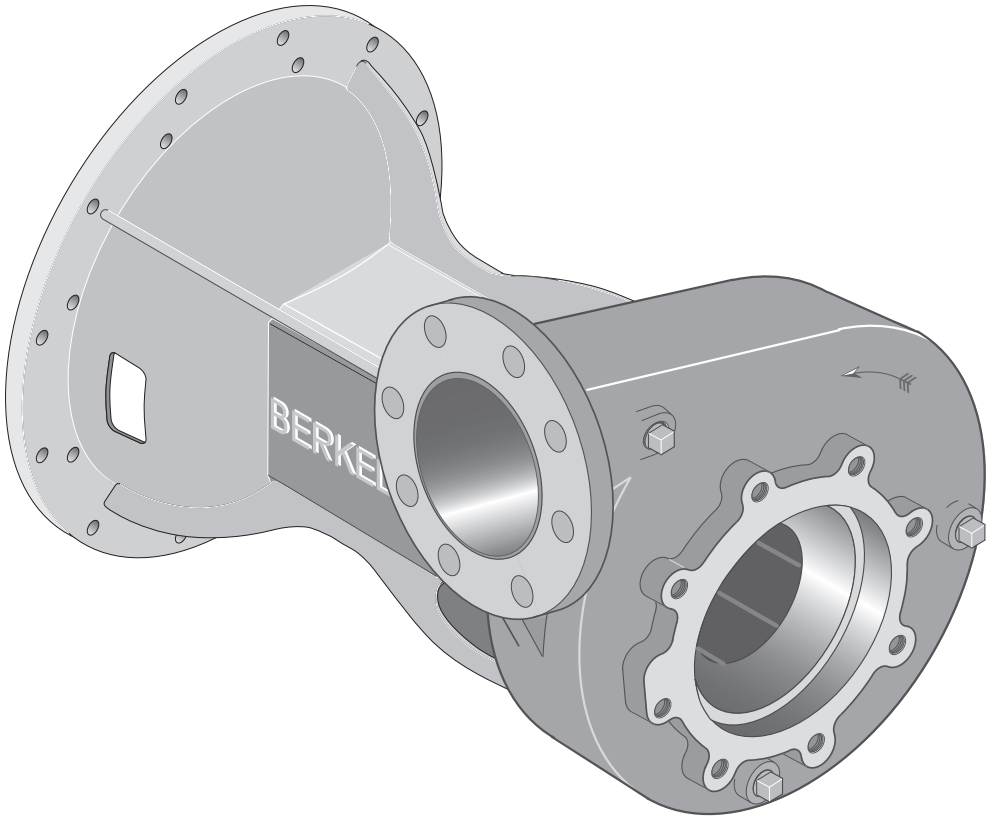
OWNERS MANUAL

INSTALLATION, REPAIR, AND OPERATING INSTRUCTIONS

S.A.E. Engine-Mount Centrifugal Pump



IMPORTANT

For best possible performance and continuous, satisfactory operation, read these instructions before installing your new pump.
Should service be required, this manual can be a valuable guide.
It should be kept near the installation for ready reference.
Record nameplate data from pump on blank nameplate inside this manual for future reference.

Berkeley Pumps / 293 Wright Street / Delavan, WI 53115

F00636 (Rev. 7/21/09)

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Safety First

General Information

READ AND FOLLOW SAFETY INSTRUCTIONS!

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 **will** or **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 label **NOTICE** indicates special instructions which are important but not related to hazards.

Carefully read and follow all safety instructions in this manual and on pump.

Keep safety labels in good condition.
Replace missing or damaged safety labels.



WARNING

Rotating parts. Can catch hands, feet, or clothing.

Stay clear of equipment and keep shields in place while pump is running.

Stop motor or engine before servicing pump.

Read owner's manual before using equipment.

General Safety

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.

Periodically inspect pump and system components.

Wear safety glasses at all times when working on pumps.

Keep work area clean, uncluttered and properly lighted; store properly all unused tools and equipment.

Keep visitors at a safe distance from the work areas.

Installation

General Information

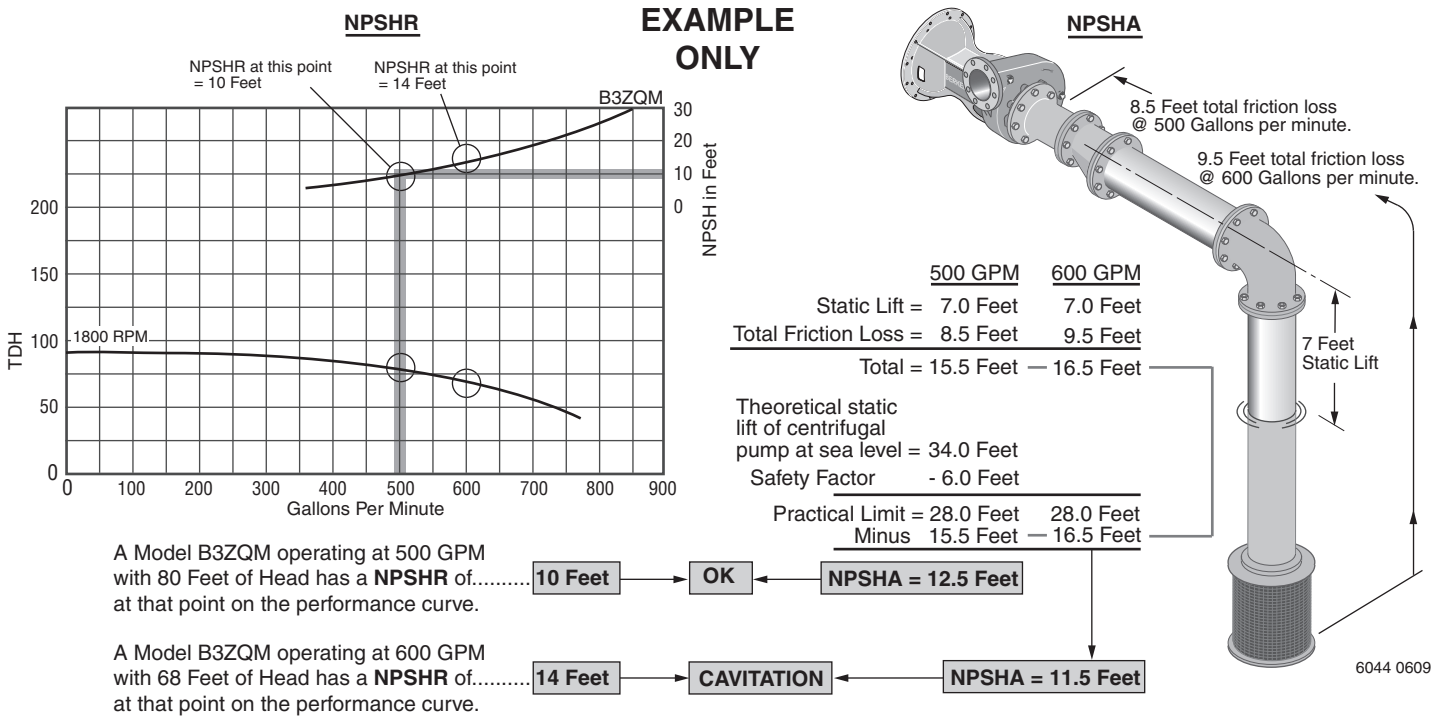


Figure 1

LOCATION

Locate the pump as near the water source as practical. Make pipe run short, straight and with as few pipe fittings as possible, to keep total friction loss to a minimum.

Install pump in a clean, dry and 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.

Because of the portable nature of this style pump, 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.

NOTE: 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.

PUMP FOUNDATION

⚠WARNING **CRUSHING WEIGHT.** Models with larger suction and discharge openings are extremely heavy. Use care and proper equipment when handling pump for installation.

Be sure to allow for the weight of the water in the pump and piping.

Portable Installation:

Pump should be placed on an area that will provide a solid foundation substantial enough to support the weight of pump and engine and also to provide stability while the pump is running. Engine vibration will cause shifting on any type of loose surface and cause piping strains and possible damage.

NOTICE: Settling and/or shifting during operation can cause piping to place excessive strain on the pump and may damage pump case.

Permanent Installation:

Pump and Engine should be set on a concrete foundation which is sufficiently substantial to absorb vibration and which will provide a permanent and rigid support. Bolt engine directly to concrete.

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.

⚠ CAUTION 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. If ANSI type flange connections are used, 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.

General Information

TABLE 1

Flywheel Housing Dimensions		S.A.E. Flywheel Housing Size				
		1	2	3	4	5
A		20-1/8	17-5/8	16-1/8	14-1/4	12-3/8
B		20-7/8	18-3/8	16-7/8	15	13-1/8
C	No.	12	12	12	12	8
	Size	7/16-14	3/8-16	3/8-16	3/8-16	3/8-16

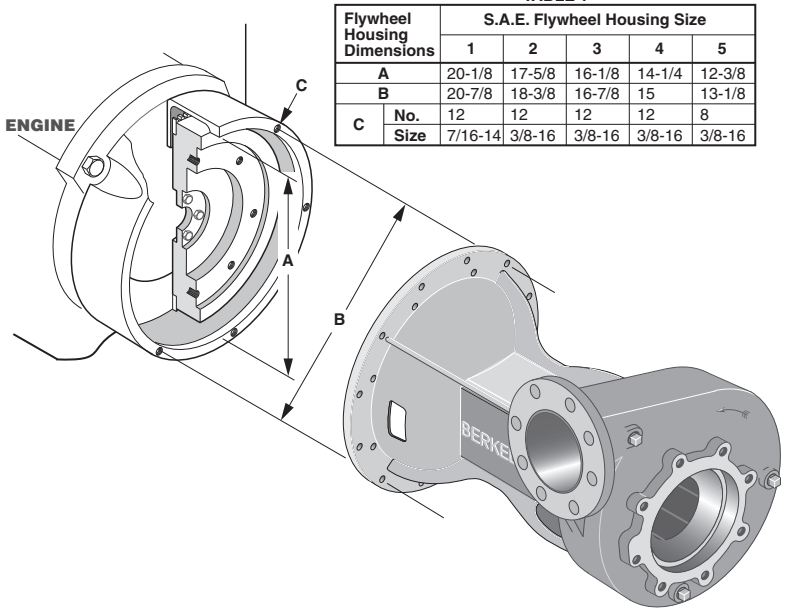


Figure 2

SUCTION PIPING

Refer to illustrations on Page 10 and 11 for recommended and not recommended practices in suction connections.

DISCHARGE PIPING

Refer to illustrations on Page 12 and 13 for recommended and not recommended practices in discharge connections.

REQUIREMENTS FOR PROPER OPERATION

Pump End:

When delivering the required capacity (GPM) to the system piping, the pump must add the amount of Head required by the system at that capacity. The operating head-capacity point should be as close as possible to the highest efficiency line shown on the performance curve, and MUST be below the head-capacity line labeled “Maximum” RPM. The maximum operating RPM for the pump is determined by bearing life, or in some cases, by the pressure limits of the pump. “The maximum working pressure for NPT tapped and flanged pumps, per ANSI B16.1 class 125, is 175 PSI unless otherwise stated on the pump curve”. When used as a booster pump, the pressure at the pump discharge (combination of inlet pressure plus pressure added by the pump) must not exceed the maximum working pressure shown. The Suction NPSHA must be greater than the NPSHR shown on the pump curve.

Engine:

The engine used to drive the pump must be suitable for the application. It must produce adequate power for the pump demand, and must rotate in the correct direction (standard rotation is CLOCKWISE when viewed from the front of engine).

Internal Combustion Engines are variable speed and variable power machines. The power output depends upon the engine speed (RPM) and will be reduced when operating altitude, and/or the air temperature increases. When driving the pump at the RPM required to deliver water into the system piping, the engine must operate within the engine manufacturers minimum and maximum RPM limits. The power output to supply the pump power demand must not exceed the CONTINUOUS POWER RATING of the engine, after derating for all power consuming engine accessories, and adjustment for installation site altitude and air temperature. Proper power matching of the pump and engine is the responsibility of the pump and engine unit assembler.

MATCHING PUMP END TO ENGINE

S.A.E. Bracket Size:

Type “B” engine drive pumps are available to fit engines having a standard S.A.E. 5 through S.A.E. 1 flywheel housing.

For a new engine, the engine supplier can provide the S.A.E. housing number.

For an existing engine, the flywheel housing bore and bolt circle can be measured and compared against the standard S.A.E. housing dimensions listed in Table I, to identify the housing S.A.E. number.

- Measure the flywheel housing bore (A), and the bolt circle (B), as accurately as possible with a tape measure (to the nearest 1/32 inch).
- Count the number of threaded holes in the flywheel housing (C). Test the threaded holes with a bolt, to determine the thread series.
- Compare the measured dimensions (A), (B), and (C) against Table I, to determine the S.A.E. number of the flywheel housing, to be sure it matches the S.A.E. number of your pump.
- **Record measurements on the dimension form on Page 23 in the spaces provided under Flywheel Housing Dimension.**

Flywheel Couplings

FLYWHEEL COUPLING

The flywheel coupling transmits power from the engine flywheel to the pump shaft. The maximum power that a coupling can safely handle is shown by a rating number, **"R"**, which is listed in the coupling dimensions tables.

When selecting a flywheel coupling for a pump and engine, **first** determine the power rating that the pump will demand. On the pump performance curve, find the RPM and BHP values required to produce the application head-capacity point.

Divide the BHP by the RPM, then multiply the result times 100. The result will be the *demand number* for the pump.

> For example, a B6JQBM can deliver 1500 GPM at 260 feet Total Head when running at 2200 RPM. The power required by the pump will be 120 BHP. The demand number will be:
>
> (120/2200) x 100 = **5.45**

Next, select a coupling that can safely transmit the power, and which will fit the flywheel dimensions. For a coupling to be suitable, it must have an **"R"** rating number ***GREATER THAN*** the pump *demand number*. In the above example, the minimum coupling **"R"** number would be **6**.

NOTE: The isolator disc design of Berkeley flywheel couplings provides smooth power flow from the engine to the pump, and torsional vibration problems are rare. However, with the broad range of engines available, a torsional mismatch can occur, which can cause excessive stress in the pump shaft and coupling.

Torsional compatibility of the engine, pump, and coupling is the responsibility of the assembler. Berkeley Pumps will supply data for the pump and coupling for use by the assembler for a torsional analysis.

NOTE: If the flywheel is fitted with a pilot bearing pressed into a bore at the center, remove it to avoid interference with the pump shaft.

FLYWHEELS FOR INDUSTRIAL TYPE OVERCENTER CLUTCHES

Figure 3 on the facing page, shows the hollowed-out appearance of the flywheels made for use with overcenter type Clutch Power Take-Off assemblies.

These flywheels will have a recessed bore machined into the face, and a set of tapped holes, which will be used to attached the coupling to the flywheel. Dimensions are governed by an SAE standard and are listed in Tables IIA and IIB, Figure 3. The "Clutch Size" shown in the table is the nominal clutch facing diameter for Drive Ring Type Overcenter Clutches.

For a new engine, the engine supplier can furnish the dimensions.

For an existing engine, measure the flywheel dimensions, "D" through "H", using a tape measure and a machinists combination square. Measurements to the nearest 1/32" will usually be adequate.

When dimensions match a standard flywheel coupling listed in Tables IIA, IIB, and IIC, Figure 3, select the one that has an "R" rating number greater than the pump demand number.

- **Record measurements on the dimension form on Page 23 in the spaces provided under Flywheel Dimensions.**

OTHER FLYWHEELS

Some engines are fitted with flywheels especially machined for coupling to other kinds of machinery (electrical generators, torque converters, etc.), and require nonstandard flywheel couplings. If the measured flywheel dimensions do not correspond to dimensions listed in Tables IIa or IIb, write the measured dimensions into the Dimension Form provided on page 23, and send it to Berkeley for quotation of special flywheel coupling.

Installation
Flywheel Couplings

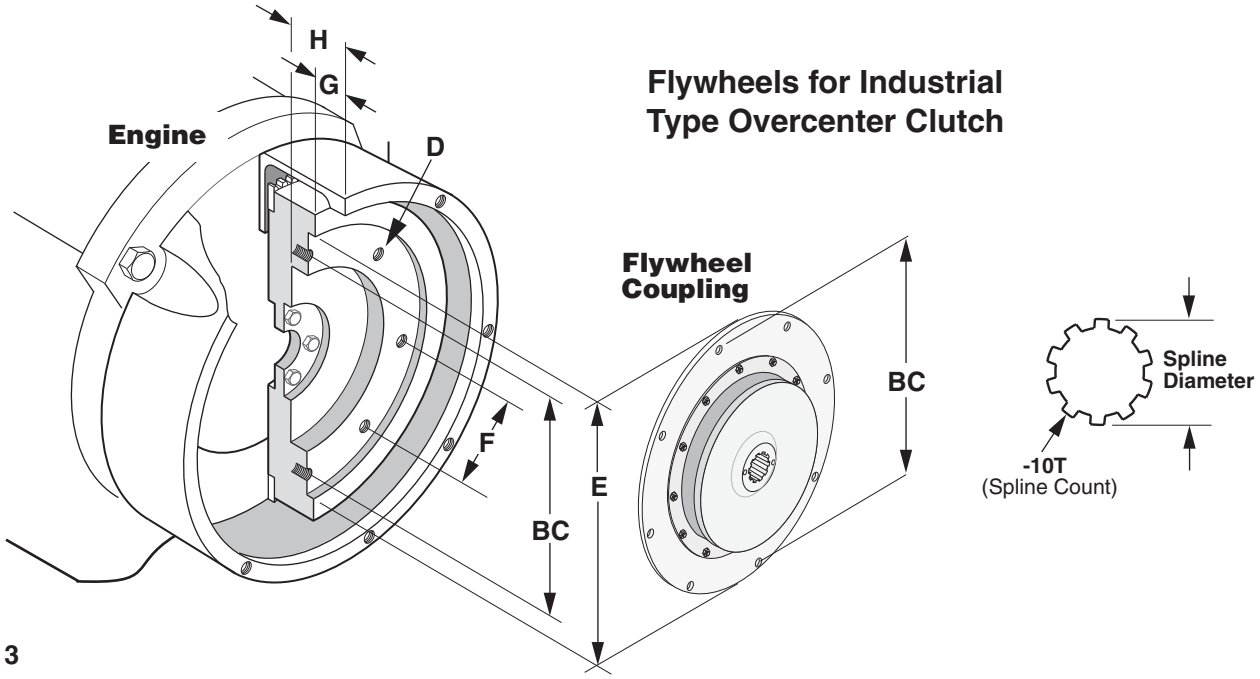


Figure 3

TABLE IIA – WIDE RPM RANGE, ELASTOMER MOUNTED HUB

Clutch Size	Flywheel Dimensions							Flywheel Coupling		
	D		E	BC	F	G	H	R	Catalog Number	Shaft Spline Diameter
	Qty.	Size (UNC)								
6-1/2”	6	5/16-18	8-1/2” OD	7.88	3.94	1.19	1.69	7	B85397	1-3/8” 10T
6-1/2”	6	5/16-18	8-1/2 OD	7.88	3.94	1.19	1.69	7	B85398	1-1/2” 10T
7-1/2”	8	5/16-18	9-1/2” OD	8.75	3.69	1.19	1.69	7	B85399	1-3/8” 10T
7-1/2”	8	5/16-18	9-1/2” OD	8.75	3.69	1.19	1.69	7	B85400	1-1/2” 10T
8”	6	3/8-16	10-3/8” OD	9.62	4.81	2.44	2.94	7	B85401	1-3/8” 10T
8”	6	3/8-16	10-3/8” OD	9.62	4.81	2.44	2.94	7	B85402	1-1/2” 10T
10”	8	3/8-16	12-3/8” OD	11.62	4.47	2.13	2.75	7	B85403	1-3/8” 10T
10”	8	3/8-16	12-3/8” OD	11.62	4.47	2.13	2.75	7	B85404	1-1/2” 10T
11-1/2”	8	3/8-16	13-7/8” OD	13.12	5.06	1.56	2.69	7	B85405	1-3/8” 10T
11-1/2”	8	3/8-16	13-7/8” OD	13.12	5.06	1.56	2.69	7	B85406	1-1/2” 10T

TABLE IIB – HEAVY DUTY, ELASTOMER MOUNTED HUB

Clutch Size	Flywheel Dimensions							Flywheel Coupling		
	D		E	BC	F	G	H	R	Catalog Number	Shaft Spline Diameter
	Qty.	Size (UNC)								
10”	8	3/8-16	12-3/8” OD	11.62	4.47	2.13	2.75	9	B85407	1-3/8” 10T
10”	8	3/8-16	12-3/8” OD	11.62	4.47	2.13	2.75	9	B85408	1-1/2” 10T
11-1/2”	8	3/8-16	13-7/8” OD	13.12	5.06	1.56	2.69	9	B85409	1-3/8” 10T
11-1/2”	8	3/8-16	13-7/8” OD	13.12	5.06	1.56	2.69	9	B85410	1-1/2” 10T
14”	8	1/2-13	18-3/8” OD	17.25	6.63	1.00	2.13	9	B85411	1-1/2” 10T

Pump To Engine Assembly

PREPARATION FOR ASSEMBLY OF PUMP ON ENGINE

- Clean face and register fit of flywheel housing and flywheel as necessary to remove all grease, dirt, or rust (and all traces of rust preventative) which would interfere with installation of pump and/or prevent correct alignment. If flywheel is fitted with a pilot bearing for a transmission shaft, remove and discard. The pilot bearing is not required for installation of the pump end, and could interfere with the pump shaft.
- Examine shaft spline closely. Use a file, if necessary, to remove any burrs that would prevent coupling from sliding freely onto the shaft.
- Lubricate pump shaft spline sparingly with light grease.
- Slide the coupling onto shaft until it is stopped against the shaft.
- Measure the distance from the engine side of flywheel coupling adapter ring to the mounting face of the pump bracket. Refer to Figure 4 below, **Dimension "A"**.
- Next, measure depth from face of flywheel housing on engine, to face on flywheel against which coupling will be bolted. Refer to Figure 4 below, **Dimension "B"**.

Pump measurement must be less than engine measurement or axial interference will result in thrust force on engine crank shaft bearings. Simply stated, **Dimension "A" must be less than Dimension "B"**.

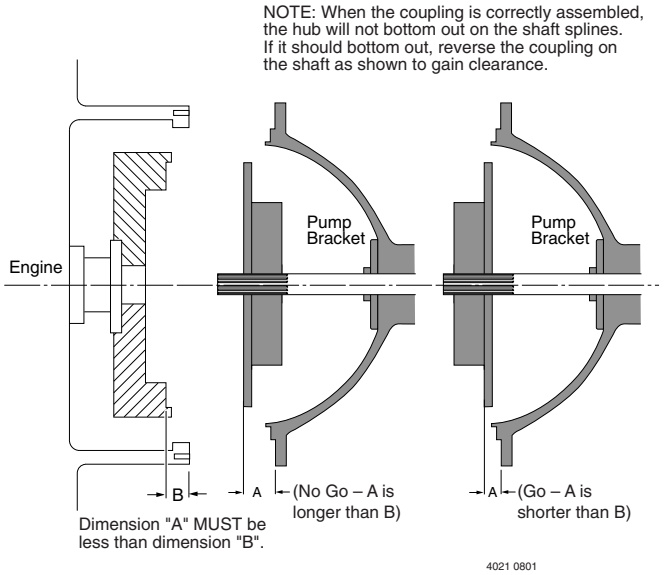


Figure 4

INSTALLATION OF COUPLING ON FLYWHEEL

Flywheel Coupling Overcenter Type:

These couplings are aligned concentrically with the flywheel by register fit on the flywheel.

Be sure to remove all preservatives from the engine's flywheel.

Fit the coupling into the flywheel. Align the bolt holes and engage coupling with register fit on flywheel. Tap coupling with a soft heavy hammer, if necessary, to be sure that it is seated flat against flywheel. Secure coupling tightly to flywheel with capscrews and lockwasher.

INSTALLATION OF PUMP ON ENGINE

- Lift pump with suitable lifting apparatus and align pump shaft with coupling. End of pump shaft has a pilot diameter which permits easy engagement of pump shaft into coupling.
- Reach into pump suction opening and rotate impeller slightly until the splines on the shaft will engage the coupling. Verify that there is no gap between bracket and flywheel housing faces. Rotate pump as necessary to align bracket holes with engine. Install capscrews and bolt pump end securely to engine.

NOTE: If any interference, or incompatibility of parts is detected during installation, DO NOT proceed with assembly. Direct the problem to your nearest Berkeley Professional Dealer.

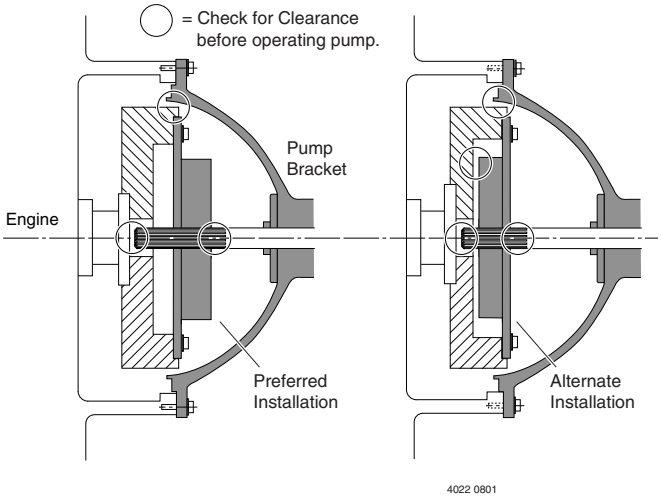
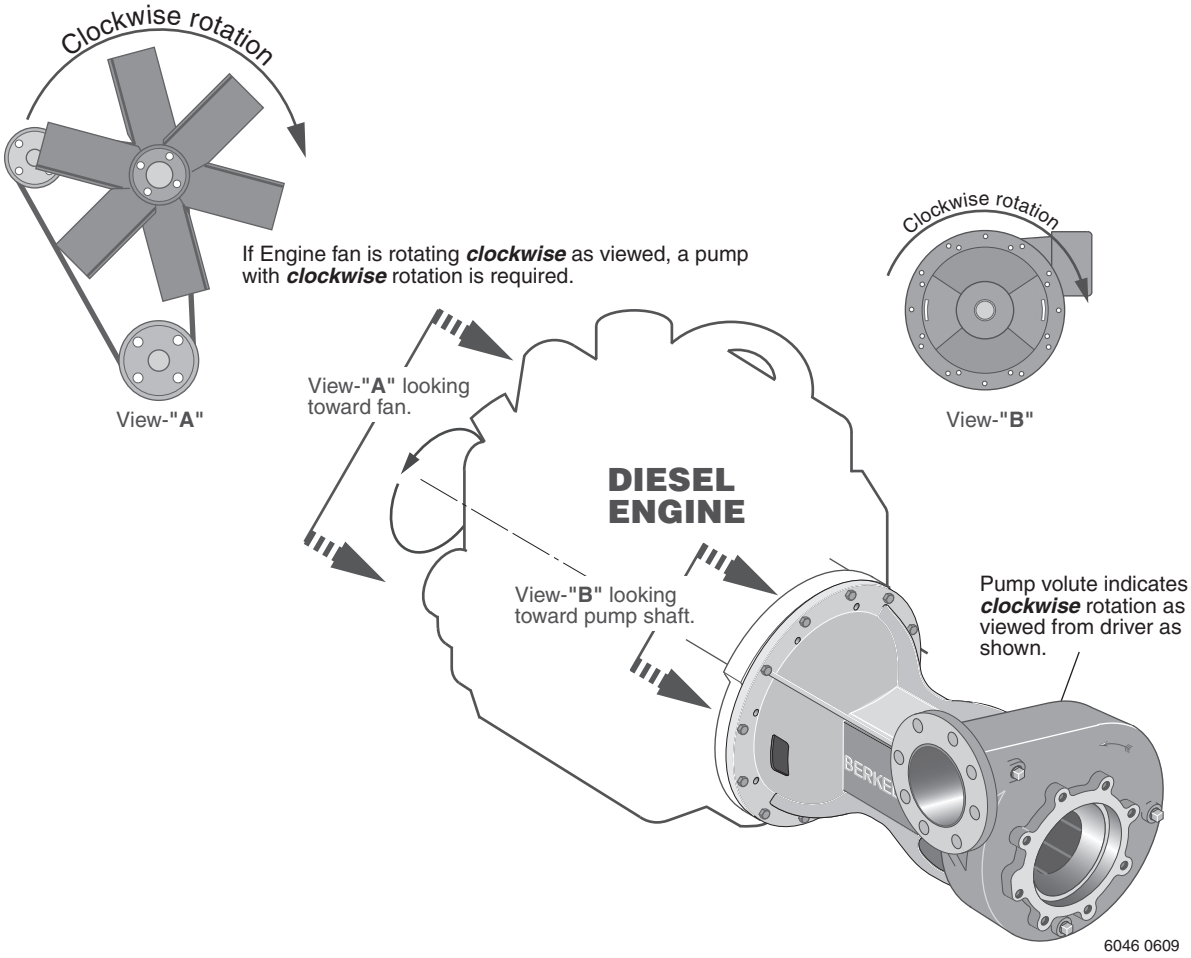


Figure 5

Installation

Verify Pump Rotation

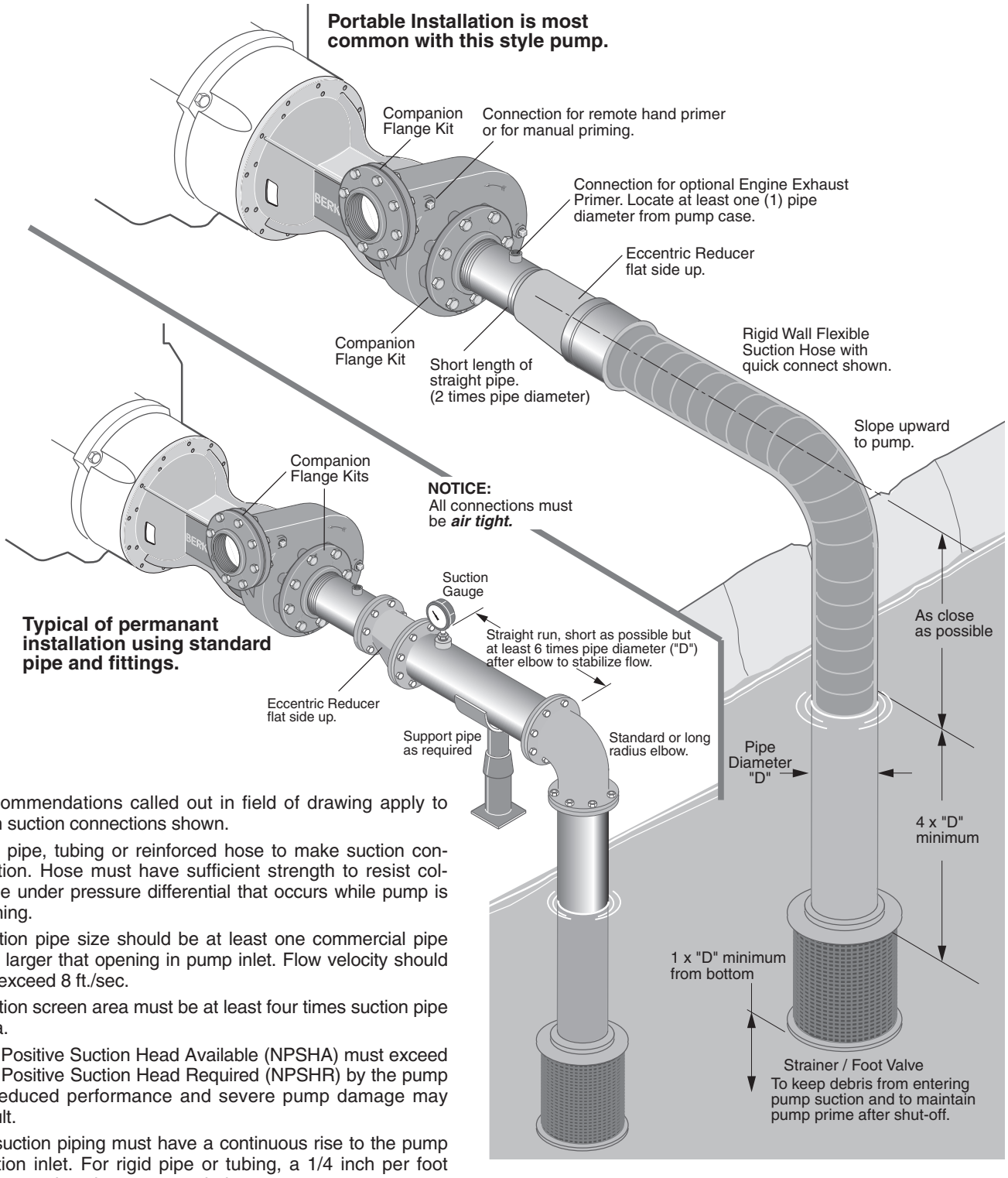


- Before pump is put into operation, rotational direction must be verified to assure proper performance of pump.
- Standard engine rotation is clockwise.
- Pump running backward: Centrifugal pumps will still pump liquids, however, GPM and head will be a fraction of the published performance.
- Threaded impellers may loosen.

Installation

Suction Connection

Portable and Permanent



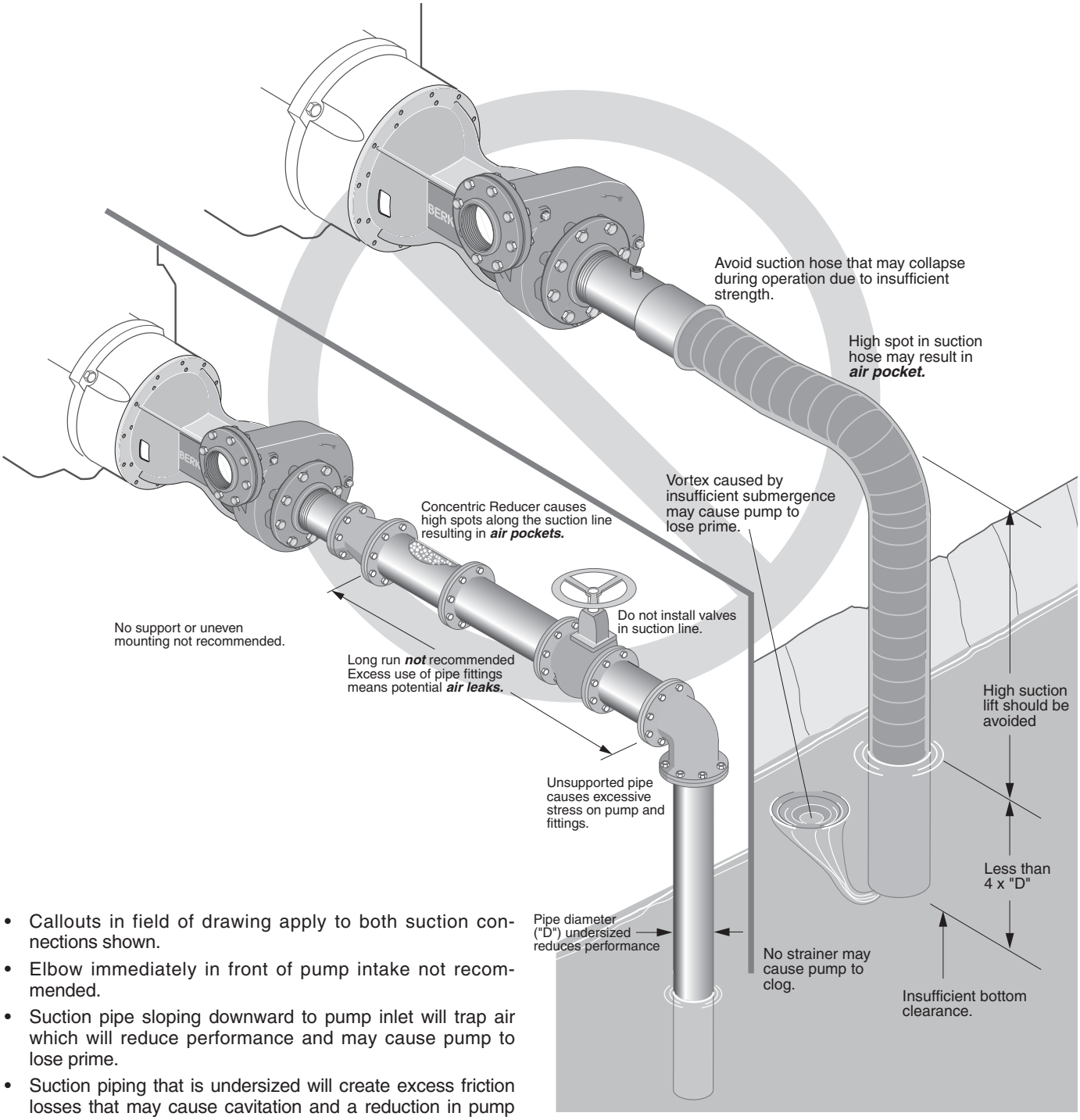
- Recommendations called out in field of drawing apply to both suction connections shown.
- Use pipe, tubing or reinforced hose to make suction connection. Hose must have sufficient strength to resist collapse under pressure differential that occurs while pump is running.
- Suction pipe size should be at least one commercial pipe size larger that opening in pump inlet. Flow velocity should not exceed 8 ft./sec.
- Suction screen area must be at least four times suction pipe area.
- 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.
- All suction piping must have a continuous rise to the pump suction inlet. For rigid pipe or tubing, a 1/4 inch per foot minimum slope is recommended.

Recommended

Installation

Suction Connection

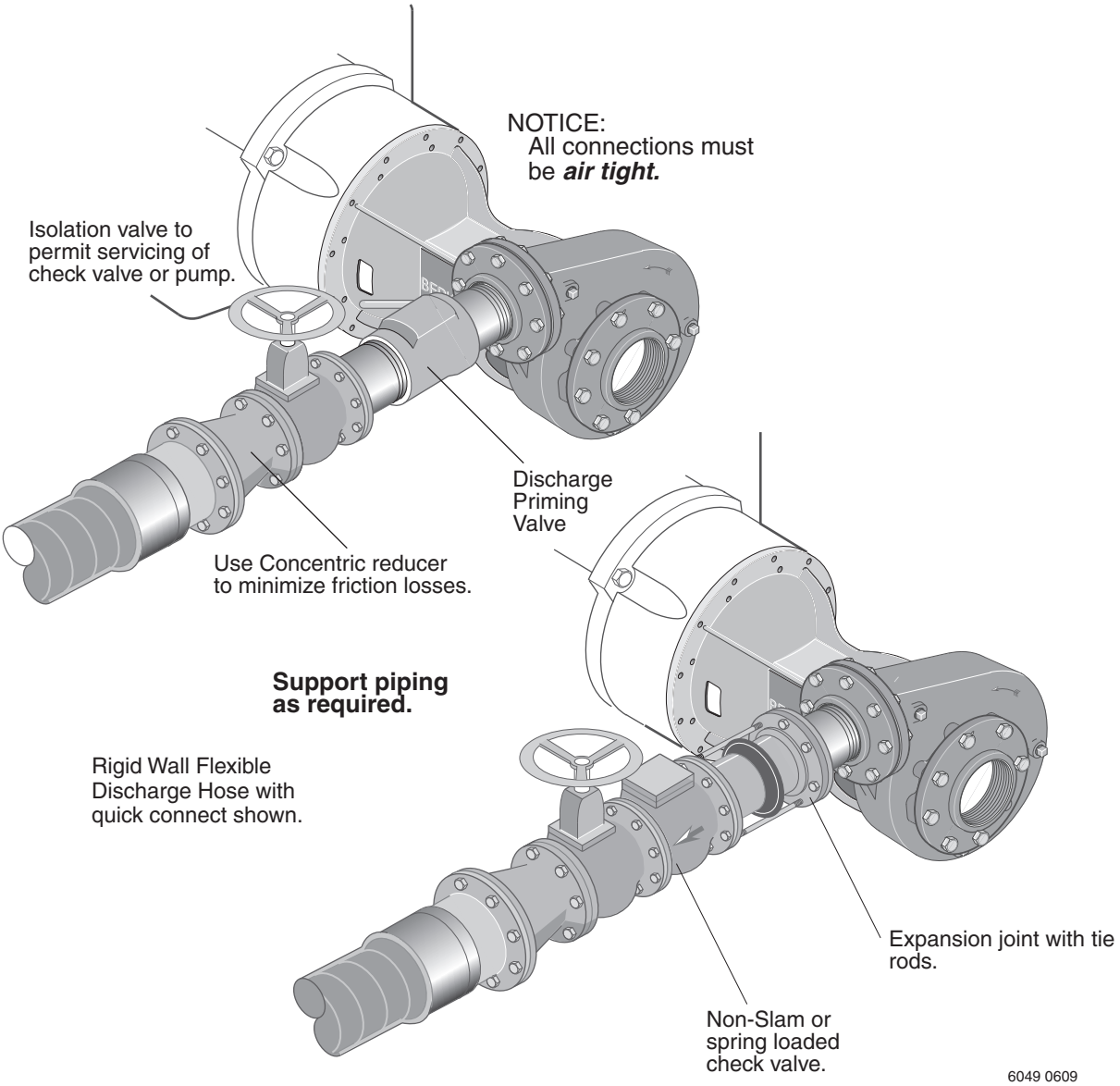
Portable and Permanent



- Callouts in field of drawing apply to both suction connections shown.
- Elbow immediately in front of pump intake not recommended.
- Suction pipe sloping downward to pump inlet will trap air which will reduce performance and may cause pump to lose prime.
- 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 results in trapped air, reduced performance, and high friction losses which may cause cavitation.

Not Recommended

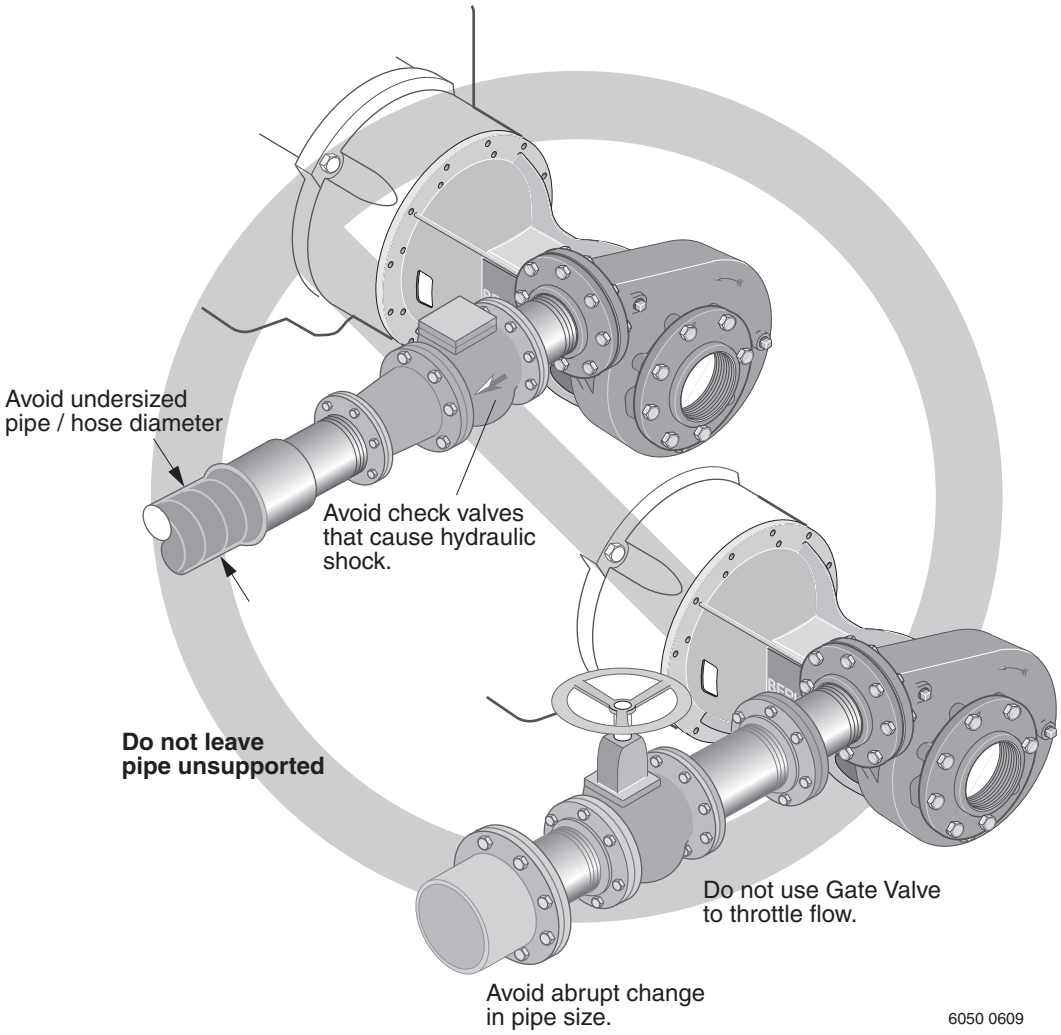
Discharge Connection



- Use pipe, tubing or reinforced hose to make discharge connection. Hose must have sufficient strength to contain the pump discharge pressure.
- Discharge pipe diameter should be at least one nominal pipe size larger than discharge opening in pump and sized so that flow velocity is below 8 ft./sec.
- Use only non-slamming 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 size throughout discharge system, using as few elbows and tees as possible to keep friction loss to a minimum.
- Install pressure gauge after reducer to check operating pressure.

Recommended

Discharge Connection

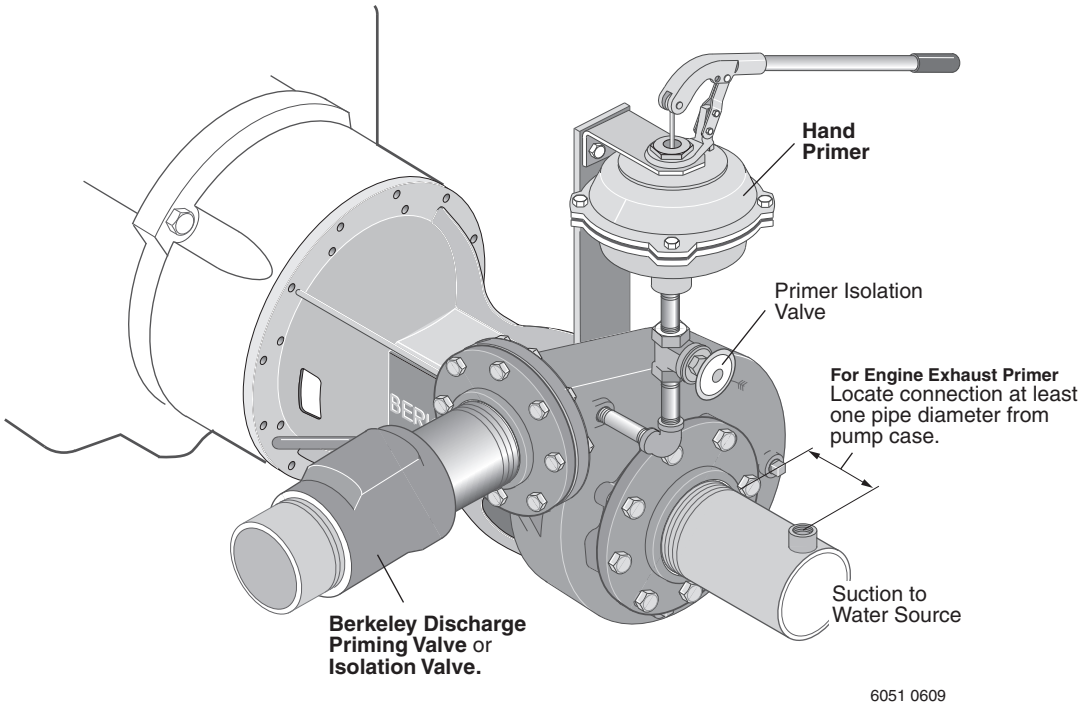


- Avoid excess friction loss caused by numerous fittings, insufficient pipe diameter, and sharp turns in pipe run.
- Some swing type check valves may permit buildup of reverse velocity before closing, causing hydraulic shock (water hammer).
- Do not force pipe alignment that can cause flange stress.

Not Recommended

Start-Up

Pump Priming



Installations With Suction Lift and Priming Pump.

- Close air tight valve on discharge.
- Hand primer operation:

1. Open the hand primer isolation valve.
2. Work handle of the hand primer up and down to evacuate air from the suction line.

   (Refer to primer owner's manual for proper pro-cedure).
3. When water flows freely from primer, close the hand primer isolation valve.

   (Pump case should now be filled with water).

- Immediately start pump.
- Slowly open discharge valve (if used).

  (Discharge Priming Valve will open automatically).

Installations With Suction Lift and Exhaust Primer.

- Locate exhaust primer connection as shown above.
- For complete operation, refer to specific instructions included with exhaust primer, or consult your nearest Berkeley Professional Dealer.

Installations With Suction Lift and Foot Valve.

- Close air tight valve on discharge.
- Remove pipe plug from highest opening on pump case.
- Completely fill pump and suction piping with water.
- Rotate shaft slowly allowing any air trapped in impeller to escape.
- 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 Flooded Suction.

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

Start-Up
Pump Priming

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 Page 14 for instruction on the following conditions:

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

Special Case – Hydraulically Balanced Pumps

Packed Pumps:

Hydraulically balanced pumps operate at 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, communicating through the side of the stuffing box to a lantern ring in the packing set, is provided to grease-seal the stuffing box to prevent 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 on Page 17. 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 the flow of water the stuffing box during normal operation.

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

Mechanically Sealed Pumps:

Mechanically sealed pumps require no special procedures unless they are mounted vertically. In this case, call Berkeley Customer Service at 1-888-237-5353 for more information.

STARTING

⚠WARNING **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.

Engine Operation

Refer to engine owner/operator manual supplied with pump for starting and operating instructions.

Pump performance varies depending on engine RPM. Refer to engine operators manual to adjust engine speed.

⚠ CAUTION **Risk of Engine Damage.** Operating pump at lower than rated head can cause excessive load on engine. In addition, pump has the capability of overloading engine if allowed to run continuously at an RPM or flow rate that is above specified hydraulic performance.

⚠ CAUTION **Risk of pump damage.** Operate the engine in its preferred RPM range. Reduced RPM for long periods may damage the pump liquid end.

Pump Operation

Prime pump by one of the previous described procedures. Start engine. Slowly open discharge valve until desired flow rate is achieved, or pump is operating against head for which it was selected.

After pump is running, 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 a minute.

If pump is equipped with a rotary mechanical seal, no adjustment is necessary.

Shutting Down

Close discharge valve to hold prime before stopping pump. Valve should remain closed until pump/engine is restarted. Reduce the engine RPM prior to shutting down to reduce hydraulic shock (water hammer).

Maintenance
General Information

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!**

BRACKET: Add approximately 2 oz. of a lithium-based NLGI No. 2 extra pressure ball bearing grease to each bearing during quarterly inspection. Refer to pump parts drawing on Page 24, grease fittings are labeled with a circled "L". Excessive grease will cause bearings to run hot.

NOTE: Grease fitting in packing area is for priming only. See *Priming* in start-up section for instruction.

The following brands of bearing grease are factory approved by Berkeley Pumps and are recommended for use in maintenance operations.

- Shell Brand Alvania Grease EP2
- Mobil Oil brand Mobilith AW#2
- Exxon Ronex MP
- Atlantic Richfield Litholine EP2
- Amoco Amolith EP2

ENGINE: Refer to engine manufacturer's operating manual for complete maintenance instructions.

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, 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 near the bearings will be quite warm (as high as 150° F), which is normal. If the surface temperature of the pump bracket or engine is excessive, discontinue operation, determine cause of 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 thorough 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 *DROPLET* form (40 to 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 travel, additional packing is necessary.

REPACKING

Refer to illustration on Page 17.

MECHANICAL SEAL

Adjustment or maintenance is not required. The seal is enclosed within the pump and is self-adjusting. Seal is cooled and lubricated by the liquid being pumped.

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.

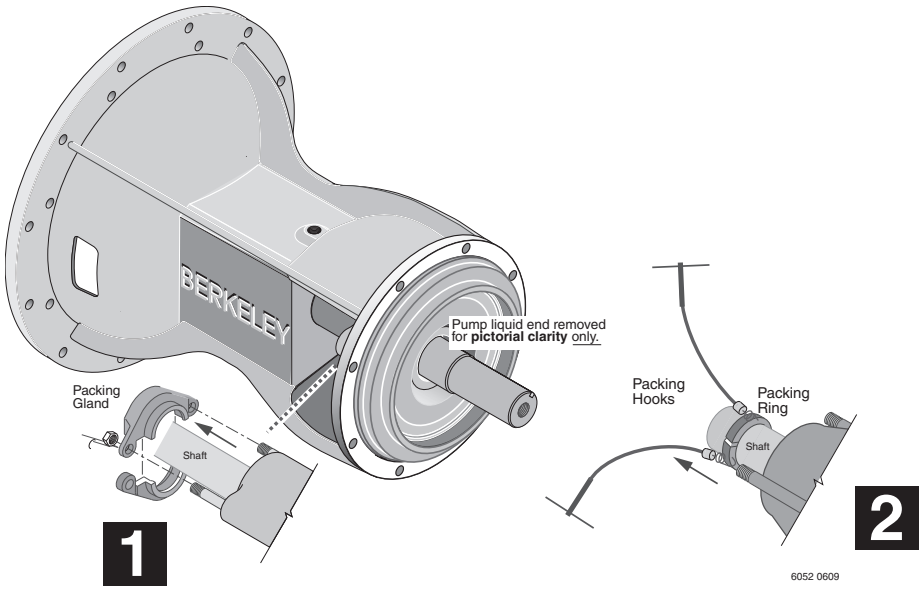
CONDENSATION: When the temperature of metal parts is below dew point and the surrounding air is moist, water will condense on the metal surfaces and can cause corrosion damage. In severe situations, a space heater can be considered to warm the unit.

Maintenance

Packing Ring Replacement

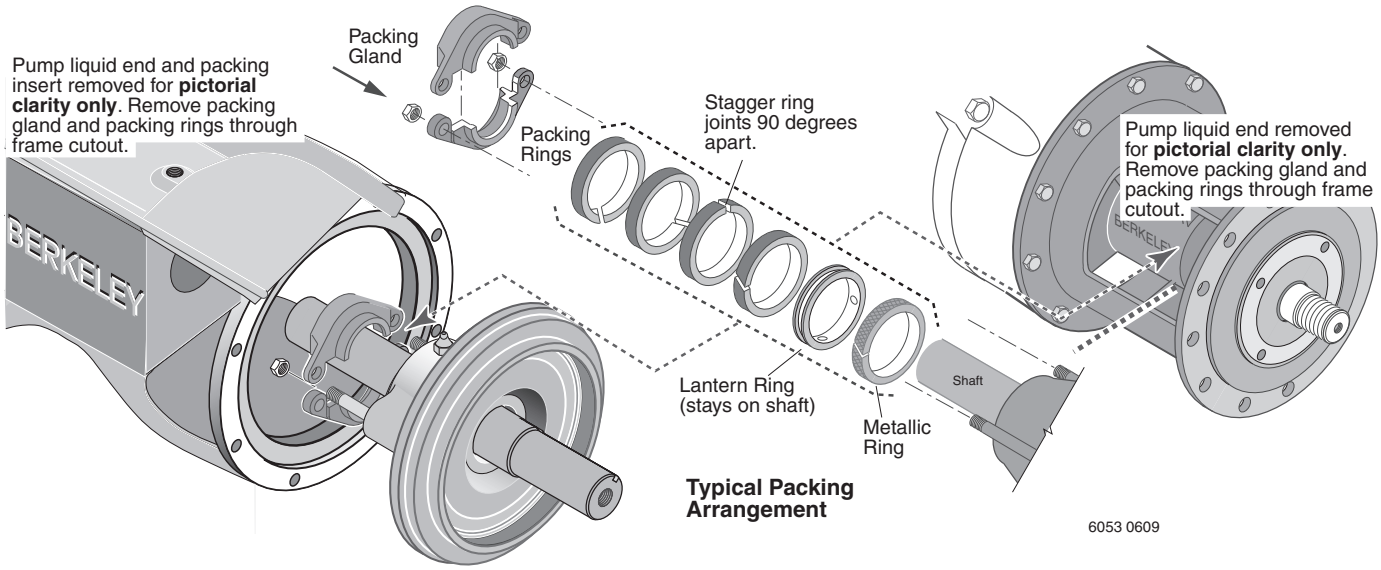
Removal

See Page 19 for Seal Replacement.



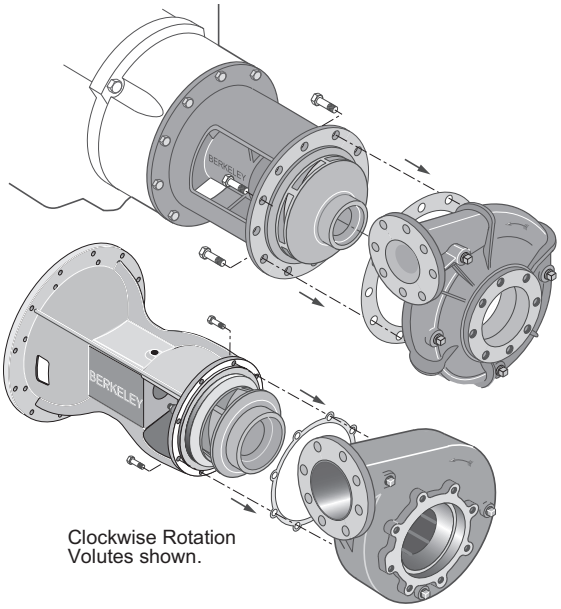
- Unfasten hardware holding packing gland in place and slide back on shaft to expose packing rings. A split packing gland with threaded studs is shown.
- Remove packing rings from stuffing box using two commercially available packing hooks as shown.
- Slide lantern ring (if used) back to expose any remaining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

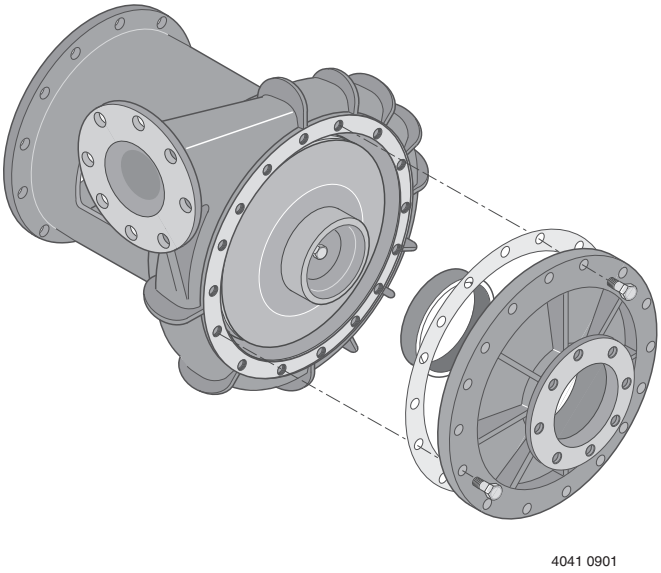
Installing New Rings



- 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).

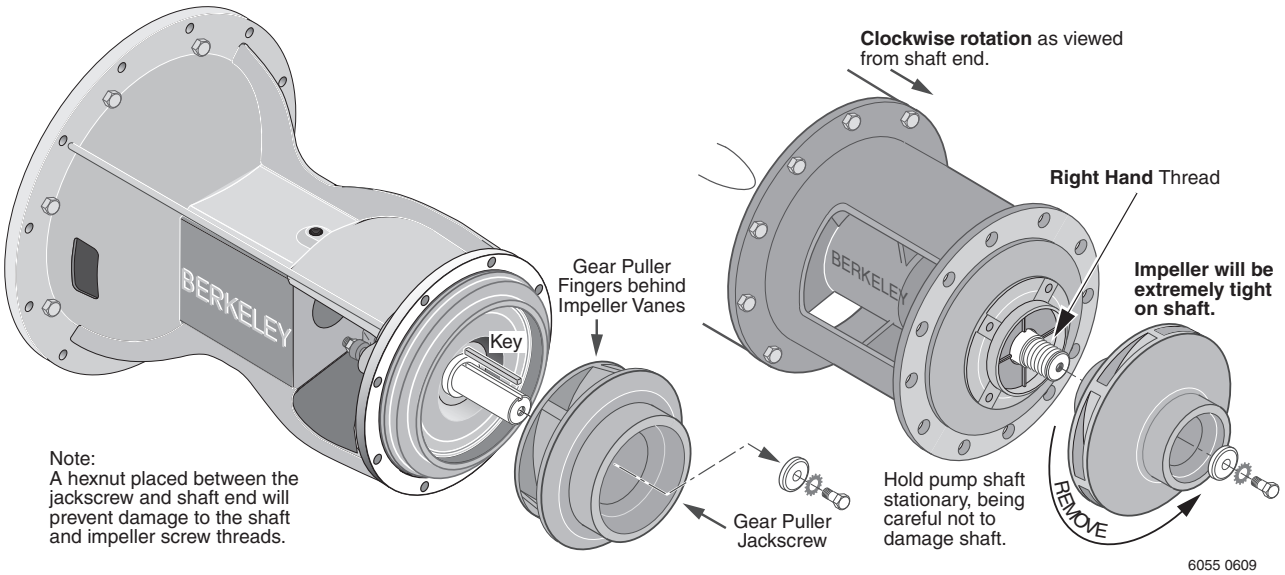
Impeller Removal





1. Remove the volute and the old gasket(s) and O-Ring(s). Discard the gaskets and O-rings.
   - 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.



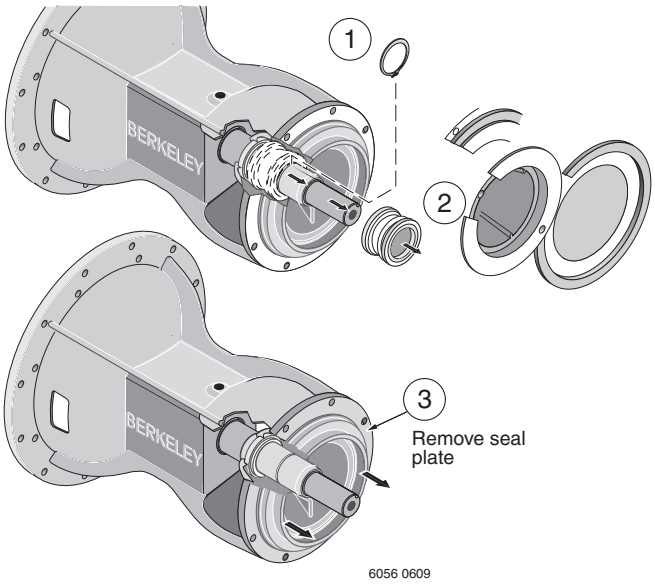
2. Remove the impeller:
   A. Pull keyed impellers off the shaft with a standard gear puller against the end of the shaft and pulling on the impeller.

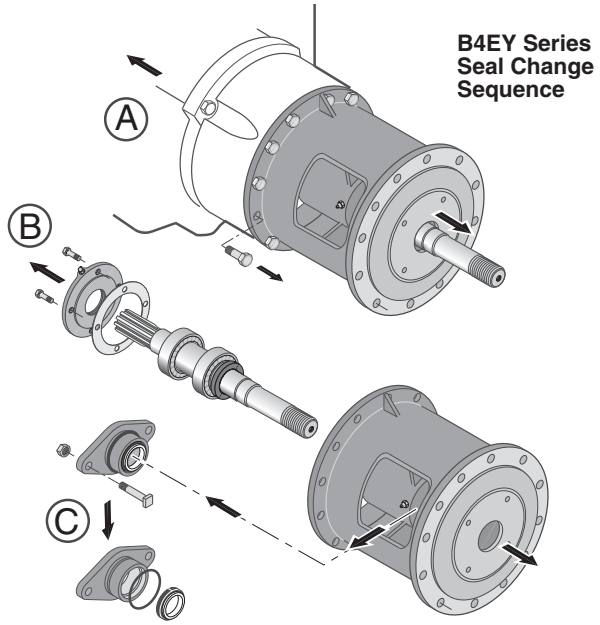
   NOTE: Place the puller’s fingers against the vanes in the impeller. Pulling on the impeller’s unsupported back shroud could easily break the impeller.

   B. Unscrew threaded impellers.

   NOTE: 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.

Seal/Impeller Replacement





3. 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.
4. Remove the seal retaining ring and pull the rotating part of the seal off the shaft.

Model B4EYQBHS and similar pumps: See the special section on this page. Others: go to Step 5.

5. **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.

   Other Pumps: Pull the stationary part of the seal out of the cavity and clean the cavity.
6. 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.
   - 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.
   - 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.
   - 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.
8. After lubricating the rotating part of the seal, slide it onto the shaft and sleeve until it seats against the stationary (ceramic) part.
9. Compress the seal spring on the shaft sleeve and reinstall the seal retaining ring (if used).
10. Reinstall the balance ring (if used).
11. 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.
12. Replace the volute. Use new gasket(s) and O-Ring(s).

B4EYQBHS and similar pumps (See Picture Above):

After STEP 4, you will need to:

A. Remove the bracket from the engine.

B. Remove the outer bearing cap and slide the shaft assembly back out of the bracket.

C. Remove the seal retainer and tap out the stationary seal.

D. Clean the seal retainer and shaft (don't scratch the shaft!).

E. 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.

F. Use the cardboard washer (supplied) and a piece of pipe to press the stationary seal into place.

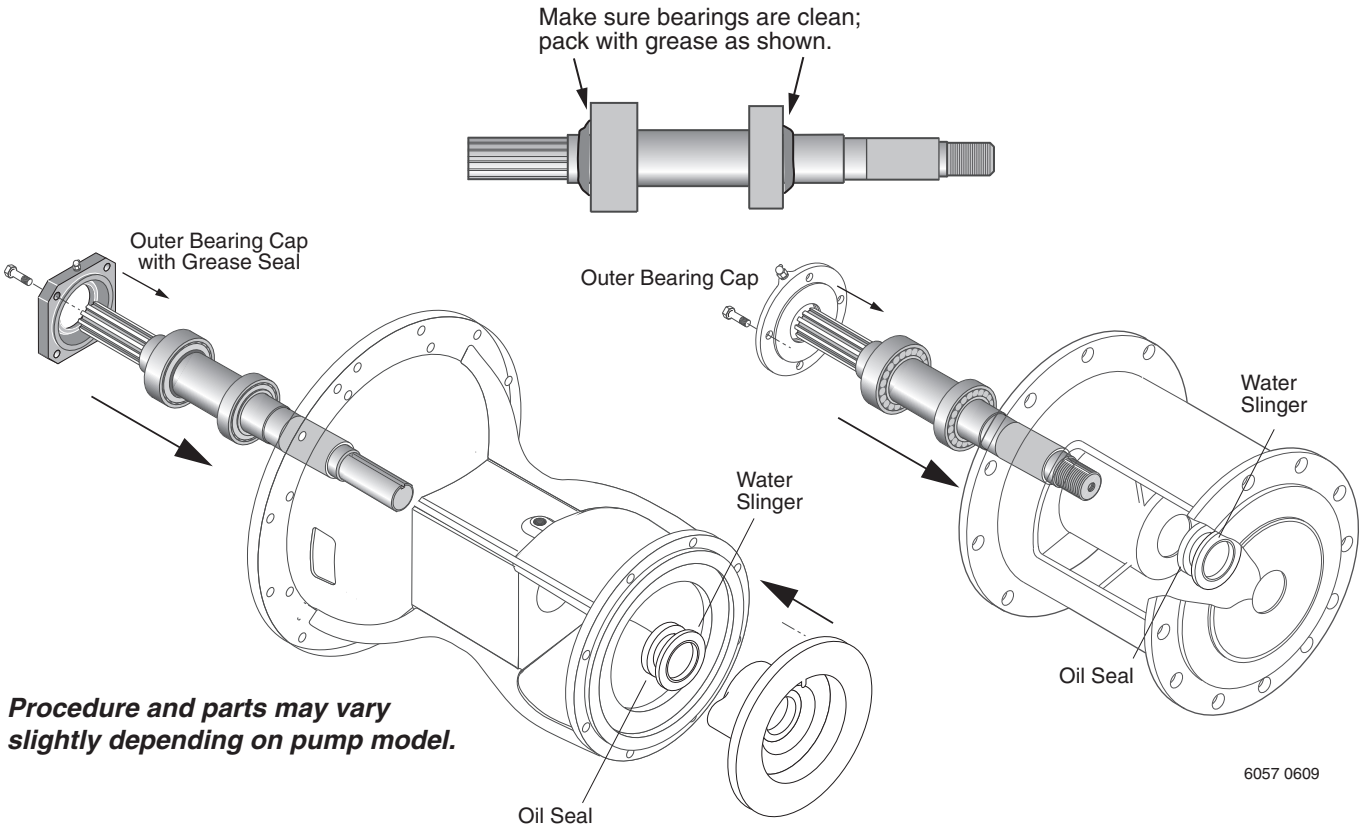
G. Inspect the oil seal and replace it if necessary.

H. Repack the bearings and reinstall the shaft in the bracket.

   NOTE: 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!

J. Reinstall the outer bearing cap with a new gasket and proceed to STEP 7 ("Reinstall the shaft sleeve....")

Shaft Maintenance/Replacement



Procedure and parts may vary slightly depending on pump model.

- Remove volute to expose impeller.
- Peel off old volute gasket (or O-Ring) and discard.

NOTE: Certain models such as the B4EY, are constructed with a suction cover which is removed first to access impeller.

GENERAL

- Shaft assembly of S.A.E. mounted pumps should be periodically (annually minimum) torn down for inspection of worn parts, cleaning, 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.

PUMP DISASSEMBLY

- Remove packing gland and packing arrangement as described in Page 17.
- Remove pump volute and impeller as described on Pages 18 and 19.
- Remove outer bearing cap and slide shaft assembly from bearing bracket.
- Clean and inspect all components.

SHAFT INSTALLATION

- 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.
- Pack bearings with a lithium-based NLGI No. 2 extra pressure ball bearing grease (see “Lubrication”, Page 16). Force enough grease into each bearing to fill internal space between the races.
- Coat the bearing bores of bracket with oil. Orient shaft assembly in the direction shown above. Slide shaft and bearing assembly into bearing bracket. *Do not force them!* When threaded end of pump shaft comes through inside opening of bearing cavity, place oil seal, water slinger, and lantern ring over end of shaft. If packing gland or seal retainer is not of the split variety, place it over the shaft at this time as well. Slide shaft on through stuffing box until the first bearing makes contact with the bracket. Carefully align bearing with the bearing bore and press or tap bearing assembly into place. **Do not use excessive force.**

NOTE: Be sure bearing bores and bracket area are clean and free of contamination or early bearing failure may occur.

- Reinstall outer bearing cap and oil seal.
- Rotate pump by hand, 10-12 rotations.
- Reassemble pump parts and reinstall unit to piping system. Refer to *Installation* section in this manual for correct procedure.

Maintenance
General Pump Care

ROUTINE MAINTENANCE

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.

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 on Page 16. For quarterly and annual maintenance, refer to check list on the following page. Copy page as necessary for continual usage.

For engine maintenance refer to engine manufacturer's owners/operators manual.

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 drawings on Pages 24 and 25 when selecting spares.

- Mechanical Shaft Seal (or)
- 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. Coat machined surfaces 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 the wear ring by dripping oil into the gap while rotating impeller by hand.
- Winterize the engine according to the engine manufacturer's instructions.

SPRING START-UP

- Inject sufficient amount of grease into bearing to displace old grease.
- Perform a visual inspection of all components.
- Rotate by hand to be sure impeller and shaft turn freely. If binding occurs, disassemble and inspect.
- Follow engine manufacturer's recommendations for starting the engine.

Maintenance
Routine Inspection
Record

I. QUARTERLY INSPECTION

- ☐ Inspect all system piping connections for leakage or possible misalignment.
- ☐ 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.
- ☐ Check pump bearings from signs of wear. Repack or replace as necessary.
- ☐ Check alignment of flywheel coupling.
- ☐ _____
- ☐ _____
- ☐ _____

II. QUARTERLY INSPECTION

- ☐ Inspect all system piping connections for leakage or possible misalignment.
- ☐ 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.
- ☐ Check pump bearings from signs of wear. Repack or replace as necessary.
- ☐ Check alignment of flywheel coupling.
- ☐ _____
- ☐ _____
- ☐ _____

NOTES:

III. QUARTERLY INSPECTION

- ☐ Inspect all system piping connections for leakage or possible misalignment.
- ☐ 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.
- ☐ Check pump bearings from signs of wear. Repack or replace as necessary.
- ☐ Check alignment of flywheel coupling.
- ☐ _____
- ☐ _____
- ☐ _____

IV. QUARTERLY INSPECTION

- ☐ Inspect all system piping connections for leakage or possible misalignment.
- ☐ 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.
- ☐ Check pump bearings from signs of wear. Repack or replace as necessary.
- ☐ Check alignment of flywheel coupling.
- ☐ _____
- ☐ _____
- ☐ _____

ANNUAL INSPECTION

- ☐ Inspect pump and entire pumping system for signs of wear.
- ☐ Inspect system valves, screens, etc.
- ☐ Check pump impeller and balance ring for clearance.
- ☐ Inspect impeller, volute case, and seal chamber for signs of excessive wear or corrosion.

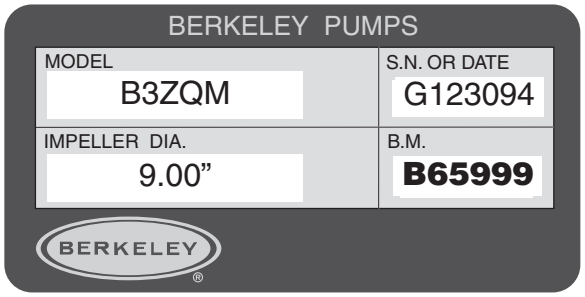
General Information

ORDERING REPLACEMENT PARTS:

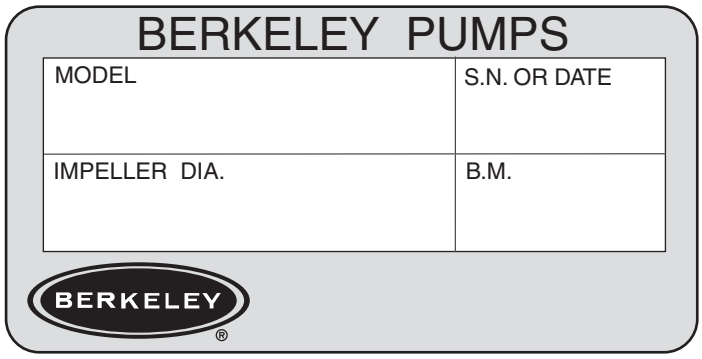
Locate the Berkeley nameplate on the pump, plate is normally on the bearing bracket. Information found on this plate is shown below. To be sure of receiving correct parts, provide all nameplate data when ordering. The **BM (Bill of Material)** number is most important. Write your nameplate information on the blank nameplate below for future reference as nameplates can become worn or lost.

The illustrations on Pages 24 and 25 shows typical components used in the assembly of S.A.E. mount centrifugal pumps. Refer to these drawings when ordering any replacement parts.

SAMPLE ONLY



788 0394



344 1093

Record your nameplate data here.

Engine Flywheel Dimension Form

Measured Dimensions For:

Job name _____ Order Number _____

Engine Manufacturer _____ Model _____

For Pump Model _____ HP Req'd _____ At _____ RPM

Flywheel Housing Dimensions (From page 5)

"**A**"= _____ In. "**B**"= _____ In. Hole "**C**"= Qty: Size:

From Table I, Page 5 , SAE Housing Size is: _____

Flywheel Dimensions (From page 7) Hole "**C**" Qty: Size: Dim. "**BC**"= _____ In.

"**E**"= _____ In. "**F**"= _____ In. "**G**"= _____ In. "**H**"= _____ In.

If all even except one, center to center of odd hole is _____ In.

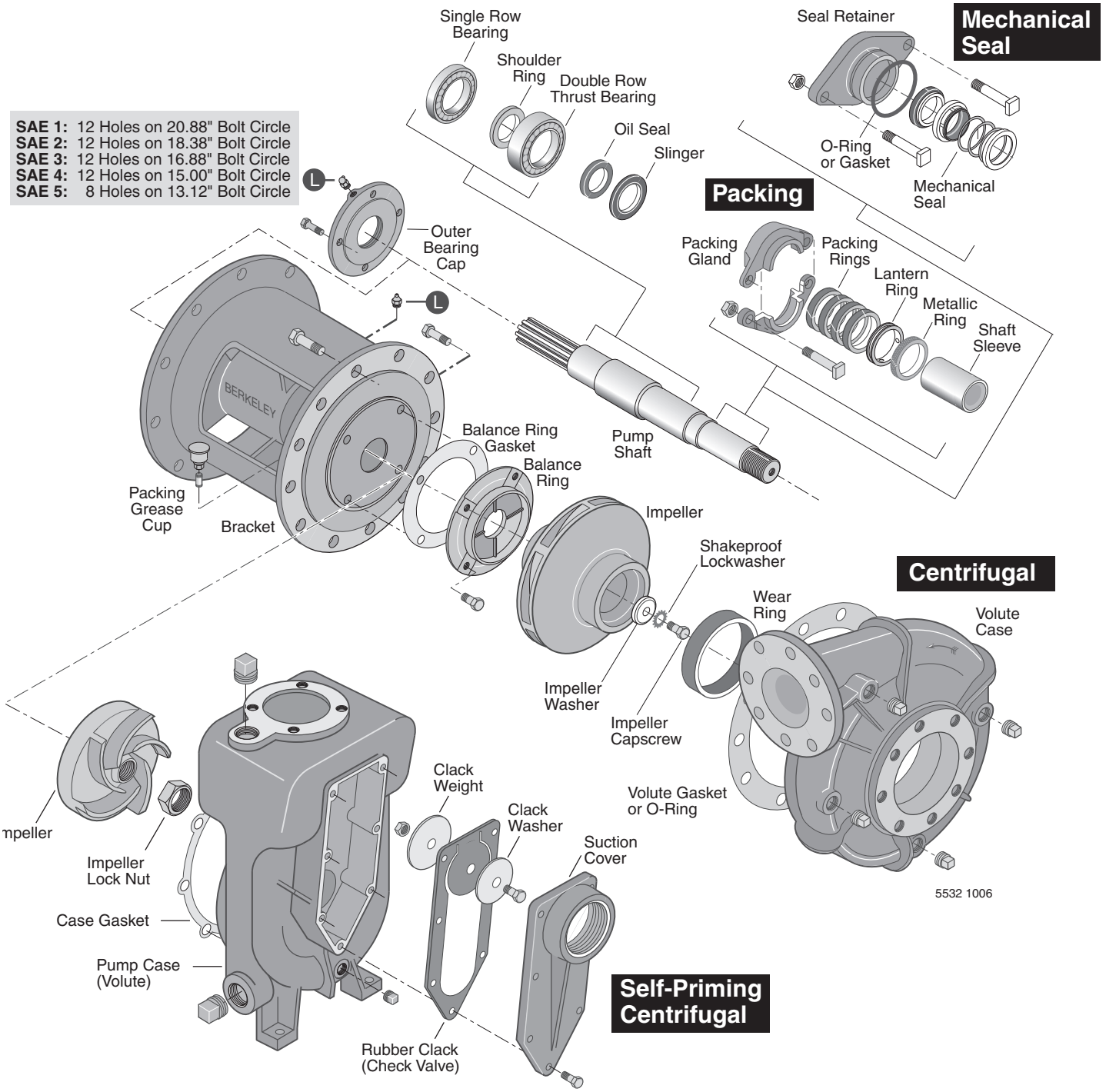
For Fig. 4 symetrically grouped set of holes: "**F1**"= _____ In. "**F2**"= _____ In.

"Standard" Flywheel Coupling from Table IIA, IIB, IIC or Table III: (From page 7) __ __ __ __ __ __

1463 0195

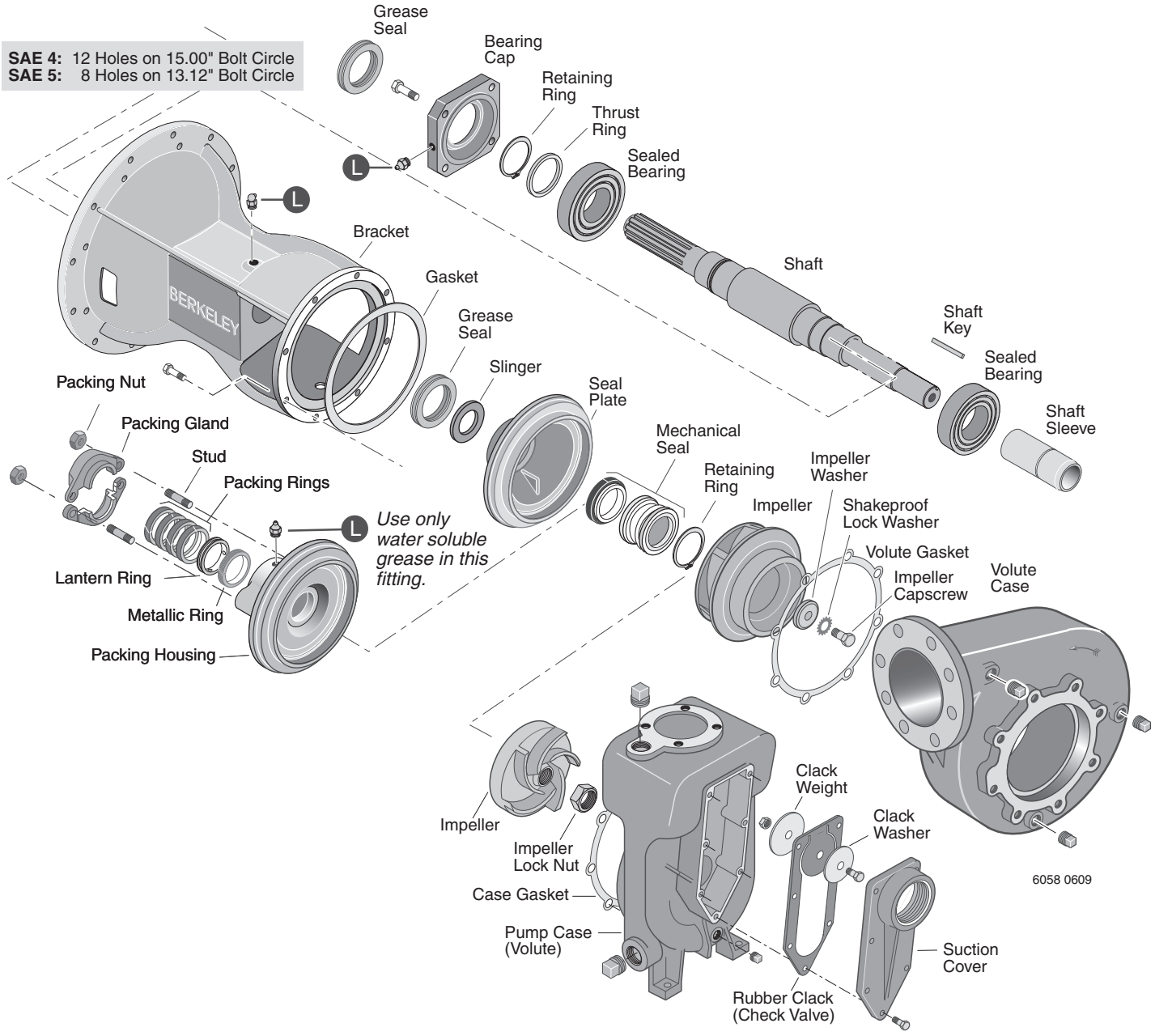
Pump Nomenclature

S.A.E. Engine Mount



Pump Nomenclature

S.A.E. Engine Mount



Troubleshooting

SYMPTOM	PROBABLE CAUSE													
	GROUP I ELECTRICAL				GROUP II MECHANICAL						GROUP III SYSTEM			
	A	B	C	D	A	B	C	D	E	F	A	B	C	D
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	
Engine heats excessively		X	X				X	X	X	X		X		X
Abnormal noise and/or vibration				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	Maximum engine speed not to exceed maximum performance curve speed as shown.
D. Loose or broken parts	Refer to engine manufacturer's manual.
II. PUMP	
A. Not primed	Reprime. Inspect suction system for air leaks.
B. Flow through pump completely or partially obstructed	Locate and remove obstruction.
C. Internal leakage	Check wearing surfaces.
D. Rotating parts drag	Inspect. Repair.
E. Case, bracket and/or shaft distorted	Refer to installation instruction under "Pipe" and "Foundation".
F. Impeller	Inspect for damage or insufficient diameter for condition.
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. Reduce system pressure requirement. Increase pressure capability of pump.
B. Obstruction in suction piping	Locate and remove obstruction.
C. Suction lift too high	Check with gauge or measure vertical distance between water surface and center line of pump, allowing for friction loss in suction pipe. Reduce rate of flow to obtain desired lift. Refer to pump characteristic curve.
D. Discharge head too low	Decrease rate of flow.

Berkeley

Warranty

LIMITED WARRANTY

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

Product	Warranty Period
Water Systems:	
Water Systems Products — jet pumps, small centrifugal pumps, submersible pumps and related accessories	*whichever occurs first:* 12 months from date of original installation, or 18 months from date of manufacture
Pro-Source™ Composite Tanks	5 years from date of original installation
Pro-Source™ Steel Pressure Tanks	5 years from date of original installation
Pro-Source™ Epoxy-Lined Tanks	3 years from date of original installation
Sump/Sewage/Effluent Products	12 months from date of original installation, or 18 months from date of manufacture
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 limited warranty will not apply to any product that, in our sole judgement, has been subject to negligence, misapplication, improper installation, or improper maintenance. 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.

Your only remedy, and BERKELEY's only duty, is that BERKELEY repair or replace defective products (at BERKELEY's choice). You must pay all labor and shipping charges associated with this 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 SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE FOREGOING WARRANTIES SHALL NOT EXTEND BEYOND THE DURATION EXPRESSLY 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 supersedes and replaces all previous warranty publications.

In the U.S.: BERKELEY, 293 Wright St., Delavan, WI 53115

In Canada: 269 Trillium Dr., Kitchener, Ontario N2G 4W5