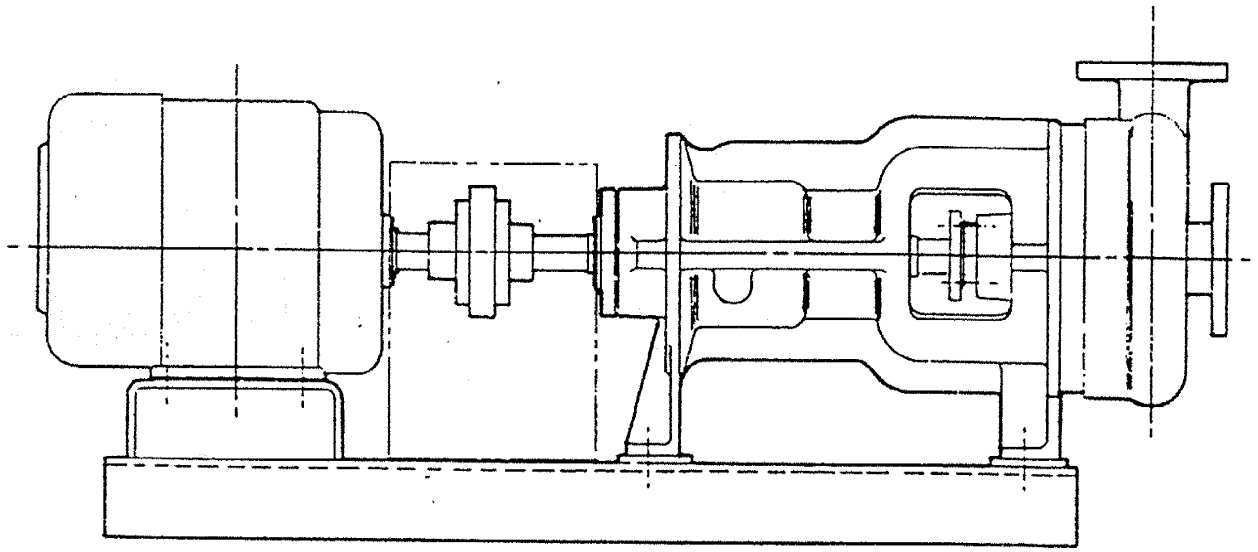
INSTALLATION AND OPERATING

INSTRUCTIONS

MODEL HS



GOULDS PUMPS, INC.
SLURRY PUMP DIVISION

INST NO:
2376

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Section I General Pump Instructions

This section is a general installation and operating instruction for most Morris pumps. Specific text and illustrations are included in Section II. The purpose of Section I is to explain those conditions common to different types of pumps.

To insure pump performance and operating life, proper installation and reasonable maintenance are required. The following instructions are a guide for installation and maintenance personnel and the pump operator.

A. PREPARATION FOR SHIPMENT

Morris 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.

B. INSTALLATION

1. 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.

2. Piping

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

Suction Piping

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

Discharge Piping

a. Excessive friction losses result in insufficient head.
b. 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 subbases can be designed to carry loads due to thermal expansion.

3. Foundation

The foundation must be a permanent, rigid support for the subbase or floorplate. It should be an industrially accepted design capable of absorbing excessive vibration. Foundations are typically concrete with anchor bolts cast in to secure the pump.

An anchor bolt assembly consists of a bolt and washer with a sleeve 2-½ 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.

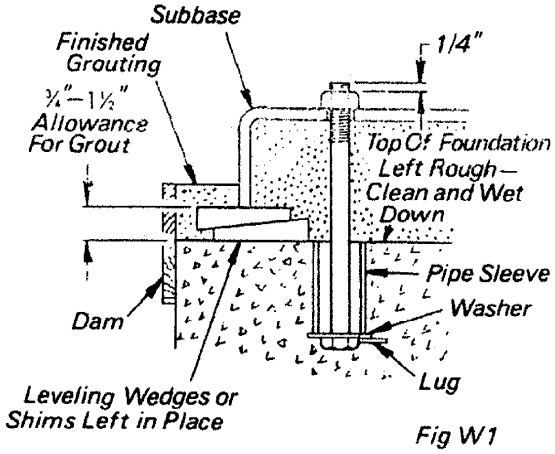


Fig W1

Typical Anchor Bolt

4. Installing Pump on Foundation

If subbases or floorplates 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 subbase or floorplate, see Fig. W2 and Fig. W3. The anchor bolts are then drawn tight enough to maintain position and level.

To secure the shims in place and provide a level surface for the base or plate, grout is poured over the concrete foundation. A ¾" to 1-½" 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.

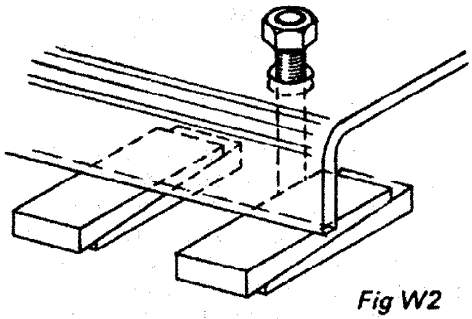


Fig W2

Leveling With Wedges

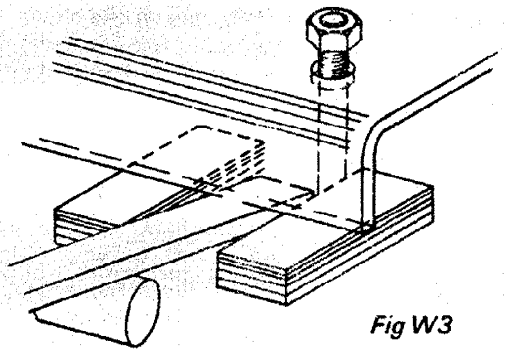
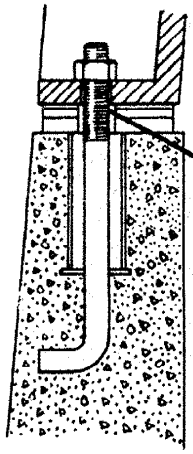


Fig W3

Leveling With Blocks and Shims

When the grout has hardened and the anchor bolts are permanently secured, recheck level.
NOTE: On large subbases/floorplates, shimming is recommended to be at 24" spacing.



TYPICAL

DO NOT Use Nut Here To Level Pump.

Subbase 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.

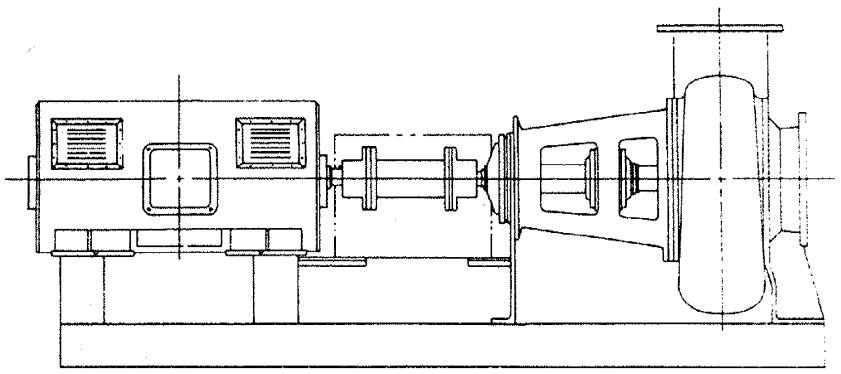
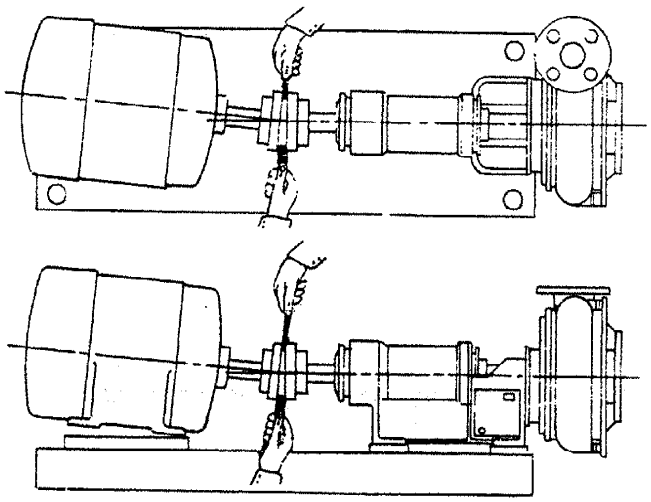


Fig W6

C. PUMP-DRIVER ALIGNMENT

1. Shaft Alignment of Horizontal Pump & Driver
Pumps and drivers that are received from the factory with both machines mounted on a common subbase were accurately aligned before shipment. Because all subbases are, to some extent, flexible, factory alignment may be altered during shipment and handling. After the subbase 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".
   a. 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.
   b. 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 section I.C.3 is recommended.

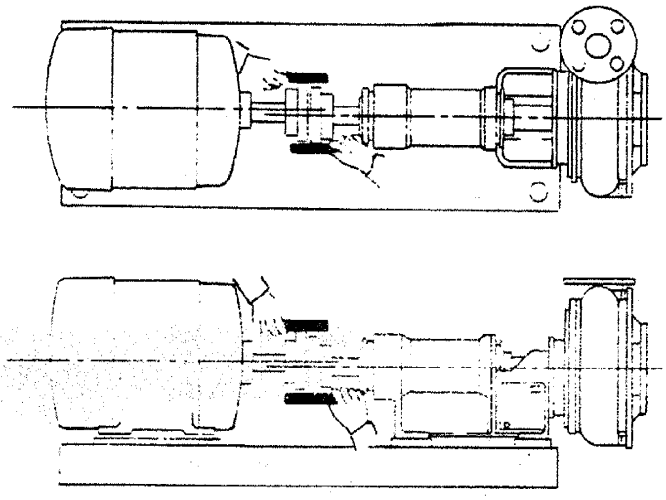
2. Alignment Procedure
A check for angular alignment is made by inserting the taper gauge or feelers at four points between the coupling faces and comparing the distance between the faces at four points spaced around the coupling. The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points (Fig. W7).



CHECKING ANGULAR ALIGNMENT

Fig.W7

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.



CHECKING PARALLEL ALIGNMENT

Fig.W8

NOTE: Care must be taken to have the straight edge parallel to the axis of the shafts (Fig. W8).

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 subbase in the field, it is necessary to place the subbase with 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.

3. 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.

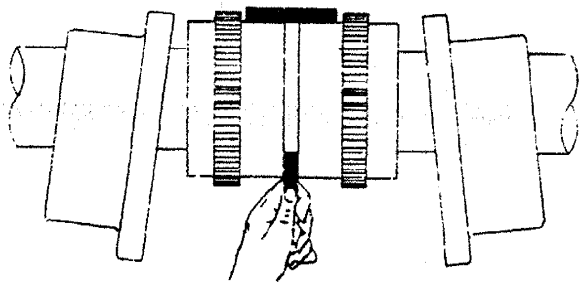
Bolt the indicator to the pump half of the coupling. with the indicator button resting on the other half coupling periphery, set the dial to zero, and chalk mark the coupling half at the point where the button rests. For any check, top, bottom, or sides, rotate both shafts by the same amount; i.e., all 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 coupling unbalance or abnormal coupling wear and may need to be corrected for reasons other than accomplishment of shaft alignment.

4. 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 on Fig. W9.



GEAR COUPLING ALIGNMENT

Fig.W9

5. 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 base plate 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.

D. STUFFING BOXES

In the convential 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 10-15 PSIG higher than the suction pressure.

NOTE: 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.

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

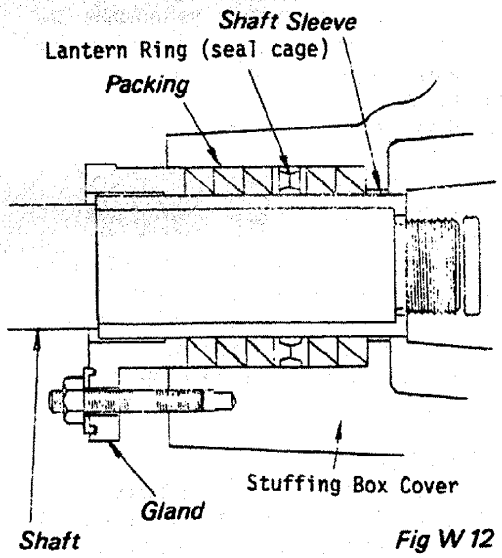
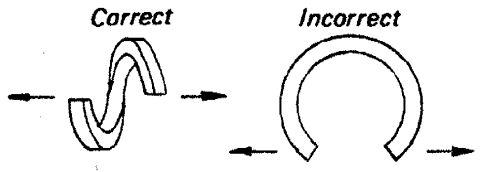


Fig W 12
Typical Stuffing Box

   Refer to Bill of Material and Assembly Drawing for specific packing size and configuration.

2. Packing Procedure
   a. Stuffing box and shaft sleeve must be clean and free of grit.
   b. Form packing over shaft or mandrel of same diameter. Carefully cut to packing length. Discard rings cut too short.
   c. Pre-form each ring by coiling 1-½ turns.
   d. To install packing rings, do not pull straight. Expand the coil as a coil spring. (See Fig. W13.)



Stuffing Box Packing Fig W 13

   e. 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.
   f. Install second and third coils as required by assembly drawing, staggering the cut 90°-120°.
   g. 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.
   h. After packing and seal cage are properly installed, insert gland into stuffing box. Tighten gland nuts finger-tight only. Shaft should turn freely.
   i. Follow pump start-up procedure. Turn on stuffing box lubricating liquid and start pump.
   j. 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.

      NOTE: Do not overtighten 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.

   k. 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.

3. 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 replacement of the rotating and stationary sealing elements. Do not replace only one component.

To insure 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. Morris 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.

E. PUMP START-UP

1. Bearing Lubrication: Bearing must have adequate lubrication. Engage external lubrication system. Consult "BEARING SECTION" of these instructions for specific information.
2. 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.
3. 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 pumps is indicated in a prominent location. For pumps with impellers threaded on the shaft, reverse rotation would back the shaft from the impeller thread. Considerable damage may occur.
4. 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.
5. Priming: The pump must be completely primed before operation.

F. 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.

G. FREEZING

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

H. LOCATING PROBLEMS

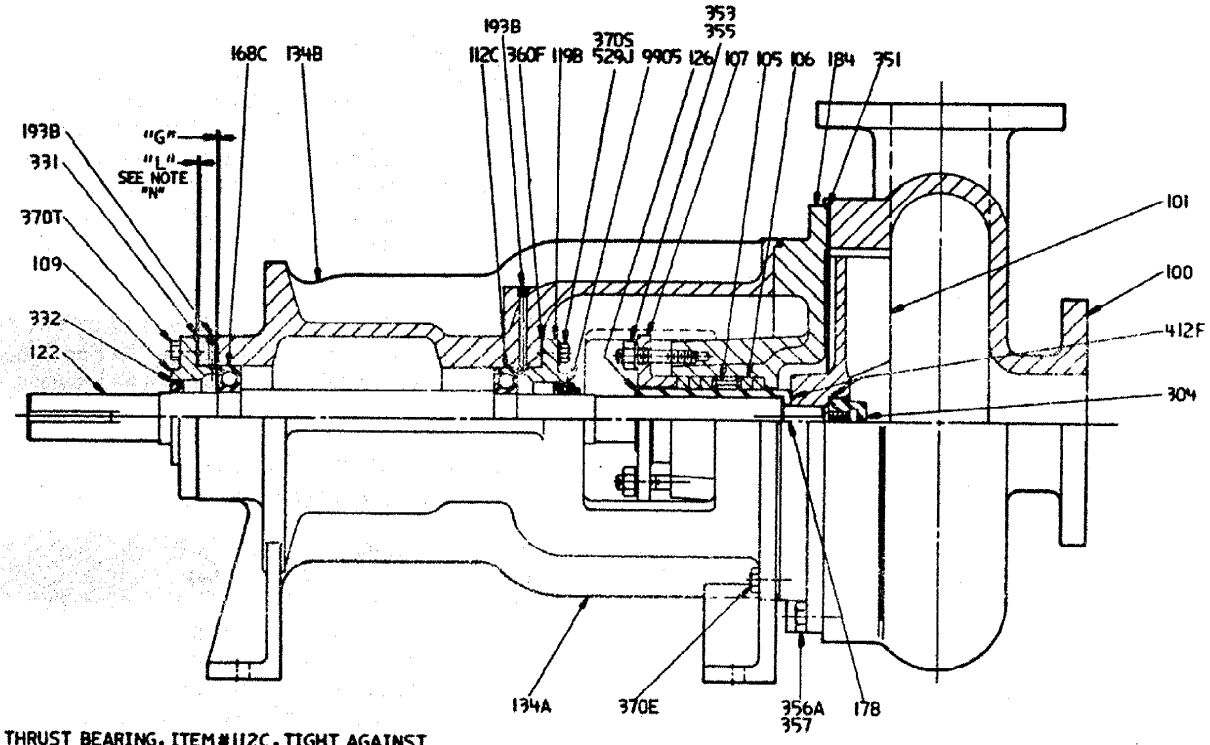
1. Conditions Leading to Insufficient or No Discharge
   a. Insufficient speed.
   b. Excessive discharge head.
   c. Insufficient NPSH.
   d. Worn pump components.
   e. Incorrect direction of rotation.
   f. Incomplete pump priming.
   g. Impeller or discharge pipe clogged.
   h. Pumpage viscosity too high.

2. Conditions Leading to Excessive Power Consumption
   a. Excessive speed.
   b. Pump operating at high horsepower area of the pump curve (off design point).
   c. Mechanical binding or rubbing of rotating element.
   d. 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 AN UNACCEPTABLE AND DANGEROUS PRACTICE. IT CAN RAPIDLY LEAD TO A VIOLENT PUMP FAILURE.



NOTE "N"

WITH THRUST BEARING, ITEM #112C, TIGHT AGAINST INBOARD END COVER, ITEM #119B, MEASURE LENGTH "L" AND INSTALL NECESSARY SHIMS TO MAKE .005"-.008" GAP AT "G".

Dwg. C00200G

Model HS

Grease Lubrication

Fig. W14

Section II Bearing Frame Assembly

A. GENERAL

The inboard or lower bearing is an angular contact ball bearing with high thrust capacity and the outboard or top bearing is a high radial capacity ball bearing. Grease is the standard lubricant, but bearing assemblies can be furnished for oil lubrication. The bearing assembly has a split housing for ease of assembly and disassembly.

B. BEARING LUBRICATION AND CARE

NOTE: 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 insure lubrication of the seal lip while the seal is "running in".

GREASE LUBRICATION

1. When the pump is furnished with grease lubrication, a quality bearing grease equivalent to Mobilux #2 should be used to insure 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 Fig. W14.

OIL LUBRICATION

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

good grade of non-detergent oil of #30 wgt. 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. See Fig. W17.

C. 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 insure adequate lubrication at startup.

D. 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.

E. TO 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** &**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. Tap the taper pins out and then remove the cap screws which hold the two housing halves together. Separate the two halves and lift the shaft, with bearings, out.

4. Press the bearings off the shaft by pushing against the inner race.

F. TO ASSEMBLE THE BEARING ASSEMBLY

1. See Fig. W15.

2. 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.

3. Carefully lower the shaft with bearings into the half of the housing that has the small end of the taper pins.

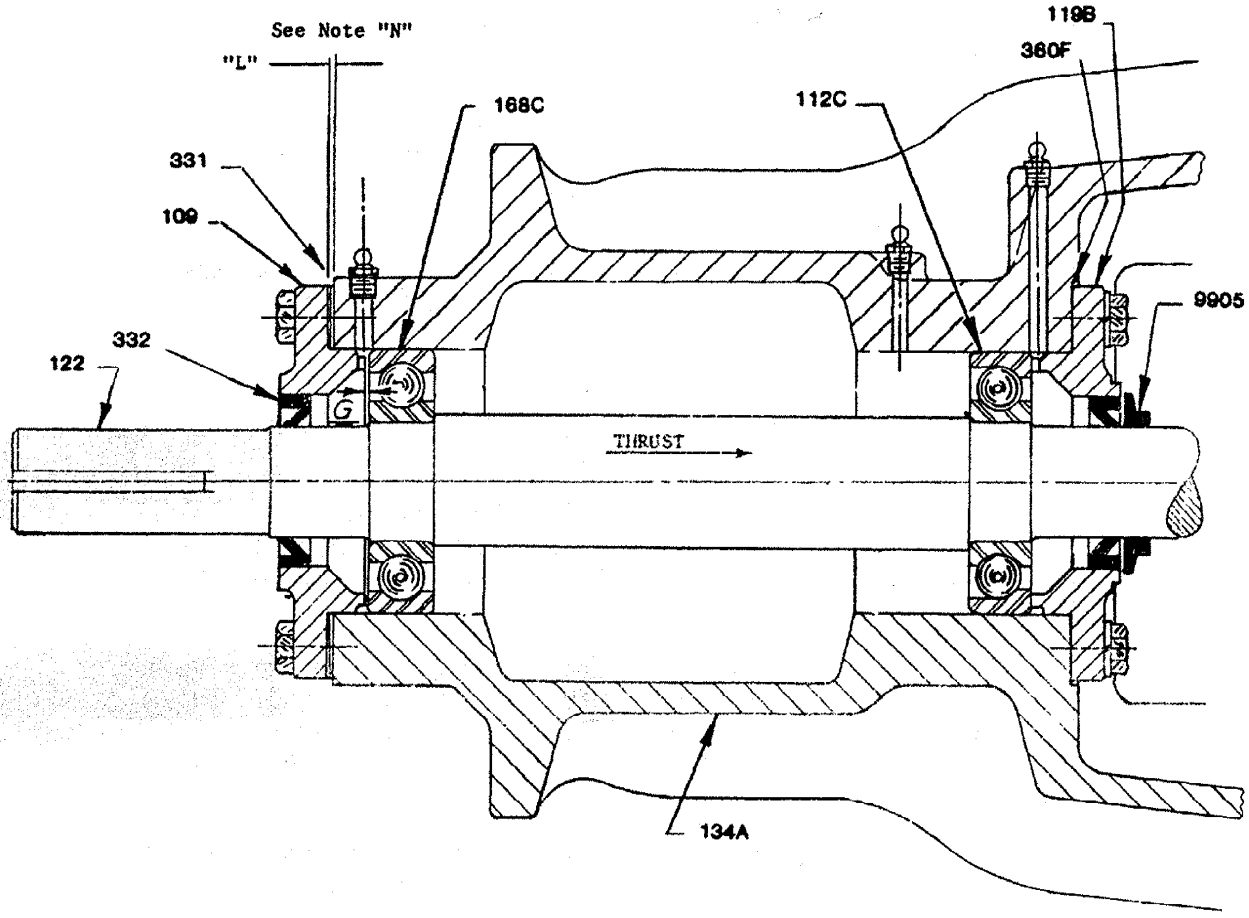
4. Lower the other half of the housing into position. Use the taper pins as a guide. Capscrew the two halves together.

5. Slide the thrust bearing retainer (**119B**) into position and secure with cap screws.

6. 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".

7. 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.

8. Slide the slinger (**9905**) into position close to the retainer, but with sufficient gap to prevent it from rubbing.



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

Model HS

Bearing Assembly

Fig. W15

Section III Liquid End

A. GENERAL

See Fig. W16.

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 the 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 passageways.

B. 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.

C. TO 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 casing 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 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**).

D. TO 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.

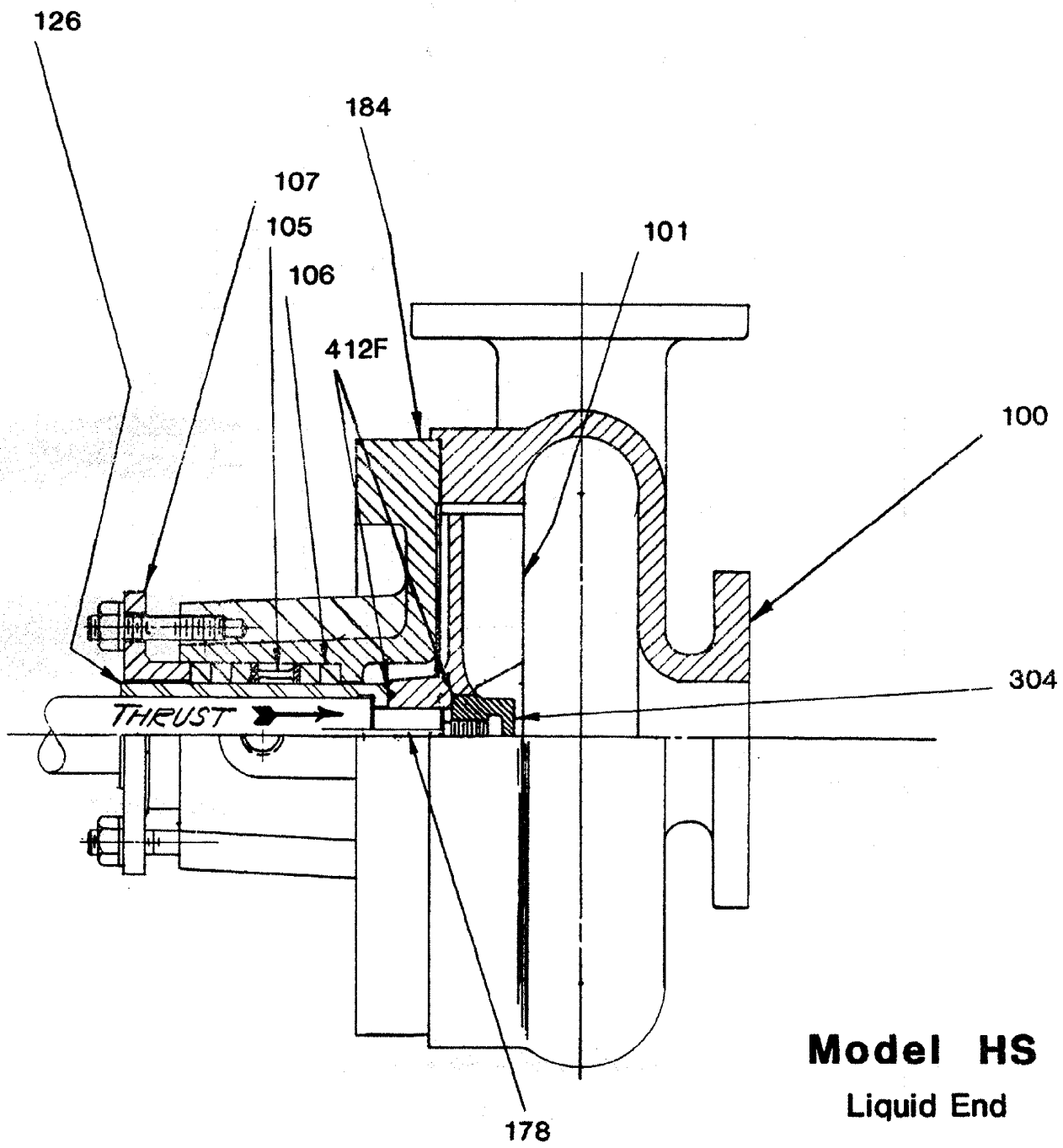
3. Install the impeller:

   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 retighten 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.

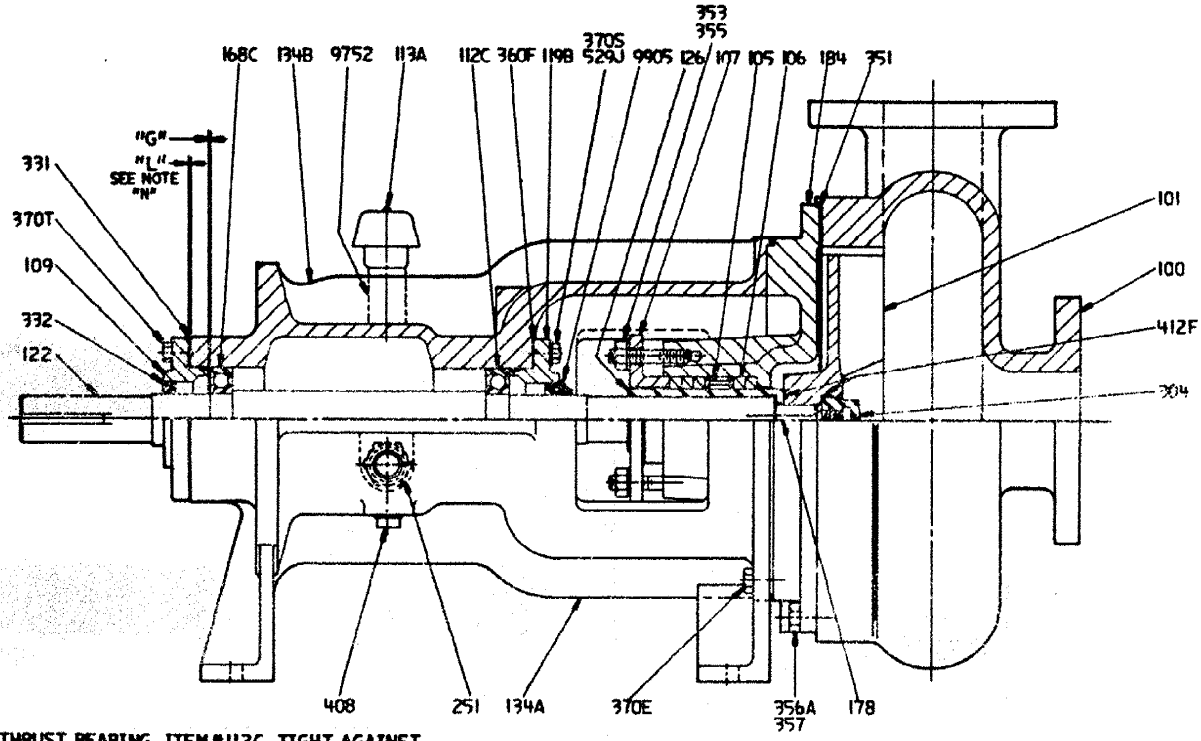
This drawing shows a standard packed stuffing box.



Model HS

Liquid End

Fig. W16



NOTE "N"

WITH THRUST BEARING, ITEM #112C, TIGHT AGAINST INBOARD END COVER, ITEM #119B, MEASURE LENGTH "L" AND INSTALL NECESSARY SHIMS TO MAKE .005"-.008" GAP AT "G".

Dwg. C00201G

Model HS

Oil Lubrication

Fig. W17

-- SPECIAL NOTICE --

To insure against possibe 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 of material.
3. Give the number of parts required.
4. Give complete shipping information.

GOULDS PUMPS INC.

SLURRY PUMP DIVISION
EAST CENTRE STREET
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