

**INSTALLATION, OPERATION,
AND
MAINTENANCE MANUAL
FOR ROPER
FIGURE 2001 TYPE 10
PUMP**



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Part No. G12-304

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NOTE: BOLDFACE TOPICS CONTAIN IMPORTANT SAFETY INFORMATION

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 this 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. 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.
- **DO NOT** adjust packing while the pump is operating or if there is a chance of the driver becoming energized.

- **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** 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** 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 will 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.

3. 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: 2001 SPEC XXX TYPE 10 SERIAL NO. ZZZ

1. The FIGURE number is a five character window for a sequential identifying number.

NOTE: The preceding description of the figure number is to assist in identifying your Roper 2001 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.

4. MAXIMUM PUMP RATINGS

The maximum pressure, temperature, and speed limits for 2001 Type 10 are shown below. They are for the design liquid which is an approximate 60% water based proprietary lacquer commonly used in the aluminum can industry to coat the inside surface of the can to protect it from attack by the contents.

Maximum Speed: 500 rpm

Maximum Discharge Pressure: 1200 psig [8274 kPa]

Maximum Inlet Pressure: 50 psig [345 kPa]

Maximum Pressure Delta: 1150 psi [7929 kPa]

Temperature Range: 34° to 140°F [1° to 60°C]

5. PREOPERATION CHECKS

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

Disconnect the coupling between the driver and pump.

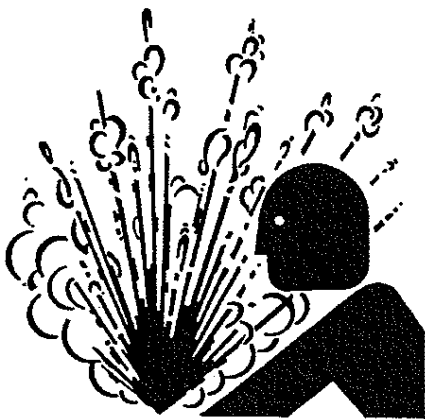
Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Rotation is shown on the packing box housing of the pump. After the unit is mounted and the piping is connected, the pump should be checked to be sure it operates freely without binding. After 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 21, **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.

6. PREPARATION OF FOUNDATION

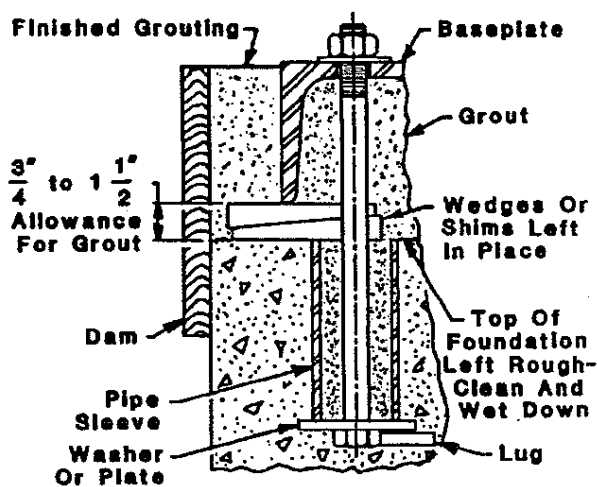
Locate the pump so that it is as low and as close to the fluid source as practical and so that piping to and from the pump will be as short and simple as practical. The pump and its driver must be accessible for inspection and maintenance. Accessibility to the unit and adequate clearance should be a 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. 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 7, **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.



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

Fig. 1: Typical Baseplate Anchoring

components and precautions. Extra pump supports, special drivers, 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.

7. ALIGNING DRIVER AND PUMP

The flexible coupling or belts and sheaves must be accurately re-aligned 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 6, 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. Allowance should be made for wear of the thrust bearings. 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.



WARNING! DO NOT operate without guards in place.

! DANGER

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.

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.

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.

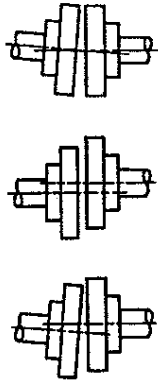


Fig. 2: Misalignments; Top, Angular; Center, Parallel; Bottom, Both.

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

These pumps are not designed to permit the mounting of the driven sheave directly on the pump shaft. 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.

! DANGER

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.

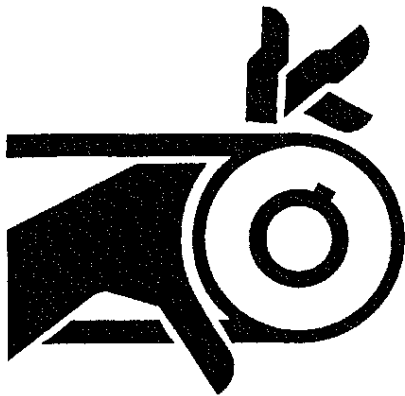
The driver and pump shafts must be parallel, and the belts at right angles to these shafts. Misalignment will cause undue belt wear, or turn-over in the grooves. *Approximate alignment should be checked by placing a long straight edge evenly across the rims of both sheaves. If the faces of the sheaves 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.



WARNING! DO NOT operate without guards in place.

8. 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 Section 4, **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 figure out 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).

<input type="checkbox"/> Explosion	<input type="checkbox"/> Fire
<input type="checkbox"/> Corrosion	<input type="checkbox"/> Exposure to Extreme Temperatures
<input type="checkbox"/> Chemical Burns	<input type="checkbox"/> Environmental Impact
<input type="checkbox"/> High Pressure Spray	<input type="checkbox"/> System Impact
<input type="checkbox"/> Toxic Exposure	<input type="checkbox"/> 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 5, **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; ALIGNING DRIVER AND PUMP; INSTALLATION OF PIPES; and PRE-OPERATION CHECKS**.

9. INSTALLATION OF PIPES

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.

10. RECOMMENDED TOOL LIST

NOTE: Tools not furnished with pump.

Tools for all pumps:

- (1) Safety Glasses
- (1) 5/16" Combination Wrench
- (1) 1/2" Combination Wrench
- (1) 1-1/8" Combination Wrench
- (1) 1-5/8" Combination Wrench
- (1) Pliers
- (1) 3/4" Male Pipe Plug Socket
- (1) L-0200 External Retaining Ring Pliers
- (1) 3/8" Hex Key

11. DIRECTION OF ROTATION

Prior to operating pump, make sure that the shaft rotation, pipe connections, and endplate position are in accordance with the following instructions and illustrations shown below. The pump "inlet" plate will be located on backplate end of pump next to inlet port and the pump "discharge" plate will be located on backplate end of pump next to the discharge port.

For inlet pressure over 50 psig [345 kPa], consult a Roper distributor or Roper Pump Company.

12. INSTRUCTIONS FOR DRAINING PUMP

Refer to Section 16, **PUMP DRAWINGS**.

- **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.
- **WARNING!** Take necessary precautions to prevent the pump from becoming energized while draining the pump.
- **WARNING!** Relieve all internal fluid and air pressure inside the pump before attempting to drain 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, the areas at the blind end of the bearing bores and the mechanical seal chamber will not drain.

1. Read sections on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION** before starting draining procedure.
2. To drain pump, loosen approximately one to two turns, twelve soc head cap screws (B) securing faceplate (3) and pumping element kit (1) to backplate assembly (2). Move faceplate (3) away from pumping element kit (1).
3. Allow to drain.
4. Retighten the twelve soc head cap screws (B).

13. INSTRUCTIONS FOR PUMP DISASSEMBLY

Refer to Section 16, **PUMP DRAWINGS**.

1. Read sections 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 sections on **REPLACEMENT PARTS**.
2. If you do not know which pump arrangement you have, collect nameplate data and refer to Section 3, **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, **DO NOT** use oil or grease. Use ethylene glycol only to avoid damage to mechanical seals (10, 11) or o-rings (1A).
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 12, **INSTRUCTIONS FOR DRAINING PUMP**.

10. Remove drive key (A) from drive shaft (4).
11. Remove three hex head cap screws (C) securing bearing (6) in packing box housing (8). Remove bearing (6)..
12. Remove six hex head cap screws (D) securing packing box housing (8) and stationary seat (12) to backplate (2). Remove packing box housing (8).
13. Remove packing box housing gasket (7).
14. Remove drive shaft (4) with mechanical seals (10, 11), retaining ring (9) and stationary seat (12) from backplate assembly (2).
15. Remove retaining ring (9) from drive shaft (4).
16. When removing mechanical seals (10, 11) from drive shaft, clean and lubricate drive shaft with compatible lubricant prior to removing mechanical seals making sure that drive shaft is smooth and free from burrs. Remove outer mechanical seal (10). Remove stationary seat (12) from drive shaft. Remove inner mechanical seal (11) from drive shaft.
17. Remove twelve socket head cap screws (B) securing faceplate (3) and pumping element kit (1) to backplate assembly (2). Remove faceplate.
18. Remove flanged bearings (1D) from faceplate (3).
19. Remove gear and shafts (1E, 1F) from case (1B).
20. Remove flanged bearings (1C) from backplate assembly (2).
21. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new o-rings (1A) and gaskets (7) be installed each time the pump is disassembled and reassembled.

14. DIMENSIONAL DATA FOR INTERNAL PARTS

Clearances are determined at the factory for new pumps and pumping element renewal kits. There are no wearing parts which need to be measured to determine when replacement should occur. The criteria for replacement is when the pump no longer provides the flow rate or pressure required.

At that time, a factory pump element renewal kit should be installed. No attempt at individual parts replacement should be made. The effect of such an attempt might be a further reduction in performance or damage to new parts.

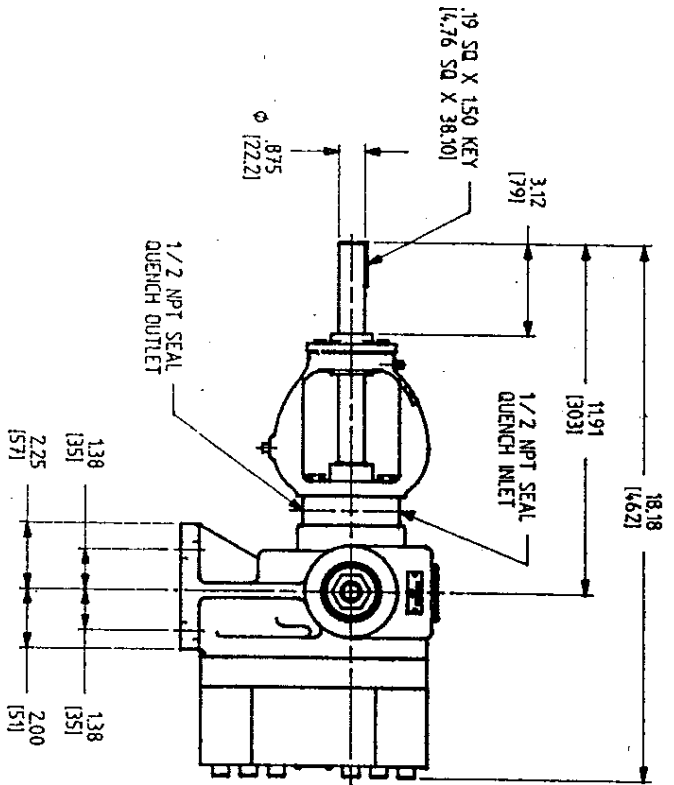
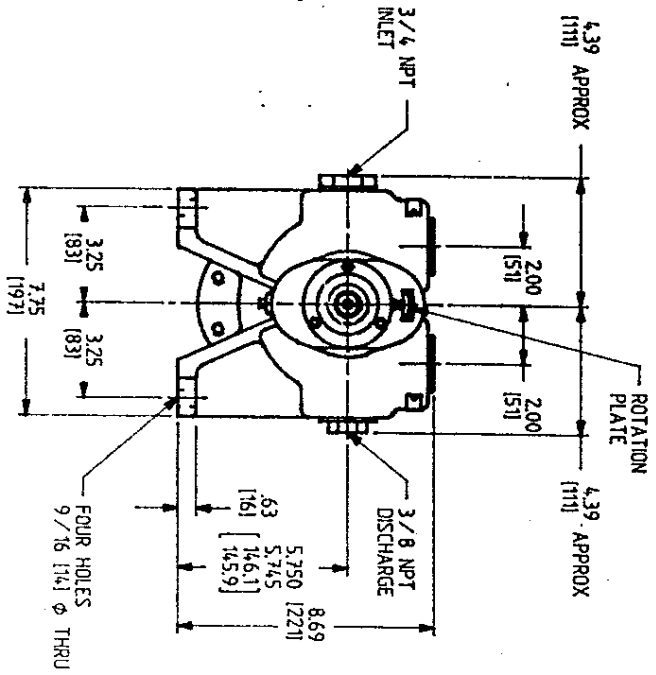
15. INSTRUCTIONS FOR PUMP ASSEMBLY

Refer to Section 16, **PUMP DRAWINGS**.

1. Read instructions on **REPLACEMENT PARTS, 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 o-rings (1A) and gasket (7) be installed when pump is being reassembled.
 - **CAUTION! DO NOT** use oil or grease in assembly of pump..
2. When cleaning or lubricating, only use ethylene glycol to avoid damage to mechanical seals (10, 11) and o-rings (1A).

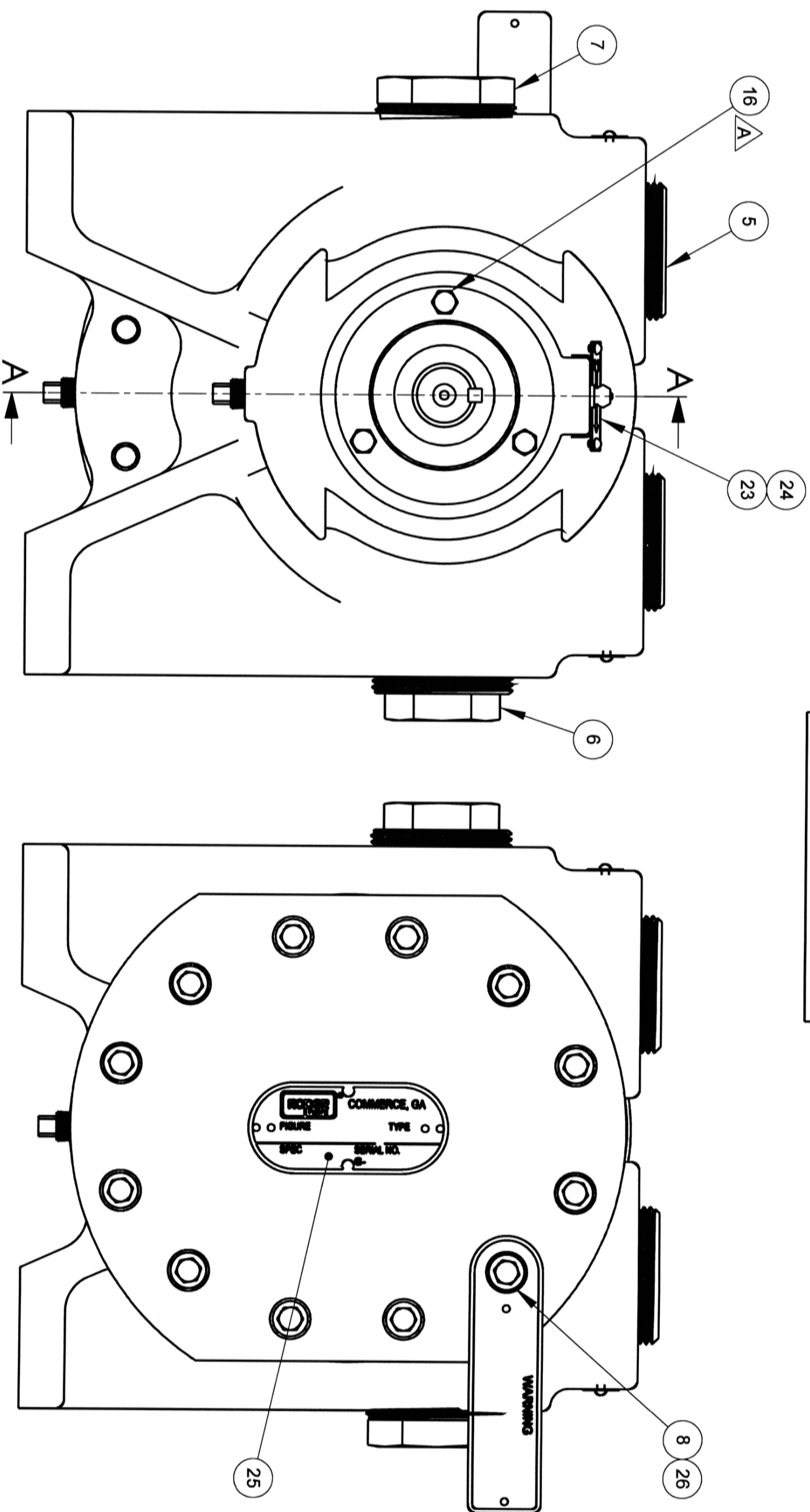
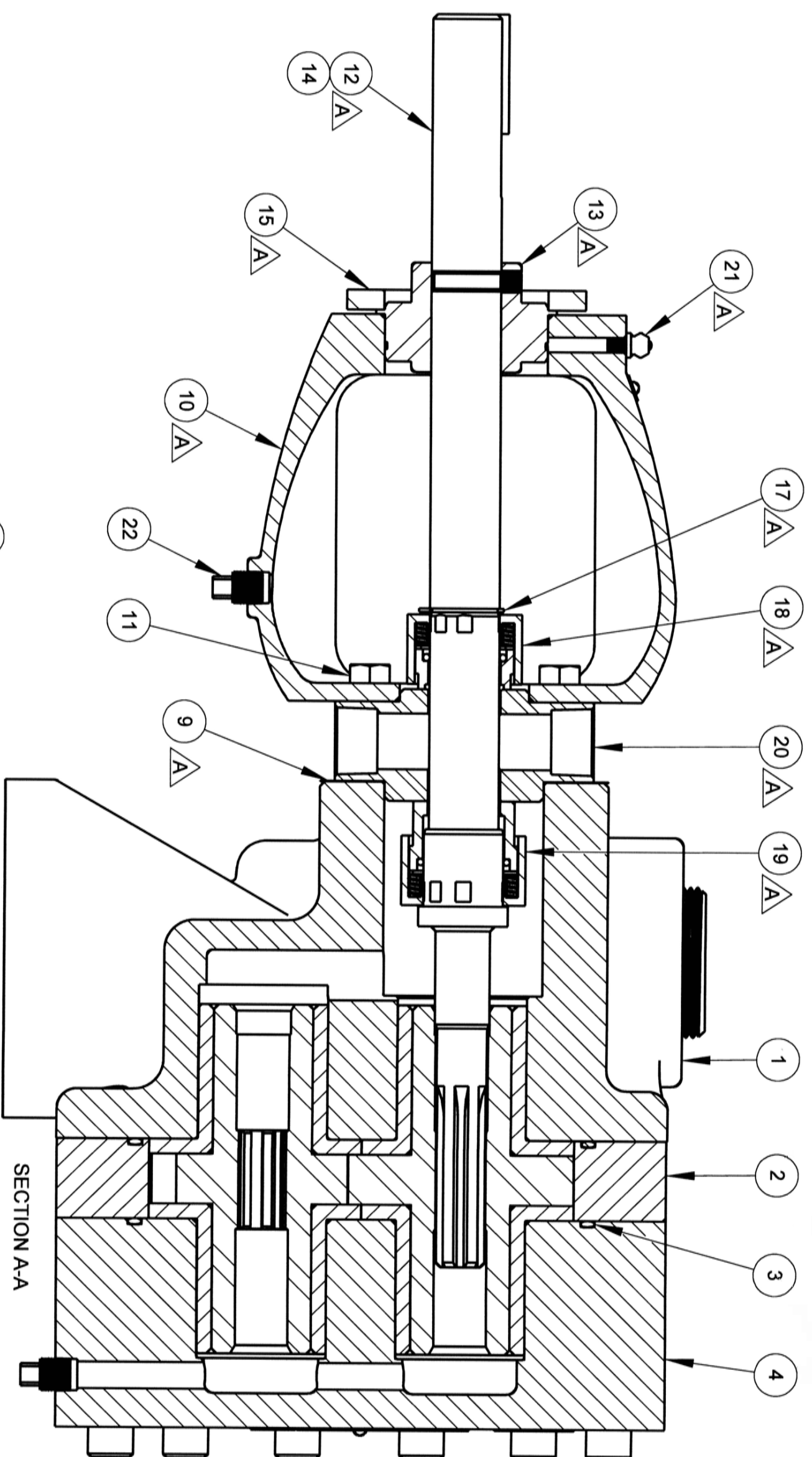
3. Mechanical seals are precision pieces of equipment. Use extreme care not to damage seal faces or elastomers during assembly.
4. To begin assembly of pump, start with the pumping element kit (1). This kit consist of the o-rings (1A), case (1B), flanged bushings (1C, 1D), gear and shafts (1E, 1F). These parts are a matched set. Keep these components together and **DO NOT** mix with other sets..
5. Install two flanged bushings (1D) into bores of faceplate (3) and two flanged bushings (1C) into bores of backplate (2) aligning hole in bushing with roll pin (J). If a new backplate (2) or faceplate (3) is required upon assembly, refer to sectional drawing on page 16 for location of roll pin (J). Rotate the bushings until the flats of the flanges engage. Drill one .125 diameter hole .56 deep from the bushing flange face into the backplate or faceplate as shown. Use the .135/.140 diameter hole in the bushing as a guide. Remove the particular bushing that was drilled and deburr the drilled hole. Clean out all chips and reinsert the bushings. Install the roll pins (J) through the bushing holes and into the newly drilled holes. Make sure the roll pins are below the bushing flange surfaces.
6. Install one o-ring (1A) in groove of faceplate (3). Set case (1B) in place with o-ring groove up using flanged bushings (1D) as guide to position case accurately.
7. Place one o-ring (1A) in the groove in case (1B).
8. Install the gears and shafts (1E, 1F) in case (1B).
9. Install the backplate assembly (2) using the trunnions of gear and shafts (1E, 1F) as a guide to accurately align backplate. Secure together using twelve socket head cap screws (B).
10. Install splined end of drive shaft (4) into bore in backplate making sure that the spline on drive shaft engages in spline on drive gear and shaft (1E).
11. Prior to installing mechanical seals (10, 11) onto drive shaft (4), lubricate shaft with a compatible lubricant and make sure drive shaft is smooth and free from burrs. Install inner mechanical seal (11) onto drive shaft (4). Slide stationary seat (12) onto drive shaft with larger pilot diameter toward backplate of pump. Install outer mechanical seal (10) securing onto drive shaft with retaining ring (9).
12. Install packing box housing gasket (7) and packing box housing (8) onto backplate (2). Secure packing box housing (8) and stationary seat (12) to backplate using six hex head cap screws (D).
13. Install bearing (6) onto drive shaft (4).
14. Install bearing cage (5) to packing box housing (8) using three hex head cap screws (C) to secure in place.
15. Install drive key (A).
16. 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.

16. PUMP DRAWINGS



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	N2-1376	BACKPLATE ASM
2	1	N22-188	CASE, GEAR, BRG SET
3	2	G83-7	O-RING
4	1	P3-786	FACEPLATE
5	2	G56-38	PIPE PLUG
6	1	G61-192	REDUCER BUSHING
7	1	G61-538	REDUCER BUSHING
8	12	G45-037425	SOC HD CAP SCREW
9	1	D11-39	GASKET
10	1	P9-316	PACKING BOX HOUSING
11	6	G49-031200	HEX HD CAP SCREW
12	1	D1-1714	DRIVE SHAFT
13	1	G40-94	BALL BEARING
14	1	D30-6	KEY
15	1	D4-20	BEARING RETAINER
16	3	G49-019062	HEX HD CAP SCREW
17	1	G41-75	RETAINING RING
18	1	G3-27	MECH SEAL
19	1	G3-28	MECH SEAL
20	1	D23-341	SEAL FACE
21	1	G63-1	LUBE FITTING, 3/16 DRIVE
22	2	G56-11	PLUG, PIPE, SQ HD, 1/8 NPT
23	1	D601-19	ROTATION PLATE
24	4	G62-9	DRIVE SCREW
25	1	G12-34	NAMEPLATE
26	1	G12-128	WARNING TAG

△ INCLUDED IN N24-130



NOTES:

1. ASSEMBLE PER ENGINEERING SPEC A.2.3.

17. PARTS LIST

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	N2-1376	BACKPLATE ASM
2	1	N22-188	CASE, GEAR, BRG SET
3	2	G83-7	O-RING
4	1	P3-786	FACEPLATE
5	2	G56-38	PIPE PLUG
6	1	G61-192	REDUCER BUSHING
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8	12	G45-037425	SOC HD CAP SCREW
9	1	D11-39	GASKET
10	1	P9-316	PACKING BOX HOUSING
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22	2	G56-11	PLUG, PIPE, SQ HD, 1/8 NPT
23	1	D601-19	ROTATION PLATE
24	4	G62-9	DRIVE SCREW
25	1	G12-34	NAMEPLATE
26	1	G12-128	WARNING TAG

18. SHAFT SEALING

MECHANICAL SEAL

The pump employs a double seal arrangement with an intermediate quench. With the design pumpage, a water thermosiphon or process water flow should be installed to provide cooling to the seals. Pressure should be limited to under 200 psig [1379 kPa].

SEAL INSTALLATION

Many seal failures can be traced to installation errors. Careful installation is a major factor in the life of a seal. The seal manufacturer's instructions and drawings for seal installation and setting should be followed. Thoroughly read and fully understand the seal installation drawings and instructions. This is a major key to proper seal installation.

Make sure that all parts are clean and not damaged, especially the mating seal faces. Inspect the primary (sealing faces) and secondary (o-rings) sealing areas. **DO NOT** scratch, nick or get those areas dirty. Keep in mind that o-rings can easily become cut or torn without paying proper attention to their well being. Remove all burrs and sharp edges from the shaft, including sharp edges of the keyway. Replace worn shafts.

Use sound judgement during the installation. **DO NOT** overtighten bolts, align or install seal or seal retainer with a hammer, or apply anything except professional workmanship to the job.

NOTE: When cleaning or lubricating, only use products that are compatible with product being pumped and elastomers within pump. **DO NOT** use petroleum based products in this pump. Clean and lubricate parts with ethylene glycol to avoid damage to seals.

Know the materials you are working with. Critical seal parts are often made from brittle materials that will chip, crack or break if carelessly handled. It is permissible to touch the seal faces, it is **NOT** permissible to abuse seal faces. Abusing the faces is handling them in such a way that they may be chipped or scratched. Denatured alcohol and lens tissue may be used to clean the faces. Cleaning solutions may remove the "shine" from carbon seal faces. Reflectiveness or "shine" is not important - flatness is important. **DO NOT** use penetrating fluids for cleaning.

It is normal for a new seal to leak somewhat after initial startup. Allow the seal faces to "wear in" to each other. Fluids with good lubricating properties will naturally delay this wear in period. However, if leakage occurs immediately and does not decrease, the secondary seals may be damaged or the seal faces may be warped out of flat.

As these type seals are designed to operate in a liquid, the seal faces must be immersed in a liquid from the very beginning. Dry operation will damage the seal faces. Refer to the section on **PREOPERATION CHECKS** before starting a pump with a new seal.

19. STORAGE

When removing a pump from service for storage, the pump should be completely cleaned and flushed of any pumped fluid. The unit should be carefully inspected and have any necessary repairs made before placing the pump into storage.

Make yourself a reminder to read and understand this manual completely before installing the pump.

SHORT TERM STORAGE (up to one year)

For storage of up to one year, special preparations are not usually necessary. The pump as shipped from the factory contains ethylene glycol based antifreeze. This material contains compounds which protect and preserve metal and the shaft seal for up to one year if the port plugs are left in place. However, the following should be observed:

- Protect the pump from the elements. Store the pump indoors whenever possible. If indoor storage is not possible, cover the pump with a protective covering. **DO NOT** allow moisture to collect in or around the pump.
- Read and understand this manual thoroughly before installing the pump.

LONG TERM STORAGE (over one year)

For storage periods over one year, observe the following:

- Recirculate one gallon [3.8 liters] (or more) antifreeze for several minutes to renew the film on parts. The protective port plugs should be reinstalled.
- Protect the pump from the elements. Store the pump indoors. **DO NOT** allow moisture to collect in or around the pump.
- Wrap exposed shafts and machined surfaces with suitable corrosion inhibiting cloth or paper. Seal the seams with an oil proof, low chloride content tape.
- Apply a suitable preservative to the pump.
- If applicable, remove the drive belts from belt driven units or disconnect the coupling on direct connected units.
- Read and understand this manual thoroughly before installing the pump.
- This process may be done again at two years.
- Once a pump has been stored for three years, the mechanical seals should be replaced along with o-rings. Refer to Section 13, **INSTRUCTIONS FOR PUMP DISASSEMBLY** and Section 15, **INSTRUCTIONS FOR PUMP ASSEMBLY** for replacing seals and o-rings.

If other equipment included with the pump (i.e., couplings, drivers, mechanical seals, etc.) is to be stored also, refer to its manufacturer's instructions for storage.

20. 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 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.
	Improper mounting. Check alignment thoroughly. See Aligning Driver and Pump and 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 Installation of Pipes.
	Pressure relief device not operating properly.
	Air leaks in inlet line.

PROBLEM	POSSIBLE CAUSES
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.

21. 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 bench mark 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, 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, shafts, gears, cases, and endplates. Replace any parts that are worn.

If the pump is used exclusively in an abrasive application or high viscosity application, you may be able to extend the life of the case. If your pump case is worn on the inlet side only, the case can be turned around and used again.

Question: What do I look for to determine excessive wear?

- Pumping Element Renewal Kit The pump renewal kit is made up of the flanged bearings, gears and shafts, case and o-rings. Check these parts for wear. The gears and shafts should have no burrs or gouges on any of the gear's surfaces. Excessive wear of the case is usually a result of worn bearings or shafts allowing the gears to contact the case bores. Minor rubbing of the case bore is normal. The bearings could be worn or cracked. If any of these parts are worn, then the whole kit must be replaced. The kits are a matched set.
- Endplates Excessive wear is usually the result of products containing abrasives. If the endplates are damaged in the area that the gears might rub, they should be replaced.
- 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: No special tools are required.

Question: Is it okay to reface worn endplates?

Answer: No. Roper does not recommend this procedure. Refacing reduces the face flange thickness and increases the possibility of interference between the internal parts.

Question: How long can my 2001 Type 10 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: 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. A "Returned Goods Authorization" number must be obtained from the Roper Sales Department before returning any pump or part.

