

**INSTALLATION, OPERATION,
AND MAINTENANCE MANUAL
FOR ROPER
9622 SERIES TYPE 1
PUMPS:
9622, 9722**



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PART NO. G12-346

Section 1.0

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1.1 NAMEPLATE DATA

Roper identifies each pump manufactured by a metal nameplate attached to the pump. This nameplate describes the pump as built at the factory. Copy the nameplate data from your pump in the area provided below. Use this for ready reference when ordering repair parts or when consulting with a Roper distributor or Roper Pump Company about this pump.

FIGURE NUMBER: _____

SPEC NUMBER: _____

TYPE: _____

SERIAL NUMBER: _____

PUMP NOMENCLATURE

Example: 9722 GHBFORVLX SPEC XXX
TYPE 1 SERIAL NO. ZZZ

- The FIGURE number consists of a thirteen digit number.
 - The first digit (9) indicates the stainless steel series.
9 -stainless steel
 - The second digit (7) indicates shaft sealing.
6 - Packing
7 - Mechanical Seal
 - The third and fourth digits (22) indicates the approximate theoretical displacement in U. S. gallons per 100 revolutions.

Gallons/100 Rev. [Liters/100 Rev.]

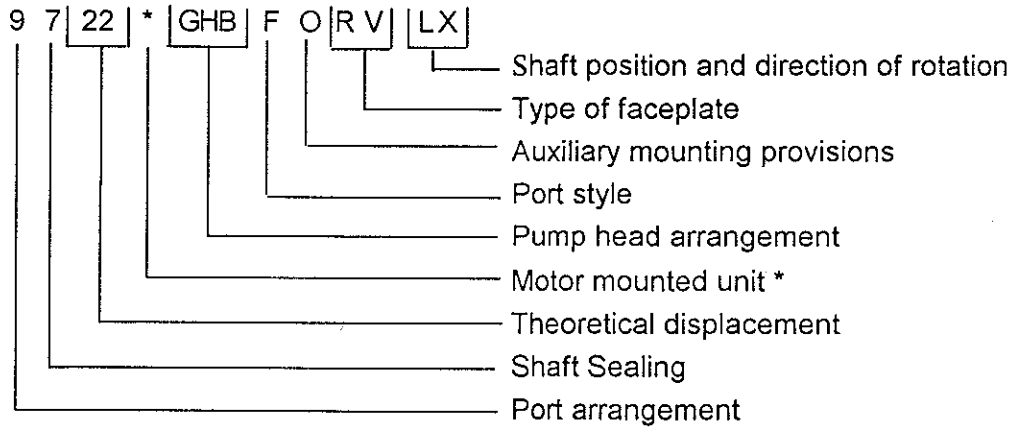
22 [83.3]

- The letter or group of letters (GHB) indicates the pump head arrangement.
H Pump without outboard bearing
HB Pump with outboard bearing
GHB Pump with outboard bearing and built-on gear reduction unit
BH Pump without outboard bearing to accommodate close coupled hydraulic drive auxiliaries through a rigid coupling

- The letter (F) indicates port style.
F - Pump with Roper standard flange ports
- On GHB pumps, the letter (O) indicates pump with outboard bearing and auxiliary mounting provisions. (Does not include built-on gear reduction unit.)
- The letters (RV) indicates pump equipped with a relief valve.
No letters -Without relief valve
RV - RV Style relief valve
- The letter or group of letters (X, LX) indicates direction of rotation and shaft position. The letter (L) indicates low drive unit. If the letter (L) is not used, the shaft will be in a high drive position.
No letter or W - Clockwise Rotation (Standard Rotation)
Z Counterclockwise Rotation
LX Counterclockwise Rotation
LY Clockwise Rotation

Example:

9722*GHBFORVLX SPEC XXX TY 1 S/N XXX



* The letter (M) may be used in this space indicating the pump is mounted with motor. The letter (E) may be used in this space indicating the pump is mounted on a base with or without engine.

As stated in the explanation of the pump nomenclature, all characters may not appear on every pump nameplate.

NOTE: The preceding description of the figure number is to assist in identifying your Roper 9622 series pump only. **DO NOT** attempt to derive any ratings or performance from the figure number. **DO NOT** use the explanation of the figure number to construct your own pump. Not all combinations are possible. For assistance in pump selection, it is recommended that you consult a Roper distributor or Roper Pump Company.

2. Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are clarified by a SPECification number. Identification of any items different than a standard pump can be made by consulting a Roper distributor or Roper Pump Company.
3. The TYPE number is a number used by Roper for in-house identification of construction and hydraulics. Always include the type number in any references to the pump.
4. The SERIAL number is a unique number assigned to each pump built by Roper Pump Company.

In any communication concerning this pump, always be sure to include the Figure, Spec,

Type, and Serial numbers so proper identification of the pump can be assured.

1.2 MAXIMUM PUMP RATINGS

The maximum pressure and speed limits for this pump SERIES are shown below.

The maximum rating of a pump with a SPEC number may be lower depending on the materials of construction.

Maximum limits for this SERIES:

50 psi [344.5 kPa] Maximum Inlet Pressure - never more than 50% of actual discharge pressure.

100 psi [689 kPa] Maximum Discharge Pressure

50 psi [344.5 kPa] Maximum Differential Pressure - never more than 50% of actual discharge pressure.

865 rpm Maximum Speed

Maximum Temperature Limits for standard pumps (no spec number) are:

Mechanical Seal Pumps: 200°F [93°C]

Packed Box Pumps: 200°F [93°C]

Section 2.0

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2.1 INTRODUCTION

! IMPORTANT

THIS MANUAL MUST ACCOMPANY THE PUMP UPON ALL TRANSFERRALS. MAKE SURE THE OPERATOR OF THE EQUIPMENT HAS READ AND UNDERSTANDS THIS MANUAL BEFORE OPERATING THE PUMP OR ANY RELATED EQUIPMENT.

When properly selected, installed, operated, and maintained, Roper pumps will provide long, dependable service. Remember, faulty selection and installation form the basis of more pump troubles than all other causes combined. No amount of maintenance can compensate for selection and installation mistakes. Read this manual carefully and understand it totally before installing or operating the pump which it accompanies.

This pump is satisfactory for its rated conditions. Its operation beyond these conditions may subject it to stresses and strains that it is not designed to withstand.

Install ample coupling or belt guards for the protection of personnel.

This manual will cover standard pumps and most SPECification number pumps. Appearance may vary among pumps and construction may vary on spec. number pumps. Specification numbers are assigned to pumps with other than standard features. Roper produces specific manuals for most standard line pump models. Contact Roper to find out if the pump model you have has a specific manual and to request a copy.

If there is any question concerning the ratings, instructions, or compatibility of the pump with the pumped liquid, consult a Roper distributor or:

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! IMPORTANT

Read the following before starting the pump! Failure to heed these warnings may result in an accident causing physical damage, serious personal injury, or death!

- Read and understand all tags and installation and operating instructions.
- **WARNING!** Install proper guard(s). **DO NOT** operate pump without guard(s) in place. Even with proper guard(s) installed, always use caution near rotating parts including the drive system for the pump. Serious injuries and death have occurred from becoming entangled in rotating shafts.
- **WARNING!** **DO NOT** operate this equipment in excess of its rated capacity, pressure, speed, and temperature, or other than according to the instructions contained in this manual.
- **WARNING!** Install and properly set devices into the system to prevent the chance of too much pressure, high temperature, and driver overload. The pump is not provided with these devices.
- **WARNING!** Proper measures and safeguards must be taken to avoid spillage and overflow from overfilling or putting too much pressure on any component of the system. This includes the receiver and lines.
- Know the operating conditions.
- Open all lines before starting pump.
- *This manual contains general information concerning the use, inspection, adjustment, and test of the pump furnished. For certain applications and installations, other precautions and safety measures may be appropriate and are the responsibility of the product installer and user. Users of this pump must have ample knowledge and training to apply*

sound safety and operating practices that may not be mentioned in the manual, and Roper's sale of this pump is in reliance on such user knowledge and training.

2.2 SAFETY PRECAUTIONS

WHEN LIQUID BEING PUMPED IS HAZARDOUS OR VOLATILE, ALWAYS TAKE FULL PRECAUTIONS. THIS INCLUDES THE RUN-IN PERIOD AND DURING DISASSEMBLY AND ASSEMBLY OF PUMP.

Controls, guards, walkways, machine arrangement, crew training, etc., are all necessary factors in the creation of a safe, practical installation and are generally not a part of our services. It is the responsibility of the contractor, installer, owner, and user to add to the materials furnished by Roper to result in a safe installation and to comply with OSHA, state and local laws, and the ANSI/NFPA Life Safety Code.

There are many kinds of devices for pumps and systems such that if one component in a system is stopped, other equipment feeding or following it also can be automatically stopped. Serious thought should be given to the installation of these types of devices in every pump system.

- **DO NOT** attempt to install, operate, or perform maintenance on this equipment without first reading and understanding the material in this manual. Also, read and understand all tags and any other documentation accompanying the pump.
- **DO NOT** operate this equipment in excess of its rated capacity, pressure, speed, and temperature, or other than according to the instructions contained in this manual.
- **DO NOT** continue to operate this equipment if there is a failure of any part of the equipment or system. Correct the failure before operating the equipment.

- **DO NOT** bypass safety controls or guards. Their purpose is to protect and they must be in proper working order.
- **DO NOT** operate equipment without proper guards in place.
- **DO NOT** walk, stand, sit, or lean on guards.
- **DO NOT** work on a pump while it is operating or if there is a chance of the driver becoming energized except to adjust the relief valve.
- **DO NOT** adjust packing while the pump is operating or if there is a chance of the driver becoming energized.
- **DO NOT** adjust the integral relief valve without coupling guards in place.
- **DO NOT** place hands, feet, head, or any other part of your body in any pump opening while the pump can be operated.
- **DO NOT** poke or prod material in the pump.
- **DO NOT** start to disassemble the pump if there is the slightest chance of it becoming energized by accident. Lock out the energy source to the driver and disconnect the coupling before performing maintenance to the equipment.
- **DO NOT** wear loose or dangling clothing or jewelry near the equipment. It could become caught and possibly cause serious injury or death.
- **DO NOT** use metallic or hard faced striking tools when the need for tapping parts into position arises. Hard faced striking tools may damage parts or they may fracture or chip and send particles flying that could cause possible injury.
- **DO NOT** allow spills to remain in the work area. Clean up spills immediately. Oils, greases, and other fluids used in the

equipment may create hazards if not cleaned up immediately after a spill.

- **DO NOT** spin bearings with compressed air. This is highly dangerous and can cause the bearing to fragment with explosive force, possibly causing serious injury or death.
- **DO NOT** attempt to install, use, or repair this equipment while under the influence of any substance that may impair physical or mental abilities. This includes, but is not limited to, alcohol and prescription and nonprescription drugs.
- **DO NOT** dispose of fluoroelastomers by burning. Toxic vapors are released by this compound upon combustion.
- **DO NOT** suspend pumps from the ports unless they have been specifically designed for this type of mounting.

-
- **DO** completely read and understand the information contained in this manual. *The operator of the equipment must be familiar with these instructions.*
 - **DO** stop the pump in a manner that there is no chance of the driver becoming energized while any kind of work is being performed on the pump or system.
 - **DO** always keep safety in mind.
 - **DO** know the operating conditions of the equipment.
 - **DO** take proper measures and precautions to avoid spillage and overflow from overfilling or putting too much pressure on any component of the system.
 - **DO** identify all possible hazards and decide what controls are needed. Remember, only you understand your product and system characteristics fully. *The ultimate responsibility for the application and safety is with you.*

- **DO** install and properly set devices into the system to prevent the chance of dry operation, overpressure, excessive temperature, and driver overload.
- **DO** provide guards for all exposed rotating parts, including all parts of the drive system, to prevent possible injury.
- **DO** be careful when working near an operating pump. Contacting or getting caught in rotating parts may cause serious or fatal injury.
- **DO** keep equipment in good working order, especially safety devices and guards.
- **DO** be aware of your location relative to the equipment.
- **DO** wear proper clothing near the equipment. Safety glasses or goggles, and safety shoes are recommended. They will help reduce the chance of injury.
- **DO** use soft faced striking tools when the need for tapping parts into position arises. Rubber or plastic faced striking tools are recommended.
- **DO** practice good housekeeping. Clean up spills immediately. Keep the work area clean to avoid hazards. Always be sure of your footing around the equipment to avoid a possible fall and injury.
- **DO** use proper tools. Avoid *cheater* bars as they are a source for serious injury should they slip or break.
- **DO** mount pumps in the manner they were designed to be mounted.

2.3 PREOPERATION CHECKS

Read and understand the instructions and recommendations contained in this manual.

Disconnect the coupling between the driver and pump.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Rotation is shown on the pump in relation to the integral relief valve and port locations. When an integral relief valve is used, make sure it is positioned and adjusted as discussed in the section titled, **DIRECTION OF ROTATION AND RELIEF VALVES**. After the unit is mounted and the piping is connected, the pump should be checked to be sure it operates freely without binding. After operation is proved satisfactory, both pump and driver should be tightly secured and the alignment rechecked before operation.

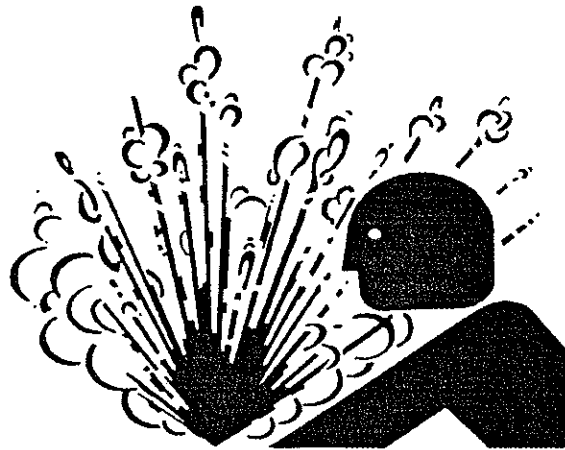
Before starting, make sure all guards are in place and the inlet and discharge valves are opened. After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and refer to Section 2.9, **CHECKING PUMP PERFORMANCE**.

After the pump is delivering liquid, check the unit for excessive vibration, localized heating, and excessive shaft seal leakage. Check the pressure or vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure or vacuum conform to specifications.

⚠ WARNING

If there is no pressure relief device in the system, **NEVER** block the discharge line. If there is a relief valve in the system, **NEVER** block the discharge line between the relief valve and pump. High pressure will occur, resulting in possible damage or breakage to the pump or system parts and possible injury to personnel. **DO NOT** operate the pump for more than one minute with the discharge line blocked downstream of the relief valve. Rapid heating and possible damage will occur. Even an open discharge line does not prevent the possibility of high pressure. Discharge

line length, diameter, and arrangement along with fluid viscosity and velocity also can create a high pressure situation at the pump.



WARNING! DO NOT overpressurize pump or system.

2.4 PREPARATION OF FOUNDATION

Locate the pump so that it is as low and as close to the fluid source as practical and so that piping to and from the pump will be as short and simple as practical. The pump and its driver must be accessible for inspection and maintenance. Accessibility to the unit and adequate clearance should be a major thought in any installation. The driver must be suitable for the environment (for example; open, splash proof, totally enclosed, or explosion proof electric motor). If the driver is not suitable, choose a different location or obtain another driver.

For best pump-driver unit life, mount each unit on a strong, fabricated, structural steel baseplate with a proper foundation. A good foundation is of major importance to the total installation. A thick, heavy concrete foundation is best since it is heavy enough to support the baseplate rigidly and absorb strain and shock. Locate anchor bolts for the baseplate in the foundation. Use a pipe sleeve, two to three times as large as the anchor bolts, around the anchor bolts to allow some lateral bolt movement during final positioning of the unit.

Place the unit, with the pump and driver mounted on the baseplate, on the foundation and disconnect the coupling (flexible coupling, belts and sheaves, etc.). **DO NOT** reconnect the coupling until all alignment operations are complete. Support the baseplate on rectangular metal blocks and shims or on metal wedges having a small taper. Place the support pieces close to the anchor bolts and directly under the part of the baseplate carrying the greatest weight. Space the support pieces close enough to give uniform support. Allow a gap of about 3/4 inch [19 mm] to 1-1/2 inches [38 mm] between the foundation and baseplate for grouting. Refer to Fig. 2.4.1.

Adjust the metal supports or wedges until the shafts of the pump and driver are level. At this time, check the faces of the inlet and discharge connections of the pump for horizontal or vertical position using a level. Correct the positions, if necessary, by adjusting the supports or wedges under the baseplate as required.

For maximum rigidity and lower noise levels, grout the baseplate to the foundation. Use a good grade of nonshrink grout. When all alignments are correct (refer to Section 2.5, **ALIGNING DRIVER AND PUMP**), tighten the anchor bolts evenly but not too firmly. Then grout the unit to the foundation. Completely fill the baseplate with grout. It is desirable to grout the leveling pieces, shims, or wedges in place. Fill the spaces between the anchor bolts and sleeves with grout, also. Allow the grout to dry according to the manufacturer's instructions. **DO NOT** fully tighten the anchor bolts until the grout has hardened.

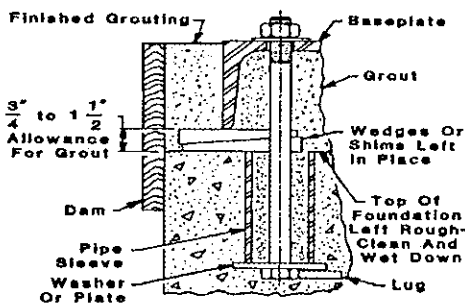


Fig. 2.4.1: Typical Baseplate Anchoring

After the grout has hardened and the anchor bolts have been properly tightened, check the unit for parallel and angular misalignment, and if necessary, take corrective measures. After the piping to the unit has been connected, check the alignment again.

NOTE: Attempts to correct alignment in one direction may alter the alignment in the other direction. Therefore, it is necessary to check alignment in all directions after making any adjustments.

Schedule semiannual inspections and checks of the foundation anchor bolts as part of a preventive maintenance program. If loose foundation bolts are found, tighten them and check the unit alignment.

Normal mounting for this pump is horizontal with the pump above the baseplate, properly grouted to a concrete foundation placed in or on solid earth. Mountings other than described above (such as vertical mounting, wall mounting, ceiling mounting, etc.) may require special components and precautions. Extra pump supports, special drivers, and extra anchor bolts may be necessary in unusual mountings. If your application requires other than normal mounting, as described above, you are urged to consult Roper Pump Company for assistance in determining any special needs that may be required.

2.5 ALIGNING DRIVER AND PUMP

The flexible coupling or belts and sheaves must be accurately realigned during and after installation. Refer to the flexible coupling or belt and sheave manufacturer's recommendations and instructions for the requirements for proper alignment. Also refer to Section 2.4, **PREPARATION OF FOUNDATION**, for additional information.

FLEXIBLE COUPLING

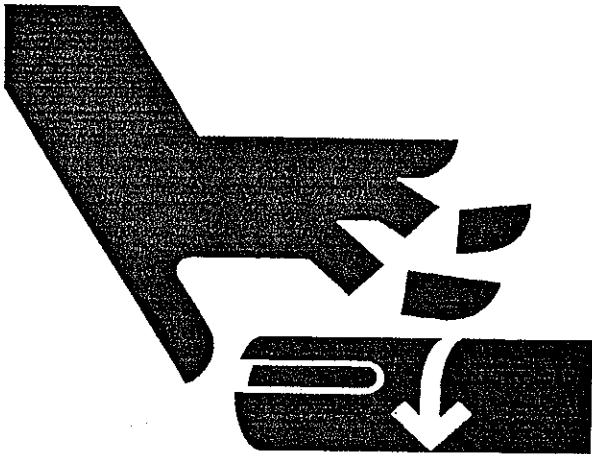
DO NOT use a flexible coupling to compensate for misalignment of the driver

and pump shafts. The purpose of the flexible coupling is to compensate for temperature changes and to permit end movement of the shafts without interference with each other while transmitting power from the driver to the pump.

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



Make sure there is no chance of the driver becoming energized while aligning driver and pump. Getting caught in rotating parts of the drive system will cause serious personal injury or death. DO NOT start or operate pump without guards in place.



WARNING! DO NOT operate without guards in place.

There are two forms of misalignment between the driver shaft and the pump shaft. The first is angular misalignment, where the axes of the shafts are concentric but not parallel. The other is parallel misalignment, where the axes

of the shafts are parallel but not concentric. Refer to Fig. 2.5.1.

Make the check for angular alignment by inserting the taper gauge or feeler gauges between the coupling faces and comparing the distance between the faces at four points spaced at 90° intervals around the coupling. The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points.

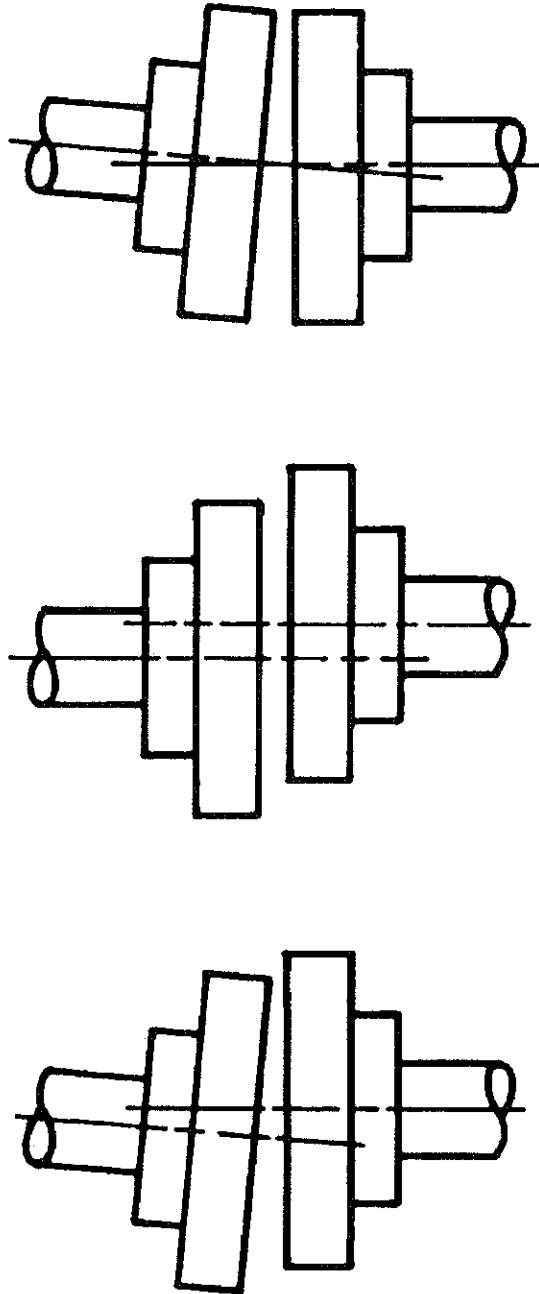


Fig. 2.5.1 Misalignments: Top, Angular; Center, Parallel; Bottom, Both.

Make the check for parallel alignment by placing a straight edge across both coupling halves at the top, bottom, and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling halves at all positions. Allowance may be necessary for temperature changes and for coupling halves that **DO NOT** have the same outside diameter. Take care to have the straight edge parallel to the axes of the shafts.

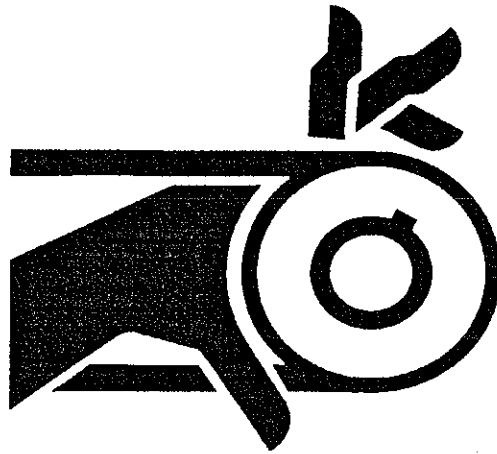
Correct angular and parallel misalignment by placing shims under the mounting feet of the equipment. After each change, it is necessary to recheck the alignment of the coupling halves. Adjustment in one direction may disturb adjustments already made in another direction.

BELTS AND SHEAVES

Some applications on gear pumps involving low discharge pressure and slow speeds may permit the mounting of the driven sheave directly on the pump shaft. However, it is recommended that all belt drive assemblies be designed with a separate jackshaft mounted on pillow blocks to carry the side loads of the sheaves and belts and a flexible coupling connecting the jackshaft to the pump shaft.



Make sure there is no chance of the driver becoming energized while aligning and adjusting the belts. Getting caught in rotating parts of the drive system will cause serious personal injury or death. **DO NOT** start or operate pump without guards in place.



WARNING! DO NOT operate without guards in place.

The driver and pump shafts must be parallel, and the belts at right angles to these shafts. Misalignment will cause undue belt wear, or turn-over in the grooves. Approximate alignment should be checked by placing a long straight edge evenly across the rims of both sheaves. If the faces of the sheaves are not of equal width, the alignment may be checked by resting the straight edge across the rim of the widest sheave and measuring the distance from the straight edge to the nearest belt groove with a scale. Adjust either sheave on the shaft to equalize these dimensions.

The driver should be mounted with adequate provision for belt center distance adjustment. Provide a minus adjustment to permit belt installation without stretching and a plus allowance to provide belt take-up.

DO NOT pry, twist, or force the belts over the sheave grooves. This will damage the belts and greatly reduce the belt life. Shorten the drive by moving the driver enough to permit fitting the belts in the proper grooves. When the belts are in place, increase the center distance until proper belt tension is obtained. Adjust take-up until only a slight bow appears on the slack side of the drive when it is operating. All the belts must be pulling evenly. Belt tension should be reasonable. It is not necessary to have belts excessively tight.

During the first few days of operation, the belts will seat themselves in the sheave grooves. After that, the drive must be adjusted to take up the slack. Slipping belts will result in lowered capacity. Squealing or smoking belts are sometimes a clue to the slipping of belts.

Keep belts clean and free from oil. Stop drive to clean belts. **DO NOT** attempt to clean belts while the drive is operating. Clean oily belts with a cloth dampened with soap and water. Never install new belts on the same drive with used belts. **DO NOT** use sheaves with chipped or worn grooves. For hazardous locations, check to see if an antistatic belt should be used. When purchasing replacement belts, the same size and type should be ordered as furnished originally.

POWER TAKE-OFF DRIVE SYSTEMS

When mounting a pump on a vehicle with a PTO drive, always check with the manufacturer of the PTO equipment to determine the alignment required for proper operation of the PTO. The mount for the pump must be rigid. The pump must be mounted the way it was designed to be mounted. Pumps with feet must be mounted by the feet. **DO NOT** use the pump ports to mount a pump that has feet. It is acceptable to mount a foot mounted pump in the three, nine, or twelve o'clock position as well as the standard six o'clock position as long as proper shaft alignment is maintained.

! DANGER

Make sure there is no chance of the driver becoming energized while aligning the power take-off shafting. Getting caught in a power take-off drive system will cause serious injury or death. Proper guarding must be provided for all power take-off drive systems.



WARNING! DO NOT operate without guards in place.

Serious injuries and deaths have resulted from persons becoming caught in power take-off (PTO) drive systems. Loose or dangling clothing and slippery or unsure footing are factors in many PTO accidents. **DO NOT** work on or adjust a pump driven by a PTO drive system while it is operating or has a chance of the driver becoming energized except as specified in the section titled, **DIRECTION OF ROTATION** and **RELIEF VALVES**.

Unless properly designed, guarded, and maintained, all drive systems are dangerous.

- **DO** be careful near rotating PTO drive systems. Contacting a PTO drive system may cause serious injury or death.
- **DO** install and maintain proper guard(s) for PTO drive systems.
- **DO NOT** operate PTO drive systems without proper guards in place.
- **DO NOT** work on or adjust a pump driven by a PTO drive system while it is operating or has a chance of the driver becoming energized except as specified in the section titled, **DIRECTION OF ROTATION AND RELIEF VALVES**.
- **DO NOT** work on a PTO drive system while it may become energized.
- **DO NOT** wear loose or dangling clothing or jewelry near the equipment. It could become caught and possibly cause serious injury or death.

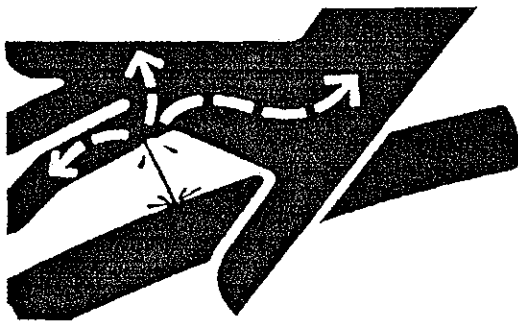
GUARDING PTO DRIVE SHAFTS

PTO drive systems can be dangerous and when used, additional safety precautions, including guarding, may be required and must be provided by the drive system installer. Roper Pump Company has no responsibility for recommending or providing proper guarding or other safety measures in any particular application.

The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who know the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application and installation is the user's.*

SPECIAL PRECAUTIONS FOR HYDRAULIC DRIVES

Avoid contact with high pressure fluids. Check all hydraulic hoses. Hydraulic hoses can fail due to physical damage, kinks, age, and exposure. Check hoses regularly. Replace damaged hoses.



WARNING! AVOID CONTACT with high pressure fluids.

! WARNING

Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a

piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. In some cases, fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type injury should reference a knowledgeable source.

! WARNING

An overload or kickdown valve in a hydraulic drive system is NOT a safe substitute for a pressure relief valve correctly installed in the pump piping system.

2.6 ADDITIONAL IMPORTANT WARNINGS AND INFORMATION

- *This manual contains general information concerning the use, inspection, adjustment, and test of the pump furnished. For certain applications and installations, other precautions and safety measures may be appropriate and are the responsibility of the product installer and user. Users of this pump must have ample knowledge and training to apply sound safety and operating practices that may not be mentioned in the manual, and Roper's sale of this pump is in reliance on such user knowledge and training.*
- Roper pumps are general purpose pumps for a wide range of uses; yet, *they are not designed nor intended for use with every known substance.* Maximum ratings are shown in the section titled, **MAXIMUM PUMP RATINGS**. Roper sales brochures contain standard ratings. Ratings for SPECification number pumps or standard pumps may be obtained by contacting a Roper distributor or Roper Pump Company.

- Review this manual to determine the proper union of the pump into the total plant or system operating programs.
- *Roper does not supply, recommend, or approve the systems in which its pumps are or may be used.* Unless designed, built, and used properly, systems may be unsafe or dangerous. You should check and comply with all federal, state, local, and other regulations and recommendations such as: NFPA, UL, OSHA, API, etc.

In particular, you must check the pumped liquid properties and take proper precautions. Among other things, consider the following:

- Decide the results of spillage or leakage (all pumps or systems may fail sometime).
 - Explosion
 - Corrosion
 - Chemical Burns
 - High Pressure Spray
 - Toxic Exposure
 - Fire
 - Exposure to Extreme Temperatures
 - Environmental Impact
 - System Impact
 - Other
- Are you using proper safeguards?
 - Temperature Controls
 - Pressure Controls
 - Leak Detectors
 - Shutoff Devices
 - High or Low Pressure Safeguards
 - Alarm Devices
 - Overfill or Overflow Detection

- Driver Overload Controls
- Consider all possible methods and series of failure.
- Are any other methods needed to control a hazard?
- Regular scheduled inspection for the wear and tear of parts.

- Identify all possible hazards. Decide upon and install the required controls. Only you, the user, understand your product and system properties fully. *The ultimate responsibility for the application and safety is with you.*
- Particularly note the chance of fire and burns from flammable or hot liquid spillage from burst hoses and take proper precautions.
- Properly guard all exposed rotating parts of the drive to the pump.
- Install a pressure relieving device in the system discharge piping to protect the equipment and crew from accident due to too much pressure. **NEVER** place a shutoff valve between the pump and system relief valve. Read Section 2.3, **PREOPERATION CHECKS.**
- Spillage or overflow, from overfilling or putting too much pressure on any component of a system incorporating this pump, may result in an accident. Proper measures and precautions must be taken to avoid spillage or overflow from overfilling or putting too much pressure on any component of the system. This includes the receiver and lines.

Prior to starting pump, read sections on **PREPARATION OF FOUNDATION 2.4; ALIGNING DRIVER AND PUMP, 2.5; INSTALLATION OF PIPES, 2.7; THREADED PORT CONNECTIONS, 2.8; and PREOPERATION CHECKS, 2.3.**

2.7 INSTALLATION OF PIPES

- **DO NOT** connect raised face flanges to the ports of a cast iron pump.
- **DO** use flat faced flanges with cast iron pumps.

Piping must be installed and checked carefully. Allow for any expansion or contraction.

Any external force or moment (torque or twist) applied on the pump ports by the piping will cause stresses in the pump and its foundation. This may cause misalignment that could result in hot bearings, worn couplings, or excessive vibration. Such forces or moments may be caused by improperly aligned piping or by thermal expansion of the piping when pumping hot or cold fluids. The piping should be supported independently. Use flexible piping connectors and insure that they are properly anchored.

If an expansion joint is installed in the piping between the pump and the nearest point of anchor in the piping, a force equal to the area of the expansion joint (which may be considerably larger than the normal pipe size) times the pressure in the pipe will be transmitted directly to the pump. Pipe couplings that **DO NOT** provide an axially rigid connection have the same effect. This reaction force can be so large that it would be impractical to design suitable components to withstand the force. If an expansion joint or nonrigid coupling is used, install a pipe anchor between it and the pump. If properly installed, this will eliminate the forces mentioned above.

The pump port size does not necessarily establish the correct pipe size. Piping must be sized and arranged to provide ample inlet pressure at the pump and to insure that the

discharge pressure will be at least as low as the rated pressure of the pump. If the fluid to be pumped is viscous, or the piping long, or the suction lift or static discharge head somewhat high, piping one or two sizes larger may be required. Friction losses should be carefully calculated (see Hydraulic Institute Engineering Data Book or similar authority for friction loss data) and compared to the pump ratings before the installation is made. Where valves are used in the piping system, gate, ball, or butterfly valves are preferable to globe or angle valves. 90° long radius elbows or 45° elbows are preferable to standard short radius elbows. **NEVER** place a valve between the pump and system relief valve.

2.8 THREADED PORT CONNECTIONS

American National Standard Taper Pipe Threads (NPT) are standard for pipe plugs and threaded ports of the pump. British Standard Pipe Threads (BSP) are available on request for most sizes.

To produce a pressure tight joint, a thread sealant must be used. TFE tape is generally not recommended where cast iron is used as one or more parts of the joint. The use of TFE tape for installing cast iron fittings may cause damage to the pump or fittings.

The following is a partial list of sealants that may be used when making up joints on the pump:

- PST Pipe Sealant No. 567 - Loctite Corp.
- Rectorseal No. 5 - The Rectorseal Corp.
- Leak Lock - Highside Chemical, Inc.

Follow the sealant manufacturer's instructions when making up a joint.

2.9 CHECKING PUMP PERFORMANCE

A summary of the causes of common malfunctions.

PROBLEM	POSSIBLE CAUSES
NO LIQUID DELIVERED	Pump rotating in wrong direction.
	Pump not primed.
	Inlet lift too high. Check this with gauge at pump inlet.
	Clogged inlet line.
	Inlet pipe not submerged.
	Air leaks in inlet line.
	Faulty pressure relief device in system.
	Pump Worn.
RAPID WEAR	Excessive pressure.
	Nonlubricating liquid.
	Pump runs dry.
	Incompatibility of liquid and pump materials.
	Pipe strain on pump. See Section 2.7, Installation of Pipes.
	Excessive abrasives in liquid.
EXCESSIVE NOISE	Starved Pump.
	Air leaks in inlet line.
	Air or gases in liquid.
	Pump speed too high.
	Relief valve chatter. Check pressure setting.
	Improper mounting. Check alignment thoroughly. See Section 2.4, Aligning Driver and Pump and Section 2.5, Preparation of Foundation.
PUMP TAKES TOO MUCH POWER	Speed too high.
	Liquid more viscous than previously anticipated.
	Operating pressure higher than specified. Check this with gauge at pump discharge.
	Discharge line obstructed.
	Mechanical defect, such as bent shaft.
	Pipe strain on pump. See Section 2.7, Installation of Pipes.
	Pressure relief device not operating properly.
INSUFFICIENT LIQUID DELIVERED	Air leaks through mechanical seal.
	Speed too slow.
	Excessive lift at inlet. Check this with gauge at pump inlet.
	Viscosity of liquid too high for size and length of inlet pipe.
	Foot valve, if used, too small, stuck, or not working properly.
	Foot valve or end of inlet pipe not immersed deeply enough in liquid.
	Excessive clearance in pump caused by wear or corrosion.
	Faulty pressure relief device.

2.11 INDEX

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SECTION 3.0

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3.1 SAFETY SIGNAL WORDS AND SYMBOLS

SAFETY SIGNAL WORDS

The safety signal words **CAUTION!**, **WARNING!**, **DANGER!**, and **TOXIC!** Have specific meanings in this manual.

CAUTION! Is used to identify hazards that may cause damage to property or equipment.

WARNING! Is used to identify hazards that may cause personal injury.

DANGER! Identifies the most serious hazards. **DANGER!** Is used to identify hazards that will cause personal injury, or death.

TOXIC! Identifies hazards that involve materials that may cause death by contact, ingestion, or inhalation. **TOXIC!** Will always be used with the safety signal word **DANGER!**

3.2 RECOMMENDED TOOL LIST

NOTE: Tools not furnished with pump.

Tools for all Pumps:

- (1) Safety Glasses
- (1) Rubber Mallet
- (1) 9/16" Combination Wrench
- (1) 6" Adjustable Wrench
- (1) 6" to 10" Round File

Additional Tools for HB Pumps:

- (1) 1/8" Hex Key
- (1) Flat Tip Screwdriver, 1/4" wide x 4" long blade

Additional Tools for GHB Pumps:

- (1) 1/2" Combination Wrench

Additional Tools for Pumps with an RV Type Relief Valve:

- (1) 7/16" Combination Wrench
- (1) 3/4" Combination Wrench

Additional Tools for Pumps with Flanges:

- (1) 15/16" Combination Wrench

Additional Tools for Pumps with Shaft Packing:

Packing Hook for .38" square packing rings

Additional Tools for Pumps with Mechanical Seals:

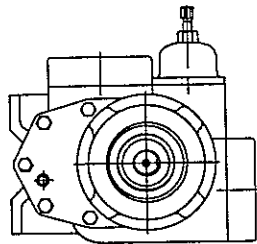
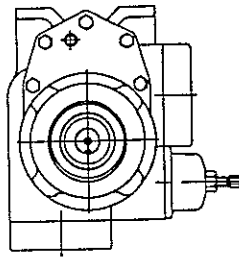
- (1) 0400 External Retaining Ring Pliers

3.3 TRUCK MOUNTING

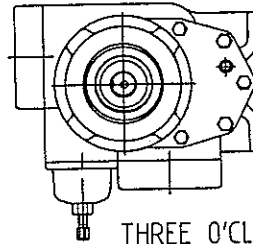
The mounting pads for truck mounted pumps must be rigid and properly aligned with the driver. When PTO drives are used, always check with the manufacturer of the PTO equipment to determine the alignment required for proper operation of the PTO and the type of guarding that must be used. See Section 2.5, **ALIGNING DRIVER AND PUMP**.

The **GHB**, **HB**, and **BH** pumps are designed to be mounted by the feet. These pumps may be mounted with the feet in the three, nine, or twelve o'clock position as well as the standard six o'clock position. See Figure 3.3.1.

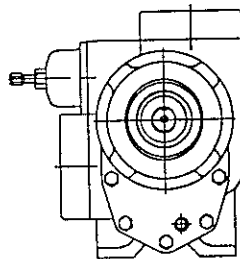
TWELVE O'CLOCK



NINE O'CLOCK



THREE O'CLOCK



SIX O'CLOCK

GHB, HB, and BH MOUNTING POSITIONS
FIGURE 3.3.1

3.4 DIRECTION OF ROTATION AND RELIEF VALVES

The standard integral relief valve is designated by the letters "RV" in the pump nomenclature.

STANDARD RV

This relief valve is externally adjustable by means of an adjusting screw located in the center of the relief valve cap. The range of adjustment is approximately 30 psi [207 kPa]

to 100 psi [689 kPa]. The actual capability is dependent on pump speed and liquid viscosity. The settings are for full bypass; that is, all of the fluid is circulating back to the inlet through the relief valve. The end user must set the relief valve for conditions that exactly match the application.

PROPER PUMP GEAR ROTATION

Proper gear rotation is shown in Figure 3.4.2 and 3.4.3.



DO NOT REVERSE ROTATION

Reversing rotation of the pump without reversing the position of the relief valve and inlet port will cause the relief valve to be inoperable. Discharge pressure will be holding the valve closed instead of pushing it open. Running the pump against the relief valve can cause very high pressure buildup on the discharge side of the pump and in the system downstream of the pump. High pressure can cause the pump or other system component to break or leak causing liquid in the system to escape resulting in possible injury or death.

PUMP INLET and PUMP DISCHARGE

The pump "INLET" must always be on the side port of the case and the "DISCHARGE" must always be on the top port of the case when an integral relief valve is used.

An integral relief valve should not be used on applications where the discharge must be closed for more than one minute. Prolonged operation of the pump with the discharge closed will cause rapid heating of the liquid circulating through the relief valve, thus resulting in possible damage. An external return to reservoir relief valve must be used.

DIRECTION OF ROTATION FOR THE PUMP

The drawings showing DIRECTION OF ROTATION FOR PUMP CONFIGURATIONS USING THE RV STYLE RELIEF VALVE (Figure 3.4.2 and 3.4.3) and position of relief valve with

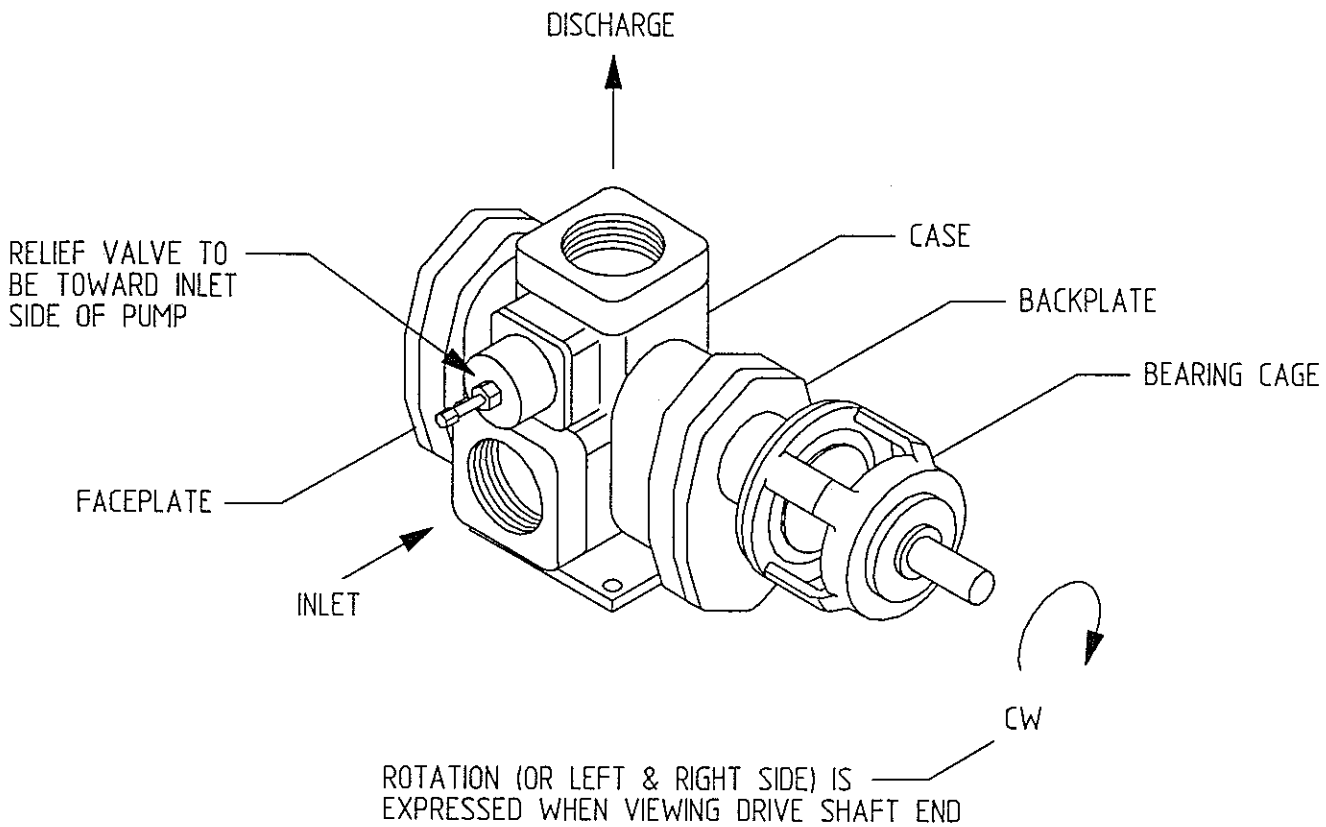
the letter "L" in the designation are for low drive applications (the drive shaft is lower than the side port). All other drawings shown are for high drive applications (the drive shaft is above the side port).

The arrow in the drawing at the end of the drive shaft indicates the direction of rotation needed to achieve proper operation of the pump and relief valve when using the pump and relief valve orientation shown in the drawing. CW indicates clockwise rotations and CCW indicates counterclockwise rotation when viewed from the drive shaft end of the pump.

To determine the correct relief valve position for any of the pump orientations, use the drawings shown titled DIRECTION OF ROTATION FOR PUMP CONFIGURATIONS USING THE RV STYLE RELIEF VALVE (Figure 3.4.2 and 3.4.3):

1. Find the group of drawings with the proper drive shaft position (high or low drive). Drawings with W or Z rotation are high drive pumps. Drawings with LX or LY rotation are low drive pumps. Eliminate all other drawings.
2. In the drawings remaining, find the group of drawings with the proper direction of rotation arrow at the end of the drive shaft. Eliminate all other drawings. CW indicates clockwise rotation and CCW indicates counterclockwise rotation when viewed from the drive shaft end of the pump.
3. In the remaining drawings, find the drawing with the proper inlet and discharge port locations. This drawing will show the proper relief valve position for the pump configuration chosen. Note the position of the word "INLET" cast next to the side port. The word "INLET" must be on the inlet "side" of the pump in order for the relief valve to work.

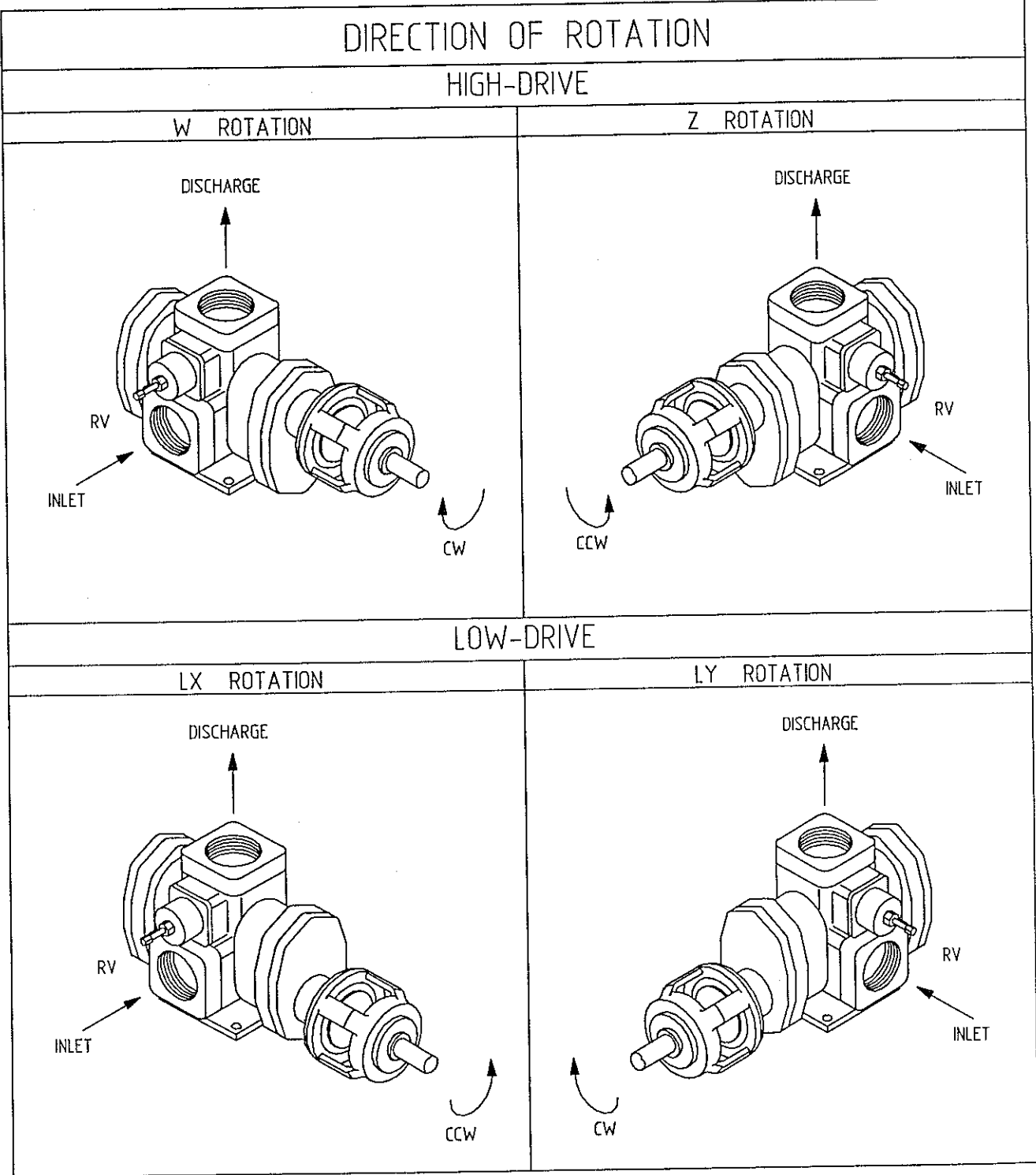
FIGURE 3.4.1



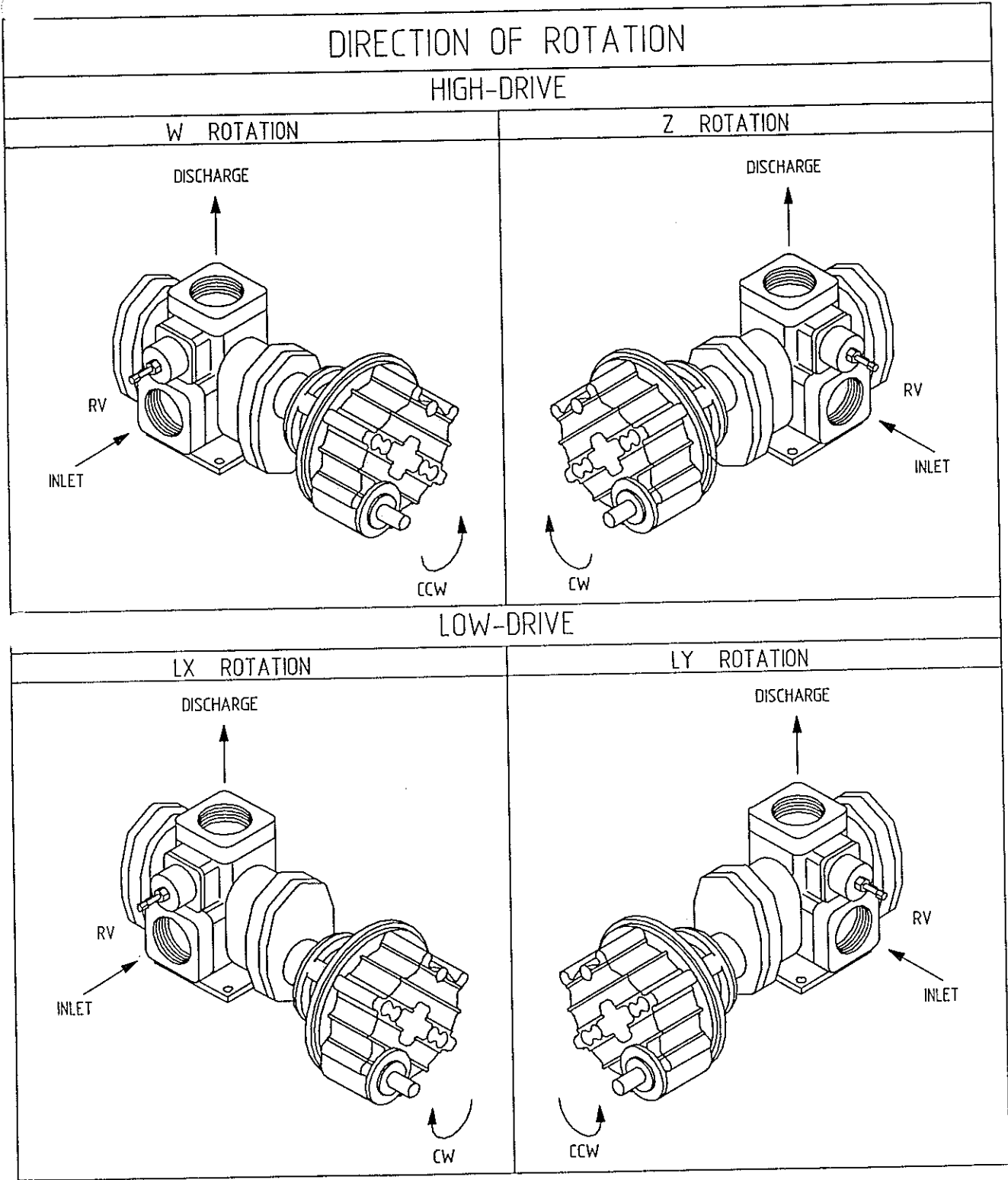
! WARNING

DO NOT operate a pump with a relief valve that is not positioned correctly. The relief valve will be inoperable. This can allow high pressure buildup on the discharge

side of the pump and in the system downstream of the pump. High pressure can cause the pump or any other system component to break or leak causing liquid in the system to escape, resulting in possible injury or death.



**DIRECTION OF ROTATION FOR BH AND HB PUMP CONFIGURATIONS
FIGURE 3.4.2**



DIRECTION OF ROTATION FOR GHB PUMP CONFIGURATIONS
 FIGURE 3.4.3

CHANGING RV STYLE RELIEF VALVE POSITION

Refer to the sectional drawing (Figure 3.4.4).

WARNING

DO NOT remove the relief valve body (6) without reading the instructions below for disassembling the relief valve. *The relief valve contains a powerful compressed spring (31) that may cause injury or death if released suddenly.*

- **WARNING!** Relieve all internal fluid and air pressure inside the pump before disassembly.
- **WARNING!** Take necessary precautions to prevent the pump from rotating while working on the relief valve.
- **WARNING!** Fluid may spill out of the pump when the relief valve body (6) is removed. Take all necessary precautions to protect yourself, others, and the nearby area from any harm this fluid may do.

You should have already checked the drawings (Figure 3.4.2 and Figure 3.4.3) to find the correct way to position your relief valve, based on the pump's direction of shaft rotation and position and the location of the inlet and discharge ports. If you have not checked, do it now to decide whether or not you should change the position of your relief valve.

If the relief valve position needs to be changed, follow the instructions below and refer to Section 3.14, **PUMP SECTIONAL DRAWINGS** (Figure 3.14.1 through 3.14.3) and the **RV STYLE RELIEF VALVE** (Figure 3.4.4).

1. Turn off pump and lock out energy source to driver.
2. Close inlet and discharge valves.

3. To drain pump, follow the procedure in Section 3.6, **INSTRUCTIONS FOR DRAINING PUMP**.
4. Follow steps through in Section 3.7, **INSTRUCTIONS FOR PUMP DISASSEMBLY** to remove endplates, bearing carriers, gears, and shafts.
5. Turn case (1) so that relief valve position and side port matches **DIRECTION OF ROTATION** drawing previously selected from charts.
6. Follow steps through in Section 3.10, **INSTRUCTIONS FOR PUMP ASSEMBLY** to reassemble pump.

DISASSEMBLY OF RV STYLE RELIEF VALVE

Refer to the sectional drawing (Figure 3.4.4).

WARNING

DO NOT remove the relief valve body (6) without reading the instructions below on disassembling the valve. *The relief valve contains a powerful spring (31) that may cause injury or death if released suddenly.*

- **WARNING!** Relieve all internal fluid and air pressure inside the pump before beginning disassembly.
- **WARNING!** Take necessary precautions to prevent the pump from rotating while working on the relief valve.
- **WARNING!** Fluid may spill out of the pump when the relief valve body (6) is removed. Take all necessary precautions to protect yourself, others, and the nearby area from any harm this fluid may do.

Refer to Section 3.14, **PUMP SECTIONAL DRAWINGS** (Figure 3.14.1 through 3.14.3) and the **RV STYLE RELIEF VALVE** (Figure 3.4.4) for correct pump configuration.

1. Turn off pump and lock out energy source to driver.
2. Close inlet and discharge valves.
3. To drain pump, follow the procedure in Section 3.6, INSTRUCTIONS FOR DRAINING PUMP.
4. Decrease pressure on spring (31) by loosening lock and seal nut (39) and unscrewing adjusting screw (42) until adjusting screw turns freely.
5. After decreasing pressure on spring (31), remove the relief valve body (6) by unscrewing four hex head cap screws. Remove o-ring (46).
6. Remove spring (31), poppet adapter (30), poppet (14), and spring guide (12).
7. Inspect all parts and replace worn or damaged parts as required.

ASSEMBLY OF RV STYLE RELIEF VALVE

1. Install seal nut (39) on adjusting screw (42).
2. Install adjusting screw with seal nut in RV body (6). Screw in until head end of adjusting screw is 2.17 inches [55 mm] from RV cap.
3. Install spring guide (12) in RV body (6) on end of adjusting screw (42).
4. Place spring (31) in RV body (6) on spring guide (12).
5. Place poppet adapter (30) on poppet (14).
6. Place poppet adapter (30) and poppet (14) into spring (31).
7. Place o-ring (46) in groove in RV body (6).
8. Slide entire RV assembly into RV area of case (1). Install four hex head cap screws (M).

9. Adjust relief valve by following steps in next section on how to **ADJUST THE RV STYLE RELIEF VALVE**.

TO ADJUST THE RV STYLE RELIEF VALVE

Refer to the sectional drawing, Figure 3.4.4, RV STYLE RELIEF VALVE.

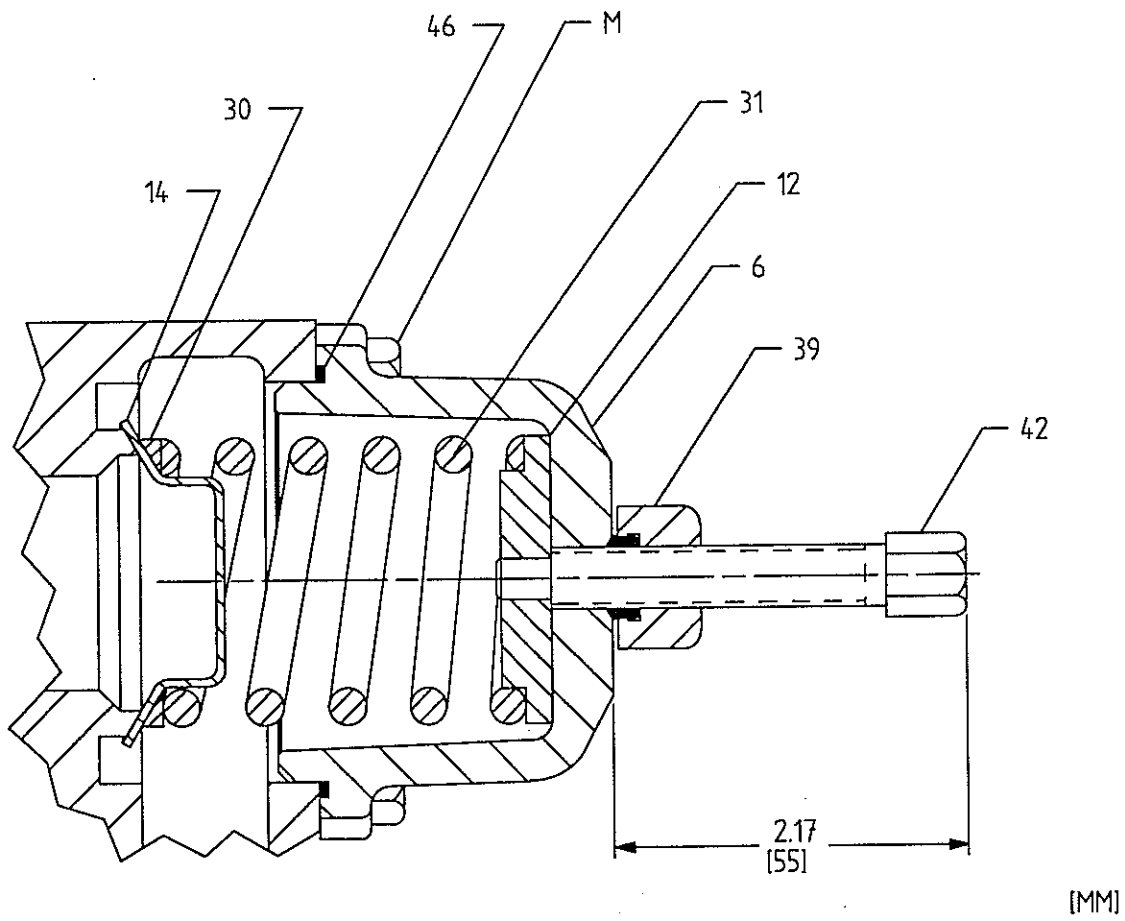
- **WARNING!** Take necessary precautions to prevent personal injury or physical damage that could be caused by any loss of the product being pumped while adjusting the relief valve. **DO NOT** adjust the relief valve without coupling guards in place.

The relief valve must be adjusted under conditions identical to the operating conditions (viscosity, rpm, etc.).

1. Connect a pressure gauge near pump in discharge line between pump and point where discharge line will be closed.
2. Loosen locknut (39) on the adjusting screw (42).
3. Back adjusting screw (42) out to point where end of adjusting screw will be 2.17 inches [55 mm] from relief valve body (6). See **RV STYLE RELIEF VALVE** (Figure 3.4.4).
4. **WARNING! DO NOT** start the pump until all rotating shafts and couplings are properly guarded. After all rotating shafts and couplings are properly guarded, start the pump and close the discharge line slowly. **DO NOT** exceed the pressure rating of pump or other equipment between the pump and the discharge line valve. If this pressure is reached while closing the discharge valve, **DO NOT** close any further. **DO NOT** run the pump with a closed discharge line for more than one minute at a time because it will result in rapid overheating.
5. With discharge valve closed, turn adjusting screw clockwise in 1/2 turn

increments until pressure gauge shows desired pressure setting.

6. Tighten locknut (39).
7. Open discharge line and turn off pump.



RV STYLE RELIEF VALVE
FIGURE 3.4.4

3.5 HIGH DRIVE TO LOW DRIVE

Prior to operating pump, make sure that the shaft rotation, pipe connections, and the relief valve position are in accordance with the appropriate illustrations (Figure 3.4.2 through 3.4.3). In order to change the rotation and/or piping orientation, it may be necessary to remove the piping from the pump or the pump from the mounting. (Flanges (5) and o-rings (44) can be removed from pump.)

Whenever changing rotation, inspect all parts before reassembly. Replace all worn parts and install new o-rings and gaskets in appropriate numbers as removed.

1. Remove coupling or universal joint and drive key (A) from drive shaft (10). Remove all burrs and sharp edges from drive shaft and keyway. See Figure 3.14.2.
2. To reverse pump rotation and keep piping arrangement the same, drive shaft (10) position must be changed. Follow steps 3 - 18.

To change port to opposite side and maintain same pump rotation, the pump must be totally disassembled (see Section 3.7, **INSTRUCTIONS FOR PUMP DISASSEMBLY**) and reassembled (see Section 3.10, **INSTRUCTIONS FOR PUMP ASSEMBLY**) in the configuration chosen from Figure 3.4.2 or Figure 3.4.3.

REVERSE ROTATION, SAME PIPING ARRANGEMENT

3. To reverse pump rotation and keep piping arrangement the same, it is necessary to change from high drive to low drive or low drive to high drive (W to LX or Z to LY or vice versa).
4. Remove ten hex head cap screws (J) securing faceplate (3) to case (1) and separate faceplate from case. Remove case gasket (33).

5. Rotate faceplate 180° and attach to ends of two bearing slugs (56, 57) using four faceplate hex head cap screws (J).
6. Using faceplate (3) as a handle, pull bearing slugs (56, 57) from case. Remove four hex head cap screws from faceplate/bearing slugs.
7. Remove idler gear/shaft (55) from case.
8. Remove drive gear (11) from case.
9. Remove drive gear key (B) from drive shaft (10).
10. Remove ten hex head cap screws (J) from backplate (2) securing backplate assembly to case (1) and separate backplate assembly from case.
11. Rotate backplate assembly 180° and attach to case using ten hex head cap screws (J). Make sure case gasket (33) does not get between backplate and ends of bearing slugs (56, 57).
12. Install drive gear key (B) in drive shaft (10).
13. Install drive gear (11).
14. Install idler gear/shaft (55).
15. Install bearing slug in lower case bore. *DO NOT FORCE SLUG. WHEN PROPERLY ALIGNED, SLUG WILL SLIDE IN EASILY. AN ALIGNMENT TOOL MAY BE PURCHASED FROM ROPER TO MAKE THE JOB EASIER.* Be sure to install slug with grooved face next to gear face and with groove on discharge side of case. Flat must be positioned at center between gear bores in case. Leave about .25" of length remaining outside case to help in alignment of second bearing slug.
16. Repeat step 15 to install second bearing slug.
17. With both bearing slugs sticking out of case bores approximately .25", align case

gasket (33) on case over ends of bearing slugs.

18. Install faceplate (3) using ten hex head cap screws (J). Tighten evenly to prevent case gasket from getting trapped between bearing slugs and faceplate.

3.6 INSTRUCTIONS FOR DRAINING PUMP

Refer to Section 3.14, PUMP SECTIONAL DRAWINGS

WARNING

- **WARNING!** Relieve all internal fluid and air pressure inside the pump before attempting to drain the pump.

WARNING! Take necessary precautions to prevent the pump from becoming energized while draining the pump.

- **WARNING!** Take necessary precautions to prevent injury or physical damage that could be caused by any loss of the product being pumped while draining the pump.

The extent to which a pump can be drained is dependent upon the product being pumped. Low viscosity products such as solvents will drain quickly and easily. High viscosity products such as molasses and tar will drain very slowly. Also, the draining of high viscosity products will be less complete.

Regardless of the product pumped, some areas may not drain completely.

FOR PUMPS EQUIPPED WITH DRAIN PLUGS:

Refer to Section 2.0 and read sections on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORTANT WARNINGS**

AND INFORMATION before starting draining procedure.

2. Remove drain plug (G) in bottom of case (1).
3. Rotate drive shaft very slowly by hand. Each time that flow from drain increases, stop turning shaft until flow stops; then resume until flow increases again. Be sure to rotate shaft several complete revolutions in each direction until all flow from drain has stopped.
4. There are two pipe plugs (G) in the faceplate (3). Remove one that is in lowest position. Allow to drain until all flow has stopped.
5. There is a pipe plug near bottom of backplate (2). Remove plug (G) and allow to drain until all flow has stopped.
6. Reinstall and tighten pipe plugs.

3.7 INSTRUCTIONS FOR PUMP DISASSEMBLY

Refer to Section 3.14, PUMP SECTIONAL DRAWINGS.

1. Read section 2.0 on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION** before starting to disassemble pump. While disassembling pump, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required. Read Section 2.0, **REPLACEMENT PARTS**.
2. If you do not know which pump arrangement you have, collect nameplate data and refer to Section 1.0, **NAMEPLATE DATA**, to determine what you have. Consult a Roper distributor or Roper Pump Company if you have any questions.

3. When cleaning or lubricating, use only cleaning solutions and lubricants that are compatible with products being pumped and with sealing elastomers. **DO NOT** use petroleum base products with seals with EPR elastomers. Use a nonpetroleum based lubricant with EPR elastomers.
4. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of pump if there is the slightest possibility that driver may be started.
5. If used, turn off and disconnect flush from mechanical seal.
6. Close inlet and discharge valves.
7. Remove guard and disconnect coupling between driver and pump.
8. Drain inlet and discharge lines. Disconnect lines from pump inlet and discharge.
9. Follow the procedure in Section 3.6, **INSTRUCTIONS FOR DRAINING PUMP.**

10a. To continue disassembly:

For 9622 "HB," and "GHBO" pumps, follow steps 11 - 20.

For 9622 "GHB" gear reduction unit, follow steps 33 - 44.

10b. To continue disassembly:

For 9722 "HB," and "GHBO" pumps, follow steps 11 - 20.

For 9722 "BH" pumps, go to Section 3.13, **INSTRUCTIONS FOR DISASSEMBLY OF A TYPE "BH" HYDRAULIC DRIVE.** After disassembling hydraulic drive, return to this section and follow steps 11 - 20.

For 9722 "GHB" gear reduction unit, follow steps 67 - 78.

10c. To continue disassembly:

For 9622 "GHB" gear reduction unit, follow steps 31 - 42.

11. Remove ten hex head cap screws (J) securing faceplate (3) to case (1) and separate faceplate from case. Remove case gasket (33).
12. Rotate faceplate 180° and attach to ends of two bearing slugs (56, 57) using four faceplate hex head cap screws (J).
13. Using faceplate (3) as a handle, pull bearing slugs (56, 57) from case. Remove four hex head cap screws from faceplate/bearing slugs.
14. Remove idler gear/shaft (55) from case. Idler gear and shaft may be disassembled by removing retaining ring (P) from one end of gear then sliding gear off of shaft.
15. Remove drive gear (11) from case on HB and GHB pumps. Drive gear/shaft (58) will remain on BH pumps.
16. Remove drive gear key (B) from drive shaft (10) on HB and GHB pumps.
17. Remove ten hex head cap screws (J) from backplate (2) securing backplate assembly to case (1) and separate backplate assembly from case.
18. Remove two dowel pins (H) and one case gasket (33).
19. Remove drive key (A) or (Z) from drive shaft (10).

20a. To continue disassembly:

For 9622 "BH" pumps, follow steps 21 - 25.

For 9622 "HB" pumps, follow steps 26 - 32.

For 9622 "GHB" gear reduction unit, follow steps 33 - 44.

For 9622 "GHBO" pumps, follow steps 45 - 53.

200. To continue disassembly:

For 9722 "BH" pumps, follow steps 54 - 59.

For 9722 "HB" pumps, follow steps 60 - 66.

For 9722 "GHB" gear reduction unit, follow steps 67 - 78.

For 9722 "GHBO" pumps, follow steps 79 - 85.

9622 "BH" Pumps (See Figure 3.14.1)

21. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4).
22. Remove four locknuts (E) from studs (F) securing packing plate (19) and packing gland (21) in place. Remove packing plate and packing gland.
23. Remove packing rings (23) and packing washer (20). Remove lantern ring (24), if used. Packing hooks are commercially available to assist in removal of packing rings.
24. Remove backplate (2) from drive gear/shaft (58). Remove bearing slug (56 or 57). Drive gear and shaft may be disassembled by removing retaining ring (P) from one end of gear then sliding gear off of shaft. Clean drive shaft and adjacent parts. Examine drive shaft. Replace drive gear and/or shaft if excessively worn or scored.
25. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets and o-rings be installed each time pump is disassembled and reassembled.

9622 "HB" Pumps (See Figure 3.14.2)

26. Remove retaining ring (38) from bearing cage (4).
27. Loosen setscrews in ball bearing (36). Remove ball bearing.
28. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4).
29. Remove four locknuts (E) from studs (F) securing packing plate (19) and packing gland (21) in place. Remove packing plate and packing gland.
30. Remove packing rings (23) and packing washer (20). Remove lantern ring (24), if used. Packing hooks are commercially available to assist in removal of packing.
31. Remove drive shaft (10). Clean drive shaft and adjacent parts. Examine drive shaft. Replace drive shaft if excessively worn or scored.
32. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets and o-rings be installed each time pump is disassembled and reassembled.

9622 "GHB" Gear Reduction Unit (See Figure 3.14.3 and 3.14.4)

33. Drain oil from gear reduction unit.
34. Remove drive key (A). Remove four hex head cap screws (U) and four lockwashers (V). Slide seal retainer (66) assembled with lip seal (68) off end of pinion shaft (71).
35. Remove seal retainer gasket (67) between seal retainer (66) and gear case (73).
36. Remove pinion shaft (71) assembly with ball bearing (70) and retaining ring (69).

37. Remove six hex head cap screws (W), twelve flat washers (X), and six lockwashers (Y).
38. Remove gear case (73). Remove gear case gasket (77).
39. Remove needle bearing (72). This bearing is installed with a press fit.
40. Remove retaining ring (74).
41. Remove drive gear (75). A gear puller may be necessary in removing gear, as a close fit is maintained between gear and shaft.
42. Remove drive gear key (Z).
43. Remove four socket head cap screws (AD) securing cover (78) to backplate (2). Remove cover gasket (79).
44. Remove spacer (76).

9622 "GHBO" Pumps (See Figure 3.14.3)

45. Remove retaining ring (38) securing ball bearing (36) in place.
46. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4) along with bearing (36) from drive shaft (10) and backplate (2).
47. Remove bearing (36) from bearing cage (4).
48. Remove lip seal (26) from bearing cage (4). Discard lip seal since it will be damaged during disassembly.
49. Remove four locknuts (E) from studs (F) securing packing plate (19) and packing gland (21) in place. Remove packing plate and packing gland.
50. Remove packing rings (23) and packing washer (20). Remove lantern ring (24), if used. Packing hooks are commercially available to assist in removal of packing.

51. Remove drive shaft (10) from backplate (2).
52. Clean drive shaft and adjacent parts. Examine shaft. Replace drive shaft if excessively worn or scored.
53. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets, o-rings, and new lip seals be installed each time the pump is disassembled and reassembled.

9722 "BH" Pumps (See Figure 3.14.1).

54. Remove four hex head cap screws (D) securing seal retainer (13) to backplate (2).
55. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4).
56. Remove seal retainer (13) and stationary seal face (15).
57. Remove mechanical seal (35) and retaining ring (37) from drive gear/shaft (58). Remove bearing slug (56 or 57).
58. When removing following types of single seals (John Crane® Type 21, Type 8-1, Type 9; Pac-Seal® Type 21; Sealol® Type 43), clean and lubricate drive shaft prior to removing mechanical seal making sure that drive shaft is smooth and free from all burrs. Loosen setscrews (if present) on mechanical seal. Remove mechanical seal (35). Inspect sealing surfaces of stationary seal face and inspect rotating element. Replace as required. Remove retaining ring (37) from drive shaft, if applicable.
59. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets and o-ring be installed each time the pump is disassembled and reassembled.

9722 "HB" Pumps (See Figure 3.14.2)

- f Remove retaining ring (38) from bearing cage (4).
61. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4).
62. Loosen setscrews in ball bearing (36). Remove ball bearing.
63. Remove four hex head cap screws (D) securing seal retainer (13) to backplate (2). Remove seal retainer (13) and stationary seal face (15).
64. Remove drive shaft (10) along with mechanical seal (35) and retaining ring (37) from backplate (2).
65. When removing following type of single seals (John Crane® Type 21, Type 8-1, Type 9; Pac-Seal® Type 21; Sealol® Type 43), clean and lubricate drive shaft (10) prior to removing mechanical seal making sure that drive shaft is smooth and free from all burrs. Loosen setscrews (if present) on mechanical seal. Remove mechanical seal (35). Inspect sealing surfaces of stationary seal face and inspect rotating element. Replace as required. Remove retaining ring (37) from drive shaft (10), if applicable.
66. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets and o-rings be installed each time pump is disassembled and reassembled.

9722 "GHB" Gear Reduction Unit (See Figure 3.14.3 and 3.14.4)

67. Drain oil from gear reduction unit.
68. Remove drive key (A). Remove four hex head cap screws (U) and four lockwashers (V). Slide seal retainer (66) assembled with lip seal (68) off end of pinion shaft (71).

69. Remove seal retainer gasket (67) between seal retainer (66) and gear case (73).
70. Remove pinion shaft (71) assembly with ball bearing (70) and retaining ring (69).
71. Remove six hex head cap screws (W), twelve flat washers (X), and six lockwashers (Y).
72. Remove gear case (73). Remove gear case gasket (77).
73. Remove needle bearing (72). This bearing is installed with a press fit.
74. Remove retaining ring (74).
75. Remove drive gear (75). A gear puller may be necessary in removing gear, as a close fit is maintained between gear and shaft.
76. Remove drive gear key (Z).
77. Remove four socket head cap screws (AD) securing cover (78) to backplate (2). Remove cover gasket (79).
78. Remove spacer (76).

9722 "GHBO" Pumps (See Figure 3.14.3)

79. Remove retaining ring (38) securing ball bearing (36) in place.
80. Remove four hex head cap screws (L) securing bearing cage (4) to backplate (2) and remove bearing cage (4) along with bearing (36) from drive shaft (10) and backplate (2).
81. Remove bearing (36) from bearing cage (4).
82. Remove lip seal (26) from bearing cage (4). Discard lip seal since it will be damaged during disassembly.
83. Remove four hex head cap screws (L) securing seal retainer to backplate (13). Remove seal retainer (13) and stationary seal face.
84. When removing following type of single seals (John Crane® Type 21, Type 8-1, Type 9; Pac-Seal® Type 21; Sealol® Type 43), clean and lubricate drive shaft (10) prior to removing mechanical seal making sure that drive shaft is smooth

and free from all burrs. Loosen setscrew (if present) on mechanical seal. Remove mechanical seal (35). Inspect sealing surfaces of stationary seal face and inspect rotating element. Replace as required. Remove retaining ring (37) from drive shaft (10), if applicable.

85. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets, o-rings, and new lip seals be installed each time pump is disassembled and reassembled.

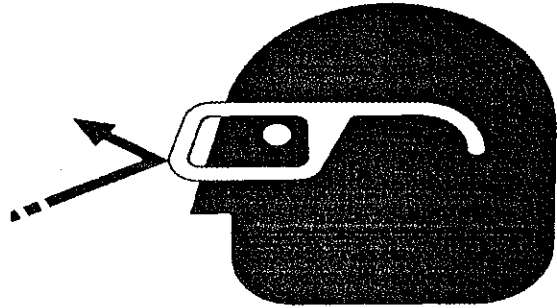
3.8 BEARING REMOVAL AND INSTALLATION

BEARING REMOVAL

Standard pump bearings are carbon. These bearings are a slip fit in the case bores and should slide out easily. If bearings are stuck, it may be necessary to press them out of the case. Both endplates must be removed and the case placed under a press with the drive shaft end down. Support the end of the case while allowing ample clearance for the bearings and gears to be pressed out the bottom end. Lay a heavy piece of wood across both bearings so that drive and idler are pressed out at the same time.

Carbon bearings may also be removed by carefully chipping the bearing out with a chisel. Take care not to scar the case bores during the bearing removal process.

! WARNING



WARNING! DO NOT chisel bearings without wearing proper safety glasses.

After removing the bearings, always check the endplate bores for nicks and burrs caused by the removal process. The bores must be clean, smooth, and free of burrs before attempting to install new bearings.

BEARING INSTALLATION

Refer to Section 3.10, INSTRUCTIONS FOR PUMP ASSEMBLY.

3.9 DIMENSIONAL DATA FOR INTERNAL PARTS

Nominal dimensions are given below. With the exception of gasket thickness and lateral clearance, your actual measurements should not vary from these numbers by no more than .002". Use properly calibrated measuring equipment when measuring parts.

ITEM	
Shaft O.D.	1.249
Case Bores	3.849
Gear O.D.	3.8335
Gear O.D. to Case Bore Dia. Clearance	.0155
Brg. Slug O.D.	3.8462
Case Bore to Brg. Slug O.D. Dia. (Clearance)	.0028
Brg. Slug I.D.	1.253
Shaft to Carbon Brg. Dia. Clearance	.004
Width of Brg.Slug.	2.497
Case Width	10.984
Gasket Thickness (one)	.01
Compressed Gasket Thickness (two)	.016
Gear Face Width	5.997
eral Clearance (two compressed gaskets)	.009

3.10 INSTRUCTIONS FOR PUMP ASSEMBLY

Refer to Section 3.14, PUMP SECTIONAL DRAWINGS.

Refer to Section 3.4, DIRECTION OF ROTATION AND RELIEF VALVE, to assure proper configuration for pump rotation, port location, and relief valve position prior to assembling pump.

1. Refer to Section 2.0 and read instructions on REPLACEMENT PARTS, THREADED PORT CONNECTIONS, SHAFT SEALING, and SAFETY PRECAUTIONS before assembling pump. Visually inspect all parts during assembly. Replace all worn or damaged parts. Although they may appear reusable, it is recommended that new gaskets, o-rings, and lip seals be

installed when pump is being reassembled.

- **WARNING!** Only use genuine Roper gaskets. Gasket thickness determines proper clearances. Always check quantity of gaskets removed and replace with exact quantity. Proper material must be used based on application.
2. When cleaning or lubricating, only use products that are compatible with product being pumped and elastomers within pump. **DO NOT** use petroleum base products with seals with EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers.
 3. Mechanical seals are precision pieces of equipment. Use extreme care not to damage seal faces or elastomers during assembly.
 4. Install two dowel pins (H) on backplate end of case (1).
 5. Install bearing slug (56, 57) in backplate end of bottom bore of case (1). Note: Grooved face of bearing slug must be toward inside of case. The face groove must be positioned opposite inlet side of case (1). You will find the word "INLET" on inlet side of case. An alignment tool may be purchased from your Roper Pump Company distributor to aid in assembly. **NEVER** force the bearing slug. If bearing slug is tight, check case for burrs or raised edges. Stone or lightly file to remove burrs or raised edges. Slide bearing slug into case until approximately 1/4 inch remains exposed.
 6. Install bearing slug (56 or 57) in top bore on backplate end of case in same manner as before. Slide bearing slug into case until approximately 1/4 inch remains exposed.
 7. Place one case gasket (33) in position on backplate end of case (1). Use ends of

of bearing slugs (56, 57) and dowel pins (H) to hold in proper position.

8. Align backplate (2) on dowel pins (H) and secure with ten hex head cap screws (J).
9. Install retaining ring (P) onto idler shaft. Place idler gear key (Q) in idler shaft keyway. Slide idler gear onto idler shaft and install second retaining ring (P) onto idler shaft. Place idler gear/shaft (55) into case bore.
- 10a. For 9622 "BH" pump with shaft packing, follow steps 11 - 25.

For 9622 "HB" pump with shaft packing, follow steps 26 - 40.

For 9622 "GHBO," and "GHB" pumps with shaft packing, follow steps 41 - 56.
- 10b. For 9722 "BH" pump with a standard positive drive mechanical seal, follow steps 66 - 83.

For 9722 "HB" pumps with a standard positive drive mechanical seal, follow steps 84 - 101.

For 9722 "GHBO," and "GHB" with a standard positive drive mechanical seal, follow steps 102 - 119.

9622 "BH" PUMPS (See Figure 3.14.1)

11. Install retaining ring (P) onto drive shaft. Place drive gear key (B) in drive shaft keyway. Slide drive gear onto drive shaft and install second retaining ring (P) onto drive shaft. Slide drive gear/shaft (58) into case bore from faceplate end
12. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.
13. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.
14. Align faceplate (3) on end of case (1).
15. Secure with ten hex head cap screws (J).
16. If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.
17. Install packing washer (20) over drive shaft and into packing bore of backplate (2).
18. Install packing rings (23) and lantern ring (24), if used, in backplate bore. Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
19. Check drive shaft for free movement after each ring is installed.
20. When packing box is sufficiently full to allow entry of packing gland (21) about 1/4 of an inch [6 mm], reassemble packing gland.
21. Install studs (F) into backplate (2). Insert packing gland (21) into packing box about 1/4 of an inch [6 mm]. Using four locknuts (E), secure packing gland (21) in place. Draw locknuts up evenly on packing gland to assure proper seating of packing (23), then loosen locknuts (E) about 1/2 turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
22. Attach bearing cage (4) to backplate (2) using four hex head cap screws (L).
23. Install drive key (Z).
24. For 9622 "BH" hydraulic drive assembly, go to Section 3.12, **INSTRUCTIONS FOR ASSEMBLY OF A TYPE "BH" HYDRAULIC DRIVE**.
25. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION**,

**INSTALLATION OF PIPES,
PREOPERATION CHECKS, SHAFT
SEALING, and ALIGNING DRIVER AND
PUMP before installing and operating
pump.**

9622 "HB" Pumps (See Figure 3.14.2)

26. Install key (B) on drive shaft (10). Slide drive gear (11) onto drive shaft.
27. Slide drive gear (11) assembled with drive shaft (10) into case bore from faceplate end.
28. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.
29. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.
30. Align faceplate (3) on end of case (1) and secure with ten hex head cap screws (J).

If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.

32. Install packing washer (20) over drive shaft (10) into packing bore of backplate (2).
33. Install packing rings (23) and lantern ring (24), if used, in packing bore of backplate. Stagger joints on each ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
34. Check drive shaft (10) for free movement after each ring is installed.
35. When packing box is sufficiently full to allow entry of packing gland (21) about 1/4 of an inch [6 mm], reassemble packing gland.

36. Install studs (F) into backplate (2). Insert packing gland (21) into packing box about 1/4 of an inch [6 mm]. Using four locknuts (E), secure packing gland (21) in place. Draw locknuts up evenly on packing gland to assure proper seating of packing (23), then loosen locknuts (E) about 1/2 turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.

37. Attach bearing cage (4) to backplate (2) using four hex head cap screws (L).

38. Install ball bearing (36) on drive shaft (10) and into bearing cage (4) as shown in the sectional drawing (Figure 3.14.2). **DO NOT** strike the outer race of the bearing or the grease seal just inside the outer race. This could damage the bearing. The bearings are prelubricated and **DO NOT** require lubrication at time of initial installation. A small amount of a good quality bearing grease will be required during regular maintenance. Align setscrews in inner race of ball bearing with wide groove in shaft. Tighten setscrews in ball bearing (36) to secure bearing to drive shaft (10). Install retaining ring (38) into bearing cage (4) to secure ball bearing (36) to bearing cage.

39. Install drive key (A).

40. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING, and ALIGNING DRIVER AND PUMP** before installing and operating pump.

9622 "GHBO" and "GHB" Pumps (See Figure 3.14.3)

41. Install key (B) on drive shaft (10). Slide drive gear (11) onto drive shaft.
42. Slide drive gear (11) assembled with drive shaft (10) into case bore from faceplate end.

43. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.
 44. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.
 45. Align faceplate (3) on end of case (1) and secure with ten hex head cap screws (J).
 46. If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.
 47. Install packing washer (20) over drive shaft (10) into packing bore of backplate.
 48. Install packing rings (23) and lantern ring (24), if used, in packing bore of backplate. Stagger joints on each ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
 49. Check drive shaft (10) for free movement after each ring is installed.
 50. When packing box is sufficiently full to allow entry of packing gland (21) about 1/4 of an inch [6 mm], reassemble packing gland.
 51. Install four studs (F) into backplate (2). Insert packing gland (21) into packing box about 1/4 of an inch [6 mm]. Using four locknuts (E), secure packing gland (21) in place. Draw locknuts up evenly on packing gland to assure proper seating of packing (23), then loosen locknuts (E) about 1/2 turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
 52. Attach bearing cage (4) to backplate (2) using four hex head cap screws (L).
 53. Install lip seal (26) in bearing cage (4).
 54. Install ball bearing (36) on drive shaft (10) and into bearing cage (4) using retaining ring (38) to secure ball bearing (36) in place as shown in the sectional drawing (Figure 3.14.3). The fit between the drive shaft and ball bearing may be a light press fit. **DO NOT** strike or press on the outer race of the bearing. This could damage the bearing.
 55. Install spacer (47).
 56. For 9622 "GHB" gear reduction unit, follow steps 57 - 65.
- 9622 "GHB" Gear Reduction Unit (See Figure 3.14.4)**
57. Install cover gasket (79) and cover (78) on bearing cage (4) using four socket head cap screws (AD).
 58. Install key (Z) in keyway of drive shaft (10). Place drive gear (75) on drive shaft (10). Secure in place using retaining ring (74).
 59. Install needle bearing (72). The needle bearing is a press fit in bore.
 60. Install gear case (73) and gear case gasket (77) using six hex head cap screws (W), twelve flat washers (X), and six lockwashers (Y).
 61. Press ball bearing (70) onto pinion shaft (71) and install retaining ring (69).
 62. Install pinion shaft assembly by sliding small end of pinion shaft into needle bearing (72) at same time gears are meshed together.
 63. Slide bearing retainer (66) assembled with lip seal (68) and bearing retainer gasket (67) into place. Secure bearing retainer (66) to gear case (73) using four hex head cap screws (U) and four lockwashers (V).
 64. Install drive key (A).

65. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING, and ALIGNING DRIVER AND PUMP** before installing and operating pump.

9722 "BH" Pumps (Standard Positive Drive Mechanical Seal) (See Figure 3.14.1)

66. Install retaining ring (P) onto drive shaft. Place drive gear key (B) in drive shaft keyway. Slide drive gear onto drive shaft and install second retaining ring (P) onto drive shaft. Slide drive gear/shaft (58) into case bore from faceplate end.

67. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.

68. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.

69. Align faceplate (3) on end of case (1).

70. Secure with ten hex head cap screws (J).

71. If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.

72. Install four studs (F) into backplate (2).

73. Install retaining ring (37) on drive shaft to locate mechanical seal.

74. Carefully remove all burrs and sharp edges on shaft over which rotating element of seal will slide.

75. Apply a compatible lubricant to seal I.D. and to O.D. of drive shaft.

76. Slide rotating element of mechanical seal (35) onto drive shaft before removing

three or four clips that are taped to rotating element. Push rotating element back to entrance of seal chamber. Remove clips that are taped to seal. Slide rotating element back to retaining ring (37). Tighten setscrews in seal by accessing through NPT hole in top of backplate (2).

77. Slide o-ring (45) onto stationary seal face (15).

78. Slide stationary seal face over drive shaft and into front of seal chamber in backplate (2).

79. Slide seal retainer (13) over shaft and against stationary seal face (15) and secure with four locknuts (E). Tighten evenly.

80. Attach bearing cage (4) to backplate (2) using four hex head cap screws (L).

81. Install drive key (A).

82. For 9722 "BH" hydraulic drive assembly, go to Section 3.12, **INSTRUCTIONS FOR ASSEMBLY OF A TYPE "BH" HYDRAULIC DRIVE.**

83. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING, and ALIGNING DRIVER AND PUMP** before installing and operating pump.

9722 "HB" Pumps (Standard Positive Drive Mechanical Seal) (See Figure 3.14.2)

84. Install key (B) on drive shaft (10). Slide drive gear (11) onto drive shaft.

85. Slide drive gear (11) assembled with drive shaft (10) into case bore from faceplate end.

86. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.
 87. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.
 88. Align faceplate (3) on end of case (1) and secure with ten hex head cap screws (J).
 89. If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.
 90. Install four studs (F) into backplate (2).
 91. Install retaining ring (38) on drive shaft (10) to locate mechanical seal.
 92. Carefully remove all burrs and sharp edges on shaft over which rotating element of seal will slide.
 93. Apply a compatible lubricant to seal I. D. and to O. D. of drive shaft (10).
 94. Slide rotating element of mechanical seal (35) onto drive shaft (10) before removing three or four clips that are taped to rotating element. Push rotating element back to entrance of seal chamber. Remove clips that are taped to seal. Slide rotating element back to retaining ring (37). Tighten setscrews in seal by accessing through NPT hole in top of backplate (2).
 95. Slide o-ring (45) onto stationary seal face (15).
 96. Slide stationary seal face over shaft (10) and into front of seal chamber in backplate (2).
 97. Slide seal retainer (13) over shaft and against stationary seal face (15) and secure with four locknuts (E). Tighten evenly.
 98. Attach bearing cage (4) to backplate (2) using four hex head cap screws (L).
 99. Install ball bearing (36) on drive shaft (10) and into bearing cage (4) as shown in the sectional drawing (Figure 3.14.2). **DO NOT** strike the outer race of the bearing or the grease seal just inside the outer race. This could damage the bearing. The bearings are prelubricated and **DO NOT** require lubrication at time of initial installation. A small amount of a good quality bearing grease will be required during regular maintenance. Align setscrews in inner race of ball bearing with wide groove in shaft. Tighten setscrews in ball bearing (36) to secure bearing to drive shaft (10). Install retaining ring (38) into bearing cage (4) to secure ball bearing (36) to bearing cage.
 100. Install drive key (A).
 101. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING, and ALIGNING DRIVER AND PUMP** before installing and operating pump.
- “GHBO” and “GHB” Pumps (Standard Positive Drive Mechanical Seal) (See Figure 3.14.3)**
102. Install key (B) on drive shaft (10). Slide drive gear (11) onto drive shaft.
 103. Slide drive gear (11) assembled with drive shaft (10) into case bore from faceplate end.
 104. Install bearing slugs (56, 57) in faceplate end of case in same manner as described in steps 5 and 6.
 105. Place appropriate number of case gaskets (33) on faceplate end of case (1). Use ends of bearing slugs (56, 57) to hold in proper position.

106. Align faceplate (3) on end of case (1) and secure with ten hex head cap screws (J).
107. If pump turns freely at this point, continue with assembly. If pump does not turn freely, remove faceplate and/or backplate to make sure that gasket has not slipped between endplate and end of bearing slug.
108. Install four studs (F) into backplate (2).
109. Install retaining ring (38) on drive shaft (10) to locate mechanical seal.
110. Carefully remove all burrs and sharp edges on shaft over which rotating element of seal will slide.
111. Apply a compatible lubricant to seal I.D. and to O.D. of drive shaft (10).
112. Slide rotating element of mechanical seal (35) onto drive shaft (10) before removing three or four clips that are taped to rotating element. Push rotating element back to entrance of seal chamber. Remove clips that are taped to seal. Slide rotating element back to retaining ring (37). Tighten setscrews in seal by accessing through NPT hole in top of backplate (2).
113. Slide o-ring (45) onto stationary seal face (15).
114. Slide stationary seal face over shaft (10) and into front of seal chamber in backplate (2).
115. Slide seal retainer (13) over shaft and against stationary seal face (15) and secure with four locknuts (E). Tighten evenly.
116. Install lip seal (26) in bearing cage (4).
117. Install ball bearing (36) on drive shaft (10) and into backplate (2) using retaining ring (38) to secure ball bearing (36) in place as shown in the sectional drawing (Figure 3.14.3). The fit between

the drive shaft and ball bearing may be a light press fit. **DO NOT** strike or press on the outer race of the bearing. This could damage the bearing.

118. Install spacer (47).
119. For 9722 "GHB" gear reduction unit, follow the same steps used for the 9622 "GHB" pump, steps 57 - 65.

3.11 INSTRUCTIONS FOR DISASSEMBLY OF A TYPE "BH" HYDRAULIC DRIVE

Refer to Section 3.14, PUMP SECTIONAL DRAWINGS.

1. Refer to Section 3.14 and read sections on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION** before starting to disassemble hydraulic drive components from pump. While disassembling, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required. Read Section 2.0, **REPLACEMENT PARTS**.
2. Turn off pump and lock out energy source to hydraulic motor. **DO NOT** proceed further with disassembly of the pump if there is the slightest possibility that the hydraulic motor may be started.
3. Close inlet and discharge valves.
4. If pump is to be disassembled:
 - A. Refer to Section 3.14 (Figure 3.14.1 and 3.14.5) pump sectional drawing for "BHFRV."
 - B. If used, turn off and disconnect flush for packing or mechanical seal.
 - C. To drain pump, follow the procedures in Section, 3.6, **INSTRUCTIONS FOR DRAINING PUMP**.

- D. Disconnect lines from pump inlet and discharge.
5. Remove two or four cap screws securing hydraulic motor to bracket (61).
 6. Slide hydraulic motor out of bracket. The rigid coupling (62) is a slip fit on both shafts; therefore, it may remain on pump shaft or motor shaft.
 7. Remove four socket head cap screws (64) securing bracket (61) to backplate (2). Remove bracket.
 8. For further disassembly of the pump, refer to Section 3.7, **INSTRUCTIONS FOR PUMP DISASSEMBLY**, steps 1 through 20. Also, refer to steps 21 through 32 for pumps with packing, or steps 54 through 59 for pumps with mechanical seals.

3.12 INSTRUCTIONS FOR ASSEMBLY OF A TYPE "BH" HYDRAULIC DRIVE

1. Refer to Section 3.14, **PUMP SECTIONAL DRAWINGS**, (Figure 3.14.1), for 9622-9722 "BHFRV" for pump assembly. If pump requires assembly, refer to Section 3.10, **INSTRUCTIONS FOR PUMP ASSEMBLY**, steps 1 through 10. Also, refer to steps 11 through 25 for pumps with packing, or steps 66 through 83 for pumps with mechanical seals.
2. Refer to Section 3.14, (Figure 3.14.5), sectional drawing for TYPE "BH" **HYDRAULIC DRIVE COUPLING ASSEMBLY** for assembly of bracket and coupling.
3. Install retaining ring (63) in rigid coupling (62).
4. Install key (Z) in pump shaft keyway. Slide rigid coupling (62) onto shaft until end of the shaft is against retaining ring (63).

5. Place bracket (61) onto pilot of backplate (6A, B). Secure bracket with four socket head cap screws (64).
6. Slide rigid coupling (62) back until outboard end of coupling is even with outboard end of bracket (61).
7. Install key in hydraulic motor shaft. Line up shaft key and rigid coupling keyway and slide units together. Rotate hydraulic motor to align motor mounting holes and secure motor with two or four cap screws as required.
8. Refer to Section 2.0 and read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, and SHAFT SEALING** before installing and operating pump.

3.13 GEAR REDUCTION UNIT

ALIGNING GHB PINION SHAFT HEIGHT

Refer to Section 3.14, **PUMP SECTIONAL DRAWINGS-GEAR REDUCTION ASSEMBLY**, (Figure 3.14.4).

The pinion shaft of the GHB gear reducer can be positioned at any location over a full 360°. This must be done before the gear reducer oil is added. The pinion shaft can be positioned in the following manner.

1. Loosen six hex head cap screws (W).
2. Rotate gear case (73) on six slots in cover (78).
3. If pinion shaft (71) cannot be moved to proper position at this point, remove six hex head cap screws (W) along with washers (X and Y).
4. Rotate pinion shaft to desired position and reinstall and tighten six hex head cap screws (W) along with six flat washers (X) and six lockwashers (Y).

5. If six threaded holes in gear case (73) are not fully visible within cast slots on cover (78), gear reducer will have to be partially disassembled so that cover (78) can be rotated.
6. Slide gear case (73) off of cover (78).
7. Remove retaining ring (74) from end of pump drive shaft (10).
8. Remove drive gear (75). A gear puller may be necessary.
9. Remove four socket head cap screws (AD).
10. Rotate cover (78) 90° and reinstall and tighten four socket head cap screws.
11. Install drive gear (75) on drive shaft (10).
12. Install retaining ring (74).
13. Replace gasket (77) and slip gear case (73) complete with pinion assembly onto cover (78).
14. Rotate pinion to desired position and install and tighten six hex head cap screws (W) along with six flat washers (X) and six lockwashers (Y).
15. If necessary, reposition plugs (AA), petcock (AC), and oil cup (AB). Oil cup should be at uppermost point and petcock at second hole from bottom.
16. Refill with oil to level of petcock (AC) Mobil 600W Cylinder Oil, or AGMA No. 7 compounded oil.

LUBRICATION INSTRUCTIONS FOR INITIAL STARTUP

The oil cup (AB) is shipped separate to prevent breakage. Before placing the gear reduction unit in operation, install oil cup (AB) and check the oil level in unit. The oil level should be maintained even with petcock (AC) all times.

SERVICING INSTRUCTIONS

The oil should be clean and free from sludge at all times and should be changed at regular intervals. A drain plug (AA) has been provided near the bottom of the gear case (73) for this purpose. The oil (Mobil® 600W Cylinder Oil, or AGMA No. 7 compounded oil) should be changed every 1000 hours or every four months, whichever comes first. Where operating conditions are severe, such as rapid rise and fall of temperature, or the atmosphere is moist or dusty, it may be necessary to change the oil every one or two months or sooner. The oil cup (AB) at the front of gear case (73) is for filling the unit with oil and also serves as a breather. **DO NOT** allow oil cup (AB) to become clogged. This could cause excessive pressure inside the gear case (73).

CHANGING RATIO OF GEAR REDUCTION UNIT

Refer to appropriate sectional drawing (Figure 3.14.4) showing internal construction of the gear reduction assembly. The internal construction for all ratios are identical, except for the drive gear (75) and pinion shaft (71), which determines the gear ratio of that particular unit. The drive gear (75) and pinion shaft (71) are interchangeable in pairs only. See **GEAR RATIO CHART** for ratios available. It is recommended that new gaskets (67, 77) and new lip seal (68) be installed each time unit is disassembled and reassembled.

1. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of gear reduction unit if there is slightest possibility that driver may be started.
2. Drain oil from gear reduction unit.
3. If unit is assembled on a baseplate, directly connected to a motor, it will be necessary to remove flexible coupling as follows:
 - A. Loosen setscrew on motor half of coupling.

- B. Slide motor coupling half towards motor to clear pump coupling half. (In case coupling cannot be removed in this manner, it will be necessary to remove either motor or pump in order to remove pump coupling half).
4. Loosen six hex head cap screws (W) and rotate gear case (73) in slots provided until pump coupling half is clear of motor coupling half.
 5. Remove pump coupling half.
 6. Remove drive key (A). Remove four hex head cap screws (U) and four lockwashers (V). Slide seal retainer (66) assembled with lip seal (68) off the end of pinion shaft (71).
 7. Remove seal retainer gasket (67) between seal retainer (66) and gear case (73).
 8. Remove pinion shaft (71) assembly with ball bearing (70) and retaining ring (69).
 9. Remove six hex head cap screws (W), twelve flat washers (X) and six lockwashers (Y).
 10. Remove gear case (73). Remove gear case gasket (77).
 11. Remove retaining ring (74).
 12. Remove drive gear (75). A gear puller may be necessary in removing gear, as a close fit is maintained between gear and shaft.
 13. Refer to gear ratio chart to select desired gear ratio.
 14. Slide drive gear (75) on drive shaft (10) securing in place using retaining ring (74). Make sure key (Z) and spacer (76) are in place. The number of teeth is stamped on drive gear (75).
 15. Install gear case (73) and gear case gasket (77) using six hex head cap screws (W), twelve flat washers (X), and six lockwashers (Y).
 16. Press ball bearing (70) onto pinion shaft (71) and install retaining ring (69). **DO NOT** strike or press on the outer race of the bearing. This could damage the bearing.
 17. Install pinion shaft assembly by sliding small end of pinion shaft into needle bearing (72) at same time gears are meshed together.
 18. Slide bearing retainer (66) assembled with lip seal (68) and bearing retainer gasket (67) into place. Secure bearing retainer (66) to gear case (73) using four hex head cap screws (U) and four lockwashers (V).
 19. Install drive key (A).
 20. Install pump coupling half and tighten setscrews on drive key (A).
 21. Rotate gear case (73) until coupling halves are accurately aligned. Tighten six hex head cap screws (W). Assemble coupling and tighten setscrew in motor coupling half.
 22. Refill with oil to level of petcock (AC) using Mobil® 600W Cylinder Oil, or AGMA No. 7 compounded oil.

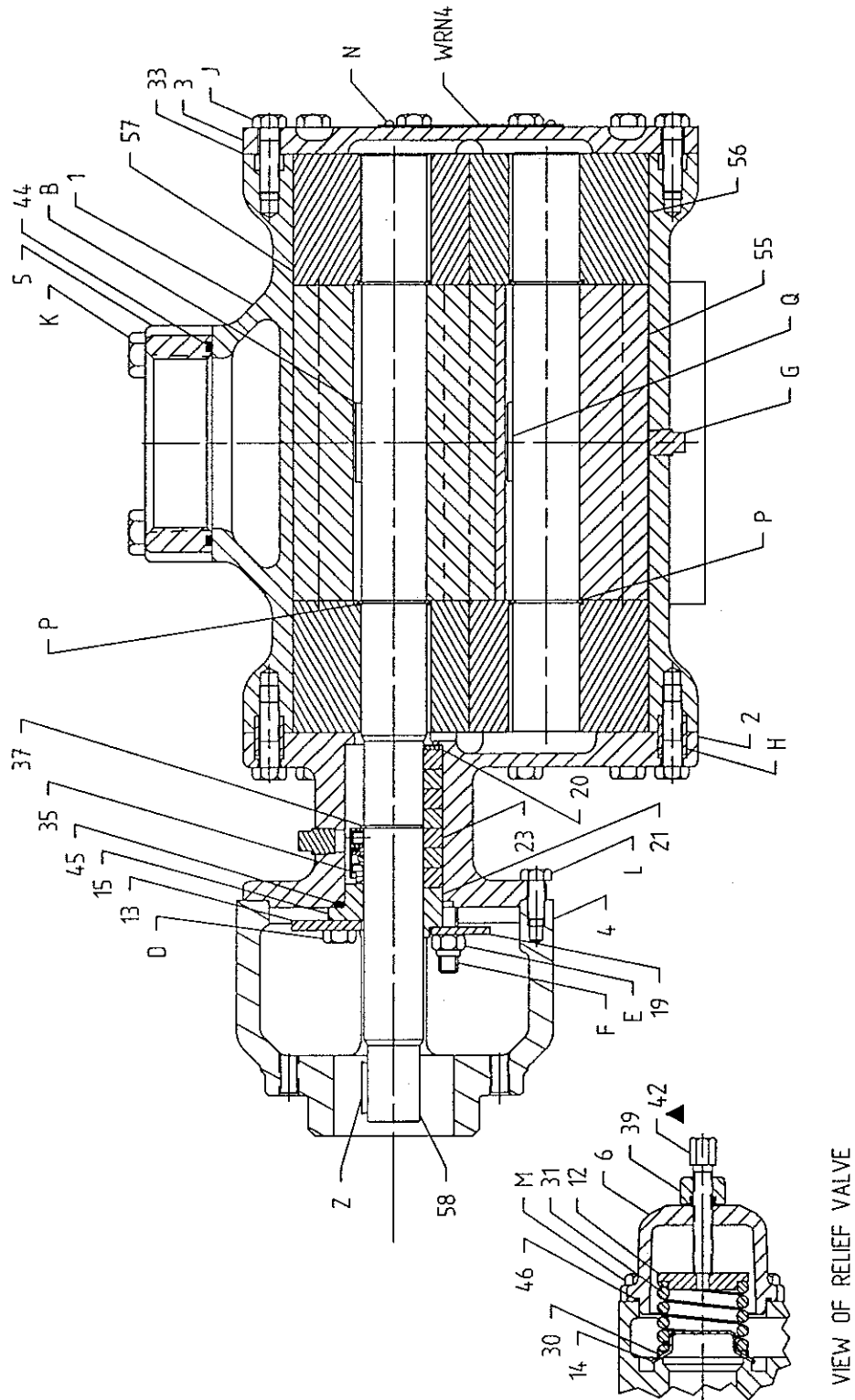
GEAR REDUCTION RATIOS AND CAPABILITIES

Gear reducers are rated to transmit up to the horsepower's (kW) shown below. Three interchangeable gear ratios are available.

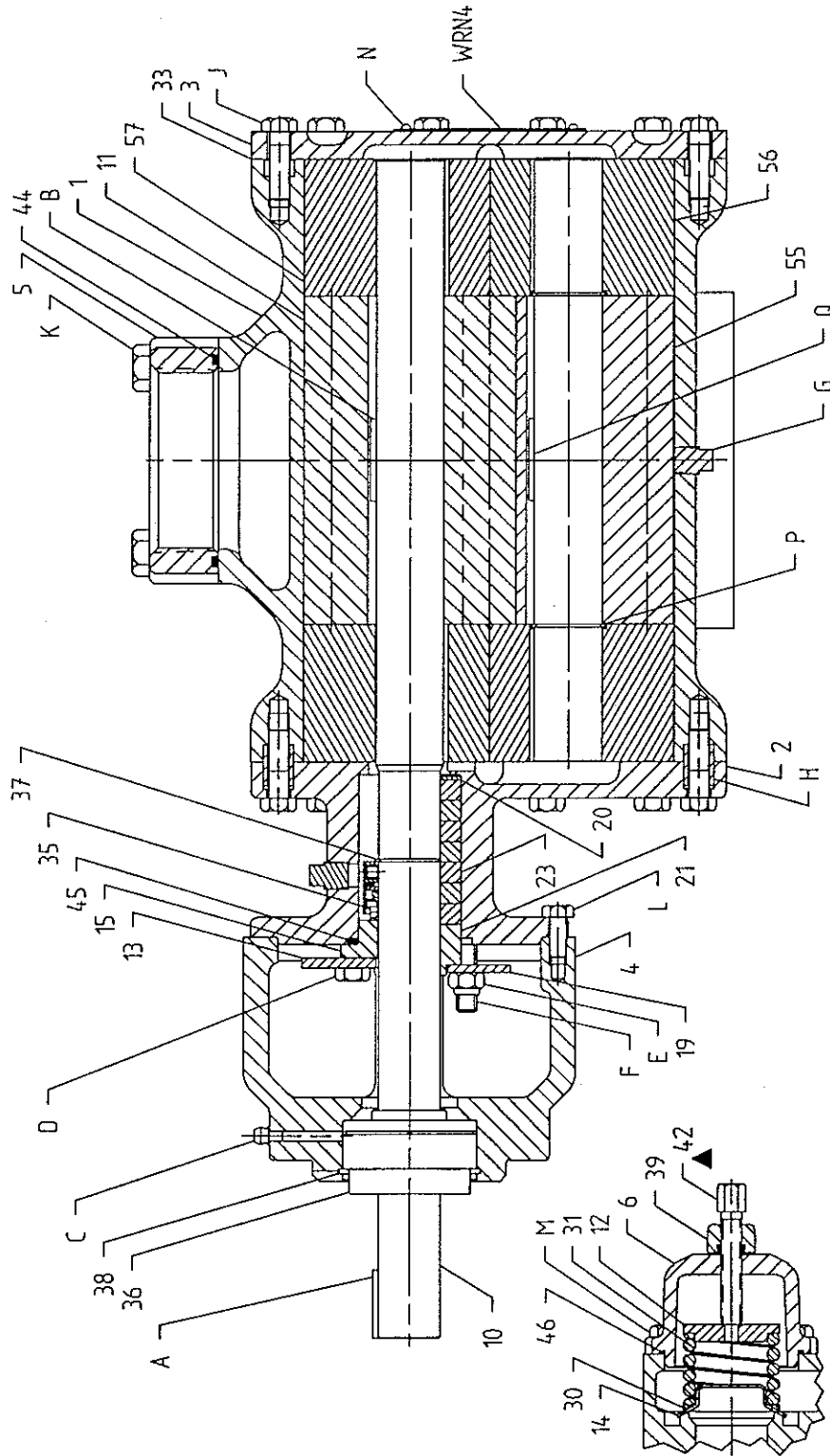
GEAR RATIO CHART

				60 HZ OPERATION			50 HZ OPERATION		
PUMP MODELS	GEAR RATIOS	NUMBER OF TEETH		MOTOR RPM	PUMP RPM	MAX. HP ALLOWED	MOTOR RPM	PUMP RPM	MAX. KW ALLOWED
		HIGH SPEED GEAR	LOW SPEED GEAR						
9622	4.60:1	15	69	580	126	2.8	485	105	1.7
	3.94:1	17	67		147	3.3		123	2.2
	3.20:1	20	64		181	4.0		152	2.7
	4.60:1	15	69	870	189	4.2	730	159	2.8
	3.94:1	17	67		221	4.9		185	3.3
	3.20:1	20	64		272	6.1		228	4.0
through 9722	4.60:1	15	69	1150	250	5.5	950	206	3.6
	3.94:1	17	67		290	6.5		241	4.3
	3.20:1	20	64		360	8.0		296	5.3
	4.60:1	15	69	1750	380	8.5	1450	315	5.6
	3.94:1	17	67		445	10.0		368	6.6
	3.20:1	20	64		545	10.0		453	6.6
4.60:1	15	69	3450	750	10.0	2850	620	6.6	

3.14 PUMP SECTIONAL DRAWINGS

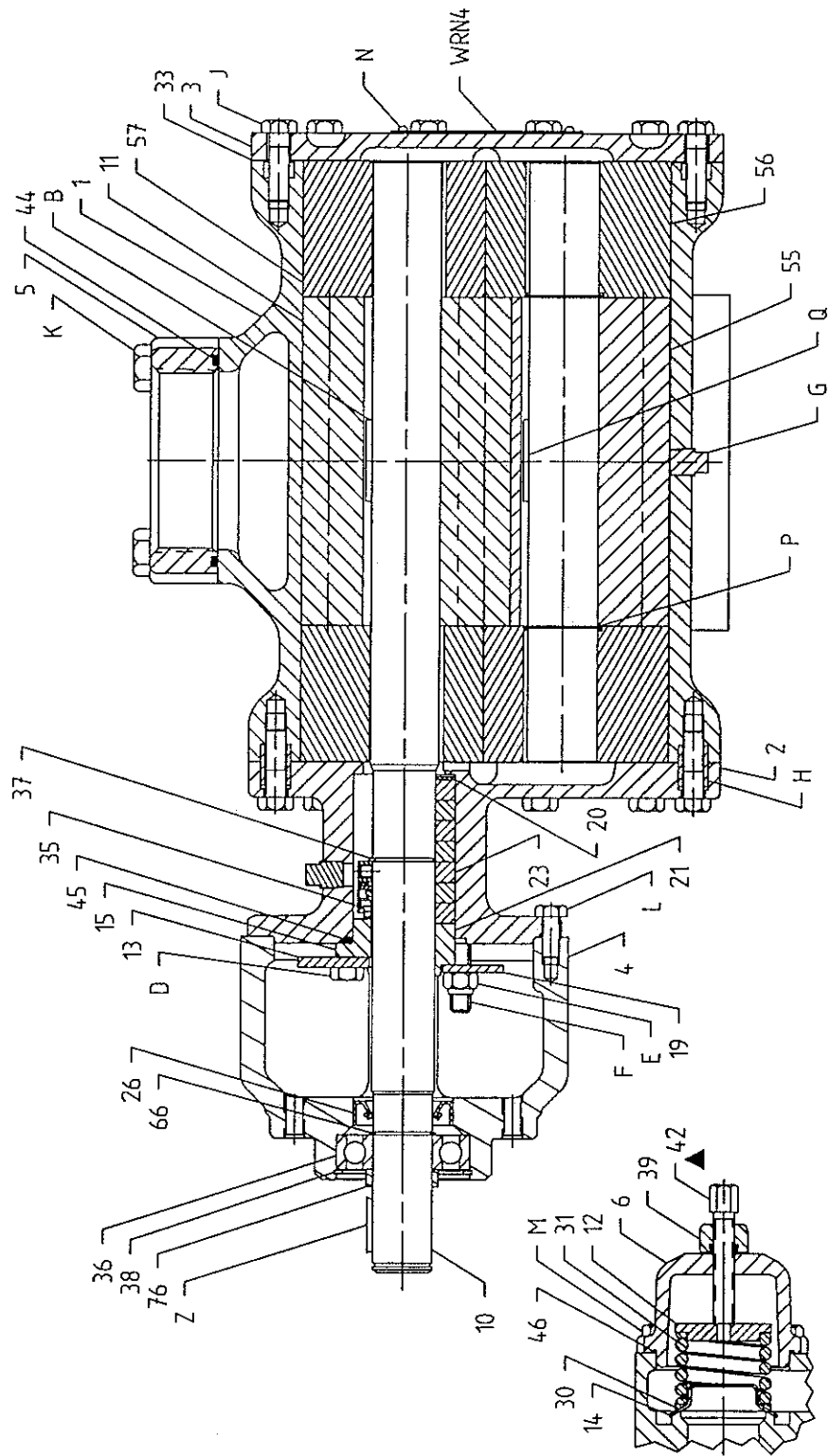


BHFRV
FIGURE 3.14.1



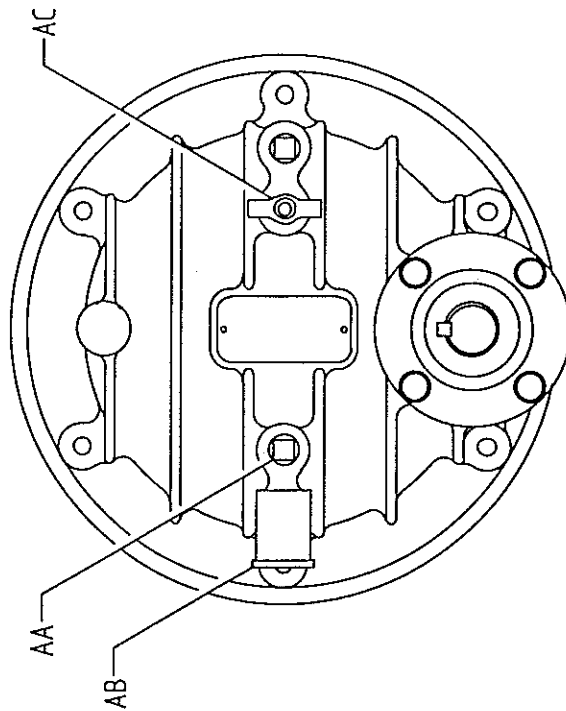
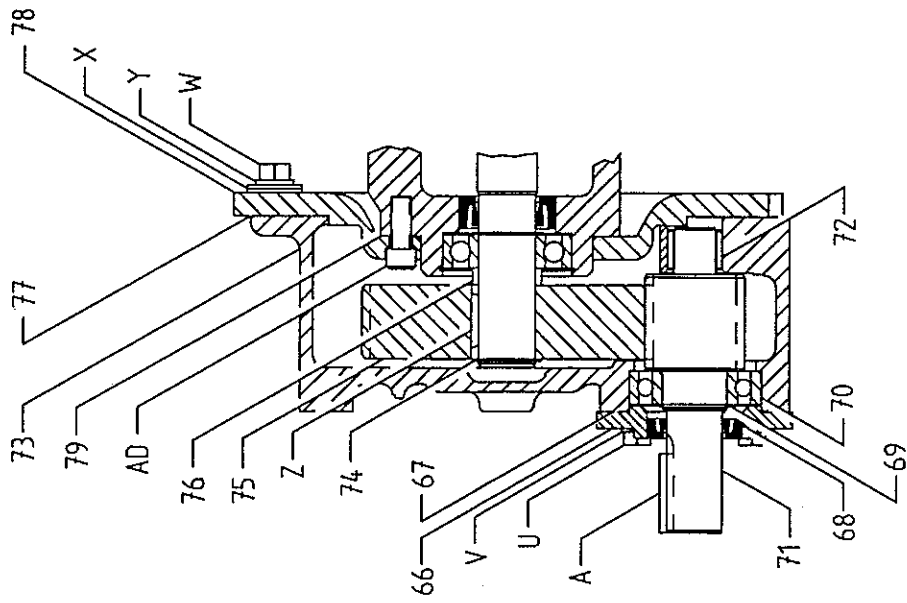
HBFRV
 FIGURE 3.14.2

VIEW OF RELIEF VALVE

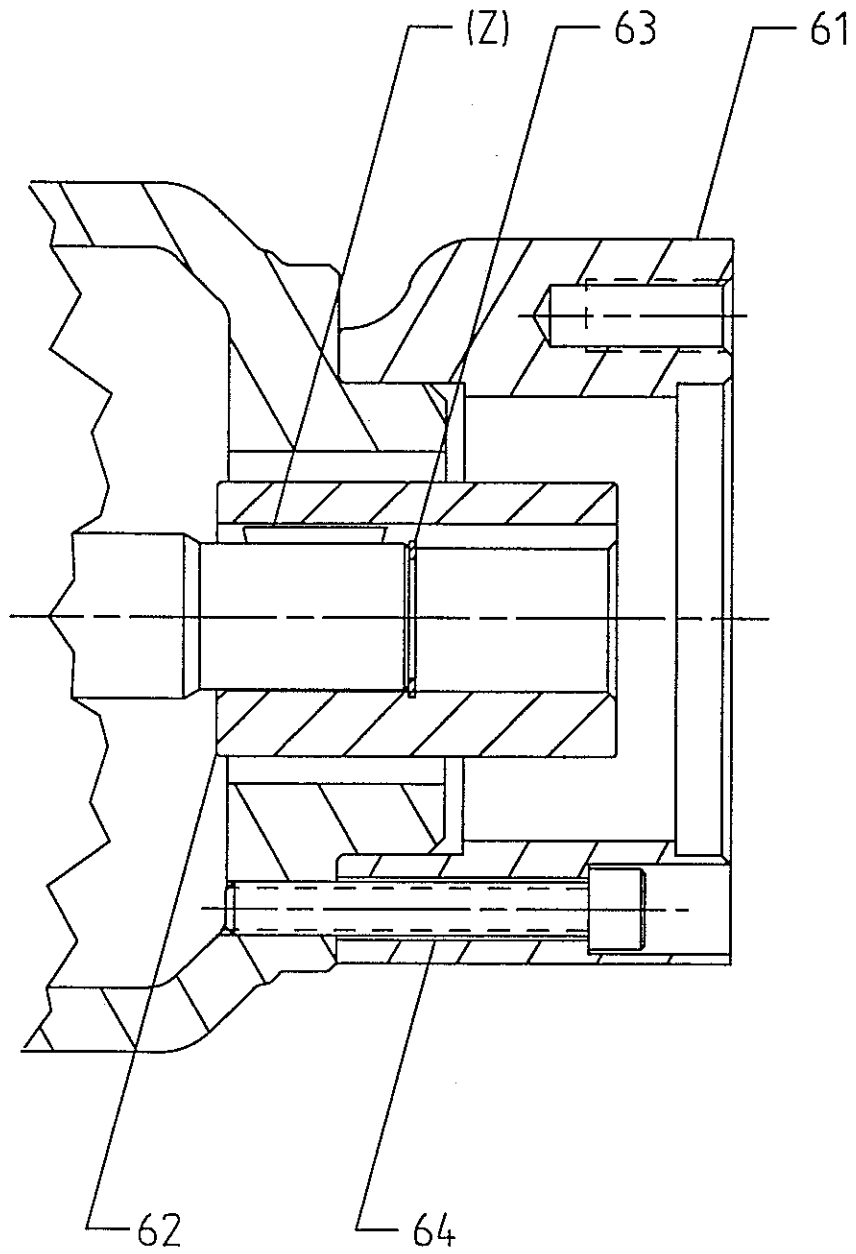


VIEW OF RELIEF VALVE

GHBFORV
FIGURE 3.14.3



GEAR REDUCTION ASSEMBLY
FIGURE 3.14.4



TYPE BH
HYDRAULIC DRIVE COUPLING ASSEMBLY
FIGURE 3.14.5

3.15 PARTS LIST

1. Case
2. Backplate
3. Faceplate
4. Bearing Cage
5. Flange
6. Relief Valve Cap
10. Drive Shaft
11. Drive Gear
12. Spring Guide
13. Seal Retainer
14. Poppet
15. Stationary Seat
19. Adjusting Plate, Packing
20. Packing Washer
21. Packing Gland
23. Packing Set
24. Lantern Ring (Not Shown)
26. Lip Seal (GHB and GHBO only)
30. Poppet Adapter
31. Spring
33. Case Gasket
35. Mechanical Seal, Rotating
36. Ball Bearing
37. Retaining Ring, Mechanical Seal
38. Retaining Ring, Bearing Cage
39. Nut, Lock and Seal
42. Adjusting Screw
44. Flange O-ring
45. Stationary Seat, O-ring
46. Relief Valve Cap, O-ring
53. Bearing Slug
 - A. Right-hand
 - B. Left-hand
54. Bearing
55. Idler Gear/Shaft Assy
56. Bearing Slug
57. Bearing Slug
58. Drive Gear/Shaft Assy
- WRN4 Warning Plate
 - A. Drive Key
 - B. Key, Drive Gear
 - C. Lube Fitting
 - D. Hex Head Cap Screw, Seal Retainer to Backplate
 - E. Locknut, Packing Gland Stud
 - F. Stud, Packing Gland
 - G. Pipe Plug
 - H. Dowel Pin
 - J. Hex Head Cap Screw, Endplates to Case
 - K. Hex Head Cap Screw, Flange

- L. Hex Head Cap Screw, Bearing Cage
- M. Hex Head Cap Screw, RV Body to Case
- N. Drive Screw, Warning Tag
- P. Retaining Ring
- Q. Key, Idler Gear

Gear Reduction Assembly only

- 66. Bearing Retainer
- 67. Bearing Retainer Gasket
- 68. Lip Seal
- 69. Retaining Ring, Ball Bearing
- 70. Ball Bearing
- 71. Pinion Gear and Shaft
- 72. Needle Bearing
- 73. Gear Case
- 74. Retaining Ring, Drive Gear
- 75. Drive Gear
- 76. Spacer
- 77. Gear Case Gasket
- 78. Cover
- 79. Cover Gasket
- U. Hex Head Cap Screw, Bearing Retainer to Gear Case
- V. Lockwasher, Bearing Retainer
- W. Hex Head Cap Screw, Cover to Gear Case
- X. Flat Washer, Gear Case
- Y. Lockwasher, Gear Case
- Z. Key, Drive Gear

- AA. Pipe Plug, Gear Case
- AB. Oil Cup, Gear Case
- AC. Petcock, Gear Case
- AD. Socket Head Cap Screw, Cover to Backplate

Type BH Hydraulic Drive Bracket Assembly only

- 61. Bracket
- 62. Rigid Coupling
- 63. Retaining Ring
- 64. Socket Head Cap Screw

Special Dry Running Packing only (Garlock® DSA Packing)

- 65. Packing Set
- AR. Locking Nut
- AS. Gland Nut

3.16 SHAFT SEALING

STANDARD COMPRESSION PACKING

One type of shaft sealing used in these pumps is formed ring packing with or without a lantern ring. When using a packed box pump, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Packing rings are available in a wide selection of materials for various applications and temperatures. Previous experience with the pumped fluid is the best guide in selecting the proper packing ring material for your particular application.

Some backplates are furnished with tapped holes on the stuffing box to provide access to the lantern ring or packing set for either flushing or grease lubrication. An external flush or lubrication of the packing may be necessary for proper operation and to help prolong the life of the packing and shaft.

A flush is recommended when the fluid to be pumped is abrasive or the pump operates with negative inlet pressure (suction lift). Clean water is often used to flush the packing. On applications where clean water is not available or where it is incompatible with the fluid being pumped, other clean, nonhazardous liquids may be used for flushing the packing. The flush should be supplied to the stuffing box at a rate of 1/4 to 1/2 gallons per hour (1 to 2 liters per hour). The pressure of the flushing liquid should exceed the sum of the inlet pressure and half of the differential pressure by 10 to 15 psi [70 to 100 kPa].

If the packing is to be grease lubricated, a good grade of bearing grease should generally be used. Should bearing grease be unacceptable or incompatible with the fluid being pumped, another paste type lubricant may be used. Lubrication of the packing must be performed with the pump stopped. Before daily start-up, if applicable, is a good time.

lubricate the packing, stop the pump. Carefully clean the stuffing box pipe plugs of any contaminants. After removing the pipe plugs from the stuffing box, install a lubrication fitting into one of the tapped holes. Lubricant now may be injected into the stuffing box through the lube fitting. Inject clean, fresh unused lubricant until it is seen coming out of the other tapped hole. Clean up any excess lubricant and remove the lube fitting. Replace the pipe plugs. This procedure should be performed daily, prior to start-up if the pump is purchased with provisions for grease lubrication. In certain applications, more frequent lubrication of the packing may be necessary. Experience will provide a guide as to how frequently the packing should be lubricated. Applying lubricant often will extend the life of the packing and shaft.

CARE OF PACKING

WARNING

DO NOT work on or adjust packing while the pump is running.
If truck mounted, disengage the PTO or hydraulic drive and shut off the engine.
If motor driven, **TURN OFF** motor and lock out the energy source.

CLOSE VALVES on the inlet and discharge while working on the pump.

Packing hooks are commercially available to help in removing packing rings from the stuffing box. It is generally not recommended to reuse old packing rings. When installing packing, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed. **DO NOT** forget to install the lantern ring if applicable. Three rings of packing, followed by the lantern ring, should allow the lantern ring to be approximately aligned with the flush/lube holes in the stuffing box.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft. **DO NOT** over-tighten the packing. The gland nuts should then be backed off until finger-tight. Connect the flush or lubricate the packing if either method is used. After the pump is started, note the stuffing box. If the packing leakage exceeds ten drops per minute, stop the pump and adjust the gland nuts. The gland nuts should be adjusted evenly in 1/6 to 1/3 turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above

procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers, and generate excessive heat.

The pump should be stopped and the packing gland adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

SPECIAL DRY RUNNING PACKING (GARLOCK® DSA PACKING)



DO NOT work on or adjust packing while the pump is running.

If truck mounted, **DISENGAGE** the PTO or hydraulic drive and shut off the engine.

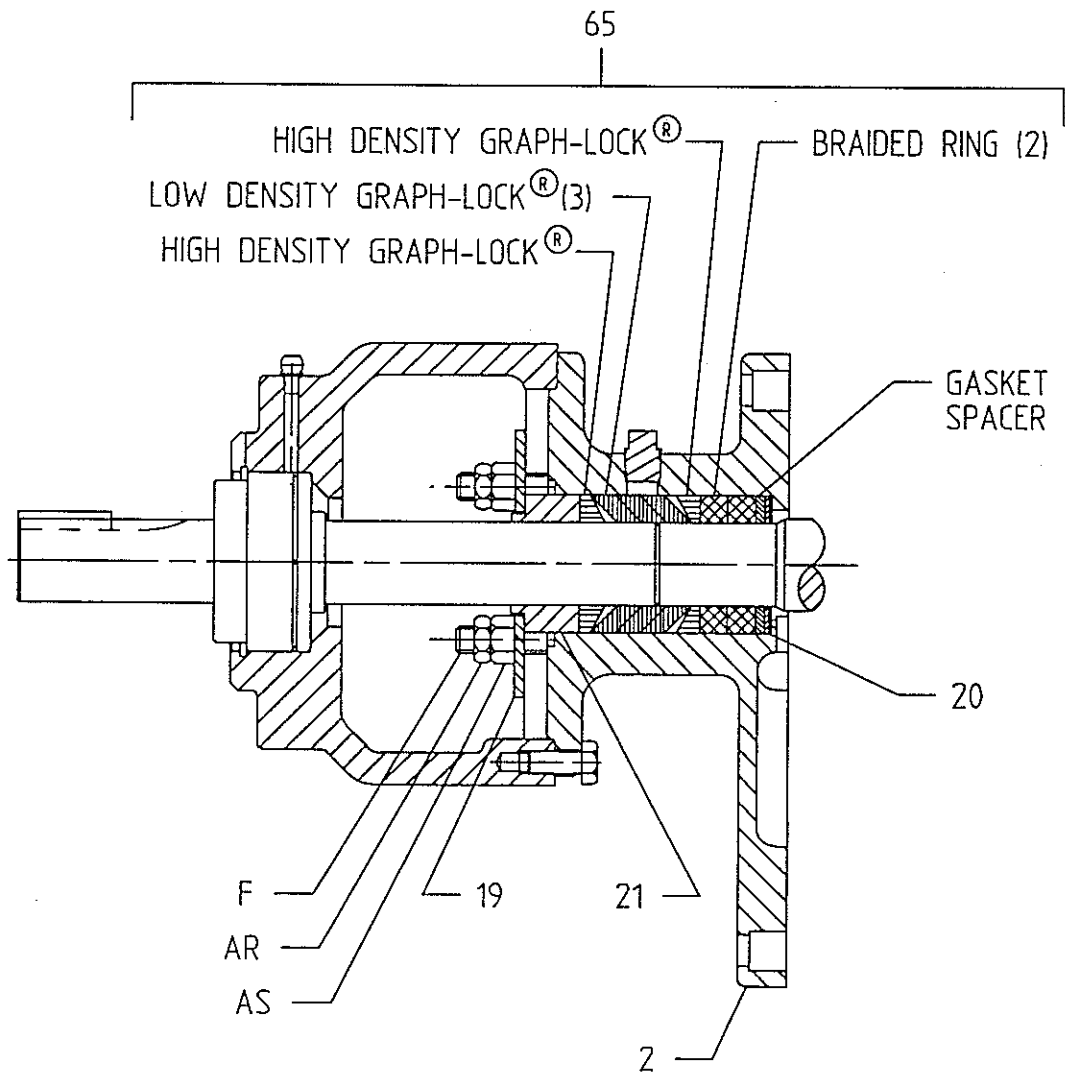
If motor driven, **TURN OFF** motor and lock out the energy source.

CLOSE VALVES on the inlet and discharge while working on the pump.

INSTALLATION AND INITIAL ADJUSTMENT

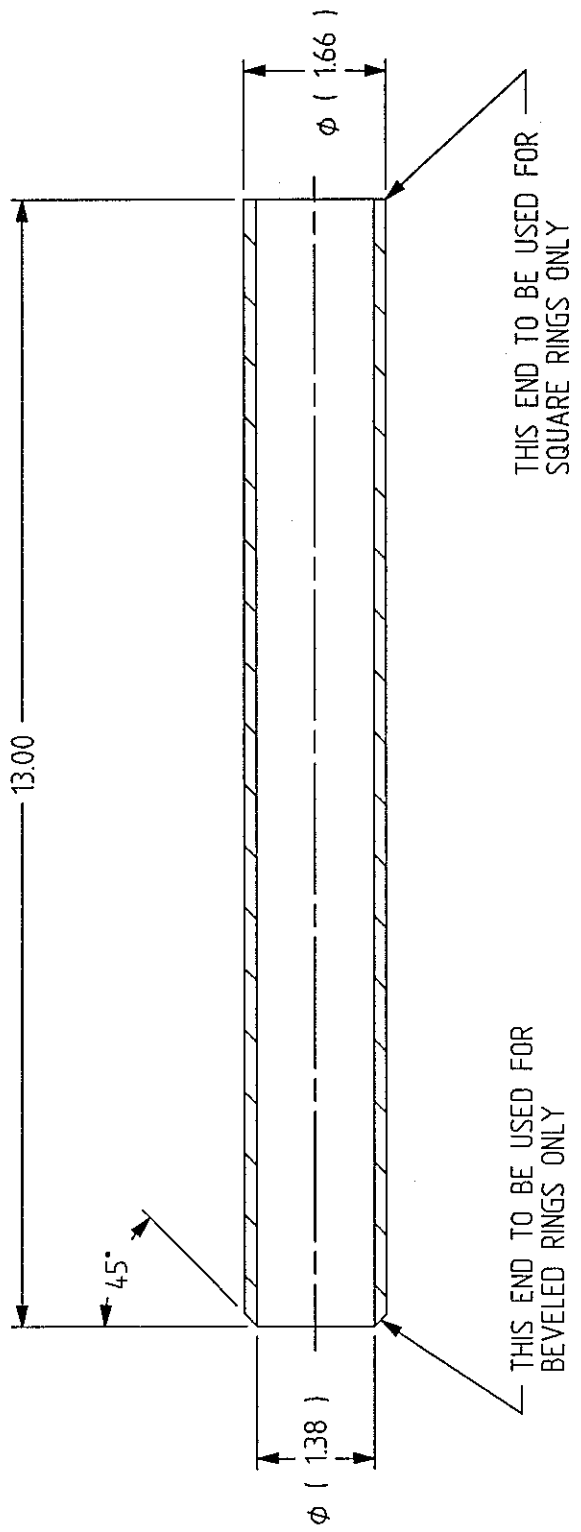
1. An installation tool for the DSA packing may be made as described (see Figure 3.16.2). The installation tool may only be used prior to the installation of the outboard ball bearing or when the outboard ball bearing has been removed from the pump.

2. Lubricate I.D. of braided rings with thin film of supplied break-in lubricant.
 3. Install the packing rings one at a time, in the order shown in the drawing on page with the joints of adjacent rings staggered 90°.
 4. Push each ring firmly in place before installing the next ring.
 5. The packing nuts (AR and AS) should first be evenly tightened with a wrench to compress the packing a minimum of 1/16" to 1/8" [1.59 to 3.18 mm].
 6. Loosen the gland (21) and wait several minutes.
 7. Tighten the gland (21) to a finger-tight condition, then tighten the gland nuts (AS) one additional flat. Tighten the locking nuts (AR) against the gland nuts.
 8. After installing guards and following all other safety precautions, start the pump and check for leakage. Leakage should be no more than an occasional drop.
 9. If leakage is noted, stop the pump, follow all safety precautions, loosen the locking nuts and tighten the gland nuts one additional flat. Tighten the locking nut (AR) against the gland nuts (AS).
 10. After installing guards and following all other safety precautions, start the pump and check for leakage. Leakage should be no more than an occasional drop.
- Repeat steps 8 through 10 as necessary to initially adjust the packing.
- Follow up adjustments during the life of the packing should be infrequent.



DRY RUNNING PACKING ASSEMBLY (GARLOCK® DSA PACKING)
FIGURE 3.16.1

Graph-Lock® is a registered trademark of Garlock Inc.



NOTES:

1. MATERIAL: 1-1/4" PVC PIPE (SCHEDULE 40)
2. INSTALLATION TOOL MAY ONLY BE USED PRIOR TO INSTALLATION OF OUTBOARD BALL BEARING OR WHEN BALL BEARING IS REMOVED.
3. USE ONLY TO PUSH PACKING RINGS IN PLACE. DO NOT HAMMER.

**DSA PACKING INSTALLATION TOOL
FIGURE 3.16.2**

MECHANICAL SEALS

Various types of mechanical seals are available to fit most pumps. (See **VARIOUS SEALING ARRANGEMENTS** (Figure 3.16.5 and 3.16.6). Due to the various seal types and styles available, the seal manufacturer's instructions for installation and setting should be followed when available.

NOTE: Not all seals will fit or function in all pumps. Modification to the pump backplate, drive shaft, and/or retainer may be required. Consult with a Roper distributor or Roper Pump Company if you are considering a seal change in your pump.

For removal or installation of mechanical seals, refer to disassembly and assembly procedures for pumps.

CONVERSION FROM PACKED BOX TO MECHANICAL SEAL OR MECHANICAL SEAL TO PACKED BOX

Conversion kits are available to convert from a packed box pump to a mechanical seal pump or visa versa. Contact your Roper distributor or Roper Pump Company for availability of conversion kits.

INSTALLATION OF A POSITIVE DRIVE SEAL (JOHN CRANE® TYPE 8-1 AND TYPE 9)

Refer to the exploded parts drawing (Figure 3.16.3) and to the appropriate seal chamber dimensional drawing (Figure 3.16.4).

To install a John Crane® Type 8 - 1 or Type 9 seal, follow procedure outlined in Section 3.10, **INSTRUCTIONS FOR PUMP ASSEMBLY**.

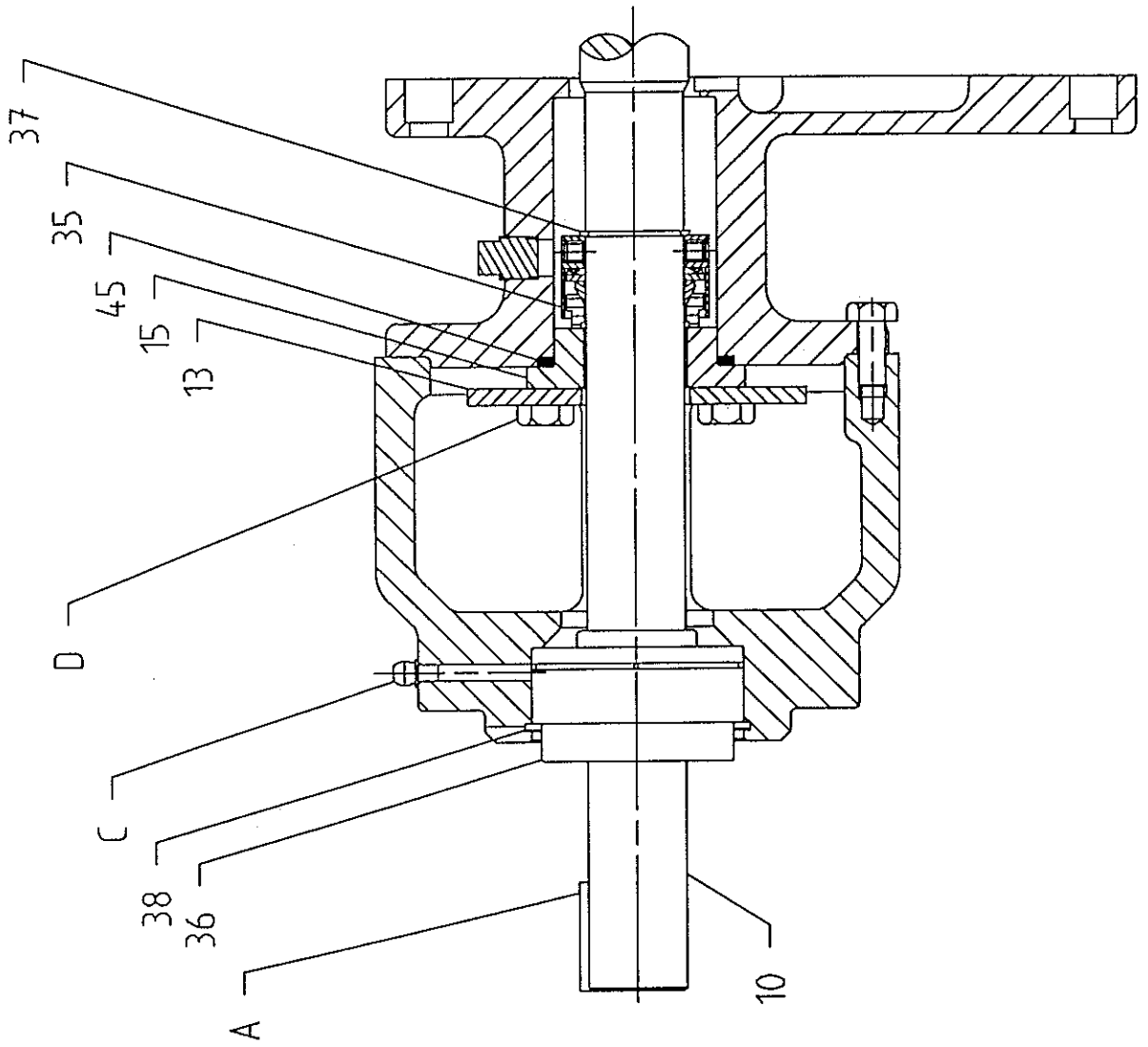


FIGURE 3.16.3

SEAL CHAMBER DIMENSIONALS

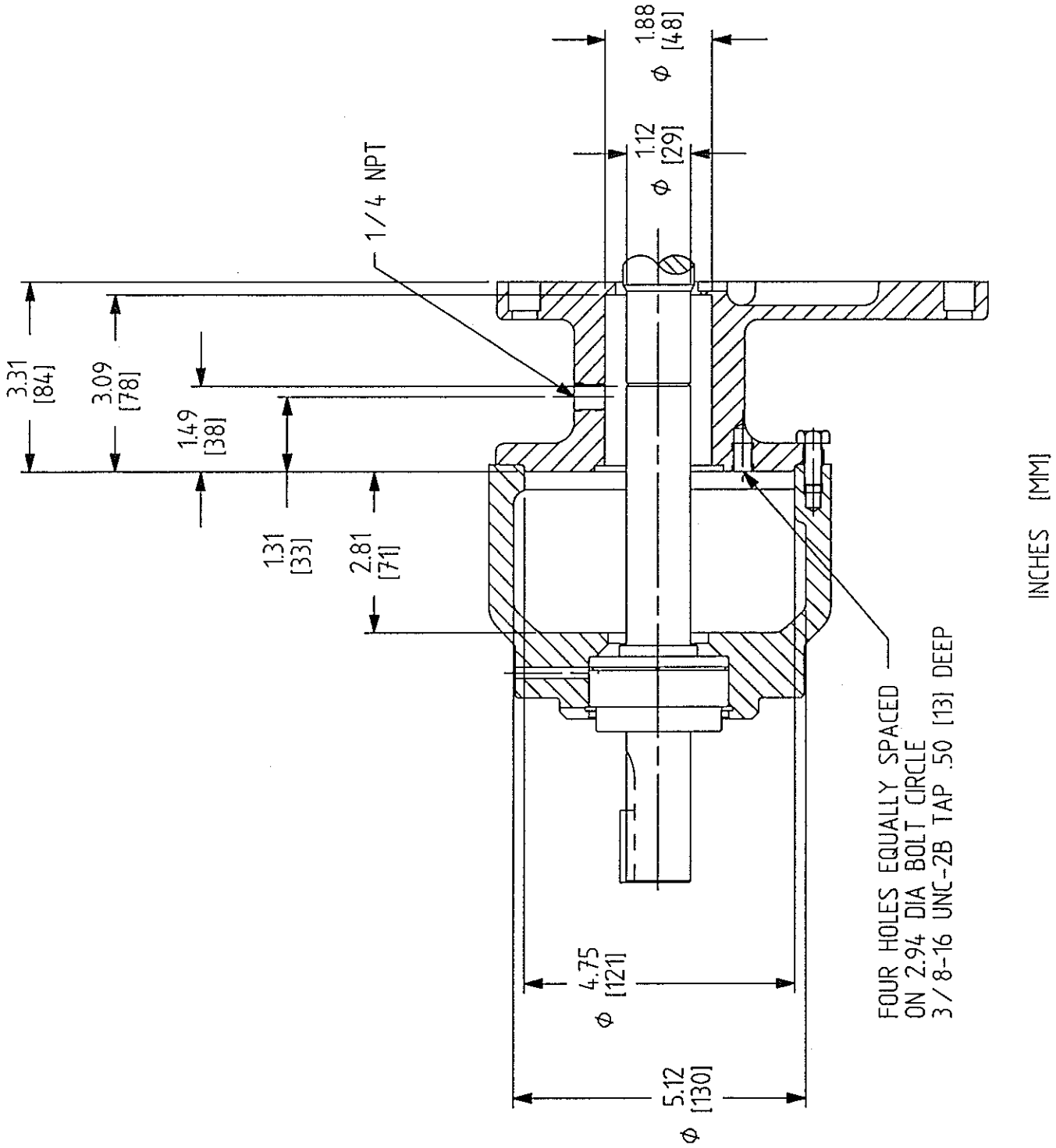
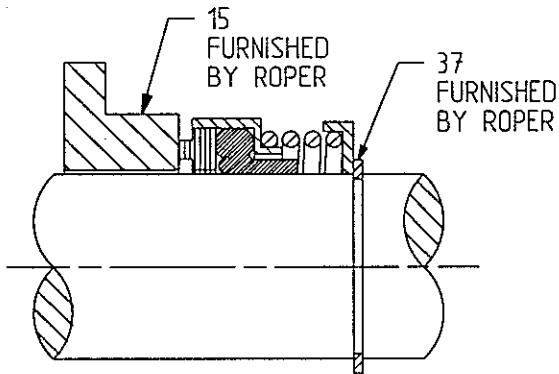


FIGURE 3.16.4

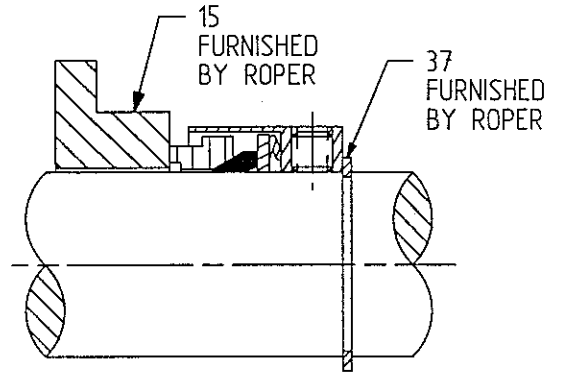
VARIOUS SEALING ARRANGEMENTS

SINGLE MECHANICAL SEAL FIGURE 3.16.5

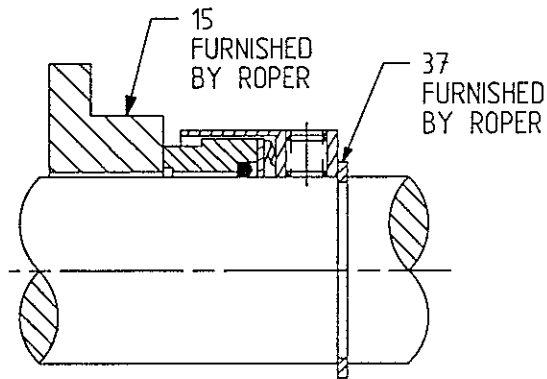
JOHN CRANE® TYPE 21



JOHN CRANE® TYPE 9



JOHN CRANE® TYPE 8-1



3.17 COMMON MAINTENANCE QUESTIONS

Question:

At what point do I need to overhaul my pump?

Answer:

As with all rotating equipment, your pump will eventually wear to a point where the pump's performance is diminished. The pump's performance is dependent upon the application. For instance, a very worn pump may work at an acceptable level in an application involving a high viscosity (thick) liquid when combined with low discharge pressure. This same pump would most likely be unsatisfactory in a low viscosity, high pressure application. The best answer to the above question is the following: You need to overhaul your pump when you feel that the performance has dropped to an unacceptable level for your application.

If you have set up your own test procedure to check your used pumps, it will be helpful to test at least one new pump of each size to use as a benchmark for setting your own acceptance levels.

Question:

What parts will I need to replace to get my pump back to "like-new" condition?

Answer:

As a general rule, replace all gaskets, o-rings, packing, lip seals, and mechanical seals at each servicing regardless of their apparent condition. These parts are usually less expensive than the labor costs and downtime incurred if the pump has to be serviced a second time to stop a leak.

The parts subject to wear should be examined for obvious wear and corrosion. This includes bearings, bearing slugs, shafts, gears, and cases. Measurements should be made and compared to the dimensions shown in Section 3.9. Replace any parts that are worn beyond the limit shown.

If the pump is used exclusively in an abrasive application or high viscosity application, you may be able to extend the life of the gears or case. If the gears show heavy wear on only one side of the tooth, very little wear on the ends and O.D., the gears can be turned over, end-for-end, in the pump. This will put the previously unworn sides of the gear teeth in contact.

Question:

What do I look for to determine excessive wear?

• **Gears**

The gears are serviceable if there is no degradation of the teeth or end faces. Check for uniform wear. There should be no burrs or gouges on any of the gear's surfaces.

• **Endplates**

Excessive wear is usually the result of pumping products containing abrasives. If the endplates are damaged in the area that the ends of gears rub, they should be replaced. If a bearing has turned or spun in the bore, the bearing slug must be replaced.

• **Cases**

Excessive case wear is usually the result of worn bearings or shafts allowing gears to contact the case bores.

• **Bearings**

If bearing measurements differ from the dimensions shown in Section 3.9, the bearings should be replaced. See Section 3.8 for proper bearing removal and installation.

• **Shafts**

Replace the shaft if it is scored in the packing, seal, or bearing area. Even shafts that appear smooth must be measured and compared to the dimensions shown in Section.

• **Packing**

Replace packing if it cannot be properly adjusted to control leakage as described in Section 3.16, **SHAFT SEALING**. It is normal

and necessary for packing to drip slightly. Never rebuild a pump with used packing.

- **Mechanical Seals**

Scratches on seal faces and deterioration of the elastomers will result in seal leakage. Mechanical seal failures can result in large amounts of liquid leaking from the pump.

Question:

Do I need special tools to disassemble and reassemble my pump?

Answer:

The only special tools required are for removal and installation of the bearings. A list of all tools required can be found in Section 3.2, TOOL LIST.

Question:

Is it okay to reface worn bearing slugs?

Answer:

No. Roper does not recommend this procedure. Refacing increases the lateral clearance in the pump and reduces the pump efficiency.

Question:

How long can my 9600 Series pump run dry?

Answer:

One minute is a practical maximum for running a pump dry. Anything longer could cause the pump to overheat resulting in possible pump damage or failure.

Question:

At what point should I buy a new pump?

Answer:

A new pump should be purchased when the old pump cannot be economically repaired.

Question:

Are there service centers where I can get my pump repaired?

Answer:

Most Roper distributors are able to repair pumps. Consult the factory to find your nearest distributor. Also, Roper Pump Company has a repair department. Any

pump repaired at the factory is rebuilt to like-new condition and carries a new pump warranty. Pumps may be returned to the factory by an authorized Roper pump distributor.

Question:

Are repair kits available? What do they contain?

Answer:

Overhaul kits are available and stocked by most Roper distributors. The following page illustrates some of the kits available. In some cases, installing some new parts with existing worn parts can actually decrease your pump's performance. Therefore, Roper recommends purchasing a complete overhaul kit whenever servicing is required.

3.18 INDEX

A

Aligning Shafts

GHB Pinion Shaft Height, 3 - 25 through 3 - 26

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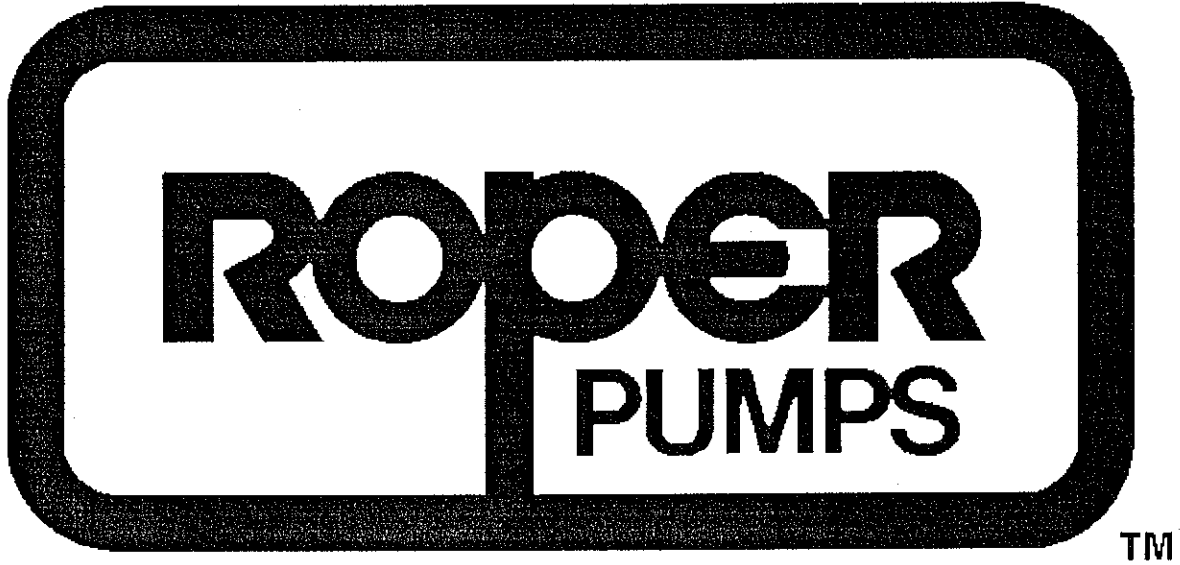
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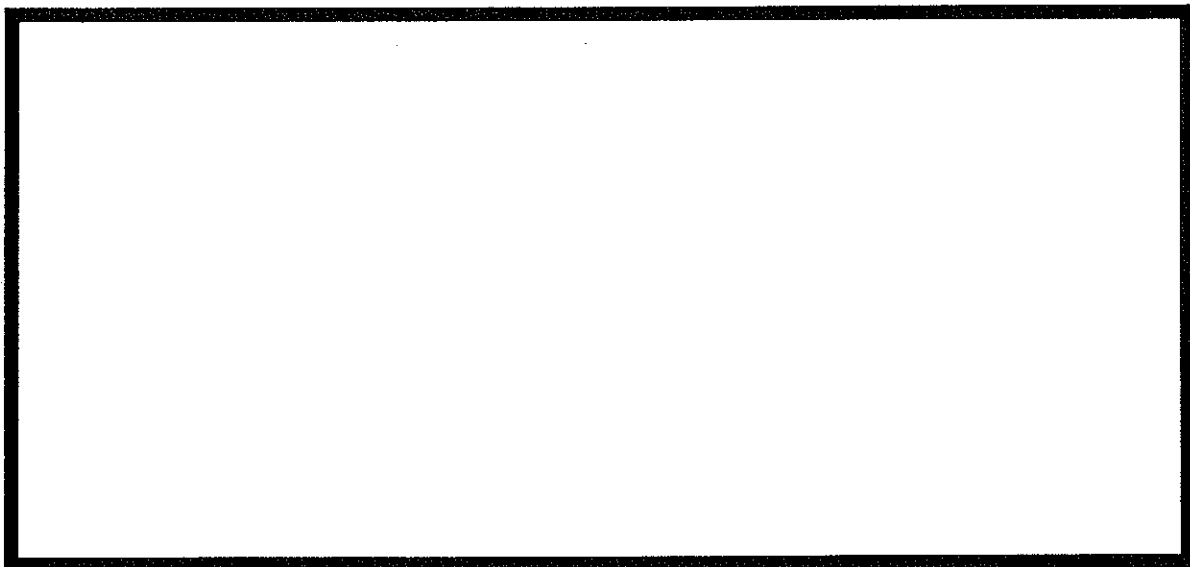


Additional copies of the installation and operation manual may be obtained by contacting a Roper distributor or:

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