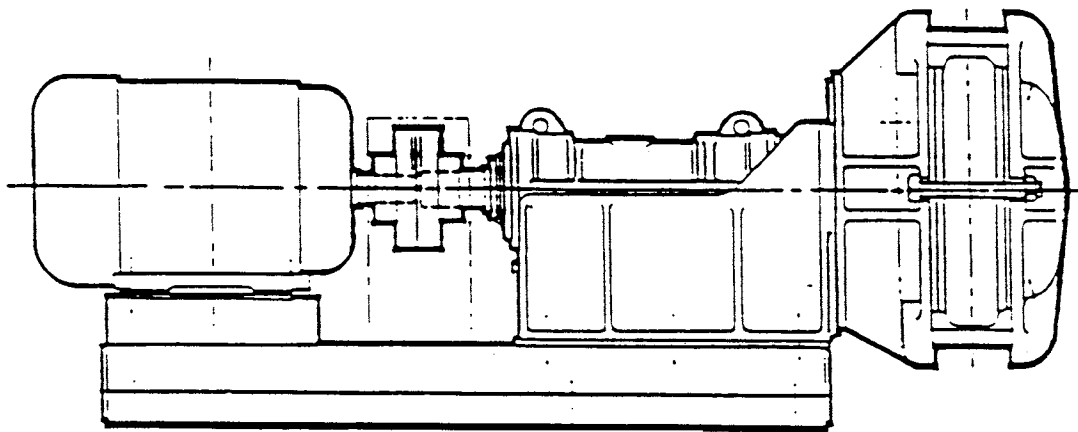


# **GOULDS PUMPS**

**INSTALLATION, OPERATION and MAINTENANCE INSTRUCTIONS**



**MODEL RXA**



**ITT**

## IMPORTANT SAFETY NOTICE

*To: Our Valued Customers*

User safety is a major focus in the design of our products. Following the precautions outlined in this manual will minimize your risk of injury.

ITT Goulds pumps will provide safe, trouble-free service when properly installed, maintained, and operated.

Safe installation, operation, and maintenance of ITT Goulds Pumps equipment are an essential end user responsibility. This *Pump Safety Manual* identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient — it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this Pump Safety Manual and the Instruction, Operation, and Maintenance (IOM) manual. Current manuals are available at [www.gouldspumps.com/literature\\_ioms.html](http://www.gouldspumps.com/literature_ioms.html) or by contacting your nearest Goulds Pumps sales representative.

**These manuals must be read and understood before installation and start-up.**

For additional information, contact your nearest Goulds Pumps sales representative or visit our Web site at [www.gouldspumps.com](http://www.gouldspumps.com).

# SAFETY WARNINGS

Specific to pumping equipment, significant risks bear reinforcement above and beyond normal safety precautions.

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 **WARNING**

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A pump is a pressure vessel with rotating parts that can be hazardous. Any pressure vessel can explode, rupture, or discharge its contents if sufficiently over pressurized causing death, personal injury, property damage, and/or damage to the environment. All necessary measures must be taken to ensure over pressurization does not occur.

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 **WARNING**

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Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

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 **WARNING**

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The pump may handle hazardous and/or toxic fluids. Care must be taken to identify the contents of the pump and eliminate the possibility of exposure, particularly if hazardous and/or toxic. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.

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 **WARNING**

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Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for disassembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

ITT Goulds Pumps will not accept responsibility for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this Pump Safety Manual or the current IOM available at [www.gouldspumps.com/literature](http://www.gouldspumps.com/literature).

# SAFETY

## DEFINITIONS

Throughout this manual the words **WARNING**, **CAUTION**, **ELECTRICAL**, and **ATEX** are used to indicate where special operator attention is required.

**Observe all Cautions and Warnings highlighted in this Pump Safety Manual and the IOM provided with your equipment.**



### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**Example:** Pump shall never be operated without coupling guard installed correctly.



### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**Example:** Throttling flow from the suction side may cause cavitation and pump damage.




### **ELECTRICAL HAZARD**

Indicates the possibility of electrical risks if directions are not followed.

**Example:** Lock out driver power to prevent electric shock, accidental start-up, and physical injury.









When installed in potentially explosive atmospheres, the instructions that follow the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact an ITT Goulds Pumps representative before proceeding.














**Example:**  Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.



## GENERAL PRECAUTIONS

### WARNING

A pump is a pressure vessel with rotating parts that can be hazardous. Hazardous fluids may be contained by the pump including high temperature, flammable, acidic, caustic, explosive, and other risks. Operators and maintenance personnel must realize this and follow safety measures. Personal injuries will result if procedures outlined in this manual are not followed. ITT Goulds Pumps will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual and the IOM provided with your equipment.

General Precautions		
WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		<p><b>Safety Apparel:</b></p> <ul style="list-style-type: none"> <li>♦ Insulated work gloves when handling hot bearings or using bearing heater</li> <li>♦ Heavy work gloves when handling parts with sharp edges, especially impellers</li> <li>♦ Safety glasses (with side shields) for eye protection</li> <li>♦ Steel-toed shoes for foot protection when handling parts, heavy tools, etc.</li> <li>♦ Other personal protective equipment to protect against hazardous/toxic fluids</li> </ul>
WARNING		<p><b>Receiving:</b></p> <p>Assembled pumping units and their components are heavy. Failure to properly lift and support equipment can result in serious physical injury and/or equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at <a href="http://www.gouldspumps.com/literature_ioms.html">www.gouldspumps.com/literature_ioms.html</a> or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.</p>
WARNING		<p><b>Alignment:</b></p> <p>Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.</p>

<b>General Precautions</b>		
<b>WARNING</b>		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
<b>CAUTION</b>		<b>Piping:</b> Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
<b>WARNING</b>		<b>Flanged Connections:</b> Use only fasteners of the proper size and material.
<b>WARNING</b>		Replace all corroded fasteners.
<b>WARNING</b>		Ensure all fasteners are properly tightened and there are no missing fasteners.
<b>WARNING</b>		<b>Startup and Operation:</b> When installing in a potentially explosive environment, please ensure that the motor is properly certified.
<b>WARNING</b>		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
<b>WARNING</b>		Lock out driver power to prevent accidental start-up and physical injury.
<b>WARNING</b>		The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
<b>WARNING</b>		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
<b>WARNING</b>		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
<b>WARNING</b>		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
<b>WARNING</b>		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
<b>CAUTION</b>		The mechanical seal used in an ATEX classified environment must be properly certified. Prior to start up, ensure all points of potential leakage of process fluid to the work environment are closed.
<b>CAUTION</b>		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
<b>WARNING</b>		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
<b>WARNING</b>		Dynamic seals are not allowed in an ATEX classified environment.
<b>WARNING</b>		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.

<b>General Precautions</b>		
<b>WARNING</b>		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
<b>WARNING</b>		<b>Shutdown, Disassembly, and Reassembly:</b> Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.
<b>WARNING</b>		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
<b>WARNING</b>		Operator must be aware of pumpage and safety precautions to prevent physical injury.
<b>WARNING</b>		Lock out driver power to prevent accidental startup and physical injury.
<b>CAUTION</b>		Allow all system and pump components to cool before handling them to prevent physical injury.
<b>CAUTION</b>		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
<b>WARNING</b>		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
<b>CAUTION</b>		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
<b>CAUTION</b>		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

## ATEX CONSIDERATIONS and INTENDED USE

Special care must be taken in potentially explosive environments to ensure that the equipment is properly maintained. This includes but is not limited to:

1. Monitoring the pump frame and liquid end temperature.
2. Maintaining proper bearing lubrication.
3. Ensuring that the pump is operated in the intended hydraulic range.

The ATEX conformance is only applicable when the pump unit is operated within its intended use. Operating, installing or maintaining the pump unit in any way that is not covered in the Instruction, Operation, and Maintenance manual (IOM) can cause serious personal injury or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT Goulds Pumps. If there is any question regarding the intended use of the equipment, please contact an ITT Goulds representative before proceeding. Current IOMs are available at [www.gouldspumps.com/literature\\_ioms.html](http://www.gouldspumps.com/literature_ioms.html) or from your local ITT Goulds Pumps Sales representative.

All pumping unit (pump, seal, coupling, motor and pump accessories) certified for use in an ATEX classified environment, are identified by an ATEX tag secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:



The CE and the Ex designate the ATEX compliance. The code directly below these symbols reads as follows:

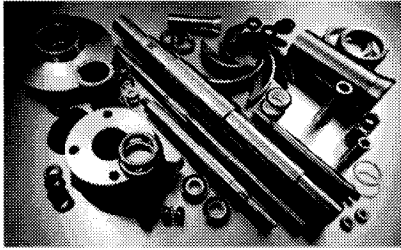
- II = Group 2
- 2 = Category 2
- G/D = Gas and Dust present
- T4 = Temperature class, can be T1 to T6 (see Table 1)

<b>Code</b>	<b>Max permissible surface temperature °F (°C)</b>	<b>Max permissible liquid temperature °F (°C)</b>
T1	842 (450)	700 (372)
T2	572 (300)	530 (277)
T3	392 (200)	350 (177)
T4	275 (135)	235 (113)
T5	212 (100)	Option not available
T6	185 (85)	Option not available

The code classification marked on the equipment must be in accordance with the specified area where the equipment will be installed. If it is not, do not operate the equipment and contact your ITT Goulds Pumps sales representative before proceeding.



## PARTS



The use of genuine Goulds parts will provide the safest and most reliable operation of your pump. ITT Goulds Pumps ISO certification and quality control procedures ensure the parts are manufactured to the highest quality and safety levels.

Please contact your local Goulds representative for details on genuine Goulds parts.

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# INSTALLATION AND OPERATING INSTRUCTIONS

## GENERAL

### INTRODUCTION

This instruction manual is intended to assist those involved with the installation, operations and maintenance of Goulds SPD slurry pumps. It is recommended that this manual be thoroughly reviewed prior to installing or performing any work on the pump or motor.

### IMPORTANCE OF INSTRUCTIONS

The design, material and workmanship incorporated in the construction of Goulds' pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by periodic inspection and careful maintenance. This Instruction Manual was prepared to assist operators in understanding the construction and correct methods of installing, operating and maintaining these pumps.

Study and follow the instructions for installation and operation. Keep this instruction manual handy for reference. Further information can be obtained by contacting the Slurry Pump Division, East Centre St., Ashland, PA 17921 (Telephone Number (717) 875-6100 or the local Goulds Pumps office).

### SPECIAL WARNINGS

Goulds' Slurry Pump Division will not be liable for any damages or delay caused by failure to comply with the provisions of this Instruction Manual. This pump is not to be operated at speeds, working pressure, discharge pressures, or temperatures higher than, nor used with liquids other than stated in the original order acknowledgement, without written permission of the Slurry Pump Division, Goulds Pumps, Inc.

Any modifications to the procedures or requirements covered in this manual should be in accordance with good engineering and shop practice.

### RECEIVING INSPECTION - SHORTAGES

Care should be taken when unloading pumps. If shipment is not delivered in good order and in accordance with the bill of lading, note the damage or shortage on both receipt and freight bill. MAKE ANY CLAIMS TO THE TRANSPORTATION COMPANY PROMPTLY.

# INSTALLATION AND OPERATING INSTRUCTIONS

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Rev. 0-11/19/92

# **INSTALLATION AND OPERATING INSTRUCTIONS**

## PRESERVATION AND STORAGE

Goulds' Slurry Pump Division's normal domestic shipping and storage preparation is suitable for protecting the pump during shipment. It also provides protection during covered storage at the job site and for a short period between installation and start-up. If the pump is to be idle and exposed to the elements for an extended period, either before or after installation, special precautions are required. One approach is to provide special preservatives and wrapping before shipment; however, after installation, the protective wrappings will have been removed. Therefore, application of preservatives after installation is considered good practice. Hand rotation of the shaft is recommended every 30 days to prevent damage to bearings.

**-- SPECIAL NOTICE --**

## ORDERING SPARES

When ordering spare parts for this pump, always refer to the pump serial number and part number. This will avoid delays in identification. In certain cases where pumps are furnished with special metals, deliveries are quite lengthy. It is therefore advisable to anticipate your requirements several months in advance so that possible long deliveries will not handicap your operation.

## **INSTALLATION INSTRUCTIONS**

### HORIZONTAL PUMPS WITH SUBBASES

#### LOCATION OF UNIT

The pump should be located in an area free from flooding, with sufficient overhead height for ease of installation and removal. There should also be access space around the pump for the required maintenance.

#### FOUNDATION

The pump foundation must be sufficiently substantial to give rigid support to the pump and to absorb vibration. Foundations are typically concrete with anchor bolts cast in to secure the pump. Skid type subbases are meant to be moved so are not anchor bolted in place, but do require a substantial support.

An anchor bolt assembly has a sleeve to allow lateral movement of the bolt after the sleeve has been cast in the concrete. Anchor bolts should be located in the concrete by a template dimensioned from the pump installation

## INSTALLATION AND OPERATING INSTRUCTIONS

drawing. The top of the sleeve should be temporarily sealed with material to prevent concrete or other items from entering the sleeve during the concrete pouring operation.

See "Typical installation on the Foundation" illustration at the end of this instruction.

### DISCHARGE PIPING

The piping must be supported independently near the pump to prevent any strain being transmitted to the pump.

It is recommended that a check valve be used in the discharge line to protect the pump from reverse flow and excessive pressure during a shut down, start-up, or upset conditions (such as a power failure) when there is a high static head or water hammer effect.

### SUCTION PIPE

The suction pipe should also be supported near the pump and must not have a flow regulating valve. (A shutoff valve is acceptable.)

Air leaks may cause a reduction in performance or a complete loss of prime if the pump operates with a suction lift. Excessive friction losses will cause cavitation. Piping size transitions should be hydraulically smooth.

### INSTALLING PUMP ON FOUNDATION

If subbases were directly anchored to concrete surfaces, surface irregularities could cause distortion when the anchor bolts are tightened. Use metal blocks with shims or tapered wedges, next to each anchor bolt, to level and support the base. The anchor bolts are then tightened just enough to maintain position and level.

An illustration page shows the use of leveling blocks and a grouted subbase with the grouting in place. A 3/4" to 1½" space between the bottom of the subbase and the foundation is recommended for grouting. Subbases with cavities have grout holes provided for filling the inside. After the grout has hardened, permanently tighten the anchor bolts.

# INSTALLATION AND OPERATING INSTRUCTIONS

## OPERATING AND MAINTENANCE INSTRUCTIONS

### DRIVE ALIGNMENT

#### DIRECT CONNECT MOTORS

Check parallel alignment by placing a straight edge across the two coupling flanges or using a dial indicator. Check angular alignment with a micrometer or feeler gauge. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Alignment of drive and pump should be within .003" or within the coupling manufacturers specifications. See Coupling Alignment at the end of these instructions or consult the manufacturers instructions for proper installation and operation. The drive manufacturer should be consulted if there are any questions or problems.

#### V-BELT DRIVES

Well designed and properly installed v-belt drives are capable of running for years without replacement. There are a few points that should be checked periodically.

##### 1. Check Belt Fit

Regardless of the belt section used, the belt should never be allowed to bottom in the groove. This will cause the belts to lose their wedging action and slippage can occur. Sheaves or belts that permit such a condition to occur should be changed.

##### 2. Keep Belts Clean

Dirt and grease reduce belt life. Belt dressing affects performance only temporarily and is never recommended. Maintaining a clean drive is a better procedure.

##### 3. Use Belt Guards

Belt guards protect personnel from danger and the drive from contamination. Inspect periodically to assure that belts or sheaves do not rub against guard.

##### 4. Maintain Proper Belt Tension

Proper tension is the primary reason for long belt life. Excessive tension could cause belt fatigue and/or hot bearings. Looseness or reduced tension could cause belt slippage, heat and wear, and/or reduced pump performance.

## INSTALLATION AND OPERATING INSTRUCTIONS

### 5. Sheave Alignment

Alignment must be maintained for full power transmission, minimum vibration, and long drive life. Make sure sheaves are aligned by placing a straight edge or string along the faces of each sheave. The straight edge should simultaneously touch both sides of both sheaves. See Belt Drive Illustration at the end of these instructions or consult the manufacturers instructions for proper installation and operation. The drive manufacturer should be consulted if there are any questions or problems.

### LUBRICATION AND SHAFT SEALS

#### GREASE LUBRICATION

The bearing housing is properly lubricated before shipment. Under normal conditions, grease should be added as required at regular intervals and care should be taken not to over-lubricate. Use Shell Alvania No. 2, Mobile Mobilux No. 2, Texaco Multifak No. 2, Sun Oil Company Prestige No. 42, American Oil Company Amolith Grease No. 2, or equal. When it becomes necessary to replace the bearing housing seals, the housing and the bearings should be flushed clean with a solvent and repacked with new grease. Over-lubrication results in excessive bearing temperatures. Typical lubrication schedule is every 500 hours of operation. The amount of grease varies with the size of the bearing with typical amount ranging from two to five squirts with a hand grease gun.

#### OIL LUBRICATION

When the pump is furnished with oil lubrication, a high quality bearing oil should be used to insure long bearing life. PUMPS FURNISHED FOR OIL LUBRICATION ARE SHIPPED WITHOUT OIL. ADD OIL UNTIL THE LEVEL IS UP TO THE OIL LEVEL LINE BEFORE THE UNIT IS STARTED. If too much oil is added, there will be excessive heat generated in the bearings and there may be leakage from the shaft seals.

We recommend a R&O bearing oil equal to Exxon Teresstic oils.

Use an oil with a viscosity equivalent to SAE 30 for ball bearings. This will provide adequate viscosity (70 SSU minimum) to 180°F temperature. Use an equivalent to SAE 40 for roller bearings. This will provide adequate viscosity (150 SSU minimum) to 160°F temperature. Anti-friction bearings require these viscosities for proper lubrication. The viscosity grade may have to be changed with higher or lower operating temperature levels.

## INSTALLATION AND OPERATING INSTRUCTIONS

For normal operating conditions, change the oil at least once a year and thoroughly flush the bearings. If the bearing assembly is exposed to dirty or moist conditions, the oil should be changed more often. If oil is contaminated, it should be changed immediately.

### SHAFT SEALS

Exposed shaft seals, for the bearing housing, should be given a few drops of oil before the initial start-up to insure lubrication. The area around the shaft seals should be kept clean to avoid excessive wear at the seal lip and dirt entering the bearing housing.

### STUFFING BOX

### LUBRICATION

A clear, clean liquid such as water, must be supplied at a pressure 10-15 PSI higher than the maximum suction pressure at the shaft centerline. Grease can be used for the lubricant when water is not available.

Double mechanical seals require in and out connections; one or both may be in the gland. An outlet flow is required for cooling. A throttling valve is used to limit the flow and provide the necessary back pressure inside the seal above the suction pressure.

### PACKING AND ADJUSTMENT

A significant amount of lubricating liquid should leak from gland side of stuffing box. Operate pump for at least 15 minutes before tightening gland nuts. Make small, even gland nut adjustments. Allow adequate run-in time between adjustments.

NOTE: Do not overtighten gland nuts. Hand tighten nut only at a rate of 1/4 turn at each adjustment. If overtightened, packing may set permanently and require removal. Overtightened packing causes excessive friction between packing and sleeve, and may result in damaged components. A noticeable temperature increase in stuffing box or in leakage would indicate insufficient lubrication.

Periodic maintenance is required for all packed stuffing boxes.

Normal shaft runout should be under .005 inch to avoid pounding of stuffing box packing. With excessive shaft runout, shaft repair or replacement is necessary.



## INSTALLATION AND OPERATING INSTRUCTIONS

When repacking the stuffing box, be sure the packing ends are staggered and the seal cage is located as shown on the "liquid end" and "stuffing box" drawings. Each packing ring should be formed and cut on a mandrel to obtain the correct size with a minimum gap at the ends.

### PUMP START-UP AND OPERATION

Check the following items before the initial pump start-up:

1. The driver rotation for being correct before the driver is connected to the pump. This pump has an impeller that could unscrew, causing considerable damage, if the pump was started in the reverse direction.
2. The shaft turns free by hand with due consideration for normal bearing and sealing drag.
3. All foundation, piping and coupling bolts have been properly tightened.
4. The required lubrication has been supplied to all components; bearings, couplings, and stuffing box.
5. The pump is completely primed, i.e., no air in the impeller or casing.

WARNING: DO NOT OPERATE THE PUMP WITHOUT PROPER DRIVE GUARD IN PLACE.

After the pump has been started, monitor the operation for any sign of developing problems.

Do not continuously operate the pump against a closed discharge valve.

WARNING: OPERATING A PUMP WITH A CLOSED SUCTION AND DISCHARGE VALVE PRESENTS A GREAT DANGER OF A VIOLENT FAILURE BECAUSE THE HORSEPOWER OF THE DRIVER IS DIRECTLY CONVERTED TO HEAT INSIDE THE CASING.

### MAINTAINED CAPACITY

Pumps having a suction liner are provided with a method for repositioning the impeller to restore the proper clearance on the suction side of the impeller. Wear at this gap will lessen the amount of liquid being pumped because of excessive leakage through the gap.

Instructions of resetting the impeller clearance are given in the Liquid End Instructions. The normal clearance is shown on the Liquid End Assembly drawing or in the liquid end instructions.

# INSTALLATION AND OPERATING INSTRUCTIONS

## LOCATING PROBLEMS

### 1. Conditions Causing Insufficient or No Discharge

#### a. Pump not primed

The pump generally cannot be primed with the shaft turning. Air leaks may cause pump to lose prime especially at low flow rates while discharge valve is being opened.

#### b. Excessive head requirements

Extra pipeline length and increases in pipe elevation require the pump to develop more head for the same flow rate.

#### c. Insufficient NPSH available

Extra suction pipe length and pump elevation above the water level reduce the NPSH available to the pump.

#### d. Worn pump components

Wear at the impeller gap increases the internal leakage and is correctable without disassembly.

#### e. Insufficient pump speed.

#### f. Pipeline or pump clogged or partially clogged.

#### g. Wrong direction of rotation.

#### h. Pumpage viscosity too high.

### 2. Conditions Causing Excessive Power Consumption

#### a. Pump speed too high.

#### b. Pump not operating at design capacity.

Pump is operating at higher HP point of its performance curve.

#### c. Mechanical rubbing or binding of rotating parts.

Rubbing at the impeller can cause considerable power loss in the pump. The equivalent power loss in a bearing or stuffing box would produce high temperature.

#### d. Viscosity or specific gravity too high.

#### e. Impeller clearance gap too wide.

## INSTALLATION AND OPERATING INSTRUCTIONS

### 3. Conditions Causing Excessive Bearing Temperatures

- a. Lack of clearance in the bearings

This should be checked first if the problem developed immediately after any work was done that could have changed the bearing alignment.

- b. Insufficient amount of lubricant.
- c. Excessive amount of lubricant.

The problem is noticed a short time after lubricant is added to the bearings.

- d. Deteriorated lubricant

A gradual, over a period of days, temperature rise above the ambient temperature indicates a deterioration of the lubricant around the rolling elements provided the bearing is not generating unusual noise.

- e. Bearing failing

This will cause an increase in its noise.

### 4. Conditions Causing Excessive Vibration

- a. Partially clogged impeller
- b. Foundation not properly supporting pump
- c. Misalignment
- d. Mechanical defects

Bent shaft, failed bearing, impeller out of balance.

### 5. Conditions Causing Water Hammer

Water hammer is a high pressure surge through a pipeline resulting from an event that forces all the liquid in the line to rapidly change velocity.

- a. Rapid Valve closing
- b. Lack of a vacuum breaker in pipeline going over a hill.
- c. Full speed filling a pipeline that has a sudden pipe friction increasing section down stream from the pump.

# INSTALLATION AND OPERATING INSTRUCTIONS

## PUMP LIQUID END

### IMPELLER CLEARANCE

The impeller should run close to, but not rub against the suction liner for the best pump performance. A satisfactory clearance is .020" + .001" per inch of impeller diameter above 10". A 20.0" diameter impeller would therefore be set at .030" clearance.

### IMPELLER CLEARANCE ADJUSTMENT

This clearance setting method requires the impeller to be screwed tight on the pump shaft and the liner clamped tight against the suction cover. To set the clearance:

1. Loosen cap screws (#370T) which fasten the bearing housing (#134) to the frame (#228).
2. While turning the shaft by hand, use the adjusting screw (#9956) to move the bearing assembly away from the casing until the impeller rubs.
3. Mount a dial indicator on the frame to indicate axial movement of the bearing assembly.
4. Turn the adjusting screw to move the bearing assembly towards the casing the required impeller clearance distance.
5. Tighten the cap screws which fasten the bearing housing to the frame.

### LINER SECURING METHOD

The liners are secured to the covers with set screws and retaining rings which engage grooves in the set screw and liner. The retaining rings are removed and reinstalled with needle-nose pliers.

For ease of removal or installation of the retaining rings, the set screw has to be positioned so that retaining ring is not binding against a groove edge of the liner.

Retaining ring removal may require loosening of the set screws. After installation of the retaining rings, lightly tighten the set screws to have the retaining rings contact the liner groove edge (cover side of the liner groove).

The groove in the liner is wide enough to allow liner movement when the o-rings are compressed during tightening of the liquid end bolts.

## INSTALLATION AND OPERATING INSTRUCTIONS

### LIQUID END DISASSEMBLY

To disassemble the pump liquid end:

1. Drain the liquid from the casing.
2. As required, install a lifting device on the end cover (#100A). There are (4) cored holes in the ribs for device attachment.
3. Remove the four bolts (#370A) fastening the end cover (#100A) to the swivel ring (#9844) and carefully pull the end cover away from the casing.

**WARNING:** Be sure the liner is being retained in the end cover when the end cover is pulled away from the casing. Do not allow any part of the body to be under the pump where injury would result if the liner came loose from the end cover.

4. Remove the discharge flange bolts and insert lifting hooks into the provided lifting lugs on the casing. Loosen the casing clamps (#9903) and slide the casing off. Be careful to prevent the casing from falling onto the impeller.
5. Check the suction cover liner (#100B) to ensure that it is being retained in place after the impeller is removed.
6. If exceptional difficulty is seen when attempting to remove the impeller, the knock-off ring option should know be used.

To break away the disposable knock-off ring, locate the notches on the O.D. of the ring (two-180 deg. apart). These notches indicate the thinnest section of the ring, thus allowing easier breakage with a chisel.

(NOTE: Proper eye protection should be worn when performing this operation.)

7. Put a strap around the impeller to prevent it from turning in the direction opposite normal rotation. Turn the shaft in the direction opposite normal rotation. Protect the impeller vane tips from any excessive loads when the high reverse torque is put on the shaft to break free the threaded impeller connection.
8. The shaft sleeve can be removed at this time. If the suction cover is to be removed, access to the shaft sleeve will be easier than with the stuffing box cover in place.
9. Remove the two screws holding the suction cover to the swivel ring (#9844). Pull the suction cover off, being careful not to damage the shaft when the cover becomes free from the dowel pins.
10. If required, the swivel ring can be removed from the frame.

## INSTALLATION AND OPERATING INSTRUCTIONS

### LIQUID END REASSEMBLY

1. Slide the knock-off ring (#458) onto the shaft with the tapered I.D. end toward the bearing frame.
2. Slide the shaft sleeve (#126) into place on the shaft against the knock-off ring. (REMINDER: Apply a bead of RTV silicone completely around the shaft approx. 1" back from the joint between the sleeve and the knock-off ring before sliding the sleeve completely onto the shaft.)
3. Put o-ring (#412F) in the suction cover groove, place suction liner (#182) in the cover counter bore, and secure with the retaining rings (two per screw).
4. Lift the suction cover, with secured liner, into position over the shaft and into place on the dowel pins by threading eyebolts into the available tapped holes located 90 deg. apart on the suction cover. (The lifting eyebolts must be removed after the suction cover is secured to the swivel ring.)
5. If the shaft sleeve does not have an o-ring, put a bead of silicone RTV rubber on the impeller end of the sleeve. Install the impeller by turning the shaft in the normal direction of rotation, firmly tightening against the sleeve.
6. Place o-ring (#496A) into groove on the suction cover side of the casing and install casing by using the appropriate lifting lugs for your desired casing position and secure in place using the two(2) provided "J" clamps.
7. Install and secure the end cover liner in the end cover using two(2) retaining clips at each retaining screw.
8. Place the final o-ring (#496A) into the groove on the rear cover side of the casing.
9. Install the end cover with liner on the casing and secure with the (4) large bolts (#370A). The bolts should have uniform tightness but not be fully tightened to the standard for the bolt size. The bolts keep the parts together against the internal liquid end pressure. The o-ring seal if the parts are held together and do not require extra clamping force for sealing.

# INSTALLATION AND OPERATING INSTRUCTIONS

## PUMP BEARING ASSEMBLY

### OIL LEVEL

The following are the distances from the housing horizontal split line down to the correct oil level for units using optional oil lubrication, rather than grease.

1F	Assembly	2.00"	±.12"
2F	Assembly	2.75"	±.19"
3F	Assembly	3.75"	±.25"

Higher oil levels cause increased bearing temperatures. Lower oil levels can cause lack of proper lubrication.

### BEARING DISASSEMBLY

Note: The illustration for the bearing assembly shows the configuration for pumps having the direction of axial thrust towards the driver. If the liquid end has the axial thrust in the opposite direction, a different shaft is used and the housing with bearings is turned around on the shaft. Some applications require tandem angular contact thrust bearings. This has no effect on the following instructions.

1. Remove capscrews fastening the bearing assembly to the frame #228. Lift the assembly out of the frame.
2. Loosen the set-screws fastening the deflectors #123 to the shaft. Slide the deflectors off the shaft.
3. Remove the capscrews fastening the bearing covers #109 and #119B to the bearing housing and slide the covers off the shaft.
4. Remove the socket head cap screws fastening the two housing halves together. Tap the taper pins out and lift the top housing half off the lower half.
5. After lifting the shaft out of its lower housing half, remove the bearing locknuts and press the bearings off the shaft. Push against the inner races to avoid damage to the bearings. While doing this, note the outer race thrust shoulder of bearing #112D because a reinstalled thrust bearing must keep the same thrust orientation.

### BEARING REASSEMBLY

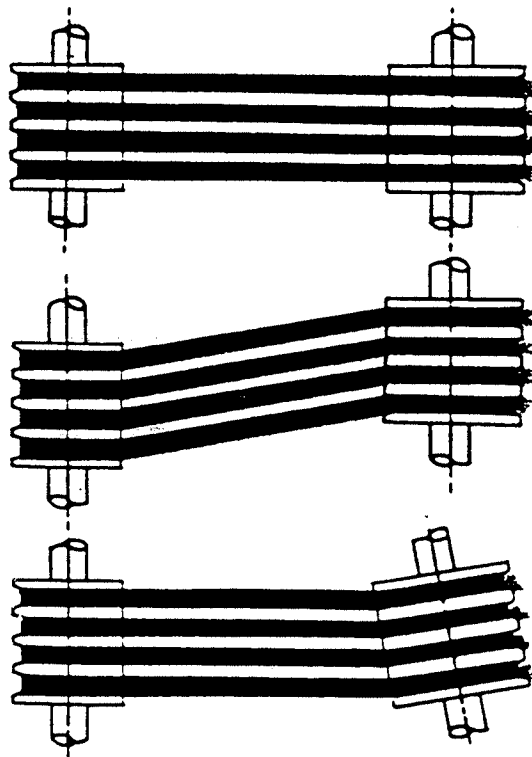
1. Make sure the shaft and parts are clean and free from nicks or burrs.
2. Heat the bearings to 200°F, preferably in a hot oil bath, and slide into position against the shaft shoulders. Be sure the thrust bearing #112D has the correct orientation and bearing collar #237 is in place next to the thrust bearing.

## INSTALLATION AND OPERATING INSTRUCTIONS

3. Install lockwashers and locknuts, tightening as the bearings cool. Set lockwasher tangs.
4. If the bearings are grease lubricated, hand pack each bearing envelope about one-Third full of grease. Completely filling a sector of the bearing will give the correct amount for the total bearing cavity.
5. Place the shaft, with installed bearings, in the bottom housing half. Carefully lower the top half of the housing into position using the dowel pins as a guide. Fasten the two halves together with socket head capscrews.
6. Install bearing covers #119B and #109. Cover #109 must be shimmed to have about .004" axial clearance at the thrust bearing. The method is to temporarily install the cover without shims, measure the gap between the cover and housing and make a shim stack .005" thicker than the measured gap. Reinstall the cover with the shim stack in place.
7. Slide the deflectors into position, leaving enough clearance to prevent rubbing against the covers and secure with set screws.
8. Reinstall the shaft assembly on the frame and secure with capscrews. If the bearings are oil lubricated, reinstall any fittings that were previously removed.
9. Continue the pump reassembly with the liquid end reassembly instructions.



# INSTALLATION AND OPERATING INSTRUCTIONS



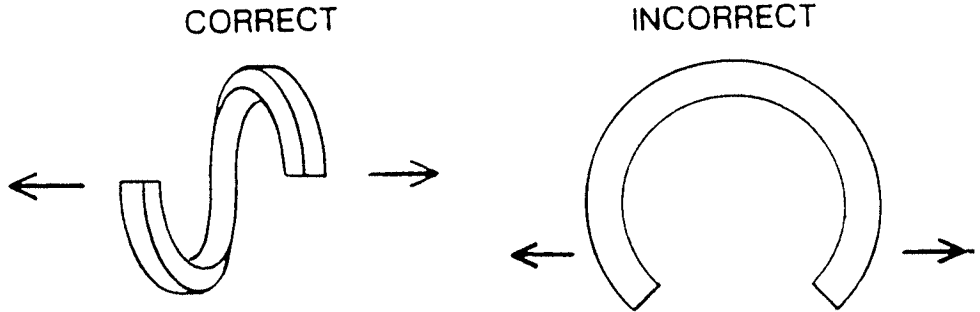
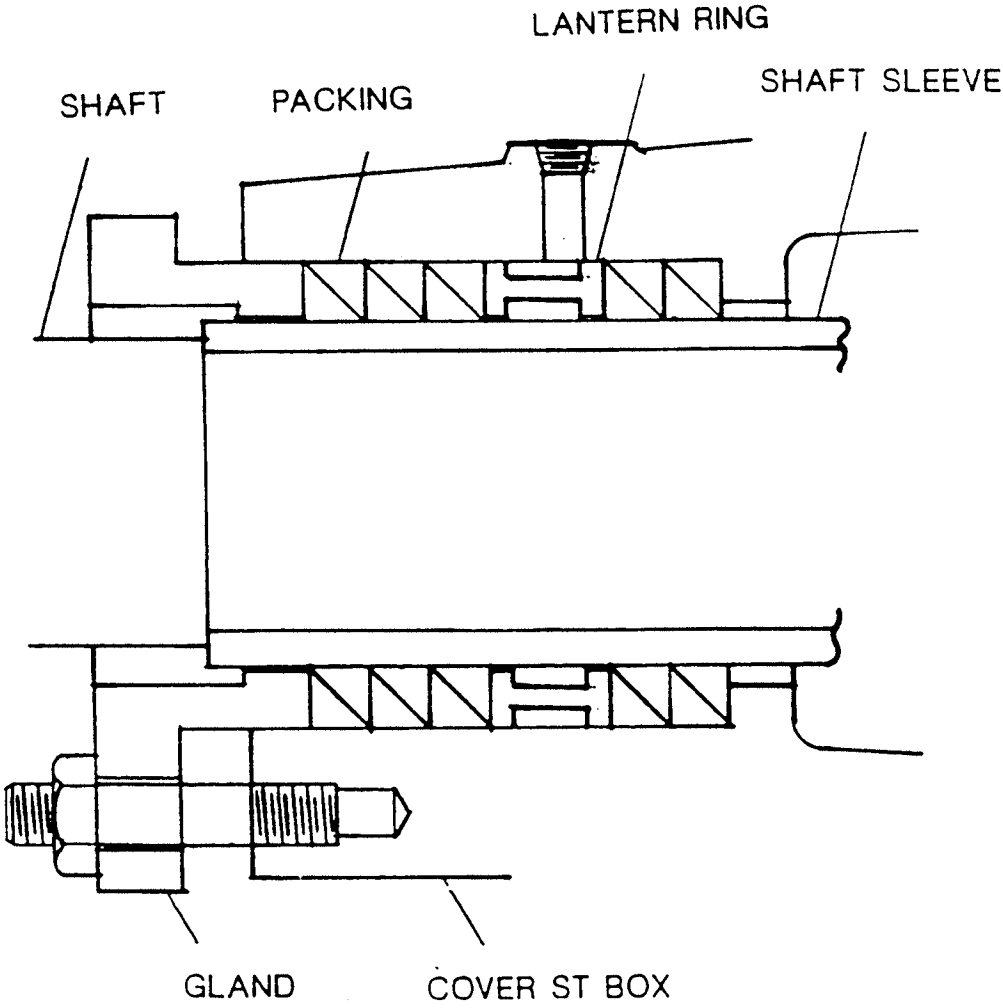
PERFECT ALIGNMENT

PARALLEL MISALIGNMENT

ANGULAR MISALIGNMENT

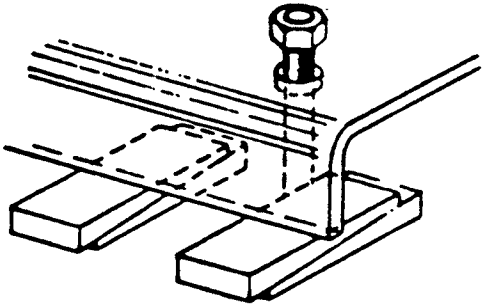
BELT DRIVE

**INSTALLATION AND  
OPERATING INSTRUCTIONS**

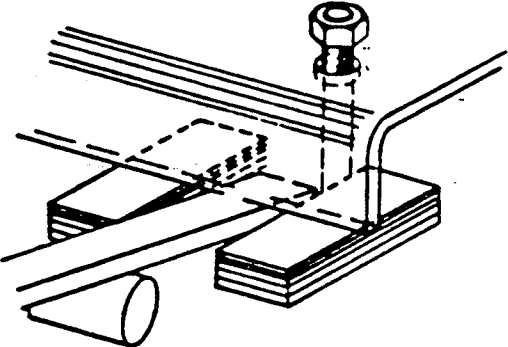


**STUFFING BOX PACKING**

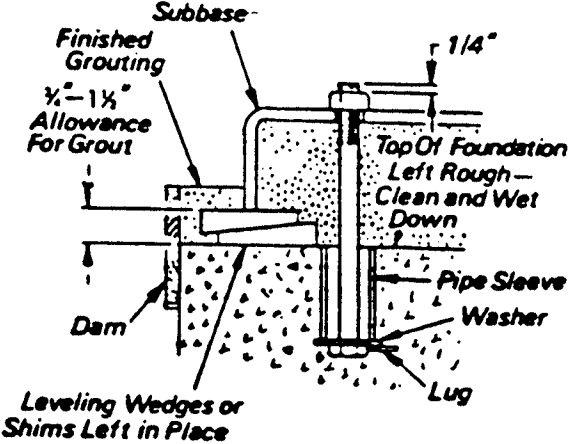
# INSTALLATION AND OPERATING INSTRUCTIONS



*Leveling With Wedges*



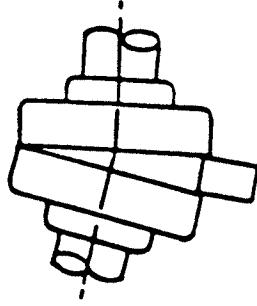
*Leveling With Blocks  
and Shims*



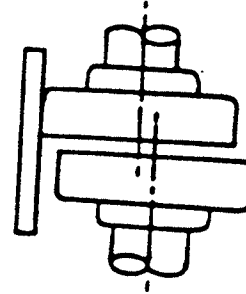
*Typical Anchor Bolt*

## SUBBASE INSTALLATION

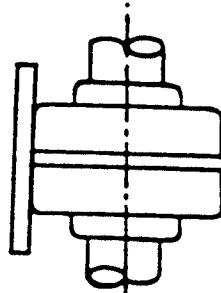
**INSTALLATION AND  
OPERATING INSTRUCTIONS**



**ANGULAR MISALIGNMENT**



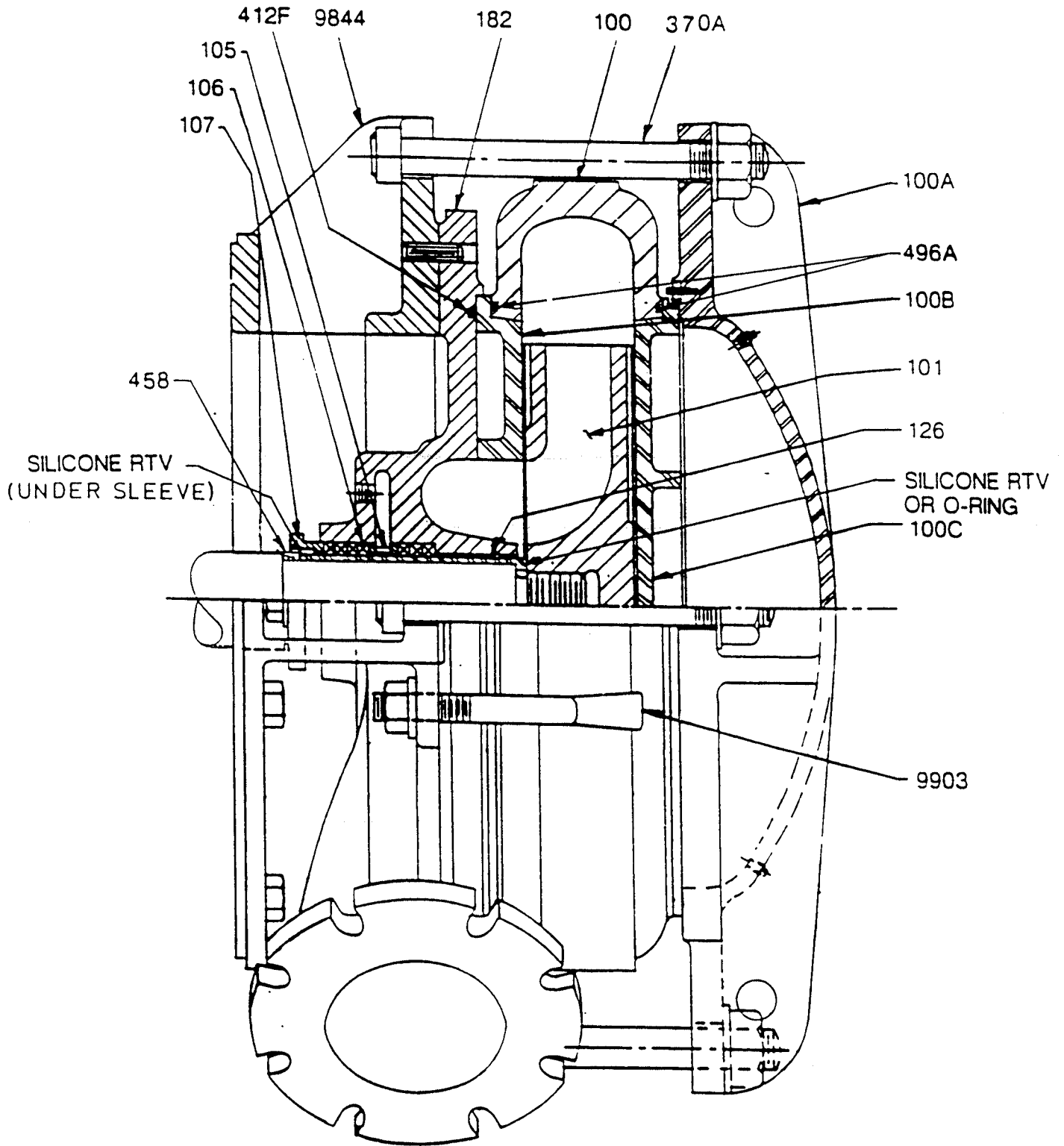
**PARALLEL MISALIGNMENT**



**PERFECT ALIGNMENT**

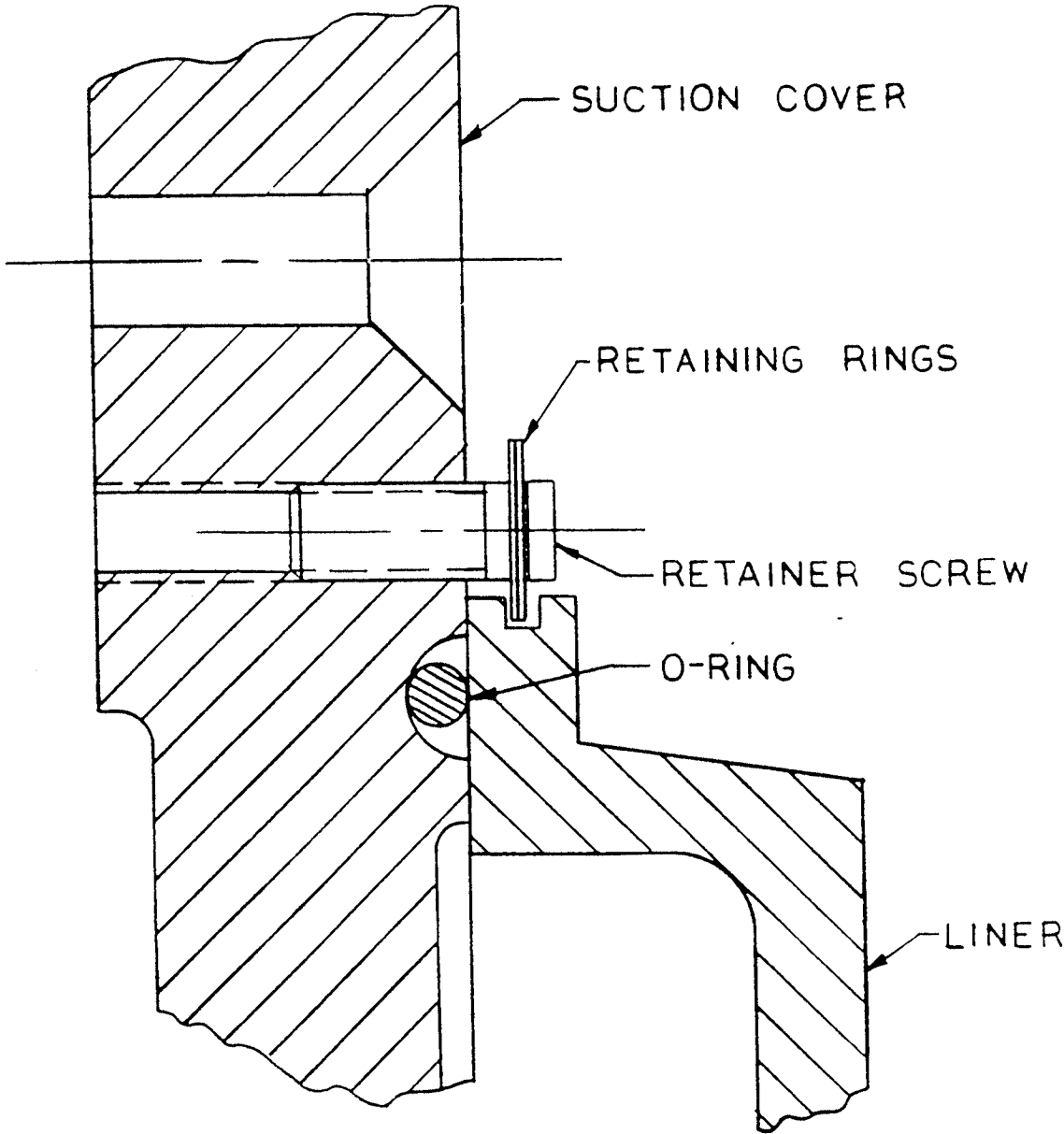
**COUPLING ALIGNMENT**

# INSTALLATION AND OPERATING INSTRUCTIONS



LIQUID END

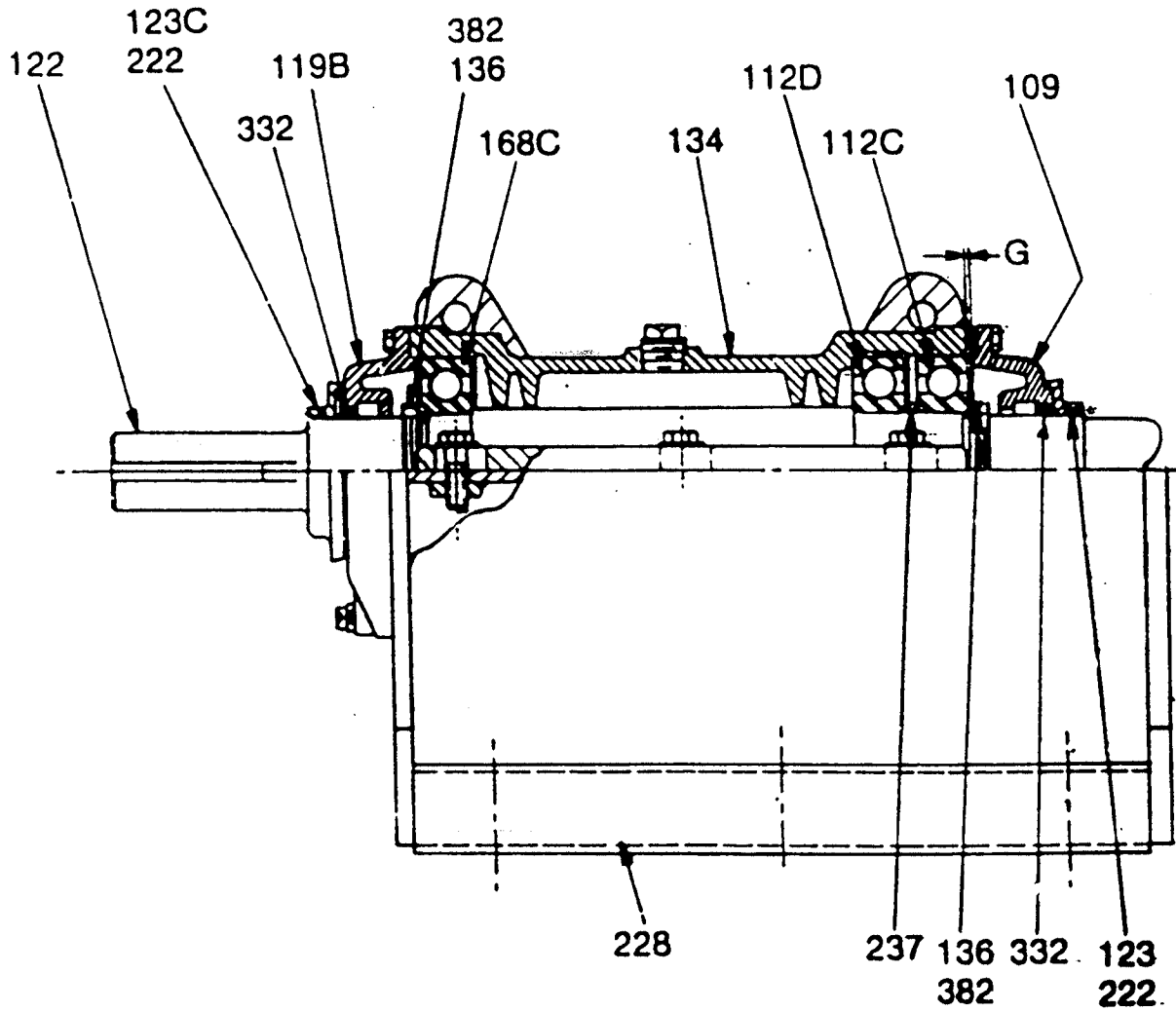
**INSTALLATION AND  
OPERATING INSTRUCTIONS**



LINER SECURING METHOD

# INSTALLATION AND OPERATING INSTRUCTIONS

At assembly install shims to make  
a clearance gap of .003"-.005" at "G".



BEARING ASSEMBLY



**ITT**