

 **GOULDS PUMPS**

# Installation, Operation and Maintenance Instructions

3500XD



**ITT**



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# Preface

This manual provides instructions for the Installation, Operation, and Maintenance of the Goulds Model 3500XD Medium Consistency Pump. This manual covers the standard product plus common options that are available. For special options, supplemental instructions are supplied. This manual must be read and understood before installation and start-up.

The design, materials, and workmanship incorporated in the construction of Goulds pumps makes them capable of giving trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these mixers.

ITT - Goulds Pumps shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions for Installation, Operation, and Maintenance contained in this manual.

Warranty is valid only when genuine ITT - Goulds parts are used.

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from ITT - Goulds Pumps.

To assure proper installation, supervision from an authorized manufacturer's representative is recommended. Additional manuals can be obtained by contacting your local Goulds representative.

This manual explains

- Proper Installation
- Start-Up Procedures
- Operation Procedures
- Routine Maintenance
- Mixer Overhaul
- Troubleshooting
- Ordering Spare or Repair Parts

# 1 Safety

## 1.1 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 <https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/> 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 <https://www.gouldspumps.com>

## 1.2 Safety warnings

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



**WARNING:**

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:**

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:**

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:**

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 <http://www.gouldspumps.com/literature>.

## 1.3 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 the 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:****WARNING:**

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.

**ATEX:****WARNING:**

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.






## 1.4 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.








**Table 1: 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>Safety Apparel:</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>Receiving:</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</p>



		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.
WARNING		Alignment: 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.
WARNING		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
CAUTION		Piping: 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.
WARNING		Flanged Connections: Use only fasteners of the proper size and material.
WARNING		Replace all corroded fasteners.
WARNING		Ensure all fasteners are properly tightened and there are no missing fasteners.
WARNING		Startup and Operation: When installing in a potentially explosive environment, please ensure that the motor is properly certified.
WARNING		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
WARNING		Lock out driver power to prevent accidental start-up and physical injury.
WARNING		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.
WARNING		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.
WARNING		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
WARNING		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.

1.4 General precautions

WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
CAUTION		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.
CAUTION		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.
WARNING		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
WARNING		Dynamic seals are not allowed in an ATEX classified environment.
WARNING		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
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		Shutdown, Disassembly, and Reassembly:  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.
WARNING		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.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		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.
WARNING		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.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

WARNING		<p>Noise:</p> <p>Sound pressure levels may exceed 80 dbA in operating process plants. Clear visual warnings or other indicators should be available to those entering an area with unsafe noise levels. Personnel should wear appropriate hearing protection when working on or around any equipment, including pumps. Consider limiting personnel's exposure time to noise or, where possible, enclosing equipment to reduce noise. Local law may provide specific guidance regarding exposure of personnel to noise and when noise exposure reduction is required.</p>
WARNING		<p>Temperature:</p> <p>Equipment and piping surfaces may exceed 130°F (54°C) in operating process plants. Clear visual warnings or other indicators should alert personnel to surfaces that may reach a potentially unsafe temperature. Do not touch hot surfaces. Allow pumps operating at a high temperature to cool sufficiently before performing maintenance. If touching a hot surface cannot be avoided, personnel should wear appropriate gloves, clothing, and other protective gear as necessary. Local law may provide specific guidance regarding exposure of personnel to unsafe temperatures.</p>

## 1.5 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:

### Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Make sure that thermal contacts are connected to a protection circuit according to the approval classification of the product, and that they are in use.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- Do not modify the equipment without approval from an authorized ITT representative.
- Only use parts that are provided by an authorized ITT representative.

### Description of ATEX

The ATEX directives are a specification enforced in Europe for electrical and non-electrical equipment installed in Europe. ATEX deals with the control of potentially explosive atmospheres and the standards of equipment and protective systems used within these atmospheres. The relevance of the ATEX requirements is not limited to Europe. You can apply these guidelines to equipment installed in any potentially explosive atmosphere.

### Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an ITT representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

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 <https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/IOMs/> 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:



**Figure 1: Typical ATEX pump nameplate**

**Table 2: Temperature class definitions**

Code	Maximum permissible pumpage temperature in °C   °F	Minimum permissible pumpage temperature in °C   °F
T1	450   842	372   700
T2	300   572	277   530
T3	200   392	177   350
T4	135   275	113   235
T5	100   212	Option not available
T6	85   185	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.

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

II - Group – Non Mining Equipment

II = Group 2

2 = Category 2

G/D = Gas and Dust present

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T4 = Temperature class, can be T1 to T6 (see Table)

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.

## 1.6 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.

# 2 Pump Description

## 2.1 Receiving the pump



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**WARNING:**

Only trained personnel should do lifting. Pumps and motors often have integral lifting eyes or eye bolts. These are intended for use in lifting the individual pieces of equipment only. Failure to properly lift equipment could result in serious physical injury or damage to equipment.

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**WARNING:**

Keep hands and feet from under the unit during these steps. If slings slip and the unit tips over, severe personal injury or death may result.

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Inspect the pump as soon as it is received. Carefully check that everything is in good order. Make notes of damaged or missing items on the receipt and freight bill. File any claims with the transportation company as soon as possible.

### 2.1.1 Storage requirements

**Short Term:** (Less than 6 months) Goulds normal packaging procedure is designed to protect the pump during shipping. Upon receipt, store in a covered and dry location.

**Long Term:** (More than 6 months) Preservative treatment of bearings and machined surfaces will be required. Rotate shaft several times every 3 months. Refer to driver and coupling manufacturers for their long term storage procedures. Store in a covered dry location.

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**NOTICE:**

For pumps or back pull-out assemblies supplied with cartridge mechanical seals, the centering tabs must be in place and tightened, and the set screw collar loosened. Failure to take these steps could result in damage to the mechanical seal or shaft sleeve.

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**NOTICE:**

Long term storage treatment can be purchased with the initial pump order or can be applied to pumps already in the field that were not treated at the factory. This service can be supplied by contacting your local Goulds sales representative.

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### 2.1.2 Handling



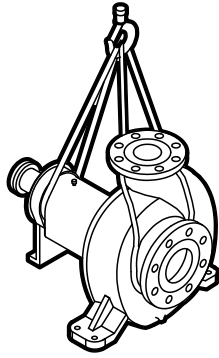
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**WARNING:**

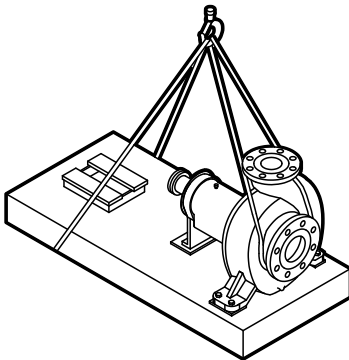
Pump and components are heavy. Failure to properly lift and support equipment could result in serious physical injury or damage to pumps. Steel toed shoes must be worn at all times.

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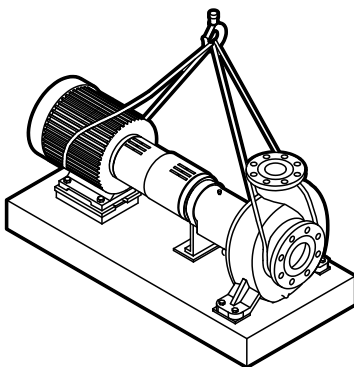
Use care when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pump using a suitable sling, under the suction flange and bearing frame. Base-plate mounted units are moved with slings under the pump casing and driver. Refer to Figs. 2-4 for examples of proper lifting techniques.



**Figure 2: Lifting method, pump only**



**Figure 3: Lifting method with pump mounted to baseplate**



**Figure 4: Lifting method with pump and motor mounted to baseplate**

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**NOTICE:**

Refer to the Installation section of this manual for detailed instructions for lifting a Polyshield® ANSI Combo with installed equipment. Never lift a Poly- shield® ANSI Combo with pump and motor mounted using the procedure shown in Fig. 3 and Fig. 4.

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## 2.2 Introduction

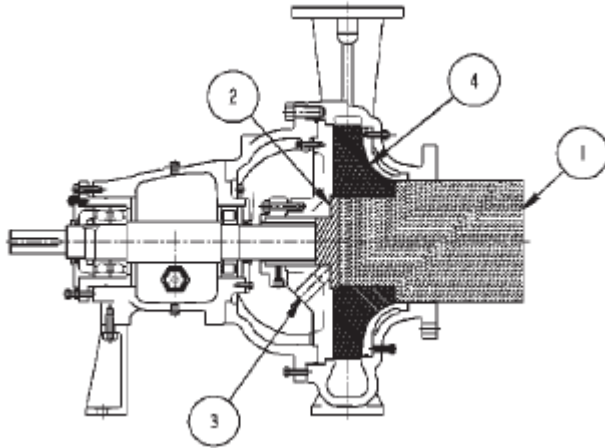
The Goulds Model 3500XD heavy duty stock pump is a centrifugal pump designed to handle paper stock up to approximately 16% O.D. consistency. The pump design

incorporates special features to induce flow into the pump suction and to remove air that is present in stock at higher consistencies.

## 2.3 Design concept

There are two major obstacles in pumping paper stock at consistencies above 8% with a centrifugal pump: the formation of a fiber network that will not readily flow, and high air content which can cause air binding of a standard centrifugal pump.

The Model 3500XD pump is normally attached to a suction vessel or "standpipe," and a constant level is maintained above the suction centerline. An X-Ducer mounted on the end of the pump shaft creates turbulence in the suction standpipe (Fig. 5, Zone 1), breaking up the fiber network and separating air from the pulp. The pulp is then induced to flow into the pump suction by the static head in the standpipe and the pumping action of the X-Ducer. The amount of turbulence required (minimum pump speed) as well as the minimum standpipe level is a function of the stock type, quality, consistency and temperature of each specific application.



1. Zone 1 - turbulence generation and air separation
2. Zone 2 - Fiber return
3. Zone 3 - Air removal
4. Zone 4 - Pumping zone

**Figure 5: Suction standpipe**

Air separation occurs due to the action of X-Ducer in Zone

1. The air collects at the center of the X-Ducer and is pumped through balance holes in the impeller shroud. Any remaining paper stock is separated from the air behind the impeller via a patented secondary separation device (U.S. Patent #5,087,171) in Zone 2. The paper stock is pumped to the casing volute via large back pump-out vanes (Zone 4), and the air flows to atmosphere or to a vacuum source depending on operating conditions (Zone 3).

Pressure generation takes place in the impeller and casing volute in the normal manner once the air has been removed (Zone 4).

## 2.4 Construction details

**Casing** - The casing is vertically split, top centerline discharge, providing a back pullout design for ease of maintenance. A renewable sideplate is incorporated into the design to reduce maintenance costs. The sideplate is sealed with an O-ring and gasket.



**Impeller** - The impeller is an open design with a full back shroud. It is designed for a matched close clearance with the suction sideplate to provide optimum efficiency. The impeller has balance holes to allow air to pass through the back shroud. Remaining paper stock is returned to the casing volute via large pump-out vanes.

The impeller is keyed to the shaft and sealed with PTFE® O-rings.

**X-Ducer** - The X-Ducer creates turbulence in the standpipe and feeds the pulp into the pump suction. The design concentrates the air present in the pulp suspension where it is expelled from the degas holes in the impeller into the degas system. The X-Ducer is key driven and secured to the shaft with a rotor nut. PTFE® o-rings protect the shaft.

**Repeller** - A patented (U.S. Patent # 5,087,171) repeller behind the impeller provides superior secondary air separation. The repeller is keyed to the shaft and sealed with PTFE® O-rings.

**Stuffing Box Cover** - The stuffing box cover contains a degasification nozzle through which excess air is removed. Shaft sealing is accomplished with a mechanical seal as standard.

**Shaft/Shaft Sleeve** - The shaft is designed to minimize deflection in the seal area and at the impeller. It is protected from the pumpage by a replaceable sleeve sealed with a PTFE® O-ring.

**Power End** - A heavy duty power end is provided for maximum reliability. It includes a duplex angular contact thrust bearing and a cylindrical roller radial bearing for maximum load carrying ability. The bearings are sized for a two year minimum  $L'_{10}$  (14 year average) life under the worst operating conditions. Oil lubrication is standard and the frame is sealed at both ends with labyrinth oil seals. External axial adjustment is provided to maintain the proper impeller clearance for optimum efficiency.

# 3 Installation

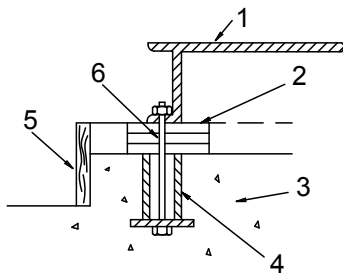
## 3.1 Site / foundation

A pump should be located near the supply of liquid and have adequate space for operation, maintenance, and inspection.

Baseplate mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing. The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit.

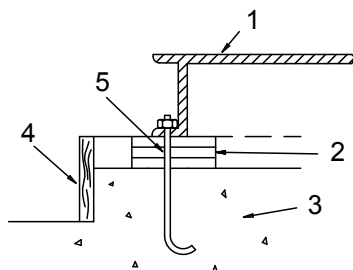
The location and size of the foundation bolts are shown on the outline assembly drawing, provided with the pump data package.

Foundation bolts commonly used are sleeve type (Fig. 6) and J Type (Fig. 7). Both designs permit movement for final bolt adjustment.



1. Baseplate
2. Shims
3. Foundation
4. Sleeve
5. Dam
6. Bolt

**Figure 6: Sleeve type bolts**



1. Baseplate
2. Shims
3. Foundation
4. Dam
5. Bolt

**Figure 7: J type bolts**

## 3.2 Level baseplate

1. Place two sets of wedges or shims on the foundation, one set on each side of every foundation bolt. The wedges should extend 20 mm (.75 in) to 40 mm (1.5 in) above foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.
2. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with rags to prevent grout from entering.

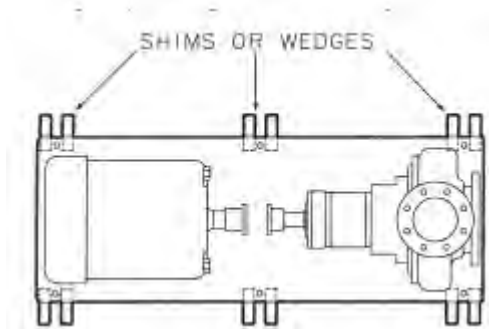


Figure 8: Top view

3. Carefully lower baseplate onto foundation bolts.
4. Level baseplate to within 3.2 mm (.125 in) over length of the baseplate and to within 1.5 mm (0.875 in) over the width of the base by adjusting wedges.
5. Hand tighten bolts.

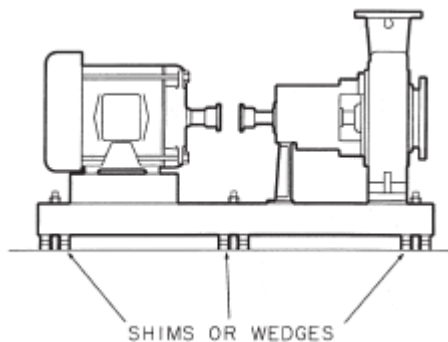


Figure 9: Side view

## 3.3 Alignment and alignment procedure



### WARNING:

Lock out driver power to prevent accidental start-up and physical injury.

The points at which alignment is checked and adjusted are:

- **Initial Alignment** is done prior to operation when the pump and the driver are at ambient temperature.
- **Final Alignment** is done after operation when the pump and driver are at operating temperature.

Alignment is achieved by adding or removing shims from under the feet of the driver and shifting equipment horizontally as needed.

Accurate alignment of the equipment must be attained. Trouble-free operation can be accomplished by following these procedures.

### 3.3.1 Alignment checks

#### Initial Alignment (Cold Alignment)

- Before Grouting Baseplate - To ensure alignment can be obtained.
- After Grouting Baseplate - To ensure no changes have occurred during grouting process.
- After Connecting Piping - To ensure pipe strains haven't altered alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.

#### Final Alignment (Hot Alignment)

- After First Run - To obtain correct alignment when both pump and driver are at operating temperature. Thereafter, alignment should be checked periodically in accordance with plant operating procedures.

### 3.3.2 Alignment criteria

Good alignment is achieved when the dial indicator readings as specified in the alignment procedure are .05 mm (.002 in.) Total Indicated Reading (T.I.R.) or less when the pump and driver are at operating temperature (Final Alignment).

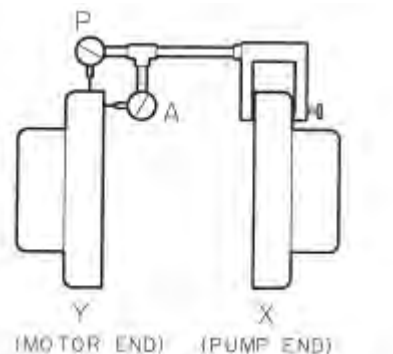
During the installation phase, however, it is necessary to set the parallel alignment in the vertical direction to a different criteria due to the differences in expansion rates of the pump and driver. The table below shows recommended preliminary (cold) settings for electrical motor driven pumps based on different pumpage temperatures. Driver manufacturers should be consulted for recommended cold settings for other types of drivers (steam turbines, engines, etc.)

**Table 3: Recommended preliminary cold settings for parallel vertical alignment**

Pumpage Temperature	Set Driver Shaft
10° C (50° F)	.05 mm (.002 in.) LOW
65° C (150° F)	.03 mm (.001 in.) High
120° C (250° F)	.12 mm (.005 in.) High

## 3.4 Set up

1. Mount two dial indicators on one of the coupling halves (X) so they contact the other coupling half (Y) (Fig. 10).



**Figure 10: Dial indicator mounting**

2. Check setting of indicators by rotating coupling half X to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.

## 3.5 Measurement

1. To ensure accuracy of indicator readings, always rotate both coupling halves together so indicators contact the same point on coupling half Y. This will eliminate any measurement problems due to runout on coupling half Y.
2. Take indicator measurements with driver feet hold-down bolts tightened. Loosen hold down bolts prior to making alignment corrections.
3. Take care not to damage indicators when moving driver during alignment corrections.

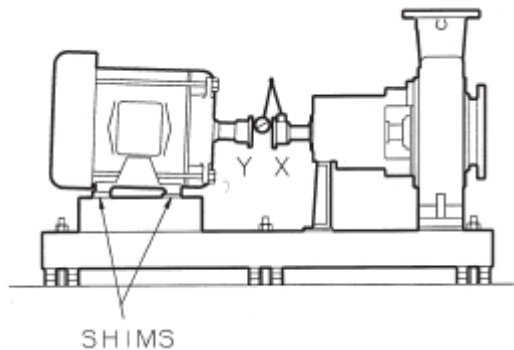
### 3.5.1 Angular alignment

A unit is in angular alignment when indicator A (Angular indicator) does not vary by more than .05 mm (.002 in.) as measured at four points 90° apart.

#### Vertical Correction (Top-to-Bottom)

1. Zero indicator A at top dead center (12 o'clock) of coupling half Y.
2. Rotate indicators to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering feet at the other end (remove shims) (Fig. 11).

**Positive Reading** - The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims).



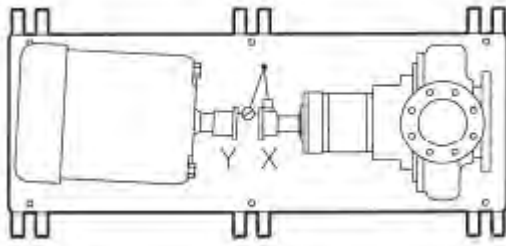
**Figure 11: Side view**

4. Repeat steps 1-3 until indicator A reads .05 mm (.002 in.) or less.

#### Horizontal Correction (Side-to-Side)

1. Zero indicator A on left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

**Positive Reading** - The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. 12).



**Figure 12: Top view**

4. Repeat steps 1 through 3 until indicator A reads .005 mm (.002 in.) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

### 3.5.2 Parallel alignment

A unit is in parallel alignment when indicator P (parallel indicator) does not vary by more than .005 mm (.002 in.) as measured at four points 90° apart at operating temperature. Note the preliminary vertical cold setting criteria, Table 3.

#### Vertical Correction (Top-to-Bottom)

1. Zero indicator P at top dead center of coupling (12 o'clock) half Y (Fig. 10).
2. Rotate indicator to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of the indicator reading under each driver foot.

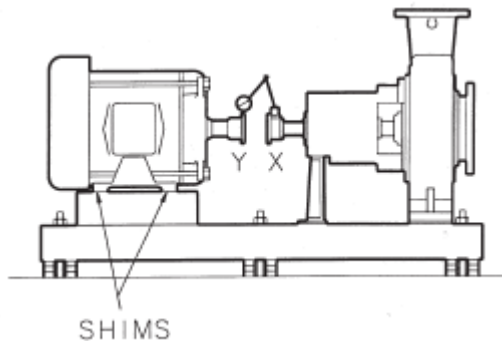
**Positive Reading** - Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of the indicator reading from each driver foot (Fig. 13).

---

#### NOTICE:

Equal amounts of shims must be added to or removed from each driver foot. Otherwise the vertical angular alignment will be affected.

---



**Figure 13: Side view**

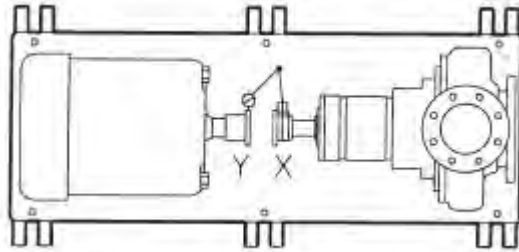
4. Repeat steps 1 through 3 until indicator reads within .05 mm (.002 in.) or less when hot, or per Table 3 when cold.

#### Horizontal Correction (Side-to-Side)

1. Zero indicator P on the left side of coupling half Y, 90° from top dead center (9 o'clock).

2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.
3. **Negative Reading** - Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. 14).

**Positive Reading** - Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction.



**Figure 14: Top view**

---

**NOTICE:**

Failure to slide motor evenly will affect horizontal angular correction.

---

4. Repeat steps 1 through 3 until indicator P reads .05 mm (.002 in.) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

### 3.5.3 Complete alignment

A unit is in complete alignment when both indicators A (angular) and P (parallel) do not vary by more than .05 mm (.002 in.) when measured at four points 90° apart.

#### Vertical Correction (Top-to-Bottom)

1. Zero indicators A and P at top dead center (12 o'clock) of coupling half Y.
2. Rotate indicator to bottom dead center (6 o'clock). Observe the needles and record the readings.
3. Make corrections as outlined previously.

#### Horizontal Correction (Side-to-Side)

1. Zero indicators A and P on the left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe the needle, measure and record the reading.
3. Make corrections as outlined previously.
4. Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

---

**NOTICE:**

With experience, the installer will understand the interaction between angular and parallel and will make corrections appropriately.

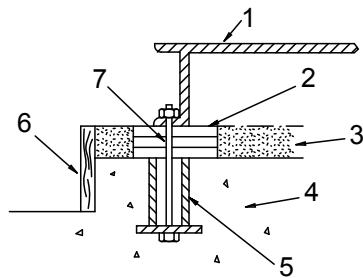
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### 3.6 Alignment troubleshooting

Problem	Probable Cause	Remedy
Cannot obtain horizontal (Side-to-Side) alignment, angular or parallel	Driver feet bolt bound.	Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved.
	Baseplate not leveled properly, probably twisted.	Determine which corner(s) of the baseplate are high or low and remove or add shims at the appropriate corner(s) and realign.
Cannot obtain vertical (Top-to-Bottom) alignment, angular or parallel	Baseplate not leveled properly, probably bowed.	Determine if center of baseplate should be raised or lowered and correct by evenly adding or removing shims at the center of the baseplate.

### 3.7 Grout baseplate

1. Clean areas of baseplate that will contact grout. Do not use oil-based cleaners because grout will not bond to it. Refer to grout manufacturer’s instructions.
2. Build dam around foundation. Thoroughly wet foundation (Fig. 15).
3. Pour grout through grout hole in baseplate, up to level of dam. Remove air bubbles from grout as it is poured into place. Non-shrink grout is recommended (Fig. 15).

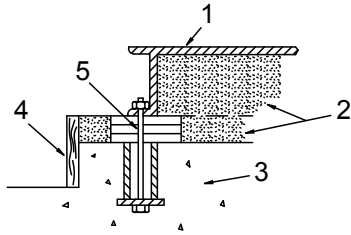


1. Baseplate
2. Shims
3. Grout
4. Foundation
5. Sleeve
6. Dam
7. Bolt

**Figure 15: Pour grout through grout hole**

4. Allow grout to set.
5. Fill remainder of baseplate with grout. Remove air as before (Fig. 16).





1. Baseplate
2. Grout
3. Foundation
4. Dam
5. Bolt

**Figure 16: Allow grout to set around baseplate**

6. Allow grout to set at least 48 hours.
7. Tighten foundation bolts.

### 3.7.1 Alignment check

Re-check alignment before continuing, using methods previously described.

## 3.8 Piping

### 3.8.1 General



#### **WARNING:**

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 affect the operation of the pump resulting in damage to the equipment and/or physical injury.

1. All piping must be supported independently of, and line up naturally with, the pump flanges.
2. Piping runs should be as short as possible to minimize friction losses.
3. Do not connect piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.
4. The piping should be arranged to allow pump flushing prior to removal of the unit.
5. After connecting the piping to pump:
  - Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
  - Check alignment per the alignment procedure outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.

# 4 Preparation for Startup

## 4.1 Check rotation

---

**NOTICE:**

Serious damage may result if pump is run in the wrong rotation.

---

1. Lock out power to driver.



**WARNING:**

Before installation or disassembly of the coupling guard is performed, the driver must be de-energized, the driver controller/starter put in a locked out position and a caution tag placed at the controller/starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump or serious physical injury may occur. Goulds Pumps, Inc. assumes no liability for avoiding the practice.

---

2. Make sure coupling hubs are securely fastened to shafts.

---

**NOTICE:**

Pump is shipped with coupling spacer removed.

---

3. Unlock driver power.
4. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation must correspond to arrow on bearing housing.
5. Lock out power to driver.

### 4.1.1 Check impeller axial clearance



**CAUTION:**

The impeller clearance setting procedure must be followed. Improperly setting the clearance can result in equipment damage and heat generation casing failure.

---

The proper impeller axial clearance is required for proper air removal and efficient pump operation. See the maintenance section of this manual for the correct clearance and method of setting.

### 4.1.2 Couple pump and driver



**WARNING:**

Before installation or disassembly of the coupling guard is performed, the driver must be de-energized, the driver controller/starter put in a locked out position and a caution tag placed at the controller/starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump or serious physical injury may occur. Goulds Pumps, Inc. assumes no liability for avoiding the practice.

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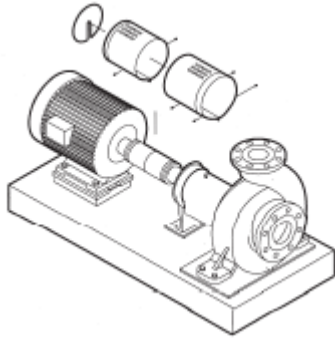


**CAUTION:**

Use of couplings which have excessive weight can cause shaft failure and lead to physical injury. Consult pump manufacturer for recommended weight limits for couplings should the originally supplied coupling be changed.

---

1. Install and lubricate coupling per manufacturer's instructions.
2. Install coupling guard (Fig. 17).



**Figure 17: Install coupling guard**




---

**WARNING:**

Pump shall never be operated without coupling guard installed correctly.

---

### 4.1.3 Lubricating bearings

---

**NOTICE:**

Operation of the unit without proper lubrication will cause bearing failure, and pump seizure.

---

**Oil Lubrication:** Pumps are shipped without oil. Fill the bearing frame with oil, through the filler connection (located on top of bearing frame), until the level reaches the mark in the middle of the oil level sight-glass. A high quality turbine type oil, with rust and oxidation inhibitors should be used.

---

**NOTICE:**

Pumps are shipped without oil. Oil lubricated bearings must be lubricated at the job site.

---

Refer to the Maintenance Section of this manual for further details on lubrication.

### 4.1.4 Shaft sealing




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**CAUTION:**

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.

---

The Model 3500XD pump is supplied with a cartridge mechanical seal as standard. Cartridge seals are preset at the factory and require no field settings. Remove the holding clips prior to operation to correctly set the seal. Refer to the manufacturer's outline drawing and instruction manual for further information.

A fresh water flush is required to lubricate and cool the seal faces. Refer to the Operation section of this manual for details on the seal flush system supplied with the pump.

# 5 Operation and Controls

## 5.1 Air removal system (general description - refer to Figure 17 and 18) for order specific description - refer to the IOM Appendix

For most Model 3500XD installations, the air removal system consists of an on/off control valve (ARV), a vacuum relief valve (VR), a compound pressure gauge (PI), a vacuum pump and piping from the Model 3500XD to the vacuum pump. (Fig. 17)

The vacuum pump pumps the air from the Model 3500XD, via the degas piping. The vacuum pump is a Nash Model AHF75 liquid ring pump operating at 1750, 1450, or 1150 RPM. The vacuum pump requires about 2-3 GPM service liquid flow (operating and maintenance instructions for the Nash vacuum pump are included in the Appendix).

Vacuum pump control is on/auto/off through a switch in the control room.

In the on mode, the vacuum pump is running. In the auto mode, the vacuum pump starts when the model 3500XD is started, and stops when the Model 3500XD is shutdown.

If the vacuum pump stops during operation, an alarm must warn the operator.

The air removal valve (ARV) prevents stock from entering the air removal piping when the Model 3500XD is not running, or the stock consistency is low.

The air removal valve is equipped with a pneumatic actuator and solenoid valve, with the choice of operation auto/on/off through a switch in the control room. In the on mode, the ARV is 100% open, in the off mode, the ARV is closed. In the auto mode, the ARV will be open when the level control valve (LCV) is open and closed when the LCV is closed.

The vacuum relief valve (VR) is used to control the pressure in the air removal system at a constant setting. The pressure in the air removal piping is indicated on the compound gauge (PI).

Before start up, the pressure in the degas system should be set at -5 inches Hg (mercury) vacuum gauge. This operation is carried out by starting the vacuum pump with the ARV closed, and adjusting the VR until a reading of 5 in Hg vacuum shows on the compound gauge (PI).

During operation, if fiber is being drawn into the air removal system, the vacuum level should be reduced by opening the VR valve. If discharge pressure or pump operation is erratic, the vacuum level should be increased by closing the VR valve.

For design pulp consistencies of 10% or less, it is possible to operate without a vacuum pump with the Model 3500XD design. In this case a degas valve would be present to allow isolation of the system and the degas nozzle would be piped to drain or an air separator. Refer to Figure 19 for the typical control schematic without a vacuum pump.

## 5.2 Level control

(Refer to Figure 17 and 18)

For Order Specific Description - Refer to the IOM Appendix

A level must be maintained in the suction standpipe for proper pump operation and air removal. A level transmitter (LT) must be installed to measure standpipe level and provide a signal to a level controller in the control room.

The level measurement range is 0 - 100%. This span must be oriented properly on the standpipe and the length of the span will be dependent on the application and the type of level transmitter used. Refer to the IOM Appendix for the order specific information on the level span.

Standpipe level is set on the level controller in the control room. Output from the controller is the input to the level control valve (LCV) on the discharge of the Model 3500XD pump.

High and low alarms in the control room should be set at 85% and 10% respectively. Neither alarm should be interlocked to shut down the Model 3500XD. The Model 3500XD will not start if the standpipe level is less than 10%.

Additional recommendations for level control valve operations are:

- Low limit stop of 10% open
- In the event of the valve failing closed, a time delay of one minute in the fully closed position shall require the 3500XD motor to stop.

The exact operating level for the standpipe must be set for each specific application to obtain optimum air removal and pump performance. With stock temperatures up to 170°F, a level of 3' to 5' above the pump centerline is typical. Above 170°F, the level must be increased to account for the increased vapor pressure of the stock. Refer to the IOM Appendix for the order specific information on the standpipe operating level, high and low level alarms.

If the unit is equipped with a variable speed drive, output from the level controller would control the pump speed rather than the LCV position. Refer to the IOM Appendix for the order specific information on the control scheme for variable speed drive systems.

For Model 3500XD units operating at 10% consistency or less, the level control system is the same as the above.

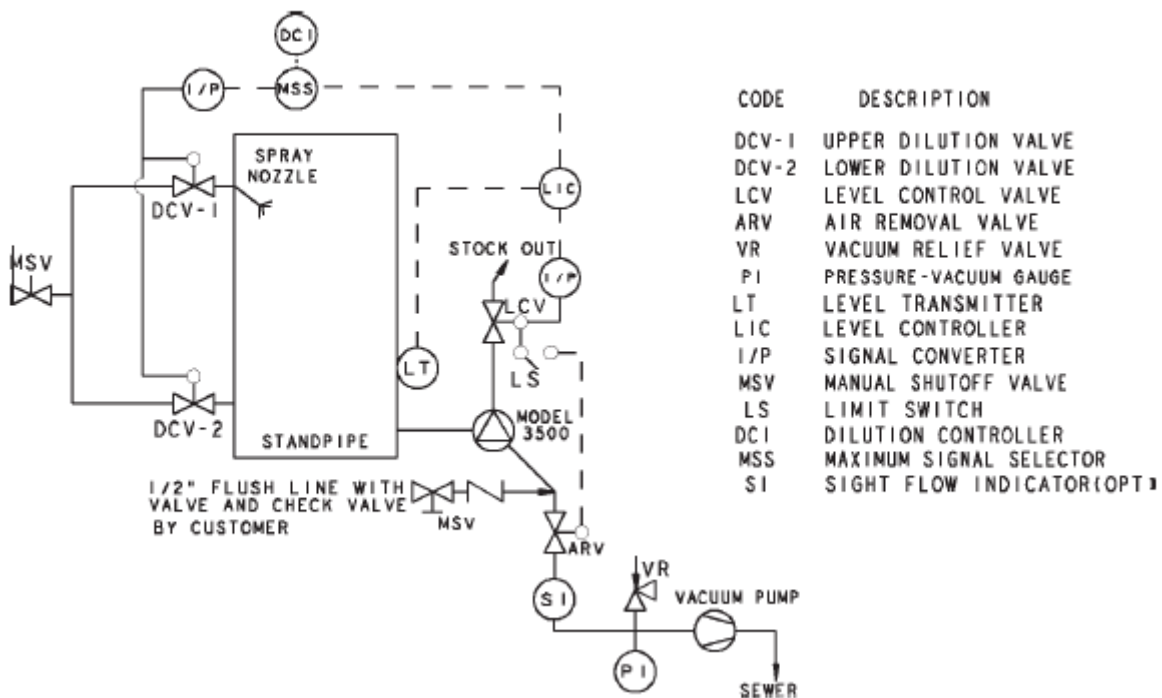


Figure 18: Vacuum pump to sewer

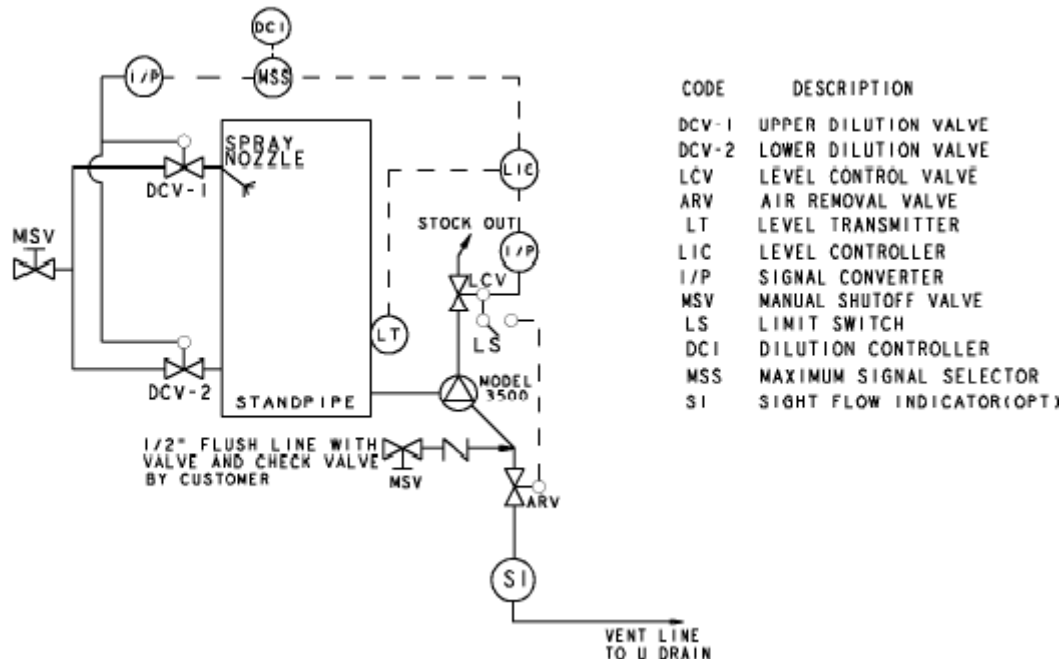


Figure 19: Vent line to drain

## 5.3 Dilution system – typical

(Refer to Figure 17 and 18)

For Order Specific Description - Refer to the IOM Appendix

An automatic standpipe dilution system is recommended so the highest possible average consistency for which the discharge piping is designed can be continuously delivered by the pump. The consistency of the stock being pumped is the major contributor to friction head loss in the discharge piping, followed by temperature and pH (this is true only if the same fiber type is being pumped). The higher the consistency, the greater the friction head loss will be. Usually the only parameter or variable that can be adjusted in the standpipe is stock consistency, which can be controlled by the dilution system.

The dilution system normally consists of an upper spray nozzle with a control valve (DCV-1) and a lower dilution header with a control valve (DCV-2)

In the auto mode, the upper dilution valve (DCV-1) will open to assist pumping when the standpipe level exceeds its set point by 10%. A maximum signal selector is also used to allow DCV-1 and DCV-2 to be open a preset amount, while still maintaining the automatic function on an increase in level.

The normal set point of the standpipe level controller (LCI) is approximately 25%. When the level exceeds 25%, the level control valve opens to bring the level back to its set-point. When the level exceeds 35%, the dilution controller (DCI) will signal the dilution valve (DCV-1) to start to open. It will open gradually with level and be 100% open at 85% level. DCV-1 will gradually close as the level decreases back to its set-point.

The lower dilution valve (DCV-2) should be programmed to begin opening when DCV-1 is greater than 50% open, and should be 100% open, when DCV-1 is 100% open. Refer to the IOM Appendix for the order specific information on the dilution scheme.

If the Model 3500XD is running and the standpipe level is less than 10%, the upper and lower dilution valves will open 100%. The valves will close when one of the above conditions change.

## 5.4 Seal/vacuum flush

(Refer to Figure 20 and 21)

Seal and flush water is manually controlled with a Safematic seal water monitoring unit. The seal water flow to the bearing frame cooling coil and then to the mechanical seal is monitored with a 0-2 GPM flow meter and alarm. The seal water from the mechanical seal outlet is directed to the gland flush connection or stuffing box flush connection. Seal water required is 1-1½ GPM. A second 0-2 GPM flow meter is supplied to provide 1-2 GPM directly to the Model 3500XD vacuum chamber. A third flow meter (0-4 GPM) with alarm provides approximately 2 GPM of make-up water directly to the vacuum pump (Fig. 20).

Check valves are provided to prevent stock from flowing back into the seal and flush water control unit.

The water supply to the seal and flush water monitoring equipment should be clean filtered water with a maximum particle size of 50 microns, a maximum temperature of 100° F (40° C) and supplied at minimum pressure of 50 PSIG (3.5 bar). The seal water flow indicators for the mechanical seal and the vacuum pump are equipped with

flow switches, which are set to give an alarm if the flow falls below 50% of the set point. The Model 3500XD pump will not start unless the seal water flow is above the minimum.

For design pulp consistencies at 10% and lower it is not necessary to utilize a vacuum pump with the Model 3500XD. In this situation only two seal flush water flow meters are required. The flow meter servicing the vacuum pump is not required (Fig. 21).



### CAUTION:

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.

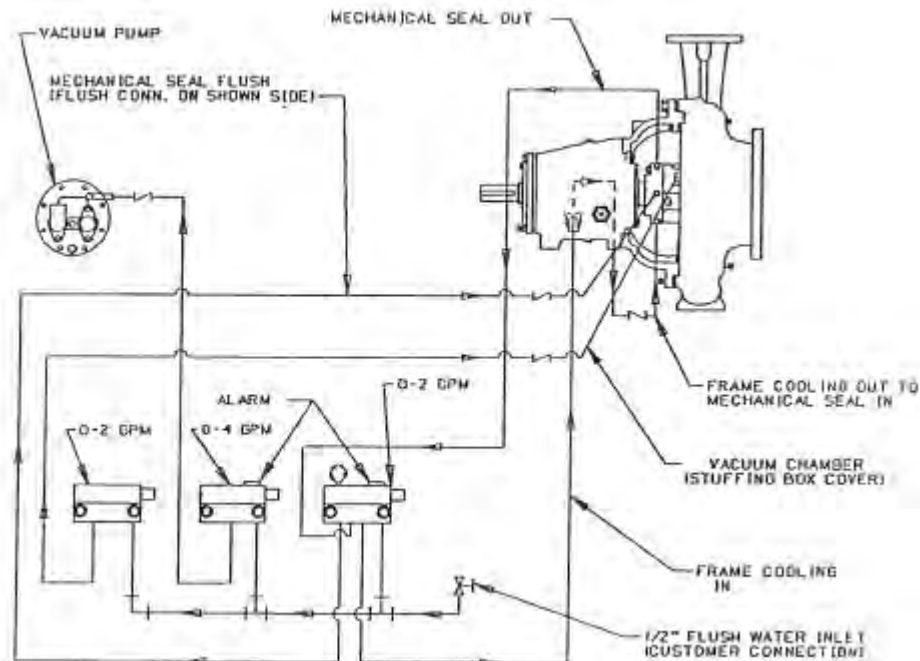


Figure 20: With vacuum pump

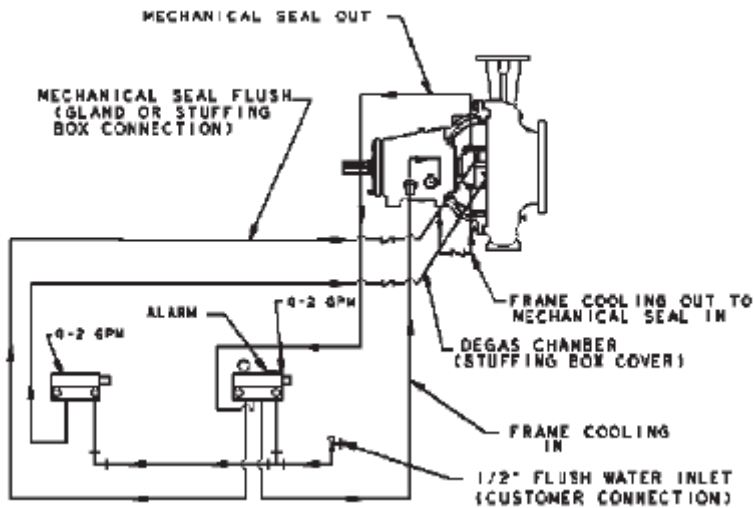


Figure 21: Without vacuum pump

### 5.4.1 Pumping water or low consistency stock

The Model 3500XD pump system should be checked out with water to make sure everything is operating in accordance with all alarms and interlocks.

When running with water the air removal valve is closed, otherwise the system will operate the same as if pumping stock.

### 5.4.2 Pumping with stock - start up procedure

Turn the seal water on to the mechanical seal (1 - 1½ GPM), the vacuum pump (2 GPM), and to the vacuum chamber (1-2 GPM).

The control switches for the vacuum pump and the air removal valve are in the automatic mode.

Fill the standpipe with water to a minimum level of 35% with DCV-1 and DCV-2.

With the level control in the auto mode, set the level at 35%, start the Model 3500, and open the dilution valves DCV-1 and DCV-2 to 100%.

The vacuum pump starts.

Begin adding stock to the standpipe. When the stock flow to the standpipe is at normal production, slowly close the dilution valves and switch the dilution controller to auto.

Gradually adjust the set point to the designated level for the specific service leaving the level controller on automatic.

If the pump discharge pressure drops or pumping becomes erratic, slowly increase the level until pumping is normal.

Follow the same sequence for the Model 3500XD for units without a vacuum pump when the consistency is 10% and lower.



#### **WARNING:**

Do not operate pump below minimum rated flows or with suction and/or discharge valve closed or with suction and/or discharge line blocked. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.



**WARNING:**

Assure that the system operating conditions are within the capabilities (e.g. – pressure, temperature, power, etc.) of the pump. Exceeding any of the limits could result in failure of components resulting in serious physical injury and damage to equipment.

## 5.5 Shutdown procedure

**WARNING:**

Do not operate pump below minimum rated flows or with suction and/or discharge valve closed or with suction and/or discharge line blocked. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.

During brief shutdowns (approximately four hours or less), it is usually sufficient to flush and drain the standpipe, pump and control valve without displacing the stock in the entire discharge line. During extended shutdowns (over four hours), it is recommended to also flush and drain the discharge line.

Stop the pulp flow to the standpipe. After the pulp is pumped from the standpipe and the discharge piping has been cleared of stock, the Model 3500XD can be shut down.

During the shutdown sequence, the dilution system, air removal valve and vacuum pump should be in the auto mode. After the Model 3500XD is shut down, the air removal valve and the vacuum pump switch should be changed to the off mode.

The seal water to the mechanical seal and the vacuum pump can be shut off. If the seal water to this mechanical seal is left on, the standpipe can gradually fill up with water.

## 5.6 Operation without a vacuum pump

The Model 3500XD can be supplied both with and without a vacuum pump. Services with design pulp consistency of 10% or less can be supplied without a vacuum pump. When a vacuum pump is supplied the flowing operating instructions can be utilized.

If, for some reason, maintenance is required on the vacuum pump and an interruption in production is not wanted, it may be possible to change out the vacuum pump by the following procedure.

Raise the set value of the level controller 70 to 75% and open the dilution valves 75%. This should dilute the stock to the point where operation without a vacuum pump can be achieved.

Reduce the vacuum in the air removal system, watching to make sure the level in the standpipe does not increase. If the level increases excessively or does not stop, increase the amount of dilution until the pump will operate without air removal system.

Stop the vacuum pump. If the standpipe level remains at its set valve, the vacuum pump can be removed from the system and repaired or replaced.

## 5.7 Monitoring during operation

The pump operation is monitored in the control room with:

- Standpipe level indication
- Discharge control valve position
- Pump speed, if variable speed drive
- Upper dilution valve position
- Lower dilution valve position

- Amp meter or percent motor load for Model 3500XD drive motor
- Signal lights showing Model 3500XD running, vacuum pump running, and air removal valve position
- Alarms for vacuum pump not running, Model 3500 shutdown, seal water flow, and standpipe high and low level

Monitors at the pump location include:

- Seal water flow to the Model 3500XD, vacuum pump, and vacuum chamber
- Vacuum level in the air removal system

The actual value of the level control (LCI) should be within the range of  $\pm 5\%$  of the set value. The normal output signal should be as indicated in the IOM Appendix for the specific service. If it is continuously lower than the set value, the regulation of the level control valve may be disturbed.

If the pressure indicator (PI) in the air removal system varies  $\pm 1$  ft., the set value of the standpipe level is too low, the pulp in the standpipe contains large amounts of air, or the level control is not working properly.

The Model 3500XD motor load should be relatively stable, although consistent variations would be considered normal. Sudden changes in motor load usually indicate that more air is entering the pump from the standpipe, which can be corrected by increasing the standpipe level set point.

Usually the main cause for pumping problems is that the stock in the standpipe contains large void areas, the stock is bridging in the standpipe, the stock consistency is too high, or because changes in consistency, pH or temperature have caused a significant increase in the discharge piping head loss. The above causes can be remedied by increasing the dilution water flow.

**Table 4: Troubleshooting the model 3500XD standpipe installation**

Problem	Symptoms	Possible cause	Solutions
Pump will not start pumping	Amps to drive motor normal	Control valve LCV does not open	Check that the supply air pressure to the actuator is sufficient
		Discharge pipe plugged	Open by flushing, check that any manual valves in the discharge pipe are open
	Amps to drive motor below normal	ARV has not opened	Open manually and check setting on LCV limit switch
		Pressure in air removal piping too high	Check that the vacuum pump is running and the setting of the vacuum relief valve
Pump discharge flow too low	Level control valve 100% open	Standpipe dilution valve not operating, or dilution water pressure too low	Check that dilution valve is operating, check dilution water pressure
		Flow too high compared to pump capacity	Check pump and motor speed, check V belts if V belt driven
	Pump power consumption and air removal pressure unstable	Level in standpipe too low, or air removal pressure too high	Raise the level set point in the standpipe, or reduce pressure in air removal piping
Stock discharge pipe vibrates	Power consumption and air removal pipe pressure stable	Discharge piping inadequately supported	Improve discharge pipe supports and anchors

Problem	Symptoms	Possible cause	Solutions
	Power consumption and air removal vacuum unstable	Stock in the standpipe has large voids, or the consistency is too high	Make sure that stock delivered to the standpipe is well shredded. Dilute if necessary by adding dilution at the shredder screw and to the upper part of standpipe.
		The signal to the level control valve is unstable	Check the valve movement, delay the input from the level transmitter if necessary
		Level measurement is too sensitive	Add filtering, or delay the input to the LIC
Motor overloaded Flow unstable	Motor overloaded	Volume flow above normal	Consistency is too low, switch to manual control
	Power consumption normal	Flow transmitter is too sensitive	Increase transmitter response time
	Power consumption normal but changes with the level control valve opening	Control not working properly	Recalibrate or adjust controller

# 6 Maintenance

## 6.1 Lubrication

---

**NOTICE:**

Operation of the unit without proper lubrication will cause bearing failure, and pump seizure.

---

**NOTICE:**

Pumps are shipped without oil. Oil lubricated bearings must be lubricated at the job site.

---

Oil lubricated bearings must be lubricated at the job site. Remove fill plug and add oil until level is at the center of the sight glass. Replace fill plug.

Change the oil after 2000 hours for new bearings, thereafter every 2000 operating hours or 3 months (whichever comes first). Change more often if oil becomes contaminated with dirt or water.

A high quality turbine oil with rust and oxidation inhibitors should be used. For the majority of operational conditions, bearing temperatures will run between 60°C (140°F) and 82°C (180°F). In this range, an oil of ISO viscosity grade 68 at 40°C (105°F) is recommended. If bearing temperatures exceed 82°C (180°F), use of ISO viscosity grade 100 is recommended.

**Acceptable Oils**

Exxon Teresstic EP 68

Chevron GTS Oil 68

Mobil Mobil DTE 26 300 SSU @ 38°C (100°F)

Gulf Gulf Harmony 68

Phillips Magnus Oil Grade 315

Phillips MM motor oil SAE 20-20W

Phillips HDS motor oil SAE 20-20W

**Table 5: Lubricating oil requirements**

	Bearing Temperature below 82°C (180°F)	Bearing Temperature above 82°C (180°F)
ISO Grade	VG 68	VG 100
Approx. SSU at 38°C (100°F)	300	470
DIN 51517	C68	C100
Kinematic viscosity at 40°C (105°F mm <sup>2</sup> /sec	68	100

## 6.2 Impeller clearance adjustment



### WARNING:

Lock out driver power to prevent accidental start-up and physical injury.



### WARNING:

Before installation or disassembly of the coupling guard is performed, the driver must be de-energized, the driver controller/starter put in a locked out position and a caution tag placed at the controller/starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump or serious physical injury may occur. Goulds Pumps, Inc. assumes no liability for avoiding the practice.



### CAUTION:

The impeller clearance setting procedure must be followed. Improperly setting the clearance can result in equipment damage and heat generation casing failure.

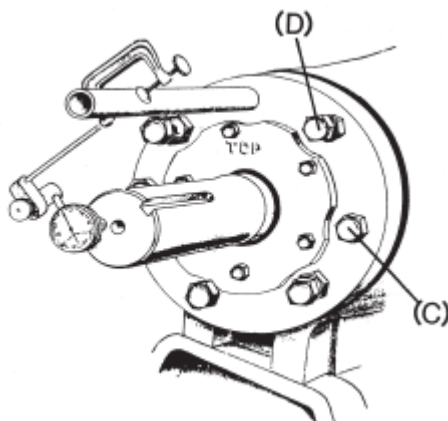
If a gradual loss of head and/or capacity occurs, performance can be restored by adjusting the impeller. If performance cannot be restored by adjusting the impeller, the pump should be disassembled and the impeller, suction sideplate, and casing inspected for wear.

The proper impeller clearance setting provides for equal clearance on both the front side (impeller to suction sideplate) and the back side (repeller to stuffing box cover). Prior to setting the impeller clearance, it is first necessary to measure the total impeller travel (normally in the range of 0.090" to 0.140"). Half of the total travel value then becomes the proper clearance to set the impeller off the suction sideplate.

### NOTICE:

If pump is equipped with a cartridge mechanical seal, the centering tabs must be in place and tightened, and the set screw collar loosened. Failure to take these steps prior to adjusting the impeller clearance can damage the mechanical seal.

To adjust clearance, proceed as follows (Fig. 20):



**Figure 22: Impeller clearance adjustment**

1. Shut down pump.
2. Lock out power to driver.
3. Remove coupling guard and coupling spacer.
4. Loosen adjustment bolts and nuts (D).

5. Tighten each bolt (C) evenly while slowly rotating shaft, until impeller just starts to rub against suction sideplate.
6. Clamp a dial indicator to the power frame, with the button resting on the end of the shaft or against the face of the coupling hub. Set indicator at 0.
7. Loosen bolts (C).
8. Be sure jam nuts on bolts (D) are loose. Tighten bolts (D) evenly while slowly rotating shaft, until impeller/repeller just starts to rub on the stuffing box cover.
9. The dial indicator will now show the total travel of the impeller. Divide the total travel by two to determine the proper front and back clearance; i.e. if total travel is 0.120", set clearance at 0.060".
10. Loosen bolts (D).
11. Tighten bolts (C) evenly until dial indicator reads the proper clearance (½ the total travel).
12. Tighten bolts (D) evenly. Check to make sure all bolts (C) are tight. Finally, tighten jam nuts on bolts (D).

The impeller is now set with equal clearance on the front and back sides. Rotate shaft several times to check for free turning.

**NOTICE:**

For pumps equipped with cartridge seals, the following steps must be taken after impeller adjustment to properly set the seal prior to start-up.

13. Tighten drive collar set screws.
14. Loosen and back off centering tabs.



**WARNING:**

Pump shall never be operated without coupling guard installed correctly.

## 6.3 Disassembly



**WARNING:**

Lock out driver power to prevent accidental start-up and physical injury.

The back pullout feature of this pump allows the complete back pullout assembly (bearing frame and rotating element) to be removed without disturbing suction or discharge piping or driver.

The sectional and parts list contains a complete sectional view of the pump and parts list with the proper identification numbers. Refer to this section as required during maintenance procedures and when ordering spare or repair parts.

To prepare for disassembly, proceed as follows:

1. Lock out power supply to motor.
2. Shut off all valves or equipment controlling flow to and from the pump.



**WARNING:**

Lock out driver power to prevent accidental start-up and physical injury.



**WARNING:**

Pump and components are heavy. Failure to properly lift and support equipment could result in serious physical injury or damage to pumps. Steel toed shoes must be worn at all times.

**WARNING:**

Only trained personnel should do lifting. Pumps and motors often have integral lifting eyes or eye bolts. These are intended for use in lifting the individual pieces of equipment only. Failure to properly lift equipment could result in serious physical injury or damage to equipment.

3. Remove all auxiliary tubing and piping.
4. Flush the pump to remove corrosive or toxic pumpage if required.
5. Drain liquid from standpipe.
6. Disconnect coupling and remove coupling spacer (refer to coupling instructions).
7. Drain oil.
8. If unit has stuffing box packing, remove the gland stud nuts. The gland is in two halves and can be removed.

**CAUTION:**

Never remove the back pull-out assembly unassisted, physical injury can occur.

To remove the back pullout assembly, proceed as follows:

**WARNING:**

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.

9. Place chain or sling from crane or hoist through frame adapter (108).
10. Remove frame foot hold-down bolts.
11. Remove bolts (370) which hold frame adapter to casing.
12. Adjust sling tension to support back pullout assembly.
13. Slide the back pullout assembly from the casing. The Model 3500XD has jacking bolts (418) to assist disassembly. Screw the jacking bolts into the tapped holes in the frame adapter. Tighten bolts evenly, a flat at a time, to jack back pullout assembly from casing.

If working space is available to the side of the baseplate, the "pullout assembly" can be turned perpendicular to the baseplate. Replace one pedestal hold-down bolt in baseplate and support the bearing frame flange with blocks. Complete disassembly of the "pullout assembly" can be accomplished on the job site. If preferred, it can be removed to an available work area.

14. Remove casing gasket (351).

**NOTICE:**

Ensure that casing gasket is not damaged.

15. Secure shaft from rotating at the coupling end and loosen and remove the X-Ducer nut (304). Do not lose or damage the X-Ducer o-ring (412A).

Remove the X-Ducer (274F) from the shaft. Careful prying may be necessary. Remove key (178B).

Remove the impeller (101) by carefully prying at the back side at 2 points 180 degrees apart.

16. Remove impeller key (178) from the shaft.

Do not lose or damage the shaft o-rings (496B and 496C).

17. Remove the repeller (262). Do not lose or damage the shaft o-rings (412F).

18. If unit has a mechanical seal, remove gland stud nuts. The gland is a solid ring and cannot be removed after unbolting. Carefully slide the gland off the gland studs and move back on shaft and shaft sleeve. Avoid contact with exposed lapped seal faces and keep them clean.

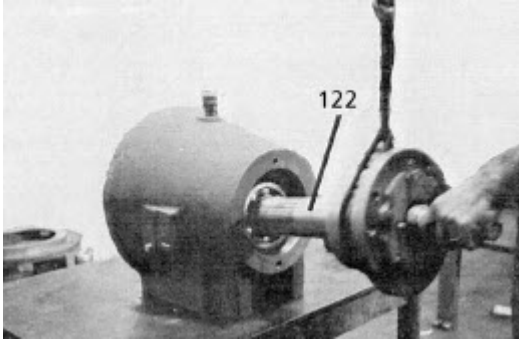
**NOTICE:**

Mechanical seal parts may be damaged if they or adjacent parts are handled improperly.

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19. Remove the adapter to bearing frame bolts (370B) and pull the adapter and stuffing box cover as an assembly. Do not allow the stuffing box cover to strike the shaft, shaft sleeve, or any mechanical seal part.
20. A cartridge mechanical seal is standard. Position and tighten the centering tabs and loosen the drive collar set screws. The cartridge seal can then be removed as a unit.
21. Scribe shaft at coupling hub for proper positioning of hub during reassembly and remove hub.

To disassemble remainder of the liquid end, casing and suction sideplate, proceed as follows:



**Figure 23: Slide shaft assembly from bearing frame**

22. Disconnect suction and discharge flanges.
23. Remove casing hold-down bolts and move casing toward driver. If preferred, casing can be removed from baseplate for further disassembly.
24. Remove suction sideplates nuts (423A).
25. Remove suction sideplate (176) by tightening the three jacking screws (370L). Be careful not to damage the suction sideplate o-ring (412C).

To complete disassembly of power end proceed as follows:

---

**NOTICE:**

Bearing replacement is recommended whenever bearings are removed from the shaft.

---

**NOTICE:**

Never use a hammer to drive shaft through bearings. Severe shaft and bearing damage may occur.

---

26. Remove the bolts (370B) which hold the frame adapter to the bearing frame. Remove the frame adapter (108).
  27. Remove the bolts (360) which hold the inboard bearing end cover to the frame. Remove the end cover (119A) and labyrinth seal (125).
  28. Remove bearing housing bolts (370C). Impeller adjustment bolts with jam nuts (370D) can be used to assist in the removal of the shaft and bearing assembly from the bearing frame.
  29. Slide the complete shaft assembly from back end of bearing frame. (See Fig. 21) This includes the shaft, both bearings (radial and thrust), and bearing housing. Do not lose or damage bearing housing o-ring.
- 



**CAUTION:**

Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

---



30. Using a bearing puller or a press, remove the inboard cylindrical roller bearing (409). Be sure to apply the removing force to the inner race of the bearing to prevent damage to the races.
31. Be sure shaft and keyway are free of burrs and sharp edges so labyrinth seal o-ring will not be damaged and remove bearing end cover (109A).
32. Slide the bearing housing (134A) off shaft.
33. Straighten "tang" in lock washer (382) and remove bearing lock nut and washer.
34. Remove coupling end bearing using a bearing puller. Care must be taken to prevent damage to bearings. Never use a hammer to drive shaft through bearing. Protect bearing from contamination.
35. The "L" group shaft is equipped with two oil flingers (236). If the shaft is being re-used, the flingers should not be removed, as they may be deformed during removal. If the shaft is being replaced, new flingers should be used.

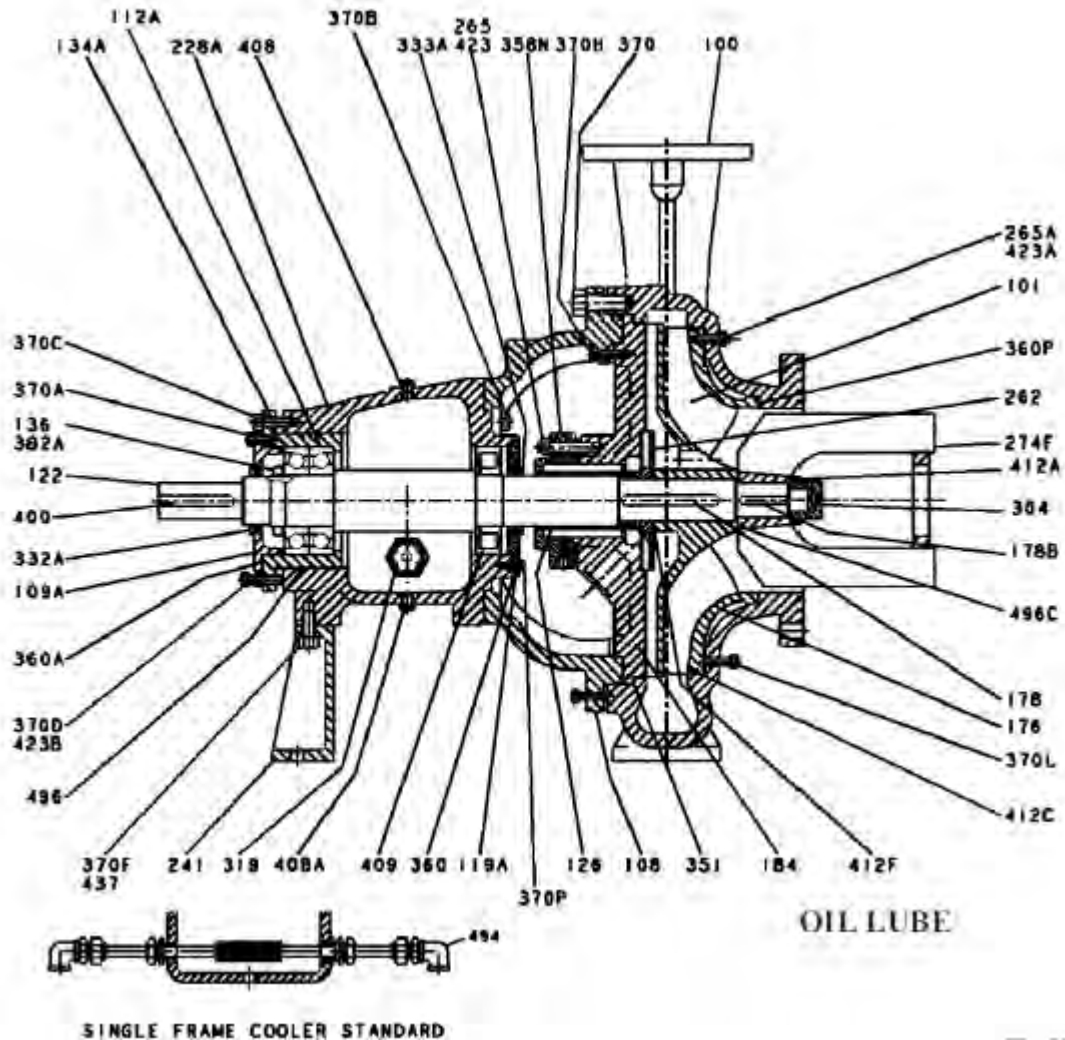


Figure 24: Oil lube

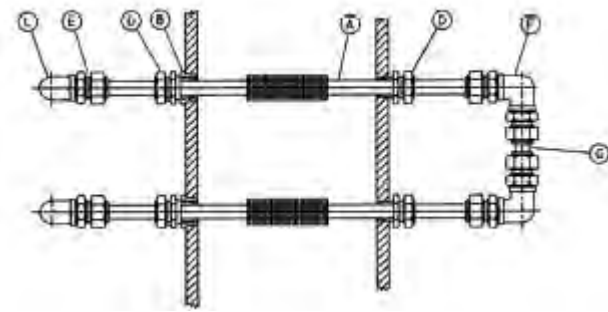


Figure 25: L Group dual frame coolers

Table 6: List of components

Item No.	No. Req'd	Part Name	Material	ASTM No.
100	1	Casing	317SS	A743 GR CG-8M
101	1	Impeller	317SS	A743 GR CG-8M
108	1	Adapter, frame	Cast iron	A48 CLASS 25B
109A	1	Cover, brg, end (thrust)	Cast iron	A48 CLASS 20
112A	2	Ball bearing (thrust)	Steel	—
119A	1	Cover, brg, end (radial)	Cast iron	A48 CLASS 20
122	1	Shaft	4140 AISI	A434 GR 4140
126	1	Sleeve, shaft	317SS	A743 GR CG-8M
134A	1	Housing, bearing	Cast iron	A48 CLASS 20
136	1	Locknut, bearing	Steel	—
176	1	Sideplate, suction	317SS	A743 GR CG-8M
178	1	Key, impeller	AISI 303	A582 TYPE 303
178B	1	Key, centrifuge	AISI 303	A582 TYPE 303
184	1	Cover, stuffing box assy	317SS	A743 GR CG-8M
228A	1	Frame, bearing	Cast iron	A48 CLASS 258
236	2*	Flinger	Steel	A569
241	1	Foot, frame	Cast iron	A48 CLASS 20
251	1	Sight gauge	Steel and glass	—
262	1	Repeller	317SS	A743 GR CG-8M
265	4	Stud (gland)	AISI 303	A582 TYPE 303
265A	4	Stud (sideplate)	AISI 303	A582 TYPE 303
274F	1	X-Ducer	317SS	A743 GR CG-8M
304	1	Nut, X-Ducer	317SS	A743 GR CG-8M
319	1	Sight window	Steel and glass	—
332A	1	Seal, oil (thrust)	Non-metallic	—
333A	1	Seal, oil (radial)	Non-metallic	—
351	1	Gasket, s.b. cover to casing	Non-asbestos	—
358N	1	Gland, stuff, box	317SS	A743 GR CG-8M
360	1	Gasket, brg, end cover (radial)	VELLUMOID	—
360A	3	Gasket, brg, end cover (thrust)	VELLUMOID	—
360P	1	Gasket, (sideplate)	Non-asbestos	—
370	8/12/16	H.C. Screw (adapt. to casing)	Steel	A307 GR 8
370A	6	H.C. Screw (end cover - thrust)	Steel	A307 GR 8

Item No.	No. Req'd	Part Name	Material	ASTM No.
370B	4	H.C. Screw (adapt to frame)	Steel	A307 GR 8
370C	4	H.C. screw (brg. hsg)	Steel	A307 GR 8
370D	4	Hex tap bold (adj.)	Steel	A307 GR 8
370F	2	H.C. screw (foot to frame)	Steel	A307 GR 8
370H	1	H.C. screw (adapt. to box)	Steel	A307 GR 8
370L	3	Hex tap bolt (jacking)	AISI 303	A582 TYPE 303
370P	6	H.C. screw (end cover - radial)	Steel	A307 GR 8
382A	1	Lockwasher, brg.	Steel	—
400	1	Key, coupling	Carbon steel	A108 GR 1018
408	1	Plug (brg, frame - vent)	Steel	—
408A	1	Plug (brg, frame - drain)	Steel	—
408B	1	Plug (s.b. cover - vent)	316SS	A276 TYPE 316
409	1	Brg., cylindrical roller (radial)	Steel	—
412A	1	O-ring, (x-ducer nut)	PTFE®	
412C	1	O-ring (suction sideplate)	VITON	—
412F	2	O-ring (shaft sleeve & repeller)	PTFE®	—
423	4	Hex nut (gland)	AISI 304	A276 TYPE 304
423A	4	Hex nut (sideplate)	AISI 304	A276 TYPE 304
423B	4	Hex nut (adj.)	Steel	A563
437	2	Lockwasher (frame to foot)	Steel	—
494	2**	Cooler (brg. hsg.)	304SS/copper	—
496	1	O-ring (brg. hsg.)	BUNA	—
496C	2	O-ring (x-ducer)	PTFE	—

**Table 7: Bearing designation vs pump size and group**

Pump Size	Group	Thrust Bearing	Radial Bearing
3x6-14XD	S	SKF BA2B459313	SKF NUP-313ECP
4x8-18HXD	M	SKF 8317	SKF NUP-317ECP
6x10-18	M	SKF 8317	SKF NUP-317ECP
6x10-22HXD	M	SKF 8317	SKF NUP-317ECP
4x8-24XD	L	SKF BA24B459422	SKF NUP-222ECP
6x12-24XD	L	SKF BA24B459422	SKF NUP-222ECP

## 6.4 Inspection and overhaul

### Impeller and Repeller

Replace if impeller, X-Ducer nut, or repeller show excessive erosion, corrosion, extreme wear or vane breakage. O-ring grooves must be in good condition. Check condition of bores, as fit on shaft is critical (0.0010 to 0.0025" clearance standard). Check impeller balance if possible (max. unbalance of 3.6 in-oz. standard).

### Inducer and Centrifuge

Replace if they show excessive erosion, corrosion, or bent/broken vanes. Check condition of o-ring grooves.

### Suction Sideplate

Replace if sideplate shows excessive metal loss due to corrosion, erosion or wear.

### Shaft

Check for runout to see that the shaft is not bent. Bearing seats and labyrinth seal areas must be in perfect condition and free of scratches and grooves. O.D. and finish in these areas must be within bearing manufacturer's specifications. Check that the keyway is free of corrosion. Replace shaft if necessary.

### Shaft Sleeve

The shaft sleeve is a push fit and is bored 0.001" to 0.003" larger than the shaft and should tap easily on the shaft. If the sleeve does not tap on easily, the bore and shaft should be inspected to see that they are free from foreign matter or burrs. The fit of the key in the keyway should also be checked to see that it is not causing binding. The key should have a sliding fit on the sides and should have clearance at the top. Sleeve surface in stuffing box must be smooth and free of grooves. If grooved, replace. O-ring groove must be in good condition. The original diametrical clearance between shaft sleeve and stuffing box bore is 0.025" to 0.032". If this clearance has increased to more than 0.050", the shaft sleeve, and at times the stuffing box, should be replaced.

### Mechanical Seal

Lapped seal faces, gaskets, and shaft sealing members must be in perfect condition or excessive leakage may result.

Replace worn or damaged parts.

### Ball Bearings

Replace if worn, loose, rough or noisy when rotated. Replacement bearings must be of the proper size and type as specified in the construction details (Table 6).

### Labyrinth Oil Seals

Inspect and replace if O-rings are torn or otherwise damaged.

### General

All parts should be clean before assembly. This is especially important at O-ring grooves, threads, lock fits, gasket surfaces and bearing areas. Any burrs should be removed with crocus cloth. Replace all gaskets and o-rings when maintenance is performed.

## 6.5 Reassembly of pump



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### CAUTION:

Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

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This procedure covers reassembly of the pump after complete disassembly. Be sure all directions in the Inspection and Overhaul section have been followed.

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### NOTICE:

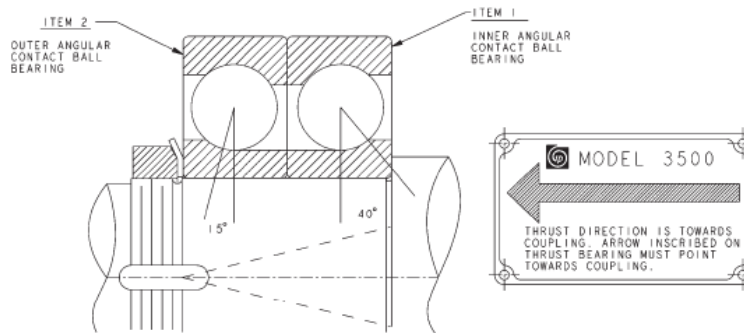
There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

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## Installation of Thrust Bearings

The Model 3500XD utilizes a thrust bearing on the coupling end of the shaft designed for high unidirectional thrust loads. It is thus critical that the thrust bearing be installed in the proper orientation. The "S" and "L" group pumps utilize a four point contact bearing paired with a standard angular contact bearing. The "M" group pump utilizes a Pumpac pair of bearings. Refer to bearing chart in Figure 24 for detailed bearing designations.

Both types of thrust bearings consist of a matched pair of bearings with an arrow scribed on the outer races (see Figures 26 & 27). The arrow must point in the direction of axial thrust (i.e. towards the coupling end of the shaft). An arrow attached to the top of the bearing frame (Figures 26 & 27) shows the correct thrust direction.



**Figure 26:**

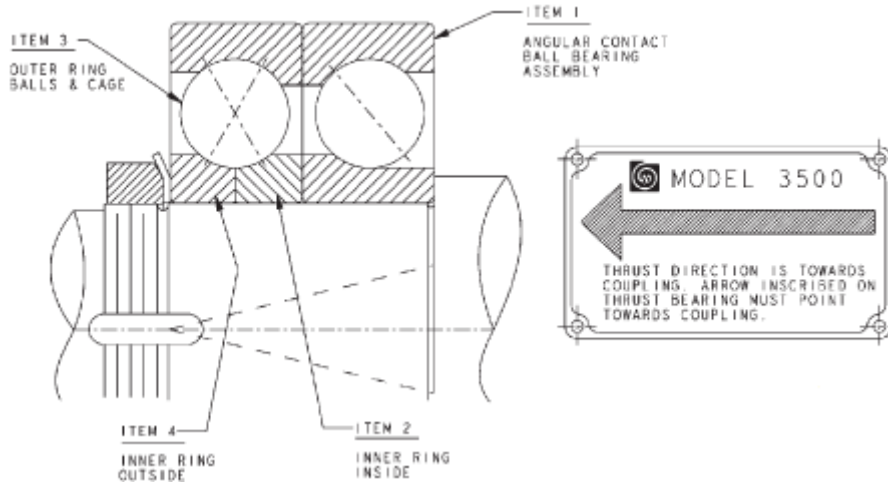


Figure 27:



**CAUTION:**

Pump and components are heavy. Failure to properly lift and support equipment could result in serious physical injury or damage to pumps. Steel toed shoes must be worn at all times.

1. Install shaft flingers. Note: flingers are required on "L" group pumps only. Prop shaft upright and apply a light coat of oil to the shaft turn for the flinger. Place flinger on shaft and push on by hand as far as possible. Use a block of wood and a hammer to seat the flinger in place against the shaft shoulder. The block should be set against the thin wall of the flinger that forms the cylindrical mounting surface (see Figure 28). Flip the shaft to place the other end up and install the second flinger in the same manner.

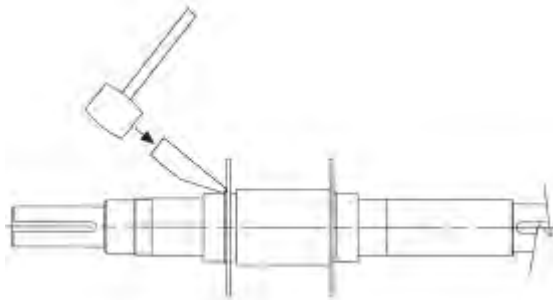


Figure 28: Shaft flinger installation

**NOTICE:**

Never use a hammer to drive shaft through bearings. Severe shaft and bearing damage may occur.

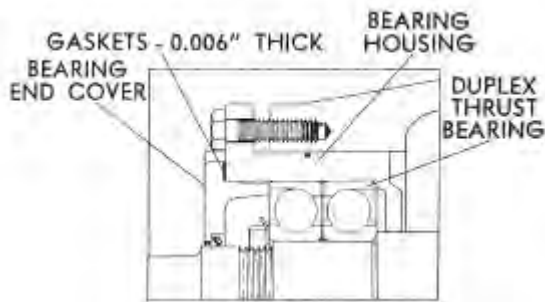
**"S" and "L" Group**

1. Refer to Figure 27 for installation of the four point thrust bearing. Remove bearings from boxes and orient as shown in Figure 26. NOTE: Items 1 and 3 are not interchangeable. Heat and mount item 1 against shaft shoulder. Lubricate and install item 2. Heat and install item 3. Heat and install item 4.

**“M” Group**

1. Install Pumpac thrust bearing as follows. Remove bearings from boxes and orient as shown in Figure 26. Oil bearing seat on shaft. Slide both bearings onto shaft as far as possible by hand. Place pipe or driving sleeve over shaft making sure it rests against inner race only. Make sure bearing is "square" on shaft. Tap or press evenly until bearing is seated firmly against the shaft shoulder. Do not mar shaft, especially where it contacts the labyrinth seal.
2. Insert the bearing lock washer (382A), pressing tang into shaft keyway until it is firmly against the bearing.
3. Oil shaft threads lightly and snug the bearing locknut
4. against the lock washer. Tighten firmly with a spanner wrench. Seat tang securely into slot in locknut with drift pin. If necessary, tighten locknut slightly to match tang with slot. do not loosen locknut to position.
5. Slide bearing housing (134A) with o-ring in place, over impeller end of shaft and over outboard bearing.
6. Install labyrinth seal stator into thrust end cover with o-ring lubricant applied to o-ring.
7. Place bearing end cover (109A) and .006" white manilla gasket (360A) over coupling end of shaft and fit into bearing housing. If oil seal is dry, oil lightly before sliding over shaft. Be sure to position "TOP" (cast on cover) in line with "TOP" on housing. Bolt end cover firmly to housing. Install labyrinth seal rotor on shaft with o-ring lubricant.
8. Oil inboard bearing seat on shaft. Slide inboard roller bearing (409) on shaft as far as possible by hand. Place driving sleeve of sufficient length over the shaft. The sleeve should contact the inside race of the bearing. Be sure the bearing is "square" on shaft then press or tap the bearing firmly against the shaft shoulder. Take care not to mar shaft.
9. Place a small amount of o-ring lubricant on inside of bearing frame at oil seal. Slide shaft assembly into the bearing frame as far as possible. When the bearing housing is properly installed (oil return hole at the bottom), the word "TOP" located on the flange of the bearing housing will line up with the top of bearing frame. Be sure bearing housing o-ring (496) is in place in groove on housing. Insert bearing housing bolts into bearing housing and screw about ½" into frame to hold shaft during further assembly.
10. Install labyrinth seal stator into the bearing end cover (inboard) with o-ring lubricant.
11. Slide gasket (360) and inboard bearing end cover (119A) over shaft and bolt to bearing frame.
12. Install labyrinth seal rotor on shaft with o-ring lubricant.
13. Bearing end play may be determined at this point as follows:

Clamp dial indicator to the pump so that the button rests against the end of the shaft. Push the shaft back and forth as far as possible. Total end play must be at least 0.001" and not more than 0.008". If end play is less than 0.001" add coupling and bearing end cover gaskets made from 0.006" thick manilla paper. Because of machining tolerances, duplex thrust bearings may vary in which by up to 0.030". A correctly assembled pump may require as few as one or as many as three 0.006" thick gaskets. Refer to Fig. 29.



**Figure 29: Gaskets**

14. Install and position coupling hub at scribe mark on shaft.
15. Slide shaft sleeve with cartridge mechanical seal in place on the shaft.
16. Assemble stuffing box cover to frame adapter before attaching frame adapter to bearing frame with bolts (370).
17. Bolt frame adapter and stuffing box cover assembly to bearing frame with (370B) adapter to frame bolts.
18. Install repeller (262) on shaft. Insure shaft sleeve and repeller o-rings (412F) are in place.
19. Place stuffing box cover-to-casing gasket (351) against shoulder of stuffing box cover. Small amounts of o-ring lube may be used on both sides of gasket to seal and secure gasket in place.
20. Lubricate shaft with never seize or similar substance and install impeller key (178). Be sure shaft sleeve o-ring (496C) is in place. Slide impeller (101) on shaft. Install X-Ducer key (178B). Install X-Ducer (274F) on the shaft. Install X-Ducer nut (304) with o-ring (412A). Prevent shaft from rotating and tighten X-Ducer nut
21. to the following torque values:
  - S group: 70 N-m (52 ft-lbs)
  - M group: 325 N-m (240 ft-lbs)
  - L group: 325 N-m (240 ft-lbs)

---

**NOTICE:**

Insufficient tightening of X-Ducer nut (304) may result in loosening during operation which may damage pump

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1. Lubricate suction liner o-ring (496A) with a silicone based o-ring lubricant and install in suction liner o-ring groove. Also, lubricate the bore in the casing which will contact with this o-ring. Carefully guide the suction liner into casing. To facilitate installation, liner should be placed with the large diameter held off the floor and the casing lowered over the line. Install and evenly tighten suction liner nuts (423A). Be sure the jacking bolts (370L) have been backed off.
2. Tighten casing hold-down bolts.
3. Connect suction and discharge flanges. Care should be taken to prevent excessive pump flange loading.
4. Slide the completely assembled "back pullout" unit into the casing. Tighten the frame adapter-to-casing bolts evenly to assure that the gap between adapter and casing is even. Check with a feeler gauge at 4 points 90 degrees apart around the adapter.
5. Install pedestal hold-down bolts. Frame pedestal (241) is not to be flush with baseplate. Clearance of 1/4" is normal. Install shims under pedestal before tightening.
6. Set impeller clearance as outlined in this section. Overall travel should be .090" to .140" depending on tolerances. If not, check casing gasket to be sure it is 1/16" thick. If total travel is greater than .250" due to impeller wear, then impeller should be replaced.



7. Tighten drive collar set screws on cartridge mechanical seal. Loosen and remove centering tabs.
8. Replace auxiliary piping.

Follow procedures outlined in Preparation for start-up. NOTE: Pay particular attention to instructions concerning alignment and lubrication.

**WARNING:**

Before installation or disassembly of the coupling guard is performed, the driver must be de-energized, the driver controller/starter put in a locked out position and a caution tag placed at the controller/starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump or serious physical injury may occur. Goulds Pumps, Inc. assumes no liability for avoiding the practice.

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**WARNING:**

Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power may result in serious physical injury.

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**NOTICE:**

Operation of the unit without proper lubrication will cause bearing failure, and pump seizure.

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**CAUTION:**

Use of couplings which have excessive weight can cause shaft failure and lead to physical injury. Consult pump manufacturer for recommended weight limits for couplings should the originally supplied coupling be changed.

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## 6.6 How to order

When ordering parts call 1-800-446-8537 or your local Goulds Representative

## 6.7 Emergency service

Emergency parts service is available 24 hours/day, 365 days/year.

Call 1-800-446-8537

Visit our Web site at <http://www.gouldspumps.com>

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