

SERIES F

TYPE 27

IGP-F  
7/2/93



## Installation and Operating Instructions

### **WARNING! DANGER!**

**READ BELOW BEFORE STARTING PUMP! FAILURE TO HEED THESE WARNINGS MAY RESULT IN AN ACCIDENT CAUSING PHYSICAL DAMAGE, SERIOUS PERSONAL INJURY OR DEATH!**

1. Read and understand tags and installation and operating instructions.
2. Always use caution near rotating parts including the drive system for the pump.
3. Install proper guard(s). Never operate pump without guard(s) in place.
4. Open all lines before starting pump.
5. Know operating conditions.
6. Do not operate this equipment in excess of its rated capacity, pressure, speed, and temperature, or other than in accordance with instructions contained in the installation and operating instructions.
7. Install and properly set relief valve.
8. Proper measures and precautions must be taken to avoid spillage and overflow from overfilling or over pressurization of any component of the system including the receiver and lines.
9. Pumps should not be mounted and/or suspended by the ports unless specifically designed for it or authorized by Roper Engineering

Correctly installed, operated and maintained, your Roper pump will give long, dependable service. Remember...faulty selection and installation form the basis for more pump troubles than all other causes combined...no amount of maintenance can compensate for selection and installation mistakes. Read these instructions carefully before installing and operating this pump.

This pump is satisfactory for the conditions for which it is rated, but its operation in excess of these conditions may subject it to stresses and strains which it is not designed to withstand.

It is recommended that appropriate coupling or belt guards be installed for the protection of personnel.

These instructions will cover standard pumps and most spec number pumps. Appearance may vary among pumps and construction may vary on spec number pumps.

If there is any question concerning the ratings or instructions, please contact a distributor, district representative, or the home office of the: ROPER PUMP COMPANY, Commerce, GA 30529. Phone 706-335-5551

**ROPER PUMP COMPANY**  
COMMERCE, GEORGIA 30529

## ADDITIONAL IMPORTANT WARNINGS AND INFORMATION

1. These instructions cannot possibly cover every situation concerning the operation, inspection, adjustment and test of the equipment furnished. Roper Pump Company, in furnishing this equipment and these instructions, must presume that the operating and maintenance personnel using this equipment have sufficient technical knowledge and experience to apply sound safety and operational practices which may not be otherwise mentioned.
2. These pumps are general purpose pumps for a wide range of applications; and it is, therefore, not practical to include performance or maximum ratings in these instructions. Standard ratings are contained in Roper Pump Company sales brochures for the type of pump involved. If you do not have ratings or performance characteristics for your installation and pump, they can be obtained by contacting a Roper distributor, representative, or Roper Pump Company.
3. In applications where Roper furnished equipment is to be integrated with a process or other equipment, these instructions should be thoroughly reviewed to determine the proper integration of the equipment into the overall plant or system operational procedures.
4. Roper Pump Company does not supply, recommend, or approve the various systems in which its pumps are or may be used. Unless designed, manufactured, and used properly, various systems may be inherently unsafe or dangerous. The user should check and comply with all federal, state and local regulations and other regulations and recommendations such as: NFPA, UL, API, OSHA, etc.

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

A. Determine consequences of spillage or leakage (all pumps or systems may fail sometime).

- Explode
- Toxic
- Corrode
- Fire
- Chemical Burn
- High Temperature
- High Pressure
- Other

B. Have Appropriate safeguards been used?

- Temperature Controls
- Pressure Controls
- Leak Detectors
- Shutoff Devices
- High or Low Pressure Safeguards
- Alarm Devices
- Overfill or Overflow Detection
- Have all possible methods and sequences of failure been considered?
- Are there any other methods needed to control a hazard?
- Inspection for wear and/or deterioration of components.

Identify all possible hazards. Determine what controls are needed. Only you, the user, understands your product and system characteristics fully. The ultimate responsibility for the application and safety is with you.

5. The possibility of fire and burns from flammable or hot liquid spillage from ruptured hoses should particularly be noted and proper precautions taken.

Exposed rotating parts of the drive to pump should be properly guarded.

7. On all pumps it is recommended that a relief valve (either a built-in valve or an external valve in the line) be used to protect the equipment and personnel from accident due to overpressure. FOR A PUMP EQUIPPED WITH A BUILT-IN RELIEF VALVE, SEE SECTION(S) ON RELIEF VALVES BEFORE OPERATING PUMP. READ SECTION ON PRE-OPERATION CHECKS, ESPECIALLY FOR A PUMP WITH NO BUILT-IN RELIEF VALVE.

If the pump is purchased with a built-in relief valve, it must be properly installed and set by the user to protect the pump. This relief valve is a safety device. It should not be used as a control device to regulate pressure. Further consideration must be given by the user as to whether the built-in relief valve is adequate to protect the system and personnel. If any part of the system is inadequate or could become inadequate through deterioration, wear, abuse, etc., such as hoses, the built-in relief valve may not give protection. An external relief valve, sized, provided, installed, and set by the user may be required to protect the system.

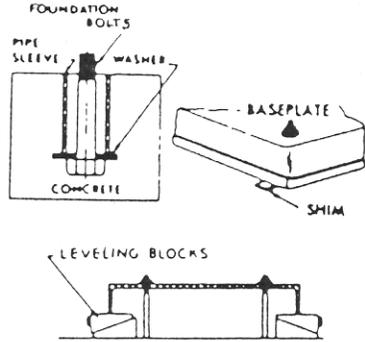
8. Certain system conditions such as sudden opening or closing of inlet or outlet valves, etc., can result in high transient (short time) pressure pulses which exceed the built-in relief valve setting. The user is responsible for determining system characteristics and providing hose, pipe, fittings, etc., adequate for these conditions.
9. Spillage or overflow from overfilling or overpressurization of 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 overpressurization of any component of the system including the receiver and lines.

Roper Pump Company continually updates its instruction books, therefore, you should periodically request an updated book or check that you have the latest.

Prior to starting pump see PREPARATION OF FOUNDATION BASEPLATE MOUNTED PUMPS, ALIGNING DRIVER AND PUMP, INSTALLATION OF PIPES, and PRE-OPERATION CHECKS sections in the back of this book.

# PREPARATION OF FOUNDATION-BASEPLATE MOUNTED PUMPS

A good foundation is of major importance. Concrete is best, since it is heavy enough to support the baseplate rigidly and absorb strain and shock. Baseplate units must be securely bolted in position, with shims or leveling wedges to correct any angular and-or parallel misalignment. Such misalignment will cause the pump or driver to be out of alignment, thus resulting in heavy stresses on the pump. Accelerated wear or vibration can be caused by a very slight misalignment.



PLACE STRAIGHT EDGE AT TOP, BOTTOM, AND BOTH SIDES TO CHECK ALIGNMENT OF COUPLING MEMBERS	
Correct	STRAIGHT EDGE
Parallel Misalignment	STRAIGHT EDGE
Angular Misalignment	GAUGE FINDER

## ALIGNING DRIVER AND PUMP

Driver and pump units are factory aligned before shipment, but they must be accurately realigned during and after installation.

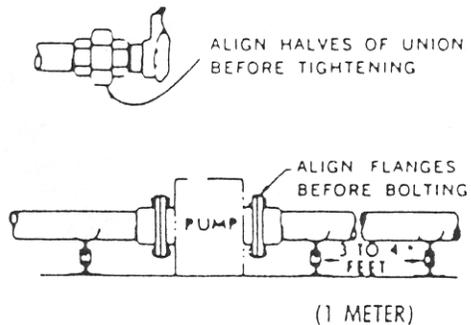
To align coupling, use a straight edge and feeler gauges to check for parallel and angular alignment as shown in illustration at left.

Check the alignment at every step during installation: after the unit is mounted on foundation, after piping has been secured, and after pump has run with the liquid at operating temperature. **DO NOT DEPEND ON FLEXIBLE COUPLINGS TO COMPENSATE FOR MISALIGNMENT.**

## INSTALLATION OF PIPES

Use of teflon tape for installing pipes may cause damage to pump. PIPING MUST BE CHECKED CAREFULLY, ALLOWING FOR EXPANSION OR CONTRACTION. Pipe strain can distort the pump components, thus increasing wear, causing bearing misalignment, or breaking parts. Pipe supports and expansion joints should be used to avoid weight and stresses on the pump. See that flanges or unions fit without forcing.

Pump port size does not necessarily establish correct pipe size. If in doubt as to pipe size to use, check with a Roper Distributor or District Representative. It is recommended that the pump be installed below the liquid level, with a short, large diameter supply line to assure a flooded inlet. Roper pumps, however are self-priming, positive displacement pumps and will prime under the most difficult conditions. Roper pumps are recommended for clean liquid only. A strainer, of ample size and regularly cleaned, should be used in the inlet piping to prevent foreign material from entering the pump.

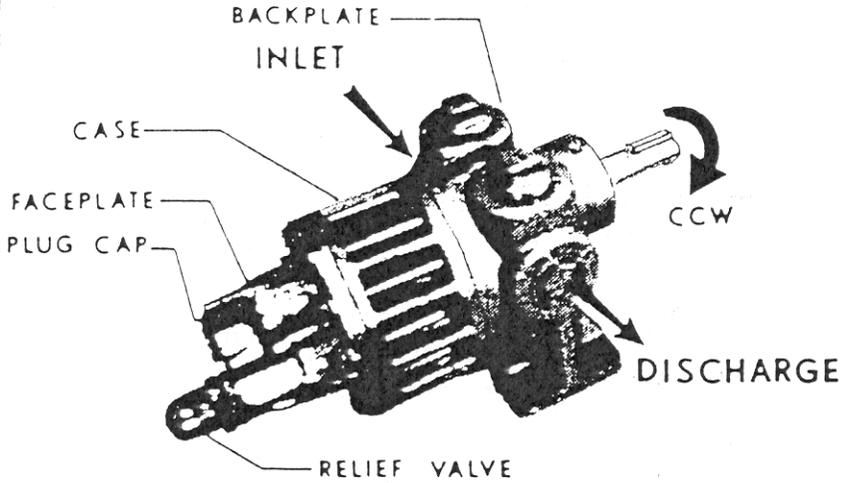


SERIES F

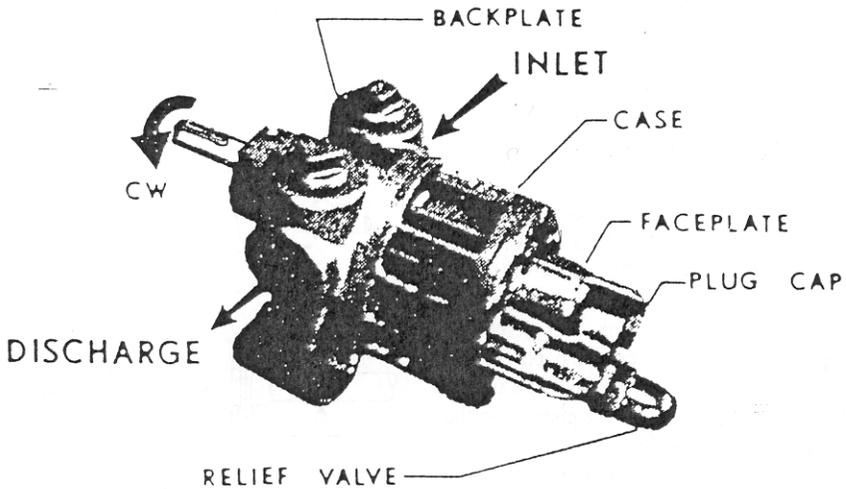
TYPE 27

DIRECTION OF ROTATION

COUNTERCLOCKWISE



CLOCKWISE



PRIOR TO OPERATING THE PUMP, MAKE SURE THAT THE SHAFT ROTATION, PIPE CONNECTIONS, AND THE RELIEF VALVE POSITION IS IN ACCORDANCE WITH THE ILLUSTRATIONS SHOWN.

To reverse rotation, the relief valve must be positioned as shown for desired direction of rotation. See appropriate instructions to change relief valve position if required.

For inlet pressures over 25 PSIG (1.7 BARS), consult a distributor, district representative, or the home office of the ROPER PUMP COMPANY, COMMERCE, GEORGIA.

## LUBRICATION

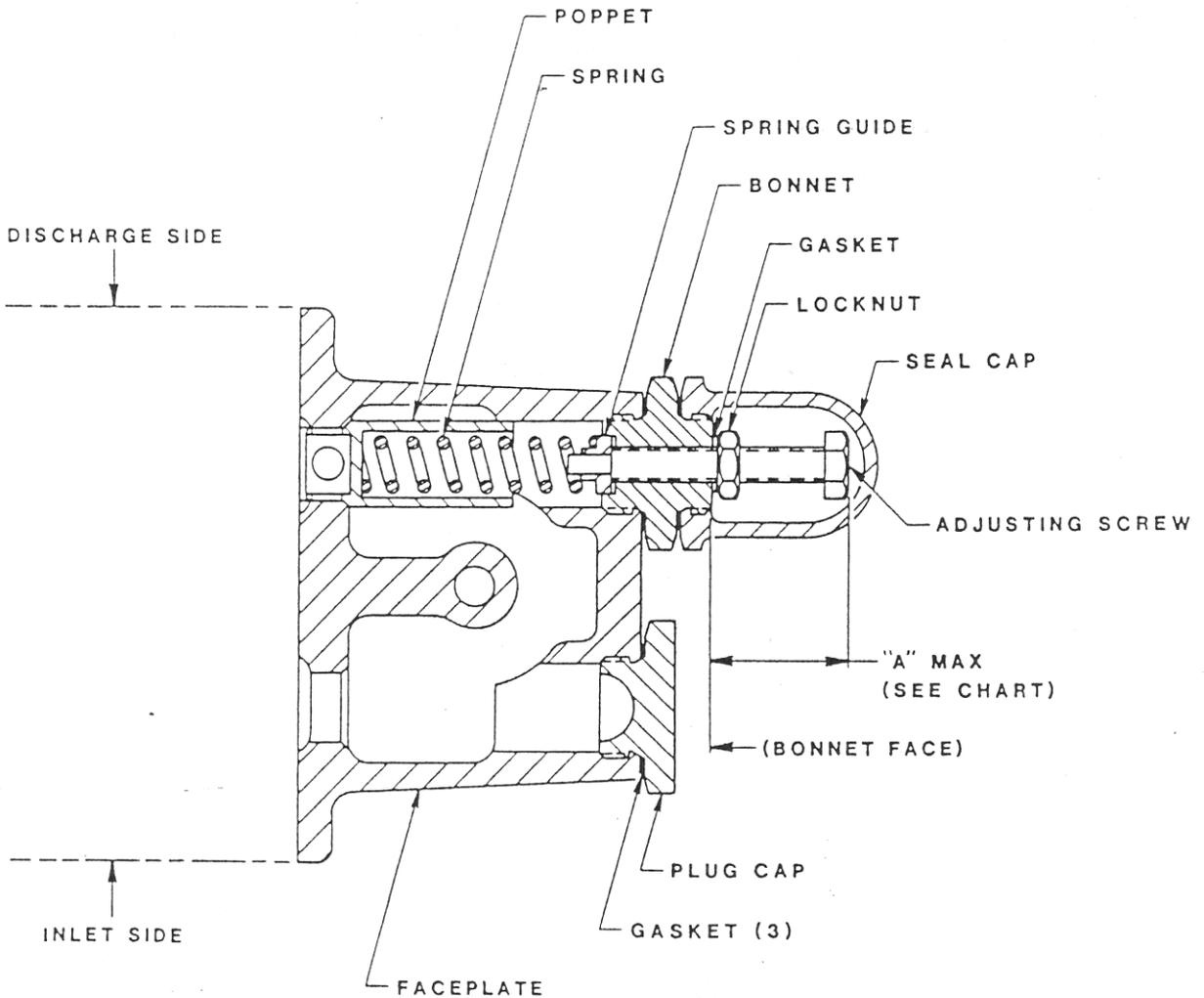
All lubrication fittings have been greased at the factory. The internal parts of the pump are lubricated by the liquid being pumped. Outboard bearing or bearing cage should be greased with ball bearing grease once a month in daily service or equivalent in intermediate service.

## RELIEF VALVE

The relief valve must be positioned as shown in instructions for direction of rotation—otherwise the valve is inoperable and will not give protection.

It is mandatory that the relief valve be set BY THE USER since the 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. If not specified otherwise, the relief valve on this pump is factory set for full by-pass at a differential pressure of 300 PSIG (20.7 BARS), at a pump speed of 900 to 1800 RPM on liquid with a viscosity of approximately 150 to 300 SSU (28 to 62 centistokes). This setting would only apply if all these conditions are duplicated. Built-in relief valves sense differential pressure only (difference between inlet and outlet pressures.)

# RELIEF VALVE



PUMP SIZE	"A"	PUMP SIZE	"A"
MAX EXTENSION	IN. [MM]	F35	1.13 [28.7]
F1,F3	.65 [16.5]	F50,F75	1.06 [26.9]
F5,F10	1.0 [25.4]	F100	1.68 [42.7]
F15,F20	1.24 [31.5]	F150,F200	2.64 [67.1]

## TO ADJUST RELIEF VALVE

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

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. (Most pumps have tapped and plugged holes in the case near the outlet or in the discharge flange which may be used for this connection.)
2. Remove seal cap and gasket.
3. Loosen the locknut on the adjusting screw.
4. Back the adjusting screw out to the point where the end of the adjusting screw will be at the max dimension "A" when measured from the relief valve bonnet. See the chart under the relief valve drawing for the proper dimension.
5. 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) it would then be necessary to install a separate relief valve in the system for protection. Do not run pump with closed discharge line for more than two minutes at a time.
6. With discharge valve closed, turn adjusting screw clockwise in  $\frac{1}{2}$  turn increments until the pressure gauge shows the desired pressure setting.
7. Tighten locknut.
8. Replace the gasket and seal cap.
9. Open discharge line, and turn pump off.

Relief Valve is now set.

To replace spring and/or piston or to change direction of rotation, shut pump off, remove seal cap and gasket. Loosen locknut and adjust relief valve pressure to minimum. Remove bonnet and gasket making sure that the spring pressure does not force bonnet out too rapidly. Remove spring, spring guide, and poppet. Remove plug cap and gasket from faceplate. Check all parts and internal passages to make sure that they are clean and free from rust or damage. To assemble, determine direction of rotation and replace plug cap and gasket as shown in direction of rotation. Place poppet and spring in correct position according to direction of rotation.

Turn adjusting screw to have shoulder flush with bonnet, place spring guide on adjusting screw; install gasket and assemble into faceplate making sure spring engages over spring guide. Tighten bonnet. Reinstall gasket and plug cap, if removed. Adjust relief valve pressure as described.

A built-in relief valve should not be used on applications where the discharge must be closed for more than a few minutes. Prolonged operation with the relief valve fully by-passing will cause heating of the liquid circulating thru the valve, thus resulting in possible damage.

CHECK POPPET PERIODICALLY TO MAKE SURE THAT IT WILL SLIDE FREELY IN PUMP FACEPLATE. FAILURE TO SLIDE DUE TO BINDING OR FOREIGN MATERIAL WILL CAUSE EXCESSIVE PRESSURE BUILDUP IN PUMP.

## MECHANICAL SEAL

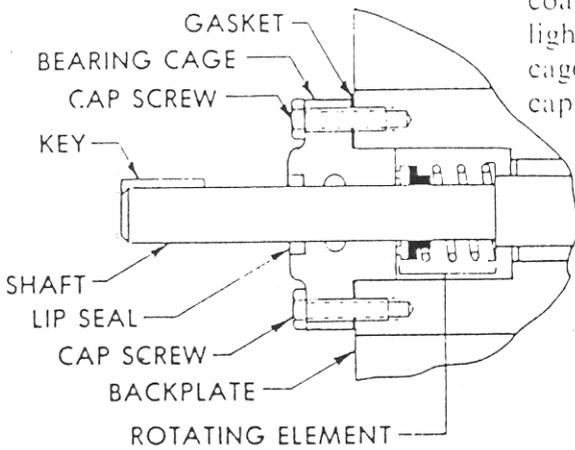
Mechanical seals do not require adjustments. Leakage developed at the seal may be due to one of the following conditions; worn, marred, or cracked rotating or stationary lapped seal faces, or bellows that has become hard, soft, cracked, expanded or extruded.

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.

# MECHANICAL SEAL, CONTINUED

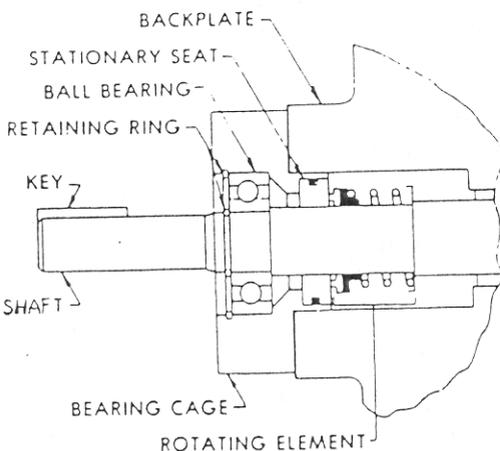
To replace the mechanical seal on pump size F1 thru F5, remove the key, cap screws, bearing cage, and gasket. Remove burrs and sharp edges from the end of shaft and keyway and clean the shaft. Next the seal parts may be removed from the shaft. To assemble, lubricate with a light machine oil the section of the shaft over which the seal is to be mounted. Slide the rotating element onto the shaft. Be sure it is properly centered on the shaft. After checking the bearing cage and lip seal and replacing if required,

coat the sealing surfaces with light machine oil. Install bearing cage and gasket and secure with cap screws.

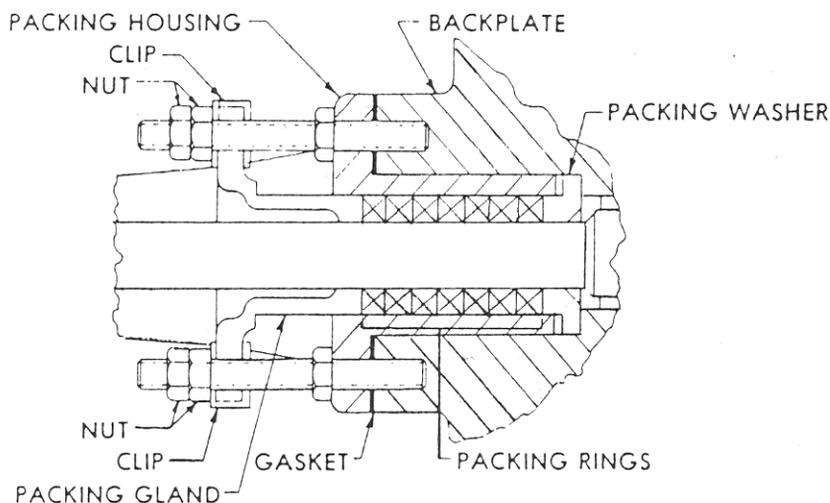


To remove the mechanical seal on pump sizes F10 thru F300, remove the retaining ring on the shaft of the F10, or loosen the set screws in the bearing of F15 thru F300. Remove the retaining ring from the bearing cage. Remove the cap screws and bearing cage. (Bearing and stationary seat will be removed along with bearing cage.) Remove burrs and sharp edges from end of shaft and keyway and clean the shaft. Next the seal parts may be removed from the shaft. To assemble, lubricate with a light machine oil the section of the shaft over which the seal is to be mounted. Slide the rotating element onto the shaft. Be sure it is properly centered on the shaft. After checking the stationary seat and "O" ring and replacing if required, coat the sealing surfaces with light machine oil. Install gasket and bearing cage and secure with cap screws. Install retaining ring on shaft for F10, or tighten set screws in bearing for F15 thru F300.

After checking the stationary seat and "O" ring and replacing if required, coat the sealing surfaces with light machine oil. Install gasket and bearing cage and secure with cap screws. Install retaining ring on shaft for F10, or tighten set screws in bearing for F15 thru F300.



# PACKING



Operate the pump under normal conditions and, after a short run-in period, examine packing for leakage. If leakage is excessive, stop the pump and follow the 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 nuts, clips, packing gland and packing rings. (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 the gear and shaft assembly. Insert packing rings making sure the joints are staggered 180 degrees and that each ring is tamped firmly in place. When the packing box is sufficiently full to allow entry of the gland about 1/4", reassemble the packing gland, clip and nuts. Draw up evenly on the gland to assure proper seating of 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.

## SAFETY PRECAUTIONS

Safe installation, operation and maintenance must be performed by qualified personnel. Do not work on pump while it is running, except to adjust relief valve. Do not adjust relief valve unless proper guarding of all rotating parts is in place. Be careful when working on or near a running pump, contacting or being caught in rotating parts could cause serious or fatal injury. Guards should be provided for all exposed rotating parts. WHEN LIQUID BEING PUMPED IS HAZARDOUS OR VOLATILE, PRECAUTIONS SHOULD BE TAKEN AT ALL TIMES INCLUDING THE RUN IN PERIOD AND DURING DISASSEMBLY AND ASSEMBLY OF PUMP.

## PRE-OPERATION CHECKS

See instructions on Preparation of Foundation for Base Mounted Pumps, Aligning Driver and Pump, and Pipe Installation.

Determine the proper direction of rotation by using the appropriate instructions and illustrations. When a relief valve is used, make sure it is positioned and adjusted properly. Check the rotation of the driver to make sure it will operate the pump in the desired direction of rotation.

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 open and there is liquid in the pump.

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. If the pump is delivering liquid, check the unit for quiet operation, vibration, localized heating, and excessive seal or packing leakage. It is recommended the pressure and-or vacuum be checked by installing gauges at both sides of the pump to make sure the pressure and-or vacuum conform to specifications.

IF THERE IS NO RELIEF VALVE IN THE SYSTEM, NEVER BLOCK THE OUTLET 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 RELIEF VALVE IN THE SYSTEM, DO NOT OPERATE THE PUMP FOR MORE THAN A FEW MINUTES WITH THE OUTLET LINE BLOCKED. RAPID HEATING AND POSSIBLE DAMAGE WILL OCCUR.

## REPAIR PARTS

Use only Roper repair parts. Roper Pump Company takes no responsibility for the use of parts other than those manufactured and supplied by Roper Pump Company. The use of substitutes may result in poor pump performance or in an accident causing physical damage or injury to personnel.

# CHECKING PUMP PERFORMANCE

A summary of the causes of common malfunctions.

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## NO LIQUID DELIVERED

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1. Pump not primed. If pump fails to deliver liquid after a minute, stop the pump and prime it by pouring some liquid into the discharge side of the pump.
2. Rotating in wrong direction.
3. Inlet lift too high. Check this with gauge at pump inlet.
4. Clogged inlet line.
5. Air pockets or vapor lock.
6. Air leaks in inlet line.
7. Foreign matter under valve seat or poppet. Remove and clean poppet and valve seat. Caution: if poppet or seat is damaged it must be remachined or replaced.

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## RAPID WEAR

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1. Abrasives in liquid.
2. Compatibility of liquid and pump material.
3. Excessive pressure.
4. Non-lubricating liquid.

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## EXCESSIVE NOISE

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1. Starved pump.
2. Air leaks in inlet line.
3. Air or gases in liquid.
4. Pump speed too high.
5. Relief valve chatter. Check pressure setting.
6. Improper mounting. Check alignment thoroughly. See instructions for aligning driver and pump and preparation of foundation for baseplate mounted pumps.

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## INSUFFICIENT LIQUID DELIVERED

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1. Air leaks in inlet line.
2. Air leaks through packing or mechanical seal.
3. Speed too slow.
4. Excessive lift at inlet. Check this with gauge at the pump inlet.
5. Viscosity of liquid too high for size and length of inlet pipe.
6. Foot valve or end of inlet pipe not immersed deeply enough in liquid.
7. Foot valve, if used, too small, stuck, or not working properly.
8. Partial air pockets or vapor lock.
9. Pump damaged by foreign matter or misalignment.
10. Excessive clearance in pump caused by wear or corrosion.
11. Relief valve set too low, or stuck partially open.

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## PUMP TAKES TOO MUCH POWER

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1. Speed too high.
2. Liquid more viscous than previously anticipated.
3. Operating pressure higher than specified. Check this with gauge at the pump outlet.
4. Outlet line obstructed.
5. Mechanical defect, such as bent shaft, packing gland too tight, or misalignment of piping.
6. Relief valve not operating properly.

# NOTES

# MAINTENANCE RECORD

DATE

MAINTENANCE OPERATION

## TERMS & CONDITIONS AND LIMITED WARRANTY

This agreement (this "Agreement"), consisting of these Terms and Conditions, and the associated Order Acknowledgement is binding upon Roper Pump Company, hereinafter "**SELLER**," and the customer, hereinafter "**BUYER**." By placing an order for a product with the Seller, the Buyer agrees to these Terms and Conditions of sale and acknowledges that the person placing the order has the authority to enter into the Order Acknowledgement on Buyer's behalf.

**LEGAL EFFECT:** Except as expressly otherwise agreed to in writing by an authorized representative of Seller, the following terms and conditions shall apply to and form a part of any Order Acknowledgement. Seller may suspend its performance of any Order Acknowledgement if Buyer defaults in the performance of its duties under the Order Acknowledgement or under any other agreement between the Buyer and Seller.

**ACCEPTANCE:** The sale of goods and services is expressly conditional on Buyer's acceptance of Seller's terms and conditions as stated herein. Provided that Seller's terms and conditions have not been previously accepted by Buyer, Buyer's receipt of goods or services shipped under this Agreement constitutes acceptance of these terms and conditions. No additional, different or conflicting provisions proposed by Buyer are acceptable to Seller and are hereby specifically rejected, Seller being unwilling to sell goods on any terms conflicting with, limiting or modifying the terms hereof. Buyer shall not sell, transfer or otherwise provide any goods to another for resale without the prior, written authorization of Seller. Seller reserves the right to sell and to authorize other entities to sell such goods through all means and channels of distribution and in competition with Buyer. Buyer acknowledges that it has no authority to bind or contract in the name or for the account of Seller, to create any liability against Seller or to exert any direction or control over Seller's personnel.

**CHANGES:** This Agreement and the associated Order Acknowledgement constitutes the entire agreement between Seller and Buyer with respect to the subject matter thereof, and supersedes all prior oral or written agreements. This Agreement and the associated Order Acknowledgement may not be amended or modified, except by a further written agreement signed by an authorized representative of Seller. Seller reserves the right to make reasonable changes to an Order Acknowledgement, including changes as to packaging, testing, specifications, designs and delivery schedules. The terms and conditions of any purchase order or other instrument issued by Buyer or its agent in connection with this Agreement and the associated Order Acknowledgement or any goods sold thereunder that is in addition to or inconsistent with the terms and conditions of this Agreement or the associated Order Acknowledgement are null and void and shall not be binding on Seller. Buyer's changes made after formation of this Agreement that affect the schedule or requirements for services or otherwise affect the scope of this Agreement shall be submitted in writing by Buyer and shall become binding only if approved in writing by Seller's cognizant representative. All charges and delays resulting from such changes shall be solely determined by Seller and shall be binding upon Buyer.

**TERMINATION, SUSPENSION, AND CANCELED ORDERS:** Provided that Seller receives adequate written notice from Buyer, Buyer may terminate or suspend performance at Buyer's convenience subject to all reasonable charges, which charges shall be solely determined by Seller. Buyer cannot cancel or alter Orders without the Seller's written consent. If Seller grants such consent, Buyer will reimburse Seller for all of Seller's losses and expense caused by such cancellation or alteration, including without limitation all of Seller's additional costs caused by changes in design or specifications, or by product revisions, and all incidental and consequential damages incurred by Seller as a result of such cancellation or alteration. No goods may be returned to Seller except with Seller's written consent. Title in a returned good will pass when Seller takes possession of the returned goods.

**CREDIT:** The amount of credit offered by Seller to Buyer is contingent upon Seller's opinion of Buyer's capacity, ability, and willingness to promptly pay for goods and services received under the terms of this Agreement. Provided that, in Seller's opinion, there is a material adverse change in Buyer's financial condition and/or Buyer has not, within the agreed time, fully paid for goods and services previously supplied under this and/or another Agreement(s) with Seller, Seller reserves the right to revoke Buyer's credit and/or suspend performance on this and/or other orders for goods and services.

**PAYMENTS:** Standard terms for customers who qualify for credit net 30. A monthly service charge of 1.5% may be charged on amounts owed by Buyer to Seller that have not been paid within by the due date, subject to the maximum amount permitted by law.

**TAXES.** Buyer assumes exclusive liability for any and all taxes, tariffs, fees, duties, withholdings or like charges, whether domestic or foreign, now imposed or hereafter becoming effective ("Taxes") related to the goods and its purchases from Seller, including without limitation, federal, provincial, state and local taxes, value-added taxes, goods and services taxes, stamp, documentary, excise or property taxes, duties and other governmental charges.

**TITLE AND LIEN RIGHTS:** The equipment will remain personal property, regardless of how it is installed or affixed to any realty or structure. After delivery to Buyer, Seller will have all such rights, including security interests and liens, in the equipment as lawfully may be conferred upon Seller by contract under any applicable provision of law. Buyer agrees to cooperate fully with Seller in the filing of any financing statements, including Uniform Commercial Code (UCC) filings or other documents necessary to perfect such interests and liens. If Buyer defaults in its obligations under the Order Acknowledgement before the price (including any notes given therefore) of the equipment has been fully paid in cash, Seller may take any and all actions permitted by law to protect its interests including, where permissible, repossession of such equipment.

**SHIPMENTS:** All sales are Ex-Works Factory (as such term is defined by the International Chamber of Commerce as of the date hereof). Shipping contracts made by Seller shall be to Buyer's account. All claims for loss or damage after risk of loss has passed to Buyer shall be filed by Buyer with the carrier. Buyer shall be liable to Seller for the full price of the goods, irrespective of loss or damage in transit. Seller shall not be required to provide freight cost receipts to Buyer at the time of invoice. Buyer shall bear all risk and expense for delivery of goods, including without limitation, shipping, loading, unloading, storage, freight, and insurance. Goods may be shipped to Buyer in whole or in part. Title to goods shall pass to Buyer when delivered to the carrier or the Buyer, whichever occurs first, even if the goods are shipped freight prepaid. Among other things, a signed delivery receipt or bill of lading will constitute proof of delivery. The choice of carrier is made solely at the discretion of Seller, and Seller makes no representation as to the acceptability of a particular carrier. Except when Seller expressly agrees in writing, Seller does not guarantee shipment or delivery by a certain date or time, although Seller will strive to deliver goods by the date that it may communicate to Buyer. Seller shall not be liable to Buyer, or any other person, for any loss or damage of any kind which results from delay in shipment, delivery, or failure to give notice of delay, whether or not such delay was caused by Seller or otherwise. Seller reserves the right to backorder any goods and to ship from backorder in such order as Seller determines.

**LIMITED WARRANTY:** Seller warrants, to its original Buyer, that goods manufactured by Seller are free from defects in material and workmanship for 12 months from date of shipment (except for specified products with warranties that supercede this limited warranty. Please consult factory for these products). The Buyer hereby acknowledges and agrees, though free from defects in material and workmanship at the time of shipment, that the useful life of goods manufactured by Seller will vary depending upon the Buyer's frequency of use, application, and other factors, with regard to such goods. In that respect, notwithstanding any other provision to the contrary in the Agreement, these Terms and Conditions, or the Order Acknowledgement, the Seller specifically does not warrant the useful life of any product. If a failure to conform to specifications or a defect in materials or workmanship is discovered within this period, Seller must promptly be notified in writing within thirty (30) days, which notification, in any event must be received no later than 12 months from the date of shipment. Within a reasonable time after such notification, Seller will correct any failure to conform to specifications or any defect in materials or workmanship, or in lieu of

such repair, and at its sole option, shall replace the equipment. THE ABOVE ARE THE BUYER'S EXCLUSIVE REMEDIES FOR BREACH OF WARRANTY. Seller does not warrant: (a) defects caused by failure to provide suitable installation environment for the product, (b) damage caused by use of the product for purposes other than those for which it was purchased, (c) damage caused by disasters such as fire, flood, wind, and lightning, (d) damage caused by unauthorized attachments, or modification, (e) any other abuse or misuse by the Buyer, including improper installation; or (f) goods which have been damaged or altered by Buyer or its customers.

Each good sold by Seller to Buyer shall be deemed to be without defect and in conformity with its specifications and the terms of this Agreement and the associated Order Acknowledgement even though reasonable variances may exist. As a result, Seller cannot and does not guarantee that goods sold hereunder, whether in whole or in part, will exactly match in specification or otherwise, and Buyer acknowledges that reasonable variance is permissible. Additionally, Seller shall have no liability if a good does not conform to any applicable state, county or local ordinance, as the conformity of a good to each state, county and local ordinance is the sole responsibility of the Buyer. Seller reserves the right to change its goods and the components of its goods without prior notice to Buyer, although in circumstances where an order from Buyer has been accepted by Seller, Seller will use commercially reasonable efforts to ensure that such change will not affect performance of the good in a materially adverse manner.

**EXCEPT AS SET FORTH ABOVE AND TO THE MAXIMUM EXTENT PERMITTED BY LAW, SELLER MAKES NO OTHER WARRANTIES FOR A PRODUCT OR UNDER THIS AGREEMENT OR ANY ORDER ACKNOWLEDGEMENT AND HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE, AND INCLUDING THE WARRANTY OF MERCHANTABILITY. IN NO CASE SHALL SELLER BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES BASED UPON ANY LEGAL THEORY, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, LOSS OF SAVINGS OR REVENUE, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT, COST OF CAPITAL, COST OF ANY SUBSTITUTE EQUIPMENT, FACILITIES OR SERVICES, DOWNTIME, THE CLAIMS OF THIRD PARTIES INCLUDING CUSTOMERS, INJURY TO PROPERTY AND, UNLESS PRECLUDED UNDER APPLICABLE STATE LAW, BODILY AND PERSONAL INJURY.**

**INDEMNITY; LIABILITY LIMITATION:** Buyer hereby agrees to indemnify, reimburse in full, defend and hold harmless Seller, its subsidiaries, affiliates, officers, directors, personnel and agents from and against any and all liability, claims, suits, actions, losses, costs or expenses including (without limitation) reasonable attorneys' fees relating to or arising out of any claim or demand (a) for any Taxes or related penalties and interest, (b) due to Buyer's breach of the Order Acknowledgement; (c) that Buyer's customers or a third party may make against Seller based upon or arising from damage due to the acts and/or omissions of Buyer or due to the installation of the goods; (d) for infringement or misappropriation of a third party's intellectual property rights based upon Seller's incorporation of any designs, formulas or specifications in any goods where such designs, formulas or specifications have been specifically ordered or requested by Buyer. To the maximum extent allowable under applicable law and excluding those liabilities that by law Seller cannot limit or disclaim, (i) Seller's aggregate liability arising from or relating to this Order Acknowledgement or goods, regardless of the cause of action asserted, is limited to the amount paid by Buyer to Seller for the applicable goods and (ii) Seller shall not be liable for any special, incidental, consequential, indirect, or punitive damages, including without limitation, lost revenues, loss of use of the goods, loss resulting from improper storage, processing, padding/cushion, delay in delivery or shipment or errors in shipment or labeling, loss of data, or the cost of any substitute goods or related equipment, even if Seller has been advised of the possibility of such damages.

**EXPORT RESTRICTIONS:** Buyer shall not export or re-export goods in violation of any applicable laws or regulations of the United States or the country in which Buyer obtained them.

**CONFIDENTIAL INFORMATION.** During the term of this Agreement and the associated Order Acknowledgement and for the longer of (a) three (3) years following its termination and (b) for such Confidential Information of Seller that is a Trade Secret of Seller as defined by applicable law, for the life of such Seller Trade Secret, Buyer agrees to receive and hold Confidential Information of Seller in trust and in strictest confidence and shall not use, reproduce, distribute, disclose or otherwise disseminate any Confidential Information except as necessary to perform its obligations hereunder. Disclosures of the Confidential Information may be made only to Buyer's employees and agents who have a specific need to know and are subject to confidentiality restrictions at least as restrictive as those contained herein. "Confidential Information" means confidential information relating to the business, products and services of Seller which is or has been disclosed to Buyer, and which has value to Seller and is not generally known to Seller's competitors, including (without limitation), information regarding the specifications provided to Buyer by Seller and Seller's product plans, designs, costs, prices, finances, marketing plans, business opportunities, personnel, R&D activities and know-how.

**CONTROLLING LAW:** This Agreement and the associated Order Acknowledgement entered into hereunder shall be governed and construed in accordance with the laws of the State of Georgia and of the United States of America without reference to any conflicts of law principles; the parties submit themselves to the jurisdiction of the federal and state courts located in Jackson County, Georgia, which shall have exclusive jurisdiction of any disputes arising hereunder, and the parties waive any objection to venue therein. The United Nations Convention on Contracts for the International Sale of Goods, the Uniform Law on the Formation of Contracts for the International Sale of Goods, and any applicable international discovery and service of process conventions shall not be applicable. In the event legal action is undertaken by Seller to collect any amounts due to Seller by Buyer hereunder and if Seller prevails in such action, then Buyer shall reimburse Seller for its reasonable attorney fees and costs incurred in conjunction with such action, which amount shall not exceed the maximum amount allowed by law of the forum in which such action is brought.

**ASSIGNMENT:** Neither this Agreement nor any associated Order Acknowledgement may be assigned by the Buyer, or its contents publicized by the Buyer, without the written consent of Seller. Seller shall have the right to assign, transfer or sublicense all or any part of this Agreement or any associated Order Acknowledgement to another at any time and without the consent of Buyer.

**MISCELLANEOUS:** The various provisions of this Agreement and any associated Order Acknowledgement are severable, and any determination of invalidity or unenforceability of any one provision hereof shall no bearing on the continuing force and effect of the remaining provisions hereof. This Agreement and any associated Order Acknowledgement and the terms and conditions contained herein constitute the entire understanding of the parties with respect to the purchase and sale of the goods, and any prior agreements, with respect thereto, whether written or oral, are superseded hereby. This Agreement and any associated Order Acknowledgement shall be binding on the parties and their respective successors and any permitted assigns.

**ELECTRONIC DATA INTERCHANGE.** The parties may execute a Order Acknowledgement by transmitting and receiving the data contained in the Order Acknowledgement electronically rather than in paper form. To provide the legal validity and enforceability of such Order Acknowledgement, the parties further agree that the data transmitted herein will be considered "in writing" and to have been "signed." The parties agree not to contest the validity or enforceability of a Order Acknowledgement because of the electronic origination, transmission, storage or handling of such Order Acknowledgement. Any computer printout of the data contained in the Order Acknowledgement will be considered an "original" when maintained in the ordinary course of business and will be admissible as between the parties to the same extent and under the same conditions as other business records maintained in documentary form. The parties agree to properly use those security procedures which are reasonably sufficient to ensure that a transmission of the data contained in a Order Acknowledgement is authorized and to protect its business records and data from improper sources.