

**GENERAL INSTALLATION
AND
OPERATION MANUAL FOR
ROPER PROGRESSING
CAVITY PUMPS**



**Roper Pump Company
PO Box 269
Commerce, Georgia 30529**

**Telephone: (706) 335-5551
TeleFAX: (706) 335-5505**

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NOTE: BOLD FACE 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. Yet, 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 crew.

As its title implies, this manual is general in nature and 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 distributor or the home office of:

**Roper Pump Company
P.O. Box 269
Commerce, Georgia 30529
Telephone: (706) 335-5551
TeleFAX: (706) 335-5505**

! 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.
- **DANGER! TOXIC! DO NOT** run the pump dry. Running dry (flow less than 10% of normal) is harmful to the pump and will cause rapid heating of the pump due to internal friction. This friction may cause the rubber element of the stator to smoke, possibly releasing toxic fumes from fluoroelastomer (FKM) stators. Devices should be installed in the suction piping to prevent dry operation of the pump. The chance of the release of toxic vapors into the system piping must be considered if FKM stators are used. Adequate provision for proper venting of the system piping must be made prior to any maintenance work, if dry operation is suspected.
- **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 crew using this pump have 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, FULL PRECAUTIONS SHOULD BE TAKEN ALWAYS. 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 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 without proper guards in place.

- **DO NOT** walk, stand, sit or lean on guards.
- **DO NOT** work on a pump while it is operating.
- **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 with a bar or stick.
- **DO NOT** work on this equipment if there is the slightest chance of it becoming energized by accident. Lockout the energy source to the driver and disconnect the coupling before performing maintenance to the equipment.
- **DO NOT** run the pump dry. Running dry (flow less than 10% of normal) is harmful to the pump and will cause rapid heating due to internal friction. This friction also may cause the rubber element of the stator to smoke possibly releasing toxic fumes.
- **DO NOT** wear loose or dangling clothing or jewelry near the equipment. It could become caught and possibly cause serious injury.
- **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** always know your position about 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.

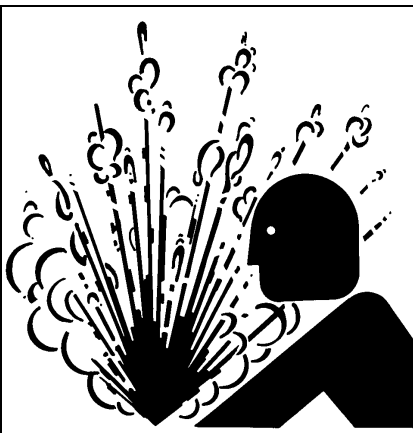
3. PRE-OPERATION CHECKS

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. Normal rotation is shown on the pump drive end. The driver rotation test must be done with the driver and pump disconnected. **DO NOT** run pump dry. Dry operation is harmful to the pump.

Before the initial startup, some fluid to be pumped should be introduced into the inlet body to insure wetting of the pumping elements. (On subsequent startups, if the pump does not discharge fluid after it has been operating for one minute, it should be reprimed.) Turn on the flush liquid to the packing, if applicable.

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 packing 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 a few seconds 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.

4. PREPARATION OF FOUNDATION

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

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

Place the unit, with the pump and driver mounted on the baseplate, on the foundation and disconnect the coupling (flexible coupling, belts and sheaves, etc.). **DO NOT** reconnect the coupling until all alignment operations are complete. Support the baseplate on rectangular metal blocks and shims or on metal wedges having a small taper. Place the support pieces close to the anchor bolts and directly under the part of the baseplate carrying the greatest weight. Space the support pieces close enough to give uniform support. Allow a gap of about 3/4 inch to 1 1/2 inches 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 on Aligning Driver and Pump), tighten 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 semi-annual inspections and checks of the foundation anchor bolts as part of a preventive maintenance the anchor bolts evenly but not too firmly. Then grout the unit to the foundation. Completely fill the baseplate with program.

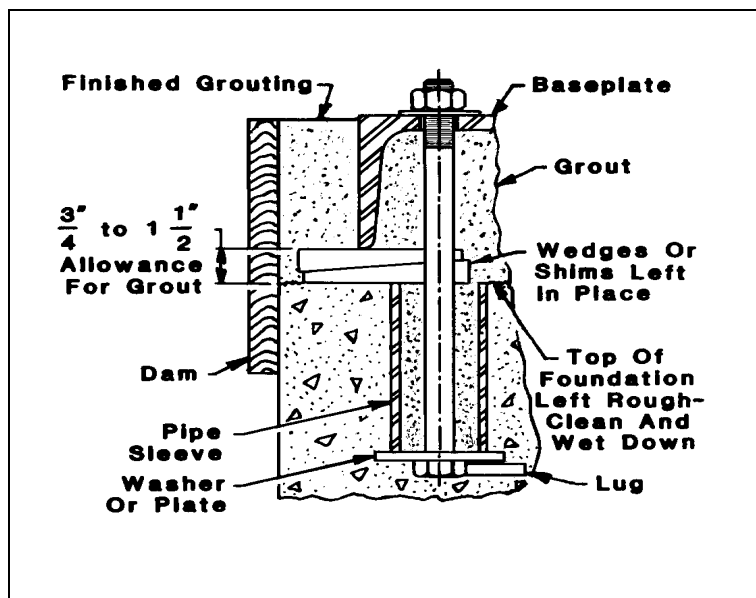


Fig. 1: Typical Baseplate Anchoring

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 that special components and precautions be used. 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.

5. 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 realigned during and after installation.** Refer to the flexible coupling or belt and sheave manufacturer's recommendations and instructions for the requirements for proper alignment. Also refer to the section on Preparation of Foundation for additional information.

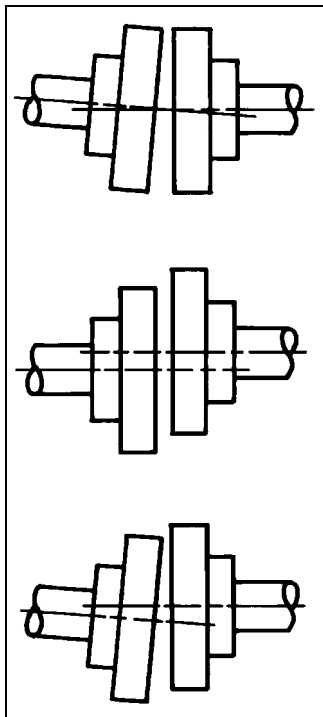


Fig. 2: Misalignments: Top, Angular; Center, Parallel; Bottom, Both.

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.

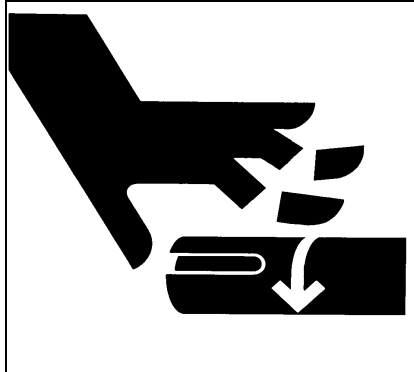
The faces of the coupling halves should be spaced far enough apart so that they cannot strike each other when the driver rotor is moved hard over toward the pump. Allowance should be made for wear of the thrust bearings. The necessary tools for *approximate* checking of the alignment of a flexible coupling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

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.



WARNING! Do not operate without guards in place.

! WARNING

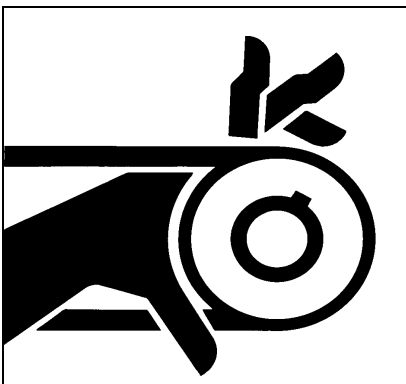
Make sure there is no chance of the driver becoming energized while aligning driver and pump. Getting caught in rotating parts of the drive system may cause serious personal injury or death. DO NOT start or operate pump without guards in place.

BELTS AND SHEAVES

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.



WARNING! Do not operate without guards in place.

! WARNING

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 may cause serious personal injury or death. DO NOT start or operate pump without guards in place.

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.

Keep belts clean and free from oil. Clean oily belts with a cloth dampened with soap and water. Stop drive to clean belts. **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.

6. 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:

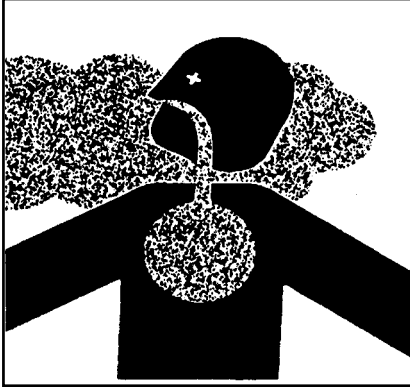
- Decide the results of spillage or leakage (all pumps or systems may fail sometime).

Explode	_____	Toxic	_____
Corrode	_____	Fire	_____
Chemical Burn	_____	High Temperature	_____
High Pressure	_____	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 ON PRE-OPERATION CHECKS.

! DANGER TOXIC



DANGER! TOXIC! Do not burn fluoroelastomers.

DO NOT run the pump dry. Running dry (flow less than 10% of normal) is harmful to the pump and will cause rapid heating of the pump due to internal friction. This friction may cause the rubber element of the stator to smoke, possibly releasing toxic fumes from fluoroelastomer (FKM) stators. Install devices into the system to prevent the chance of running dry. Consider ample provisions to allow for venting of the system piping should you suspect dry operation of an FKM fitted pump. DO NOT dispose of parts containing FKM, such as stators, o-rings, and connecting rod washers made of this material, by burning. Clearly mark FKM parts, prior to disposal, with a warning stating "DO NOT BURN" due to the danger of releasing toxic vapors.

- 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; NPT Connections; and Pre-Operation Checks. These sections may be found elsewhere in this book.

7. 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 offensive 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 offensive 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.

An easily removable section of piping between one to two times longer than the stator should be connected to the discharge port. This will allow the rotor and stator to be removed without removing the entire pump from the baseplate.

Thoroughly clean and flush the piping system before connecting the pump.

8. NPT CONNECTIONS

American National Standard Taper Pipe Threads (NPT) are used on pipe plugs, threaded stator connections, and threaded ports of the pump. 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.

For cast iron or steel joints:

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

For stainless steel joints:

- PST Pipe Sealant No. 567 -Loctite Corp.

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

- NOTE: The assembly of NPT connections, especially on stainless steel, without the use of a sealant may cause severe galling of the threads resulting in damaged parts that may require replacement.

9. PRESSURE RATINGS

Fig. 3 shows the maximum allowable differential pressure (the amount of pressure difference between the inlet and discharge of the pump) for several durometer stators and stages of pump. These values are maximum allowables and are not recommended for every application. Abrasive fluids should not be pumped at these maximum values due to the shortened life of the rotor and stator that will occur. Refer to Roper's progressing cavity pump technical literature for added information on suggested pressure limits for pumping abrasive products. Seventy (70) durometer (Shore A scale) stators include buna n (code L), EPDM (code C) and fluoroelastomer (code V). Fifty five (55) durometer stators include natural rubber (code M) and a special soft durometer buna n (code L1).

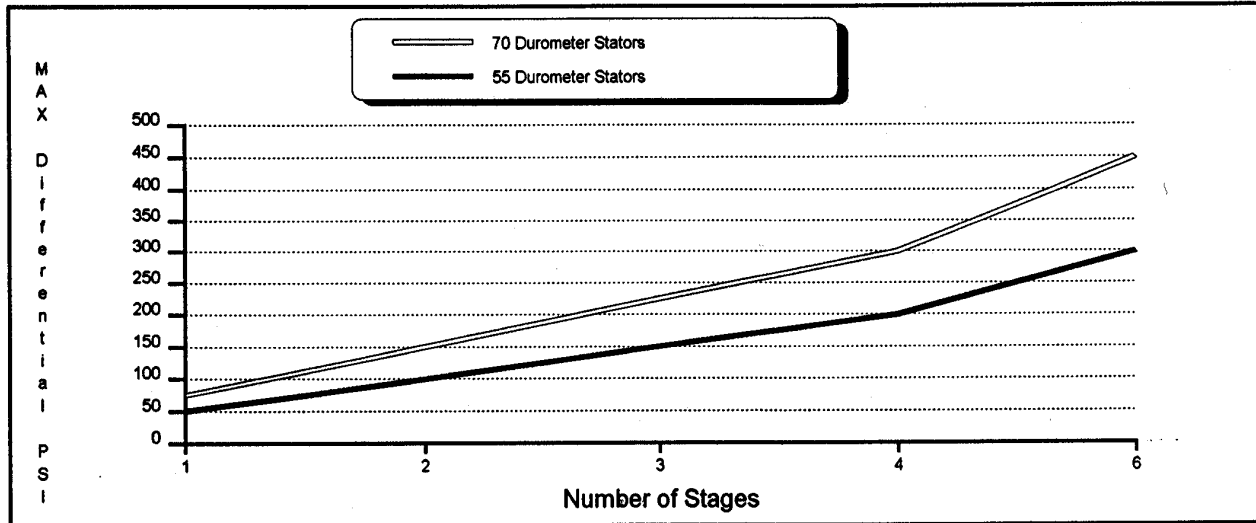


Fig. 3: Maximum Differential Pressure

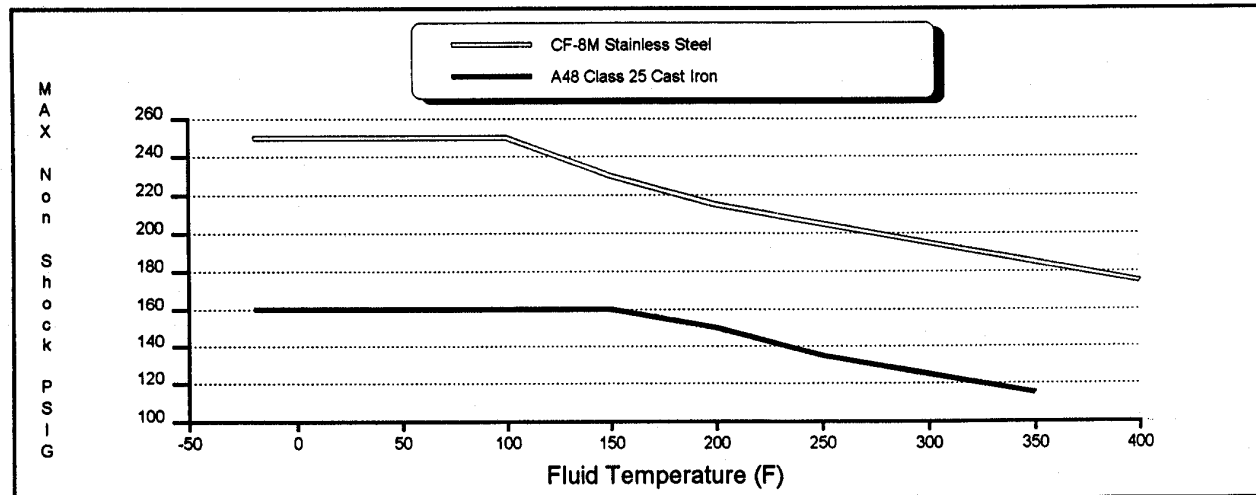
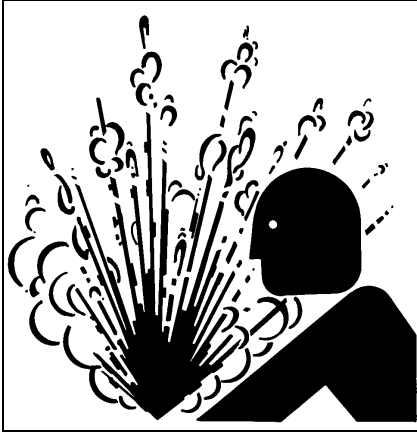


Fig. 4: Maximum Inlet Body Pressure Ratings (Not for 7X700)

Fig. 4 shows the **maximum non-shock** pressure rating of the pump inlet body against temperature. Despite the number of stages of the pump or the

direction of rotation, the values shown in Fig. 4 must not be exceeded on the inlet body of the pump. **DO NOT** apply Fig. 4 to model 70700 hopper feed pumps. Consult the factory or refer to specific hopper feed instruction manuals for maximum inlet pressures on hopper feed pumps.



WARNING! Do not overpressurize pump or system.

! WARNING

Exceeding the values shown in Fig. 4 may cause the inlet body to burst causing physical damage, loss of product, injury to personnel or death. **DO NOT** extend or exceed the curves shown in Fig. 4. **DO NOT** apply Fig.4 to Roper hopper feed pump models 70700.

10. STORAGE

If you do not intend to install this Roper pump within the time frame specified below, the following suggestions are offered. They should be followed to insure the best possible chances of a successful startup when the pump is installed.

SHORT TERM STORAGE (up to six months):

The following suggestions are offered for storage of up to six months:

- Protect the pump from the elements. Store the pump indoors whenever possible away from sources of ozone generating equipment such as motors or generators. If indoor storage is not possible, cover the pump with a protective covering. Do not allow moisture to collect in or around the pump.
- Remove the drain plug from the inlet housing and allow the pump to dry completely,
- Relieve the compression on the packing by loosening the packing gland. If you intend to grease lubricate the packing after installing the pump, inject a liberal amount of grease into the stuffing box through the lube fitting. If a water flush is to be used, do not inject grease into the stuffing box. Instead, place a small amount of light oil into the stuffing box.
- Read and understand this manual thoroughly before installing or starting pump.

LONG TERM STORAGE (over six months):

If the pump is to be in storage for over six months, follow both the suggestions above for short term storage and the following suggestions:

- If applicable, remove the drive belts from belt driven units or disconnect the coupling on direct connected units.
- Apply a rust inhibitor to the pump. **DO NOT** allow petroleum based inhibitors to contact EPDM or natural rubber (code C or M) stators.
- Approximately every two weeks, rotate the drive shaft of the pump manually for several revolutions. This will help avoid a *set* condition between the rotor and stator making startup easier. This also will help avoid deformation of the stator profile that may cause excessive vibration. If the pump must be left unattended for over six months, the stator should be removed to prevent *set*.

If other equipment included with the pump, such as drivers, seals, flow monitors, etc., is to be stored also, refer to the respective manufacturer's recommendations for storage.

11.NAMEPLATE DATA

Roper identifies each pump manufactured, by a metal nameplate attached to the pump. This nameplate describes how the pump was built at our 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: _____
 SPEC: _____
 SERIAL: _____
 TYPE: _____

PUMP NOMENCLATURE

Example: 73212 GHM Spec XXX Type 1 Serial ZZZ

1. The FIGURE number is a five or six digit number followed by a three letter material code.
 - The first number (7 in the example) shows the progressing cavity pump series..
 - The second number (3) shows the number of stages of pumping elements.
 - The third number (2) shows the drive size or configuration.
 - 2- Standard drive, pin joint construction.
 - 3- One drive size larger than standard drive, pin joint construction.
 - 4- Standard drive, gear joint construction.
 - 5- Solid shaft, pin joint construction.
 - 6- Two drive sizes larger than standard drive, pin joint construction.
 - 7- Hopper feed, pin joint construction.

- The fourth, fifth, and (where appropriate) sixth numbers show the approximate theoretical displacement in U.S. gallons per 100 revolutions:

4th, 5th, 6th	006	025	01	02	05	12	19	22	28	36	44	65	115
Gal/100 rev	.06	.25	1	2	5	12	19	22	28	36	44	65	115

- The three letters show the materials of construction. The first letter (G) shows the pump body. The second letter (H) shows the internals. And the third letter (M) shows the stator elastomer:

Item	Letter	Material
Pump	G	A48 Class 25 cast iron.
Body	N	CF-8M stainless steel.
Internals	H	Alloy steel, hard chrome plated rotor and shaft
	N	316 stainless, hard chrome plated rotor and shaft
Stator	C	EPDM (EPR)
	L	Buna N (NBR)
	M	Soft natural (NR)
	V	Fluoroelastomer (FKM)
* On figure 7X700 hopper feed pumps, hopper is (G) carbon steel or (N) 304 stainless steel.		

- NOTE: The preceding description of the figure number is to help in identifying your Roper progressing cavity pump only. DO NOT attempt to obtain any ratings or performance from the figure number. DO NOT use the explanation of the figure number to construct a pump, *not all combinations are possible*. For aid in pump selection, consult a Roper distributor or Roper Pump Company.
- Occasionally, special pumps or configurations are required that are unique for a particular application. These modifications are clarified by a SPECification number. Identification of any items different from a standard pump can be made by consulting a Roper distributor or Roper Pump Company.
 - 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.
 - The SERIAL number is a unique number assigned to each pump built by Roper.

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.

12. SHAFT SEALING

PACKING

The standard shaft sealing method used on this pump is die formed ring packing with a lantern ring. Tapped holes on each side of the inlet body provide access to the lantern ring for either water flushing or grease lubrication. A water flush or lubrication of the packing is necessary for proper operation and will help prolong the life of the packing and shaft.

Water flush when the fluid to be pumped is abrasive or the pump operates with negative inlet pressure (suction lift). Clean water should be supplied to the stuffing box at a rate of 1/4 to 112 gallon per minute. The pressure of the flushing water should be approximately 10 to 15 PSI higher than the pressure of the fluid in the inlet body.

- .Note: On applications where clean water is not available or where it is incompatible with the fluid being pumped, other clean, nonhazardous liquids may be used *for* flushing the packing.

If the packing is to be grease lubricated, a good grade of bearing grease should generally be used. Should bearing grease be unacceptable or incompatible with the fluid being pumped, another paste type lubricant may be used. Lubrication of the packing should be performed with the pump stopped and not operating. Before daily start-up, if applicable, is a good time. **DO NOT** lubricate or adjust packing with the pump operating. To lubricate the packing, stop the pump and carefully clean the lube fitting and pipe plug of any contaminants. After removing the pipe plug *from* the side of the stuffing box, lubricant may be injected into the stuffing box through the lube fitting on the other side. Inject clean, fresh unused lubricant until it is seen coming out of the unplugged hole. Clean up any expelled lubricant and the lube fitting. Replace the pipe plug. This procedure should be performed daily, prior to start-up. In certain applications, more frequent lubrication of the packing may be necessary. Experience will provide a guide to how frequently the packing should be lubricated. Applying lubricant often will help extend the life of the packing and shaft.

WHERE LIQUID BEING HANDLED IS HAZARDOUS OR VOLATILE, FULL PRECAUTIONS SHOULD BE TAKEN ALWAYS, INCLUDING THE RUN-IN PERIOD.

CARE OF PACKING

Packing hooks are commercially available to help in removing packing rings *from* the stuffing box. It is generally not recommended to reuse old packing rings.

When installing packing, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed. **DO NOT forget** to install the lantern ring. The lantern ring should be approximately aligned with the two flush/tube holes in the stuffing box.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft, and then backed off until finger-tight. Connect the flush or lubricate the packing, depending upon the method used. 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. Gland nuts should be adjusted evenly in 1/6 to 1 *fJ* 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 stuffing box leakage is between five to ten drops per minute. **DO NOT** work on a pump while it is operating.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute,

when the pump is operating, is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers and generate excessive heat.

Packing glands 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.

MECHANICAL SEALS

Certain applications may not permit the necessary leakage required for the proper operation of packing. These applications may require the use of an end face type of mechanical seal. Various types of mechanical seals may be available to fit most pumps. Due to the various seal types and styles available, the seal manufacturer's instructions for installation and setting should be followed.

- NOTE: Not all seals will fit or function in all pumps. Modification to either or both the pump or seal may be required, or it may be necessary to change to a different type of seal. Consult with both the pump and seal manufacturers if a change in shaft sealing method appears necessary.

13. BEARING LUBRICATION

The pump bearings are antifriction bearings, either ball or tapered roller bearings, and are grease lubricated. The bearings, installed in pumps, are lubricated at the factory. Under normal operating conditions, they should not need additional lubrication or relubrication for the first 5,000 to 10,000 hours (depending on pump model) of operation. Shorten the lubrication intervals when the pump operates in dusty or moist environments.

A good grade of NLGI grade 2 EP (extreme pressure) grease, suitable for the operating temperatures encountered, should be used. Pumps are lubricated at the factory with Mobil's Mobilux EP2 grease.

Replace the bearing seals each time the pump is relubricated. Add a few drops of oil to the bore of the bearing seals before reassembling.

PREFERRED RELUBRICATION METHOD:

When relubricating the bearings, the shaft-bearing assembly should be removed from the pump and cleaned of old lubricant. Carefully inspect the bearings for signs of wear or contamination and replace them if necessary. DO NOT contaminate the bearings while they are out of the pump. Pack each bearing full of grease and fill the space between the bearings about one-half full.

ALTERNATIVE RELUBRICATION METHOD:

The following alternative relubrication method is provided as a convenience for installations where the pump location creates difficulty in using the preferred relubrication method. But, bearing life may be reduced as any existing contaminants are not removed. Thoroughly clean the lube fitting found in the bearing area of either the bearing housing or inlet body. Inject approximately one to one and one-half ounce of grease into the bearing area through the lube fitting. Clean any excess grease from around the fitting to avoid attracting dirt and contaminants.

Every second or third relubrication of the pump should be performed using the preferred relubrication method. This will allow proper cleaning and inspection of the parts.

- **NOTE:** In a new or relubricated pump, the bearings may run warmer than normal for a few hours before the temperature levels to normal operating temperature. This is a normal condition of bearings freshly lubricated and is no cause for alarm. Higher than normal bearing temperature, occurring for several days after relubricating the bearings, may suggest a problem. This problem could be too much lubricant, a contaminated bearing, or it could possibly suggest a bearing about to fail. Should bearing temperatures run higher than normal for several days, the shaft-bearing assembly should be relubricated as outlined in the preferred relubrication method.

<u>! WARNING</u>

DO NOT spin bearings with compressed air. This is highly dangerous and will cause the bearing to spin at dangerously high speed. This can cause the bearing to fragment with explosive force possibly causing serious personal injury or death.

To insure that antifriction bearings can get long life and that they perform without offensive noise, temperature rise or shaft excursions, the following precautions are recommended:

- Handle bearings with care.
- Work with clean tools, clean dry hands, and in clean surroundings. .
- **DO NOT** wash or wipe new bearings prior to installation.
- Place unwrapped bearings on clean paper and keep them similarly covered, if they are not in the original container.
- **DO NOT** use wooden mallets, brittle or chipped tools, or dirty fixtures and tools in mounting bearings.
- **DO NOT** spin uncleaned bearings. **NEVER** spin any bearing with compressed air.
- **DO NOT** scratch or nick bearings.
- Insure that races are started onto shafts and into housings evenly to prevent cocking.
- Inspect shafts and housings before mounting bearings.
- When removing bearings, clean the housings, covers and shafts before exposing the bearings. All dirt can be considered an abrasive; dangerous to the reuse of any bearing.

- Treat used bearings, which may be reused, as new ones.
- Protect dismantled bearings from dirt and moisture. Wrap bearings in clean, oil-proof paper when not in use.
- In assembling bearings onto shafts, **NEVER** strike the outer race, or press on it to force the inner race. Apply the pressure to the inner race only. In disassembling, follow the same precautions.

The general classifications of failures usually requiring bearing removal are listed below. These classifications are related with many causes, some of which are outlined as follows also.

PROBLEM	POSSIBLE CAUSES
OVERHEATING	Bearing contamination
	Excessive lubrication
	Inadequate lubrication
	Housing distortion
	Cage wear
VIBRATION	Bearing contamination
	Fatigued bearing elements
	Race misalignment
	Shaft out-of-round
	Flats on bearing elements
NOISE	Inadequate lubrication
	Bearing contamination
	Brinelling due to handling abuse
	Loss of bearing clearance
	Bearing slipping on shaft
BINDING	Lubricant breakdown
	Bearing contamination
	Thermal expansion
	Race misalignment
	Cage failure
LUBRICANT LEAKAGE	Excessive lubrication
	Seal wear or failure
	Lubricant deteriorating due to high temperature
	Lubricant churning

14. JOINT LUBRICATION

This pump is provided with two universal joints that allow the rotor to rotate through an eccentric path necessary to the proper functioning of the pump. The joints may be of a pin type or crowned gear type depending upon the model of the pump. Proper lubrication of the joints is important and will help extend the service life of the joint components.

When assembling the pump, make sure that all components of the joint are coated with lubricant. Also, fill the spaces between joint components full of lubricant. This is particularly important because joint lubrication can be performed only when the pump is disassembled and the lubricant must perform its job until the next time maintenance is performed on the pump.

In pin joint pumps, use a grease that is compatible with the fluid being pumped and that will not react with the fluid. In gear joint pumps, a good grade of EP (extreme pressure) grease containing molybdenum disulfide additives should be used.

15. SPECIAL PRECAUTIONS FOR HOPPER FEED PUMPS



WARNING! Lock out power before opening hopper body.

To avoid unsafe conditions, install hopper feed pumps with the following minimum provisions besides the other directions contained in this manual:

- **DO NOT** operate hopper feed pumps unless the hopper body and inlet piping completely enclose the auger elements. Make sure all guards are in place. If the hopper body is opened for any reason, lock out the driver so that it cannot be restarted by anyone unless the hopper body is closed and all guards are in place.
- If an open hopper body is a condition of use, the entire pump is then to be guarded by a railing or fence. Post warning signs in the area.
- Feed openings for manual or mechanical equipment must be build so that a grating covers the hopper body opening. If the material is such that a grating cannot be used, then the exposed hopper body opening must be guarded by a railing or fence. Post warning signs in the area.
- **DO NOT** walk on hopper gratings or power transmission guards.
- **DO NOT** poke or prod material in the hopper body with a bar or stick.
- **DO NOT** place hands, feet, head, or any other part of the body in any hopper opening.
- Controls, guards, walkways, machinery arrangement, crew training , etc., are all necessary factors in the creation of a safe, practical installation. These items 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 Safety Code.*

16. CHECKING PUMP PERFORMANCE

A summary of the causes of common malfunctions.

<i>PROBLEM</i>	<i>POSSIBLE CAUSES</i>
<i>NO LIQUID DELIVERED</i>	<i>Pump rotating in wrong direction.</i>
	<i>Inlet lift too high. Check this with gauge at pump inlet.</i>
	<i>Clogged inlet line.</i>
	<i>Inlet pipe not submerged.</i>
	<i>Air leaks in inlet line.</i>
	<i>Faulty pressure relief device in system.</i>
	<i>Pump worn.</i>
<i>RAPID WEAR</i>	<i>Excessive pressure.</i>
	<i>Pump runs dry.</i>
	<i>Incompatibility of liquid and pump materials.</i>
	<i>Pipe strain on pump. See Installation of Pipes.</i>
	<i>Excessive abrasives in liquid.</i>
<i>EXCESSIVE NOISE</i>	<i>Starved pump.</i>
	<i>Air leaks in inlet line.</i>
	<i>Air or gases in liquid.</i>
	<i>Pump speed too high.</i>
	<i>Improper mounting. Check alignment thoroughly. See Aligning Driver and Pump and Preparation of Foundation.</i>
<i>PUMP TAKES TOO MUCH POWER</i>	<i>Speed too high.</i>
	<i>Liquid more viscous than previously anticipated.</i>
	<i>Operating pressure higher than specified. Check this with gauge at pump discharge.</i>
	<i>Discharge line obstructed.</i>
	<i>Mechanical defect, such as bent shaft.</i>
	<i>Packing too tight.</i>
	<i>Pipe strain on pump. See Installation of Pipes.</i>
	<i>Incompatibility of liquid and pump material causing stator swell.</i>
	<i>Pressure relief device in system not operating properly.</i>

SERVICE NOTES

Additional copies of this manual may be obtained, free of charge, by contacting a distributor or the home office of:

**Roper Pump Company
P.O. Box 269
Commerce, Georgia 30529**

**Telephone: (706) 335-5551
TeleFAX: (706) 335-5505**

Your Roper Distributor is: