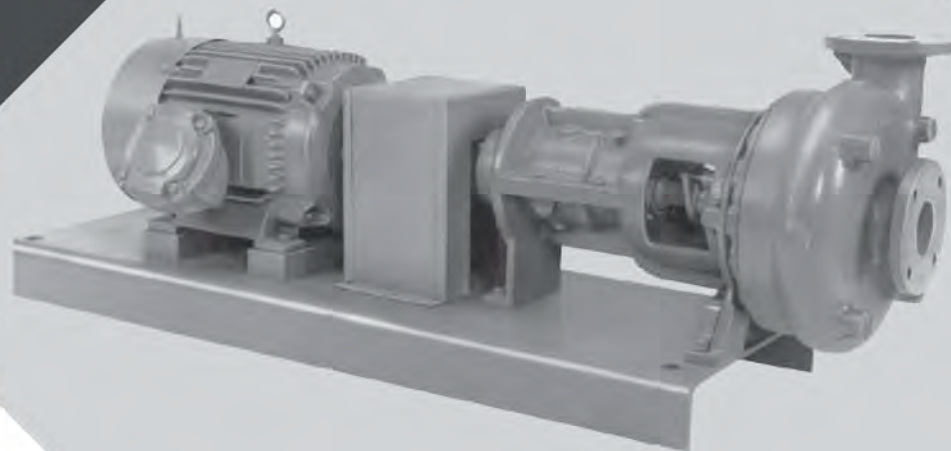


 **GOULDS PUMPS**

Installation, Operation, and Maintenance Manual

Model HS



ITT

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1 Introduction and 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.



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.



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.

**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, and Electrical 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.

Install the shaft guard - if provided**WARNING:**

- Running a pump without safety devices exposes operators to risk of serious personal injury or death. Never operate a unit unless appropriate safety devices (guards, etc.) are properly installed.
- Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.
 - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
 - Refer to driver/coupling/gear manufacturer's installation and operation manuals (IOM) for specific instructions and recommendations.

Exposed rotating shaft between pump seal and bearing frame. Avoid contact and/or install proper guarding. If guarding is not provided with the pump, contact Goulds for price and availability of proper guarding.


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"> • Insulated work gloves when handling hot bearings or using bearing heater • Heavy work gloves when handling parts with sharp edges, especially impellers • Safety glasses (with side shields) for eye protection • Steel-toed shoes for foot protection when handling parts, heavy tools, etc. • Other personal protective equipment to protect against hazardous/toxic fluids
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 equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at www.gouldspumps.com/literature_ioms.html or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.</p>
WARNING		<p>Alignment:</p>

		Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.
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		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
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		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		Noise: 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.
WARNING		Temperature: 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.

1.5 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 General Information

2.1 Preparation for shipment

Goulds pumps are prepared at the factory for shipment under covered conditions. They are protected for transport and short term covered storage. Unless otherwise specified, it is assumed the pump will be installed upon delivery. Additional protection can be provided by request.

2.2 Installation

Location of unit

The pump should be located in a clean, dry area free from flooding. The area should provide adequate space for maintenance and repair, considering complete disassembly and handling of equipment. The unit should be positioned to provide the most efficient pipeline system.

Piping

Short, direct suction and discharge pipelines and a minimum of elbows and fittings result in the least amount of pipe friction.

Suction piping

1. Excessive Friction losses will cause cavitation.
2. Must be kept free of air leaks, particularly in long lines or conditions of high suction lift.
3. Flow regulating valves must not be located on suction side of the pump.

Discharge piping

1. Excessive friction losses result in insufficient head.
2. A check valve should be located in the discharge line to protect the pump from reverse flow and excessive pressure.

Piping support

The pumps are not designed to carry loads imposed by the weight of the pipeline. Suction and discharge piping must be supported near the pump, unless otherwise specified. Pumps and sub-bases can be designed to carry loads due to thermal expansion.

Foundation

The foundation must be a permanent, rigid support for the sub-base or floor-plate. It should be an industrially accepted design capable of absorbing excessive vibration. Foundations are typically concrete with anchor bolts cast into secure the pump.

An anchor bolt assembly consists of a bolt and washer with a sleeve 2 times the diameter of the bolt. When the assembly is cast in concrete, the washer prevents the sleeve and bolt from being pulled. The sleeve I.D. provides an adjustment allowance around the bolt. A lug is generally welded on the bolt to prevent rotation when tightening. Anchor bolts should be located in the concrete by a template dimensioned from the pump installation drawing. The top of the sleeve should be temporarily sealed with waste material to prevent concrete from entering during the concrete pouring operation.

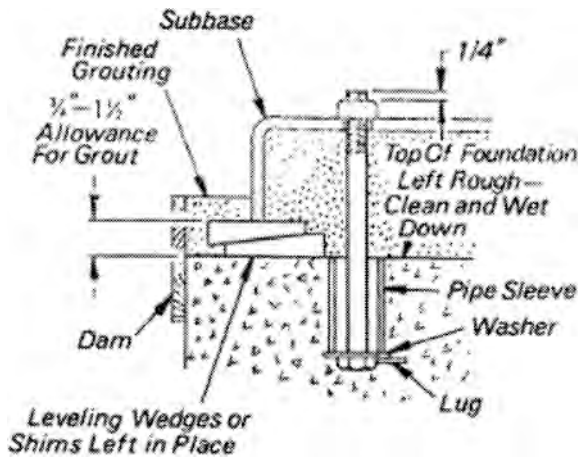


Figure 1: Typical anchor bolt

Installing Pump on Foundation

If sub-bases or floor-plates were directly anchored to poured concrete foundations, surface irregularities would cause distortion. Rectangular metal blocks and shims, or metal wedges having a small taper, are placed beside each anchor bolt to level the sub-base or floor-plate, see Figures below, *Leveling with Wedges* and *Leveling with Blocks and Shims*. The anchor bolts are then drawn tight enough to maintain position and level.

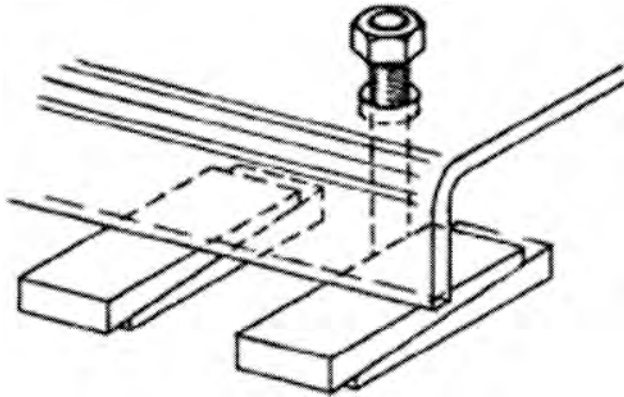


Figure 2: Leveling with wedges

To secure the shims in place and provide a level surface for the base or plate, grout is poured over the concrete foundation. A $\frac{3}{4}$ " to 1- $\frac{1}{2}$ " grout allowance is recommended. When subbases have cavities, grout holes are provided to fill all spaces. After the grout has hardened, permanently tighten the anchor bolts.

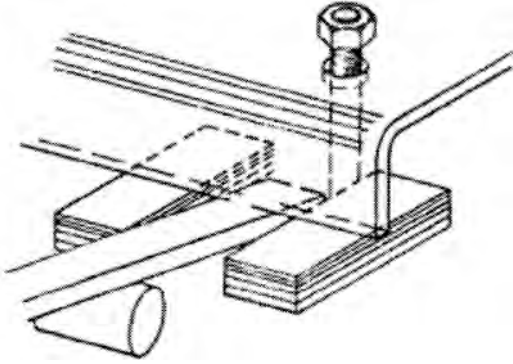


Figure 3: Leveling with blocks and shims

When the grout has hardened and the anchor bolts are permanently secured, recheck level.

NOTICE:

On large subbase/floorplates, shimming is recommended to be at 24" spacing.

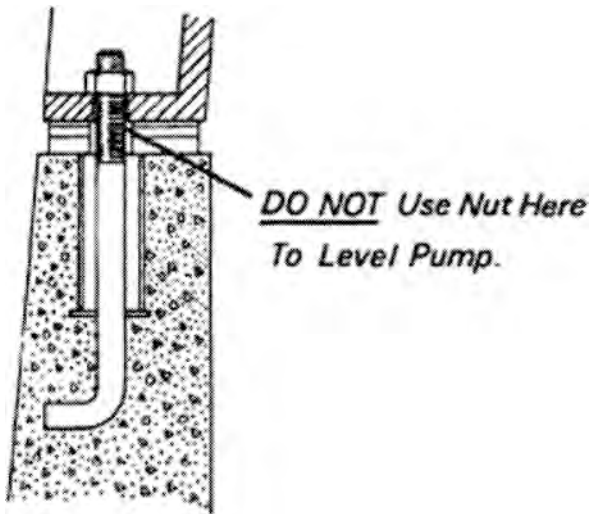


Figure 4: Typical

2.3 Pump Driver Alignment

Shaft alignment of horizontal pump and driver

Pumps and drivers that are received from the factory with both machines mounted on a common sub-base were accurately aligned before shipment. Because all sub-bases are, to some extent, flexible, factory alignment may be altered during shipment and handling. After the sub-base has been leveled, grouted, and secured, check the alignment. Alignment should be rechecked after the pump is fully installed and before startup. Refer to the "Alignment Procedure."

1. On certain large units, limited end-float couplings are used, and the instruction book furnished with such units should be consulted for the special alignment instructions that apply to such couplings.
2. Disconnect coupling halves before proceeding with alignment. Check for angular and parallel alignment in the next section, Alignment Procedure. The faces and outside diameters of the coupling halves must be square and concentric with the bores. If this condition does not exist, the

“Alternate Method” of alignment described in the Pump/Driver Alignment section, is recommended.

Sub-base mounted horizontal pumps may be shipped with or without drivers and gears. Be sure pump and drivers are uncoupled before installation. Level by shimming beside each anchor bolt and grout.

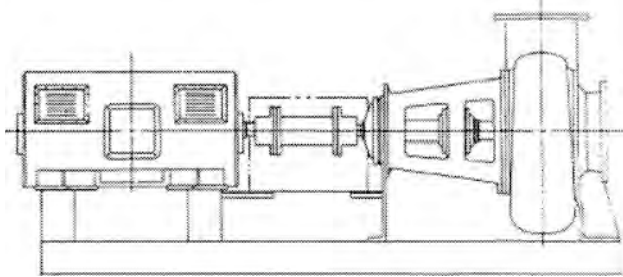


Figure 5: Alignment procedure

Alignment procedure

A check for angular alignment is made by inserting the tape gauge or feelers at four points between the coupling faces at four points spaced around the coupling. The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points (Figure *Checking Angular Alignment*).

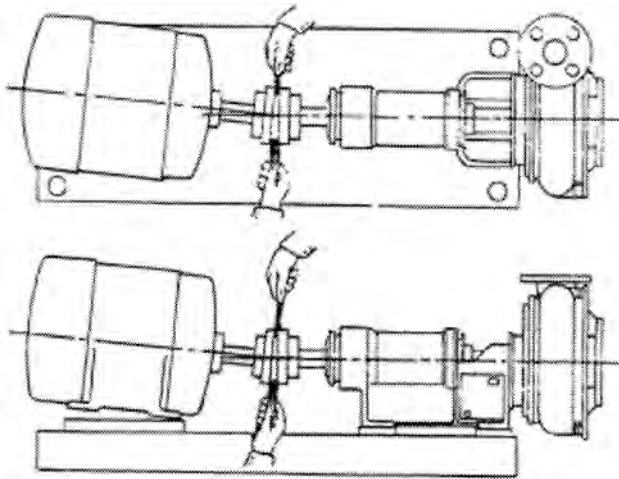


Figure 6: Checking angular alignment

A check for parallel alignment is made by placing a straight edge across both coupling rims at the top, bottom, and at both sides. The unit will be in parallel alignment when the straight edge rests evenly on the coupling rim at all positions. Allowance may be necessary for temperature changes and for coupling halves that are not of the same outside diameter.

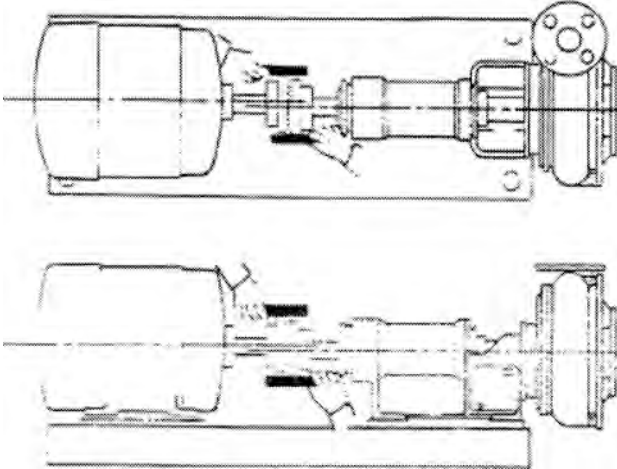


Figure 7: Checking Parallel Alignment

NOTICE:

Care must be taken to have the straight edge parallel to the axis of the shafts (Figure *Checking Parallel Alignment*).

Angular and parallel misalignment are corrected by means of shims under the motor mounting feet. After each change, it is necessary to recheck the alignment of the coupling halves. Adjustment in one direction may disturb adjustments already made in another direction. It should not be necessary to adjust the shims under the pump.

The permissible amount of misalignment will vary with the type of pump and driver. The manufacturer's recommendations should be obtained and followed.

When the driver is to be mounted on the sub-base in the field, it is necessary to place the subbase with the pump on the foundation to level the pump shaft, to check the coupling faces, the suction and discharge flanges for horizontal or vertical position, and to make any necessary corrective adjustments.

When the units are lined up cold, it may be necessary to make an allowance for the vertical rise of the driver and/or pump caused by heating.

Alternate method of alignment

An approved method for putting the coupling halves in final accurate alignment is by the use of a dial indicator. Check alignment by straight edge, taper gauge or feelers as accurately as possible by procedure indicated above.

Bolt the indicator to the pump half of the coupling. With the indicator button resting on the other half coupling periphery, set the dial to zero, and chalk mark the coupling half at the point where the buttons rest. For any check (top, bottom, or sides) rotate both shafts by the same amount; i.e., all readings on the dial must be made with button on the chalk mark.

The dial readings will indicate whether the driver has to be raised or lowered or moved to either side. After each movement, check to see that coupling faces remain parallel to one another.

With this method, accurate alignment of shaft centers can be obtained even where faces or outside diameters of the coupling halves are not square or concentric with the bores, provided all measurements for angular alignment are made between the same two points on the faces, and all measurements for parallel alignment are made between the same two points on the outside diameters. Gross deviations in squareness or concentricity, however, may cause problems due to the coupling unbalance or abnormal coupling wear and may need to be corrected for reasons other than accomplishment of shaft alignment.

Alignment of gear type couplings

Gear type couplings are aligned in the same manner as outlined above. However, the coupling covers must be moved back out of the way and measurements made on the coupling hubs as shown in Figure *Gear Coupling Alignment*.

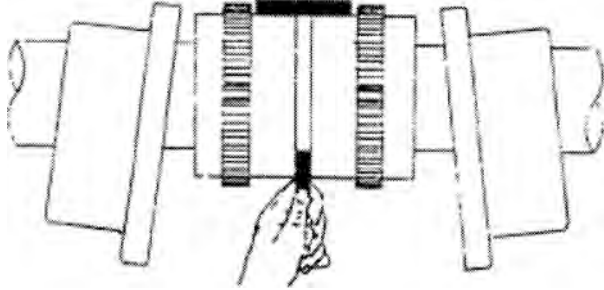


Figure 8: Gear Coupling Alignment

Factors that may disturb alignment

The unit should be checked periodically for alignment. If the unit does not stay in line after being properly installed, the following are possible causes:

1. Settling, seasoning, or spring of the foundation.
2. Wear of the bearings.
3. Pipe strains distorting or shifting the machine.
4. Springing of the baseplate by heat from an adjacent steam pipe or from a steam turbine.
5. Shifting of the building structure due to variable loading or other causes.
6. Loose nuts or bolts on the pump or driver assembly.

2.4 Remove the shaft guard

1. Remove the bolt for each shaft guard half that mounts the halves to each side of the frame.
2. Do not remove the clip that retains the bolt on the guard to maintain a captive fastener.
3. Retain each guard half with fasteners for reinstallation.

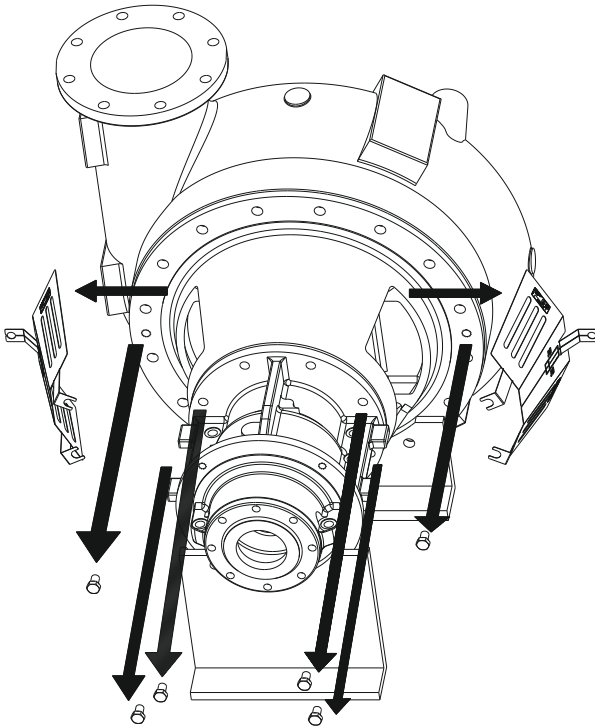


Figure 9: Shaft guard removal

2.5 Stuffing Boxes

In the conventional stuffing box, mechanical seals and packing seal between the stationary and rotating components of the pump. Generally a clear liquid such as water is forced through the stuffing box to lubricate the sealing elements. The lubricating liquid pressure must exceed the pressure of the pumpage at the stuffing box. For end suction pumps, lubricating liquid pressure should be 10-15 PSIG higher than the discharge pressure. For side and double suction pumps, lubricating liquid pressure should be between 10-15 PSIG higher than the suction pressure.

NOTICE:

To determine suction or discharge pressure, use gauge pressure only.

The piping supplying the lubrication liquid should be fitted tightly to prevent air from entering. On suction lifts, a small quantity of air entering the pump at this point may result in loss of suction.

Lubrication liquid pressure is controlled by a valve on the outlet piping. Since the liquid leaking from the stuffing box should be clear, control of the packing lubricant will vary with the condition of the packing. Increase pressure within the stuffing box by closing outlet valve. Adjustments should be slow and consistent with the run-in procedure for new packing.

The lubricating liquid must be clean, free of grit and acid. Shaft sleeve scoring, packing destruction, and mechanical seal face damage will result from contaminated lubricant.

Packing

Original equipment packing is a suitable grade for the service intended. To replace original packing, contact local packing suppliers.

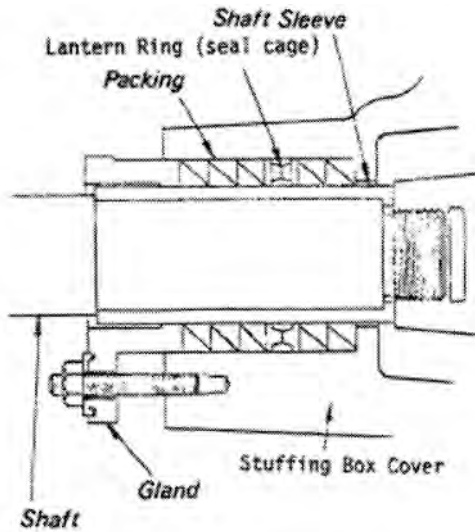


Figure 10: Typical Stuffing Box

Refer to [2.11 Bill of Material and Assembly Drawing on page 18](#) for specific packing size and configuration.

Packing procedure

1. Stuffing box and shaft sleeve must be clean and free of grit.
2. Form packing over shaft or mandrel of same diameter. Carefully cut to packing length. Discard rings cut too short.
3. Pre-form each ring by coiling 1-½ turns.
4. To install packing rings, do not pull straight. Expand the coil as a coil spring

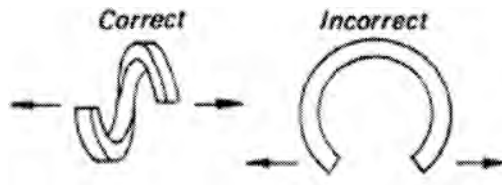


Figure 11: Stuffing Box Packing

5. Expand first coil as shown and insert into stuffing box. Tamp packing to stuffing box shoulder firmly with the gland. Note where the cut is positioned.
6. Install second and third coils as required by assembly drawing, staggering the cut 90°F-120°F.
7. Insert seal cage (lantern ring) into stuffing box, carefully noting its proper position on assembly drawing. Failure to properly locate seal cage will result in insufficient packing lubrication. Packing and shaft sleeve damage will occur.
8. After packing and seal cage are properly installed, insert gland into stuffing box. Tighten gland nuts finger-tight only. Shaft should turn freely.
9. Follow pump start-up procedure. Turn on stuffing box lubricating liquid and start pump.
10. A significant amount of lubricating liquid should leak from gland side of stuffing box. Operate pump for at least 15 minutes before tightening gland nuts. Make small, even gland nut adjustments to reduce leakage. Allow adequate run-in time between adjustments. Acceptable leakage is 30-50 drops per minute.

NOTICE:

Do not over-tighten gland nuts. Packing may set permanently and require removal. Overtightened packing causes excessive friction between packing and sleeve, and will result in damaged components. A noticeable temperature increase in stuffing box would indicate insufficient lubrication.

11. Periodic maintenance is absolutely required for all packed pumps.

Normal shaft run-out should be under .005" to avoid pounding of stuffing box packing. With excessive shaft run-out, shaft straightening or replacement is necessary.

Mechanical Seals

Most mechanical seals are installed and adjusted at the factory. Due to size and design, some installed mechanical seals are supplied with shipping retainers. Shipping retainers hold the sealing faces apart to avoid damage during transport. Shipping retainers must be removed before shaft is to be rotated. Pumps with retained seal faces will be specially marked and instructions from the seal manufacturer for retainer removal will be provided.

Mechanical seals have a stationary and a rotating sealing face. Commonly, these sealing rings are of carbon and ceramic material, brittle in nature, and easily damaged. As the sealing rings seat with the operation of the pump, a compatible wear pattern develops between the mating surfaces. To disassemble the mechanical seal after the wear pattern is established would necessitate the replacements of the rotating and stationary sealing elements. Do not replace only one component.

To ensure the life and sealing characteristics of the mechanical seal, lubricating liquid must be circulated through the stuffing box. Clear, grit-free liquid is necessary.

Special seal information and replacement seal elements should be provided by the seal manufacturer. Goulds strongly recommends the stocking of replacement sealing elements.

**CAUTION:**

Do not make shaft adjustments on mechanical seal installations without consulting seal instructions and pump assembly drawing.

2.6 Install the shaft guard

**WARNING:**

- Running a pump without safety devices exposes operators to risk of serious personal injury or death. Never operate a unit unless appropriate safety devices (guards, etc.) are properly installed.
- Failure to disconnect and lock out driver power may result in serious physical injury or death. Always disconnect and lock out power to the driver before performing any installation or maintenance tasks.
 - Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.
- Exposed rotating shaft between pump seal and bearing frame. Avoid contact and/or install proper guarding. If guarding is not provided with the pump, contact Goulds for price and availability of proper guarding.

1. Ensure that the mounting bolt for each shaft guard half is inserted with the bolt retainer in place for captive hardware.
2. Assemble a guard half from each side of the pump and fasten to the bearing frame.

3. Ensure that adequate coverage is maintained for rotating components.

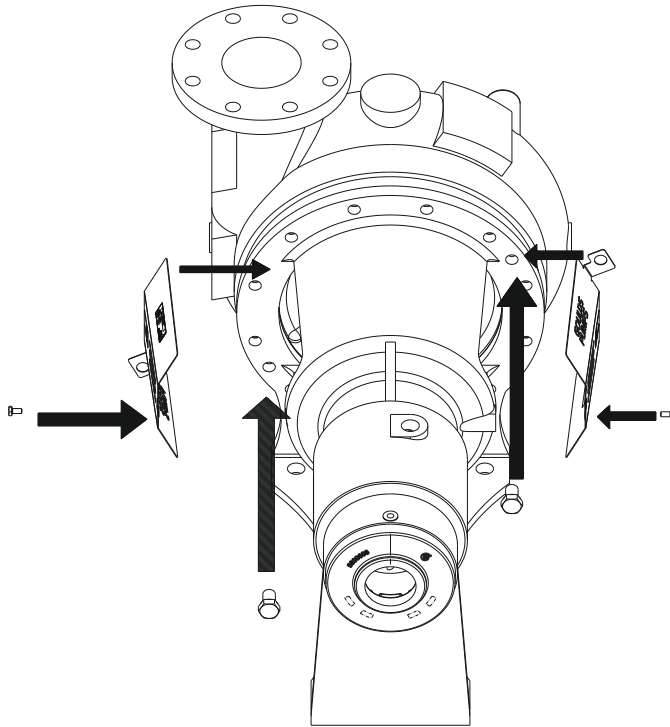


Figure 12: Shaft guard assembly

2.7 Pump Start-up

Bearing lubrication

Bearing must have adequate lubrication. Engage external lubrication system. Refer to “Bearing Frame Assembly Section” of these instructions for specific information.

Shaft Rotation

The pump shaft must turn without any binding or rubbing. By manually turning the rotating element, only the uniform frictional drag of the bearings and the stuffing box should be sensed.

Correct Rotation of the Driver

The direction of rotation of the driver must be checked before it can be coupled with the pump. The direction of rotation of the pump is indicated in a prominent location.

Lubricating Lines to Stuffing Box

Lubricating liquid must be flowing to the stuffing box before the pump is started. Both mechanical seals and packing require lubrication for continuous service.

Priming

The pump must be completely primed before operation.

2.8 Water Hammer

Water hammer is a high pressure surge within a closed pipe system, created by rapid change in the flow rate. Changes in the flow rate occur when there are sudden changes in pump speed. The most common cause is the sudden opening or closing of a valve or flow control device. Extensive damage to the pump and pipeline is a result of water hammer.

2.9 Freezing

If the pump is exposed to below freezing temperatures, the liquid should be drained during idle periods.

2.10 Locating Problems

1. Conditions Leading to Insufficient or No Discharge
 1. Insufficient speed.
 2. Excessive discharge head.
 3. Insufficient NPSH.
 4. Worn pump components.
 5. Incorrect direction of rotation.
 6. Incomplete pump priming.
 7. Impeller or discharge pipe clogged.
 8. Pumpage viscosity too high.
2. Conditions Leading to Excessive Power Consumption
 1. Excessive speed.
 2. Pump operating at high horsepower area of the pump curve (off design point).
 3. Mechanical binding or rubbing of rotating element.
 4. Pumpage specific gravity and/or viscosity too high.



WARNING:

This unit must never be used without prior installation of the safety guards for rotating parts as prescribed by O.S.H.A.

Operation of this pump with both suction and discharge valves closed for even brief periods of time is unacceptable and a dangerous practice. It can rapidly lead to a violent pump failure.

2.11 Bill of Material and Assembly Drawing

ITEM QTY/ PUMP	N	PART NAME	MATERIAL OF CONSTRUCTION	FURNISHED AS CHECKED	CD/ANCU
1.00		CASTING	CI	<input type="checkbox"/> HC600	<input type="checkbox"/> 316SS
*1.01		IMPELLER	CI	<input type="checkbox"/> HC600	<input type="checkbox"/> 316SS
*1.03A		LINER, CASTING	CI	<input type="checkbox"/> HC600	<input type="checkbox"/> 316SS
*1.05		LAMINEN RING	TEFLON	<input type="checkbox"/> TEFLON	<input type="checkbox"/> TEFLON
*1.06	1SET	PACKING RING	SYNTHETIC POLYMER FIBER (GARDOLCK 8913 OR EQUAL)		
1.07		GLAND	CI	<input type="checkbox"/> 316SS	<input type="checkbox"/> 316SS
*1.12C		RADIAL BEARING	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
1.13A		BREATHER	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
1.19A		END COVER	CI	<input type="checkbox"/> CI	<input type="checkbox"/> CI
1.19C		END COVER	CI	<input type="checkbox"/> CI	<input type="checkbox"/> CI
1.22		SHAFT	CARBON MANGANESE	<input type="checkbox"/> RUBBER	<input type="checkbox"/> RUBBER
1.23		DETECTOR	RUBBER	<input type="checkbox"/> 416SS	<input type="checkbox"/> C20
*1.26		SHAFT SLEEVE	CI	<input type="checkbox"/> 416SS	<input type="checkbox"/> C20
1.34C		BEARING FRAME	CI	<input type="checkbox"/> CI	<input type="checkbox"/> CI
*1.68C		THRUST BEARING KEY, IMPELLER	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
1.78		KEY, IMPELLER	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
1.84		STUFFING BOX COVER	CI	<input type="checkbox"/> ANNEALED HC600	<input type="checkbox"/> CDANCU
1.93B	2	GREASE FITTING	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
2.51		SIGHT OIL GAUGE	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
*3.04		IMPELLER NUT	316SS	<input type="checkbox"/> 316SS	<input type="checkbox"/> CDANCU
3.31		SHIM SET	PLASTIC	<input type="checkbox"/> PLASTIC	<input type="checkbox"/> PLASTIC
*3.32		GREASE SEAL (O. B.)	BUNA-N	<input type="checkbox"/> BUNA-N	<input type="checkbox"/> BUNA-N
*3.33		GREASE SEAL (I. B.)	BUNA-N	<input type="checkbox"/> BUNA-N	<input type="checkbox"/> BUNA-N
*3.34		GREASE SEAL (I. B.)	BUNA-N	<input type="checkbox"/> BUNA-N	<input type="checkbox"/> BUNA-N
*3.35		GLAND STUD	18-8SS	<input type="checkbox"/> 18-8SS	<input type="checkbox"/> C20
3.52	2	HEX NUT	18-8SS	<input type="checkbox"/> 18-8SS	<input type="checkbox"/> C20
3.60F		GASKET	WELLOWOOD		
3.70C	1	HEX CAP SCREW	STEEL	<input type="checkbox"/> 18-8SS	<input type="checkbox"/> 18-8SS
3.70J	12	HEX CAP SCREW	STEEL	<input type="checkbox"/> 18-8SS	<input type="checkbox"/> 18-8SS
4.00		KEY, COUPLING	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
4.08		PIPE PLUG	BRASS	<input type="checkbox"/> BRASS	<input type="checkbox"/> BRASS
4.08A	2	PIPE PLUG	BRASS	<input type="checkbox"/> BRASS	<input type="checkbox"/> BRASS
4.08B	1	PIPE PLUG	BRASS	<input type="checkbox"/> BRASS	<input type="checkbox"/> BRASS
4.08C	1	PIPE PLUG	BRASS	<input type="checkbox"/> BRASS	<input type="checkbox"/> BRASS
*4.12A	2	O-RING	BUNA-N	<input type="checkbox"/> BUNA-N	<input type="checkbox"/> BUNA-N
5.28J	2	WASHER	18-8SS	<input type="checkbox"/> 18-8SS	<input type="checkbox"/> C20
7.88Y	4	HEX CAP SCREW	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
7.88Z	4	HEX CAP SCREW	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
7.89	4	LOCKWASHER (I. B.)	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL
7.89A	4	LOCKWASHER (O. B.)	STEEL	<input type="checkbox"/> STEEL	<input type="checkbox"/> STEEL

NOTES:

- END COVER 119C AGAINST BEARING 112C TO REMOVE ALL END PLAY. MEASURE GAP "L" AND INSTALL SHIMS TO PRODUCE .002 TO .008 CLEARANCE AT "G".
- 2.51 TO .008 CLEARANCE AT "G".
- ITEM 3.70J NOT FURNISHED ON SIZES 2X2-8, 4X4-12 AND 6X6-12 SINCE 370C FASTENERS BOTH 134C AND 184 ARE REPLACED WITH (1.5) STUDS & (1.5) HEX NUTS 425.
- CASING LINER 103A IS OPTIONAL.

OPTIONAL FEATURES FURNISHED ONLY WHEN CHECKED

CASING LINER

MECHANICAL SEAL

DELETE ITEMS 105, 106 & 107 AND SEE THE MECHANICAL SEAL DATA SHEET

COULDS SERIAL NO. _____

CUSTOMER _____

CUSTOMER P. O. NO. _____

ITEM NO. _____

SERVICE _____

DRAWING IS NOT TO SCALE

CERTIFIED: FOR APPROVAL

FOR RECORD

BY: _____

DATE _____

TITLE SECTIONAL ASSEMBLY

MODEL HS

DRAWN PLN

ORDER PAD 10-15-1987

Goulds Pumps

THIRD ANGLE PROJECTION

COMPUTER GENERATED

DRAWING B00287G

REV 5

3 Bearing Frame Assembly

3.1 General

The inboard of lower bearing is an angular contact ball bearing with high thrust capacity and the out-board or top bearing is a high radial capacity ball bearing. Grease is the standard lubricant, but bearing assemblies can be furnished for oil lubrication.

3.2 Bearing Lubrication and Care

NOTICE:

The shaft seals (332) at each bearing should be oiled with a few drops of #20 or #30 oil before the pump is started to ensure lubrication of the seal lip while the seal is "running in."

Grease lubrication

When the pump is furnished with grease lubrication, a quality bearing grease equivalent to Mobilux #2 should be used to ensure long bearing life.

Grease lubricated pumps are assembled with the bearings hand-packed with grease at the factory and should be allowed to run for eight hours before any grease is added. The suggested interval for adding a small amount of grease is five hundred (500) hours; however, the operating conditions and experience of the customer with other equipment can be used to establish a more suitable lubrication schedule for the particular application.

Adding excessive amounts of grease will increase the bearing temperature and shorten the lubricating life of the grease. See [Figure 11: Stuffing Box Packing on page 14](#).

Oil lubrication

When the pump is furnished with oil lubrication, a high quality bearing oil should be used to ensure long bearing life. Pumps furnished for oil lubrication are shipped without oil. add oil until the level is up to the oil level line before the unit is started. If too much oil is added, there will be excessive heat generated in the bearings and there may be leakage from the shaft seals. We recommend a commercial oil such as Mobil D.T.E., or B.B., or equal. However, a good grade of non-detergent oil of #30 weight is usually satisfactory. The oil should have a minimum viscosity of 100 Sec. Saybolt at the normal operating temperature.

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

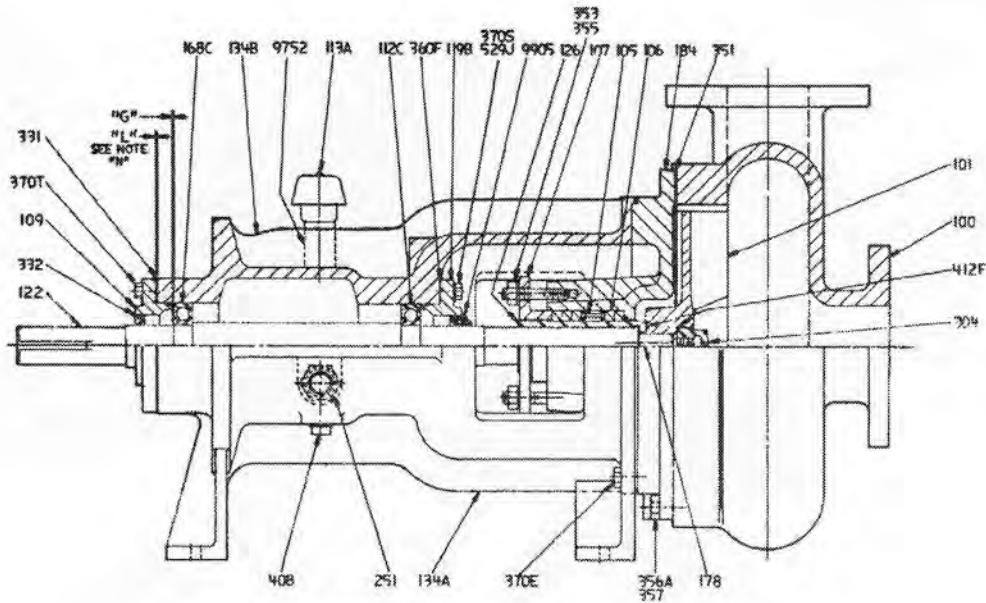


Figure 13: Oil Lubrication

NOTICE:

"N" - with thrust bearing, (112C), tight against inboard end cover (119B), measure length "L" and install necessary shims to make .005" - .008" gap at "G".

3.3 Installing a bearing

Long bearing life is quite dependent on careful handling of the bearing when it is out of the housing and during the installation procedure. Dirt and rough handling are prime enemies of precision bearings. Bearings should be pressed, not "hammered" into place. If heat is used to facilitate the installation, a hot oil bath is the best method. Bearings for grease lubrication should be hand-packed with grease to ensure adequate lubrication at startup.

3.4 Normal bearing temperature

The running temperature for a bearing assembly depends on many factors such as speed, bearing loads, ambient air temperature, and condition of bearings. Temperatures higher than the human hand can tolerate are very satisfactory for good bearing operation and should not cause any alarm.

For a given speed and loading, the bearing housing temperature will stabilize at some temperature, usually below 200°F., which will be the normal temperature for that installation. Higher temperatures than this normal temperature, without any change in speed or loading, can mean a lubrication difficulty or the approach of a bearing failure.

3.5 Disassemble the Bearing Assembly

1. Disassemble the liquid end in accordance with the instructions for that section.
2. Remove the cap screws which fasten the retainers (109 and 119B) to the bearing housing and pull the retainers off the shaft. Retainer (119B) will push the slinger (9905) off the shaft with it.
3. Remove the shaft (122) from the bearing frame (134C).
4. Press the bearings off the shaft by pushing against the inner race.

3.6 Assemble the bearing assembly

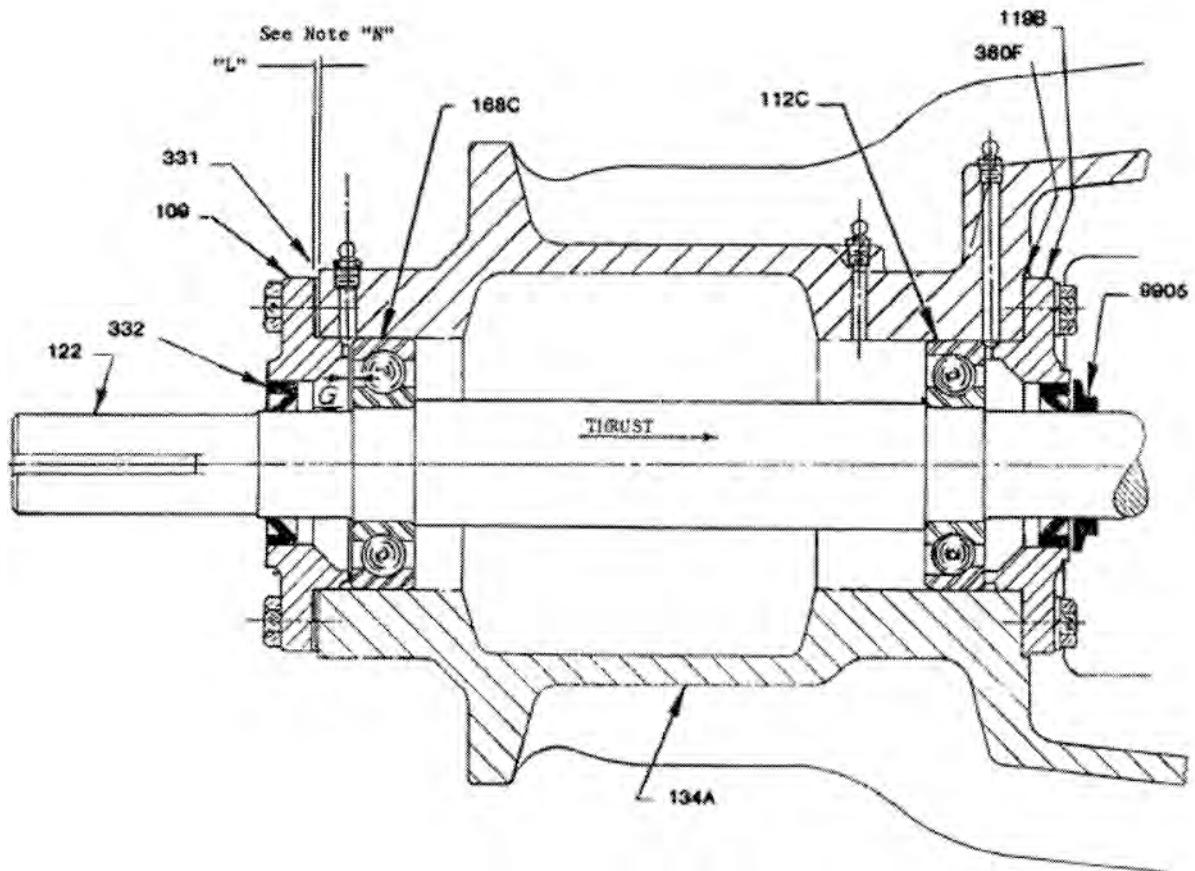


Figure 14: Model HS Bearing Assembly

NOTICE:

"N" - with thrust assembly bearing (112C) tight against retainer (119B) measure "L" and install necessary shims to make .005 to .008 gap at "G".

1. Press the bearings on the shaft. Make sure the thrust bearing (112C) is properly orientated. The thrust side of the outer race must face the retainer.
2. Carefully slide the shaft (122) with bearings into the bearing frame (134C).
3. Slide the thrust bearing retainer (119B) into position and secure with cap screws.
4. Slide the radial bearing retainer (109) into position. Make sure the thrust bearing is pushed against the other retainer and measure the gap between the retainer (109) and the housing. See note "N."
5. Remove the retainer and install the necessary shims to give a thickness .005" - .008" greater than the measured gap. This will keep the retainers from axially preloading the thrust bearing against the radial bearing. Secure the retainer with cap screws.
6. Slide the slinger (9905) into position close to the retainer, but with sufficient gap to prevent it from rubbing.

4 Liquid End

4.1 General Instructions

The impeller of the HS pump is recessed in a circular opening at the back of the casing. The uniform running clearance between the impeller and the casing keeps a uniform pressure around the outside of the impeller, and the resulting hydraulic forces on the impeller are low compared to the conventional centrifugal pump.

The bearing loads and deflection through the stuffing box are reduced with the HS configuration. The impeller is fitted with back vanes to reduce axial pressure unbalance and the resulting loads on the thrust bearings.

The HS pump is designed to pass any solid which can enter through the suction opening, provided the solid is not significantly longer than it is wide. Most of the solids do not flow through the impeller passages.

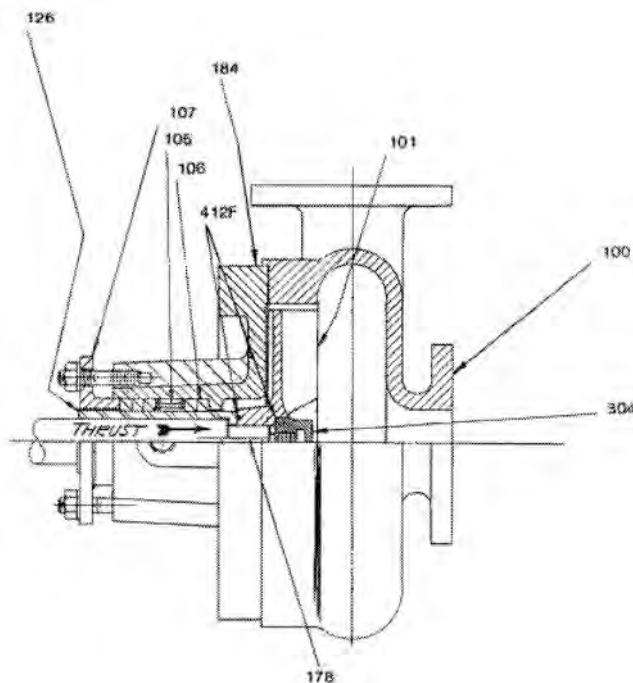


Figure 15: Liquid End

4.2 Clearance Adjustment

The HS impeller should have approximately 1/8" running clearance for the back vanes on the stuffing box side of the impeller. The standard HS bearing assemblies are machined to provide the proper clearance without any adjustment features.

4.3 Disassemble the Liquid End

1. Drain all liquid from the pipe line. Remove the discharge flange bolts and the suction pipe.
2. Remove the cap screws which fasten the casing (100) to the SB Cover (184). Carefully slide the casting away, making sure it does not drop down onto the impeller after it has cleared the fit in the SB Cover flange.
3. Remove the impeller.

The standard impeller has an impeller nut and drive key. Unscrew the impeller nut (right hand pump will have a right hand impeller nut) and then carefully pull the impeller off the end of the shaft.

4. Remove the cap screws which fasten the stuffing box cover (184) to the bearing housing (134A). Carefully slide the cover from the end of the shaft (122).



CAUTION:

Some HS pumps utilize the same cap screws to secure the casing and SB cover. In this case, clamp the SB cover in a position while removing the casing. Then the SB cover may be carefully slid from the shaft.

5. The sleeve (126) may be pulled from the shaft (122). If the stuffing box is packed, remove gland (107), seal cage (105) and packing (106).

4.4 Assemble the Liquid End

1. The shaft sleeve (126) must be clean and free of burrs. Slide the sleeve onto the shaft until it butts against the shaft shoulder.
2. Slide the SB Cover (184) into position over the shaft sleeve against the bearing housing. Secure in place with cap screws.
3. Install the impeller - Standard key drive: Make sure O-ring (412F) is in place on the impeller hub and the key (178) is in place on the shaft. Push the impeller into position and tighten on the impeller nut without the second O-ring (412F). Remove the impeller nut, install the second O-ring and re-tighten the impeller nut.
4. Install gasket (351) on the casing and carefully lift the casing into position against the SB Cover. Secure with cap screws.
5. Install the necessary packing, lantern ring and gland in the stuffing box, but do not tighten the gland more than slightly snug until the pump has been run.

4.5 Special Notice

To ensure against possible long and costly downtime periods, especially on critical services, it is advisable to have spare parts on hand.

Repair orders will be handled with a minimum of delay if the following directions are followed:

1. Give model number, size of pump, and serial number. These can be obtained from the nameplate on the pump.
2. Write plainly the name and part number of each part required. These names and numbers should agree with those on the bill material.
3. Give the number of parts required.
4. Give complete shipping information.

**Visit our website for the latest version of
this document and more information:**
<http://www.gouldspumps.com>



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Seneca Falls, NY 13148
USA

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