

**INSTALLATION
AND
OPERATION
MANUAL
FOR ROPER
FIGURE 2835 M, P, AND L
PUMPS**



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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 and understand this manual carefully before installing or operating this pump.

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 the personnel.

This manual will cover standard pumps and most spec. 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). **NEVER** 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.
- Know the operating conditions.

- Open all lines before starting pump.
- **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.
- *These instructions cannot possibly cover every situation concerning the operation, inspection, adjustment, and test of the equipment furnished. Roper Pump Company must presume that the crew using this pump has ample knowledge and training to apply sound safety and operational practices that may not be mentioned.*

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, or 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 or adjust the relief valve without proper guards in place.
- **DO NOT** walk, stand, sit, or lean on guards.
- **DO NOT** work on a pump while it is operating except to adjust the relief valve.

- **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** work on this equipment 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** completely read and understand the information contained in this manual. The operator of the equipment must be familiar with these instructions.
- **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 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 could 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.

3. NAMEPLATE DATA

Roper identifies each pump manufactured by a metal nameplate attached to the pump. This nameplate describes how the pump was 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.

PUMP NUMBER: _____

SPEC NUMBER: _____

SERIAL NUMBER: _____

TYPE: _____

PUMP NOMENCLATURE

Example: 2835 L SPEC XXX TYPE 1 SERIAL ZZZ

1. The FIGURE number consists of a five digit number.
 - The first four digits indicate the pump series.
 - The fifth digit indicates the type of shaft seal.
 - L - Lip Seal
 - M - Mechanical Seal
 - P - Packing

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 2835 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, Serial, and Type numbers so proper identification of the pump can be assured.

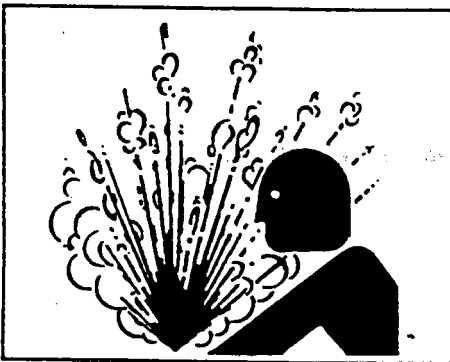
4. PREOPERATION CHECKS

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

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. The driver rotation test must be done with the driver and pump disconnected. Make sure the relief valve is positioned and adjusted as discussed in Section 10. 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 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 the section on 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! Do not overpressurize pump or system.

! WARNING

If there is no pressure relief device in the system, **NEVER** block the discharge line. High pressure will occur, resulting in possible damage or breakage to the pump or system parts and possible injury to personnel. Even with a pressure relief device in the system, **DO NOT** operate the pump for more than one minute with the discharge line blocked. 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.

5. 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 $\frac{3}{4}$ 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 inlet and discharge connections of the pump for horizontal or vertical position using a level held against a piece of pipe that has been screwed into the port hand tight. 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 on 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.

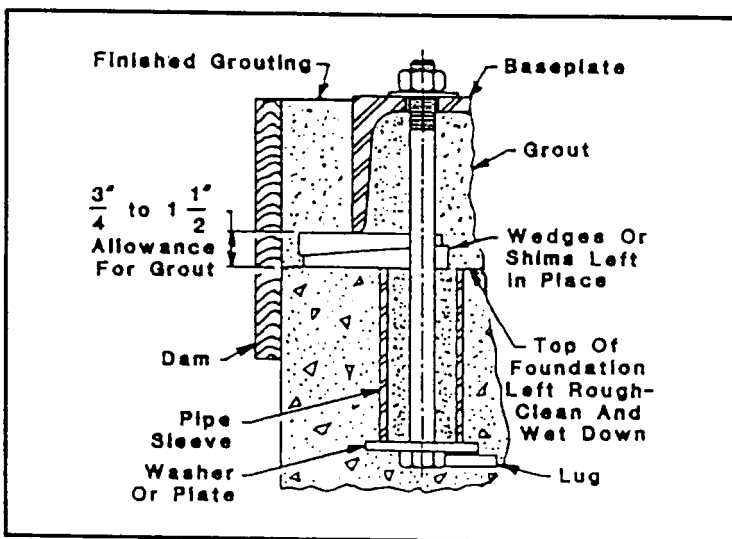


Fig. 1: Typical Baseplate Anchoring

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.

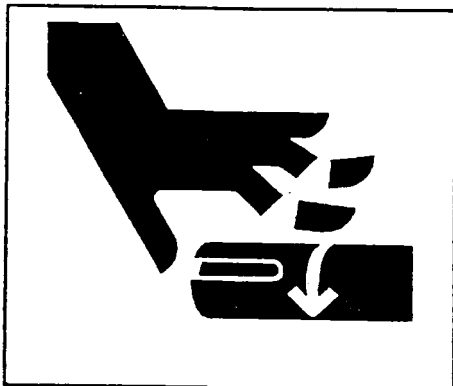
Normal mounting for this pump is horizontal with the pump above the baseplate, properly grouted to a concrete foundation placed in or on solid earth.

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, 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.

6. ALIGNING DRIVER AND PUMP

Driver and pump units built at Roper are factory aligned before shipment. Still, 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 the section on Preparation of Foundation for additional information.

FLEXIBLE COUPLING



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.

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.

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.

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.

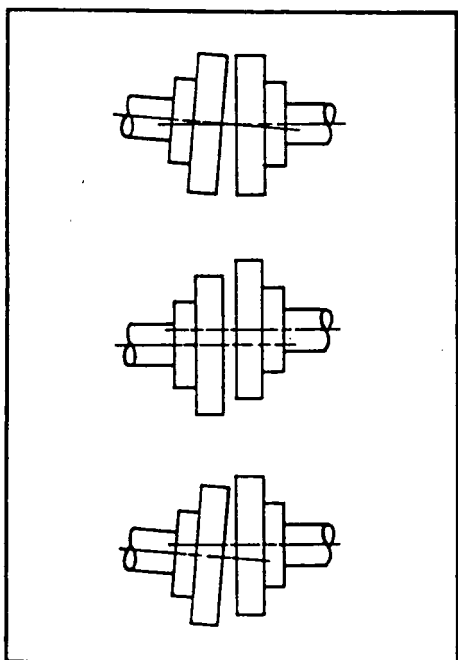
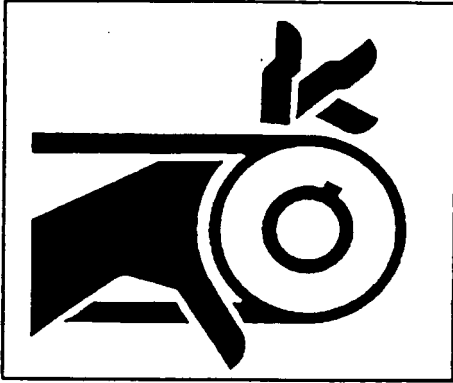


Fig. 2: Misalignments: Top, Angular; Center, Parallel; Bottom, Both.



WARNING! Do not operate without guards in place.

! DANGER

With guard removed, visually inspect belts only. Align or adjust belts with energy source to driver locked out to prevent operation. 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.

BELTS AND SHEAVES

Some applications 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.

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 but not always.

Stop drive to clean belts. Keep belts clean and free from oil. Clean oily belts with a cloth dampened with soap and water. **DO NOT** attempt to clean belts while the drive is operating. 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.

7. ADDITIONAL IMPORTANT WARNINGS AND INFORMATION

- *This manual cannot possibly cover every situation concerning the use, inspection, adjustment, and test of the pump furnished. Roper must presume that the crew using this pump have ample knowledge and training to apply sound safety and operating practices that may not be mentioned.*
- 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.* It is, therefore, not practical to include performance or maximum ratings in this manual. Roper sales brochures contain standard ratings for the type of pump involved. If you do not have ratings or performance properties for your pump, they 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"/> Explode	<input type="checkbox"/> Toxic
<input type="checkbox"/> Corrode	<input type="checkbox"/> Fire
<input type="checkbox"/> Chemical Burn	<input type="checkbox"/> High Temperature
<input type="checkbox"/> High Pressure	<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. Read Section 4 on Preoperation Checks; page 5.
- 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.
- Roper continually updates its manuals; therefore, you should periodically request an updated copy or check that you have the latest edition.

Prior to starting pump, read sections on Preparation of Foundation; Aligning Driver and Pump; Installation of Pipes; Threaded Port Connections; and Preoperation Checks. These sections may be found elsewhere in this book.

8. 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 Pipe Friction Manual 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.

9. 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.

10. DIRECTION OF ROTATION AND RELIEF VALVES

Prior to operating the pump, make sure that the shaft rotation, pipe connections, and faceplate position are in accordance with the following instructions and illustrations.

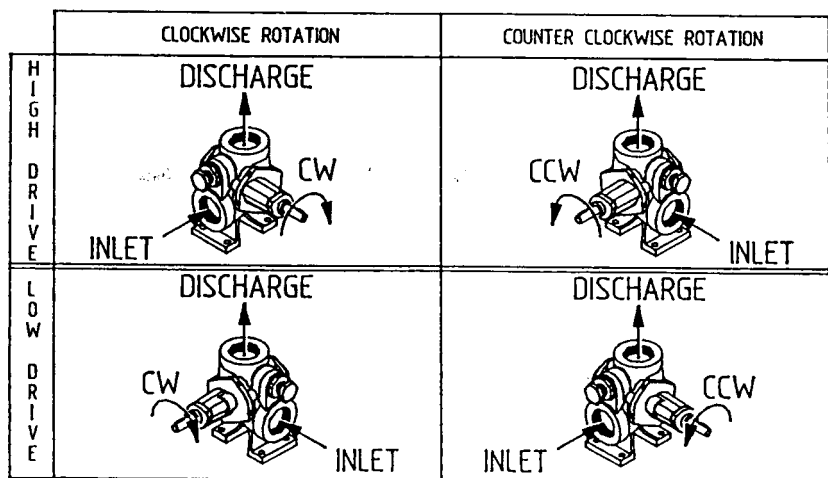
For inlet pressures over 25 psig (172.4 kPa) on pumps with a mechanical seal or packed box; inlet pressures over 5 psig (34.5 kPa) on pumps with lip seals, consult a Roper distributor or Roper Pump Company.

RELIEF VALVE FACEPLATE

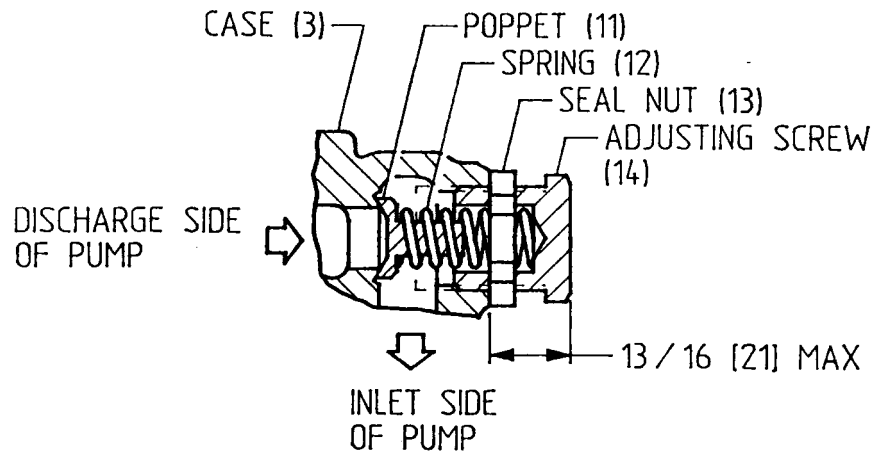
All Figure 2835 pumps have the case positioned as shown in the following drawings.

To reverse rotation, remove the backplate and faceplate from the case taking care not to damage gaskets or o-rings. Reposition the case and endplates to agree with the Direction of Rotation drawing that you have selected as meeting your requirements. Assemble the parts and tighten the cap screws or nuts.

DIRECTION OF ROTATION



NOTE: The top port **MUST** always be the pump discharge port.

RELIEF VALVE**! WARNING**

The relief valve must be positioned as shown in instructions for Direction of Rotation, otherwise the valve is inoperable as discharge pressure will be holding the relief valve in the closed position.

It is mandatory that the relief valve be set by the user since maximum relief valve pressure depends upon the viscosity and specific gravity of the liquid, the flow rate (pump rpm), and also the initial relief valve setting.

NOTE: The fact that the pump has the correct rotation and discharges liquid through the top port **DOES NOT** insure that the relief valve has the correct setting for the application.

RELIEF VALVE ADJUSTMENT**! WARNING**

Take all precautions necessary to prevent personal injury or physical damage that could be caused by any loss of the product being pumped while adjusting the relief valve.

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

1. Connect a pressure gauge near the pump in the discharge line between the pump and the point where the discharge line will be closed.
2. Loosen the seal nut (13) on the adjusting screw (14).
3. Back the adjusting screw (14) out to the point where the end of the adjusting screw will be as shown on the Relief Valve drawing.
4. Start pump and close discharge line slowly. **DO NOT** exceed pressure rating of pump or other equipment between pump and discharge line valve. If this pressure is reached while closing the discharge valve, **DO NOT** close any further. This might occur with very high viscosity liquids.

for protection. **DO NOT** run pump with closed discharge line for more than one minute at a time. If proper adjustment cannot be obtained after one minute, open the discharge valve and let pump run for one minute, then continue with adjustment.

5. With discharge valve closed, turn adjusting screw clockwise in 1/2 turn increments until the pressure gauge shows the desired pressure setting.
6. Open discharge line and turn pump off.
7. Tighten sealing nut.

The relief valve is now set.

To replace spring and/or poppet, shut pump off, decrease the pressure on the spring, and remove the plug cap by unscrewing it from the case. After inspecting parts and replacing those required, make sure the spring is centered on poppet and guide. Install the seal nut and adjusting screw and adjust the relief valve pressure as described above.

The Figure 2835 should not be used on applications where the discharge must be closed for more than one minute. Prolonged operating with the relief valve fully bypassing will cause heating of the liquid circulating through the valve, thus resulting in possible damage.

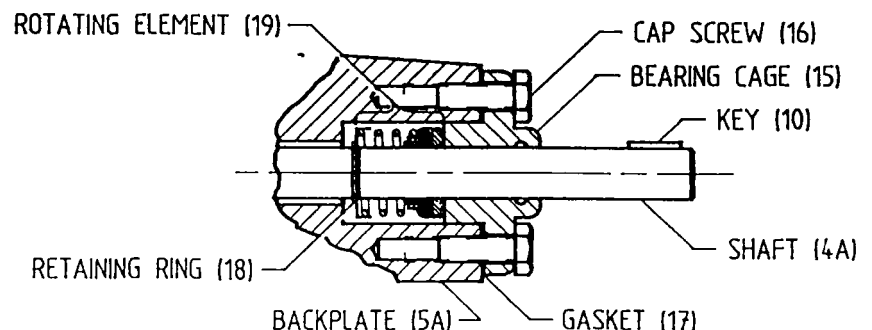
11. MECHANICAL SEAL (2835 M PUMPS)

Mechanical seals **DO NOT** require adjustment. Leakage developed at the seal may be due to one of the following conditions: worn, marred, or cracked rotating or stationary seal face, or bellows that has become hard, soft, cracked, expanded or extruded.

When replacing or servicing a mechanical seal, take particular care not to mar or scratch the sealing surfaces or damage the bellows. If the seal has been used, **DO NOT** put it back into service unless both sealing surfaces are perfectly flat and smooth or else replaced. It is recommended that mechanical seals not be reused.

To replace the mechanical seal, remove the key (10), cap screws (16), and bearing cage (15). Remove burrs and sharp edges from the end of shaft and keyway and clean the shaft. Next, the seal rotating element (19) may be removed from the shaft.

To reassemble the mechanical seal, lubricate the section of the shaft over which the seal is to be mounted. 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 which contain EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers. Slide the rotating element (19) onto the shaft. Be sure it is properly positioned against the retaining ring (18). After checking the bearing cage and replacing it, if required, lubricate the sealing surfaces. Install bearing cage (15) and gasket (17) and secure with cap screws (16).



CHANGING FROM PACKED BOX TO MECHANICAL SEAL

When it is desirable to change from packed box to mechanical seal, remove the key (10), cap screws (16), packing plate (20), packing gland (21), and packing rings (22). The exposed surface of the shaft should be free from burrs and sharp edges. Clean and lubricate the shaft. 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 which contain EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers. Install the retaining ring. Refer to the drawing on page 13 to install the seal.

12. LIP SEALS (FIGURE 2835 L PUMPS)

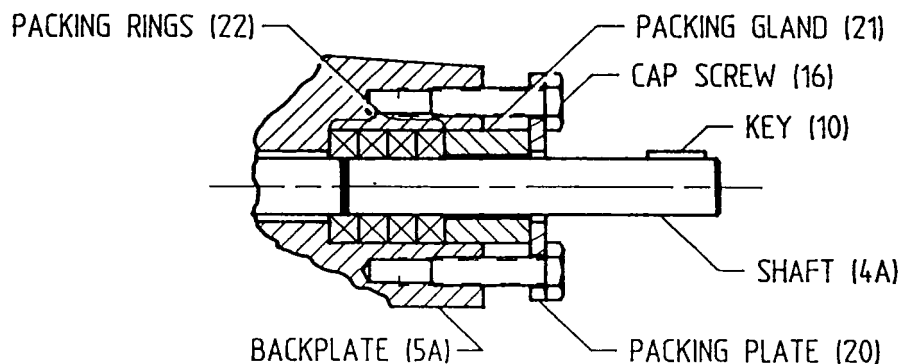
Pumps with lip seals are limited to a maximum inlet of 5 psig (34.5 kPa) pressure. For a pump equipped with a lip seal, refer to the sectional drawing on page 16. Leaking lip seals should be replaced. Note the direction of the lip on the old seal. Carefully remove the defective seal (9) from the bore, making certain that the bore is not scored or damaged. Clean the shaft (4) and bore. 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 which contain EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers. Inspect the shaft for wear. If worn or scored, replace. The exposed surface of the shaft should be free from burrs and sharp edges. Lubricate the shaft and bore into which the lip seal is to be fitted. Be careful not to damage the sealing lip, and be certain that the lip on the new seal is turned the same direction as the old seal. Slide the seal (9) onto the shaft (4) and press into the bore. Refer to the drawing on page 16.

13. PACKED BOX (FIGURE 2835 P PUMPS)

! WARNING

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

Operate the pump under normal conditions. After a short run-in period, examine the packing for leakage. If leakage is excessive, stop the pump and follow the adjustment procedure described below. A slight leakage is a necessary and normal condition for packing and allows for expansion and proper seating.



To replace packing, remove the key (10), cap screws (16), packing plate (20), packing gland (21), and packing rings (22). (Packing hooks are commercially available to assist in removing the packing rings.)

Clean the shaft and adjacent parts. Examine the shaft. If it is excessively worn or scored, replace shaft and gear assembly. 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.

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** overtighten the packing. The gland nuts should then be backed off until fingertight. After the pump is started, visually examine the stuffing box for excessive leakage. 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 overtighten 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. Overtight packing may score shafts, increase torque requirements of the pump, damage couplings and drives, and generate excessive heat.

The packing gland should be 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.

CHANGING FROM MECHANICAL SEAL TO PACKED BOX

To change from mechanical seal to packed box, remove the key, cap screws, and bearing cage. Refer to Mechanical Seal section and remove rotating element according to instructions. Remove the retaining ring. Clean and lubricate the exposed area of the shaft. Refer to the drawing on page 14 to install the packing.

14. PUMP
SECTIONAL DRAWING

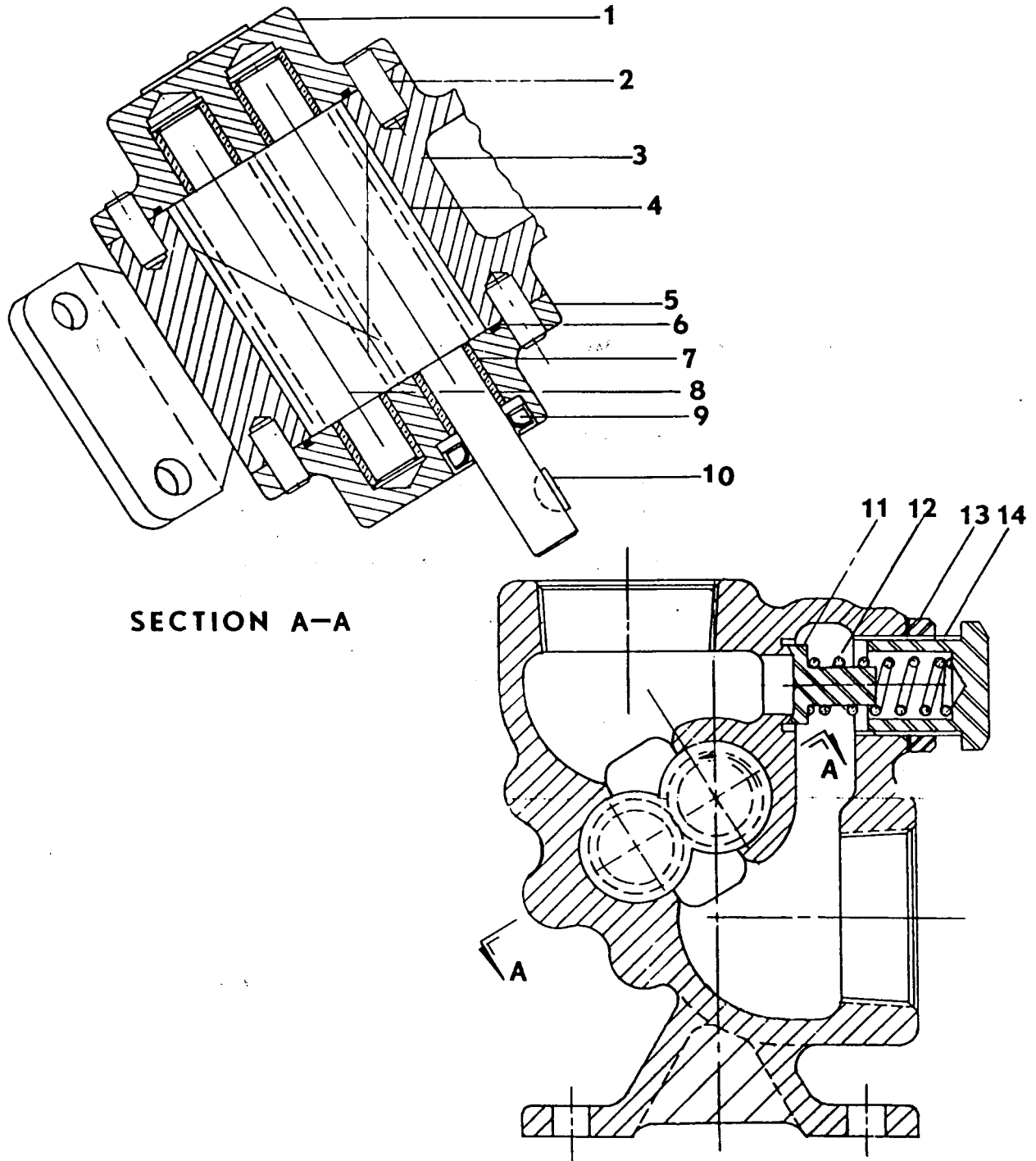


FIGURE 2835 L TYPE 1

15. PARTS LIST

FIGURE 2835 L TYPE 1

Item	Description	Qty.
1	Faceplate Assembly	1
2	Dowel Pin	4
3	Case Assembly	1
4	Drive Gear & Shaft, R.H.	1
5	Backplate Assembly	1
6	O-ring	2
7	Iron Bearing (part of assembly)	4
8	Idler Gear & Shaft	1
9	Lip Seal (2835 L only)	1
10	Hypro Key	1
11	Poppet	1
12	Spring	1
13	Seal Nut	1
14	Adjusting Screw	1

FIGURE 2835 M TYPE 1 (Parts Not Shown In Section 14, See Section 11)

4A	Drive Gear & Shaft, R.H.	1
5A	Backplate Assembly	1
15	Bearing Cage & Seal Face	1
16	Cap Screw	2
17	Gasket	1
18	Retaining Ring	1
19	Rotating Element, Mechanical Seal	1

FIGURE 2835 P TYPE 1 (Parts not shown in Section 14, See Section 13)

20	Packing Plate	1
21	Packing Gland	1
22	Packing Rings	4

16. 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.
	Relief valve chatter. Check pressure setting.
	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 mechaical 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.

