

 **GOULDS PUMPS**

# Installation, Operation and Maintenance Instructions

VHS



**ITT**



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# 1 General

## 1.1 Introduction

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

## 1.2 Importance of instructions

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

Study thoroughly Sections General, Installation Instructions Vertical Pumps, [3.1 Starting a Vertical Pump on page 6](#), Operating and Maintenance Instructions IV and carefully follow the instructions for installation and operation. Sections Disassembly and Reassembly, [6.2 Sectional drawing on page 14](#), Check List for Locating Trouble and Ordering Spare Parts VIII are answers to trouble and maintenance questions. Keep this instruction manual handy for reference. Further information can be obtained by contacting the Slurry Pump Division, 240 Fall Street, NY, 13148.

## 1.3 Special warnings

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

## 1.4 Receiving inspection - shortages

Care should be taken when unloading pumps. If shipment is not delivered in good order and in accordance with the bill of lading, note the damage or shortage on both receipt and freight bill. make any claims to the transportation company promptly.

Instruction sheets on various components as well as the Instruction Book for the pump are included in the shipment. Do not discard.

## 1.5 Preservation and storage

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

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# 2 Installation Instructions Vertical Pumps

## 2.1 Pump support

The pump support must be sufficiently substantial and level to give rigid support to the pump and to absorb vibration.

The bolts which secure the pump to the foundation should be 1/8" less in diameter than the hole in the pump frame (size is shown on the certified dimensions drawing).

**CAUTION:**

Provision must be made to support discharge piping independently from the pump to prevent excessive loads and maintain pump-driver alignment.

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## 2.2 Discharge pipe

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

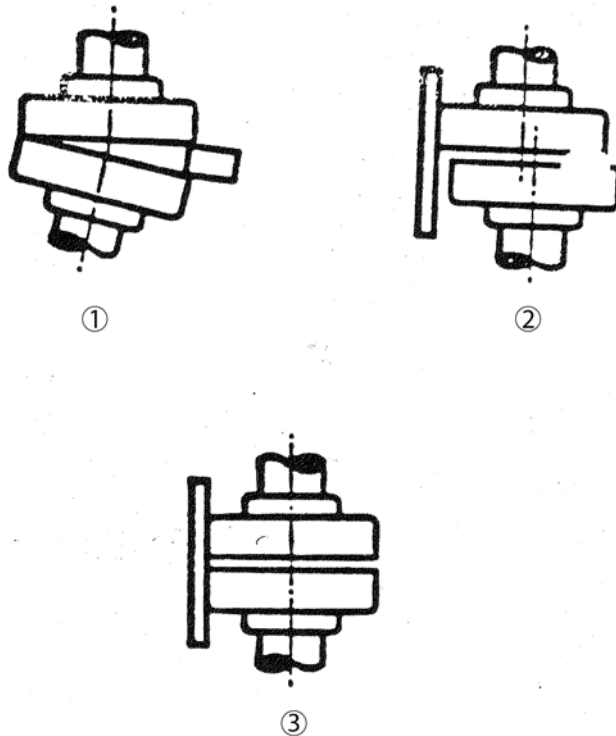
Arrangements should be made to keep the pump from back-spinning severely during shutdown. On a long discharge line, a non-slam check valve should be installed. At no point should the pump be started while the impeller is in reverse rotation.

## 2.3 Pump

The sump must be screened to prevent any foreign objects from falling into the sump and damaging the pump. The openings in the screening should be the same size or smaller than the openings in the pump strainer.

## 2.4 Direct connection

Check parallel alignment by placing a straight edge across the two coupling flanges or using a dial indicator. Check angular alignment with a micrometer or feeler gauge. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Alignment of drive and pump should be within .0762mm | 0.003".



1. Angular misalignment
2. Parallel misalignment
3. Perfect alignment

**Figure 1: Drive and pump alignment**

## 2.5 V-belt drives

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

1. Check Belt Fit

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

2. Keep Belts Clean

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

3. Use Belt Guards

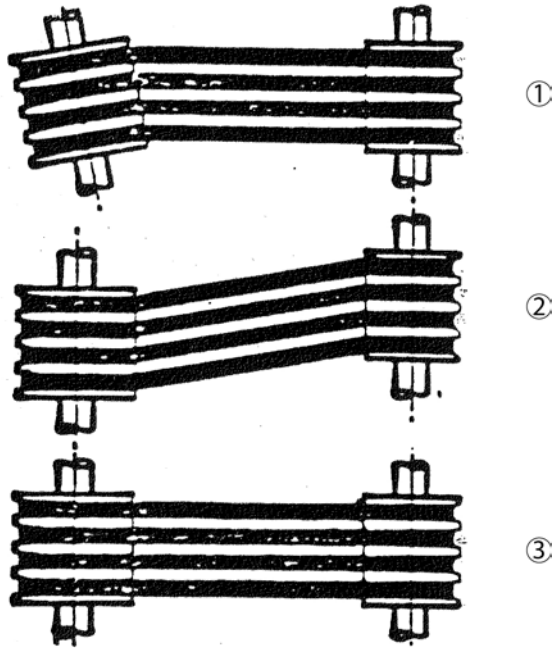
Belt guards protect personnel from danger and the drive from contamination, Inspect periodically to ensure that belts do not rub against guard.

4. Maintain Proper Belt Tension

Proper tension is the primary reason for long belt life. Improper tension could cause belt fatigue and/or hot bearings.

5. Sheave Alignment

Alignment must be maintained for full power transmission, minimum vibration, and long drive life. Make sure sheaves are aligned by placing a straight edge or string along the faces of each sheave. If any questions arise pertaining to the drive limitations, consult the manufacturer.



1. Angular misalignment
2. Parallel misalignment
3. Perfect alignment

**Figure 2: Alignment**

## 3 Starting a Vertical Pump

### 3.1 Starting a Vertical Pump

Before starting a new pump check the pump supports and piping to be certain that they conform to the specifications in the Installation Instructions Vertical Pumps section.

The bearing housing is properly filled with grease before shipment. Under normal conditions, grease should be added as required at regular intervals.

Turn the pump shaft by hand. If the pump does not turn freely, it should be checked to determine what is causing the binding.

Check the motor rotation to be certain that it will drive the pump in the correct direction.

The bearing housing seals may generate some until broken in. Oil may be applied to them if the heat becomes excessive at the time the pump is started.

The pump must be primed. The pump must not be started unless the liquid level is above the impeller.

Do not operate the pump with a closed discharge line. At the shutoff point, with no water flow, the horsepower delivered to the pump is rapidly converted into heat and presents a great danger.

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**NOTICE:**

DO not operate the pump without proper drive guard in place.

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# 4 Operating and Maintenance Instructions

## 4.1 Lubrication

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**NOTICE:**

Operation of the unit without proper lubrication can result in overheating of the bearings, bearing failures, pump seizures and actual breakup of the equipment exposing operating personnel to personal injury.

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The bearing housing is properly filled before shipment. Under normal conditions, grease should be added at regular intervals and care should be taken not to over-lubricate. Use Shell Alvania No. 2, Mobil Mobilux No. 2, Texaco Multifak No. 2, Sun Oil Company Prestige Ho, 42, American Oil Company Amolith Grease No. 2 or equal. When it becomes necessary to replace the bearing housing seals, the housing and the bearings should be flushed clean with a solvent and repacked with new grease. Over-lubrication results in excessive bearing temperatures.

## 4.2 Seals

The upper bearing housing seals may generate some heat until broken in. Oil may be applied to it if the heat becomes excessive at the time the pump is started. Make sure the seal area is free of dust and dirt prior to start.

## 4.3 Maintained capacity

The amount of liquid being pumped will lessen as impeller wear increases. To maintain full pump capacity, the impeller should be inspected periodically. Each application is different and it is necessary to determine the amount of wear for a certain time limit before setting up a schedule for inspection.

1. Impeller Clearance Adjustment
  - a) Loosen the thrust bearing housing-locking stud nuts (370C), see [Figure 4: Bearing housing and shaft disassembly on page 10](#).
  - b) Turn impeller clearance adjusting bolts (3700) CCW to move the bearing housing up until the impeller (101) touches the stuffing box cover (184). Turn the bolts to lower the bearing housing 0.03", which gives the recommended operating clearance. Make sure the impeller turns freely through the entire rotation.
  - c) Tighten housing locking stud nuts and bolts (370C).

## 4.4 Duplex thrust bearing replacement

Duplex bearings are made up of two single row bearings manufactured with controlled relationship between the axial location of the inner and outer ring faces and are supplied as matched pairs or sets.

When it becomes necessary to replace a duplex bearing, both halves of the new bearing must be marked with the letter "D". Under no circumstances should a duplex bearing be made by using two single row bearings not specifically marked for duplex use.

When replacing a duplex bearing, mount the two mated bearings back-to-back so that the stamped faces (high shoulders) of the outer rings are together.

In case of making replacements for bearings which have been installed and run, it is recommended that both halves be replaced. This avoids the dangers involved in attempting to match two bearings, one of which has unknown internal characteristics.

## **4.5 O-rings, gaskets and casing liners**

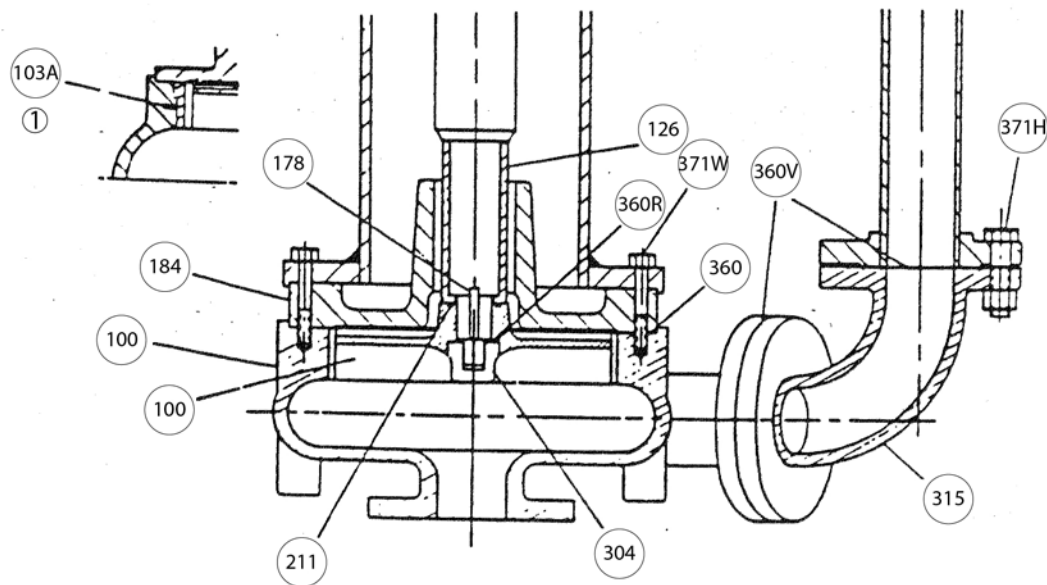
When making inspections or repairs, be sure to replace all gaskets and O-rings. Pumps will operate at reduced capacities if gaskets O-rings are not installed.

The optional casing liner has a loose fit in the casing for ease of installation and removal by hand. The liner is clamped in place by the stuffing box cover. The gasket (360) seals the joints.

# 5 Disassembly and Reassembly

## 5.1 Disassembly of bottom suction pump - VHS

1. Lock out power supply to motor.
2. Shut off valves controlling flow from the pump. Remove all auxiliary piping and tubing.
3. Remove pump from sump.
4. Loosen V-belts or disconnect coupling. Remove either from shaft.
5. Remove motor and motor mount if a direct connected pump.
6. Unbolt discharge elbow and remove.
7. Remove bolts (371W) and withdraw casing (100).
8. Remove impeller nut (304) by turning CCW and slide impeller from shaft.
9. Tape end of shaft and slide stuffing box cover (184) over shaft.
10. Slide shaft sleeve (126) from shaft (122).
11. Disassemble column pipe (192) and discharge pipe (195).
12. Remove nuts from housing locking studs (370C).
13. Draw bearing housing and shaft assembly from the frame (228A).



1. Optional liner

**Figure 3: Bottom suction pump disassembly**

### NOTICE:

Item 370C is not used on 2x2-8, 4x4-12, or 6-6-12 VHS pumps, on these pumps, Item 370C attaches Items 192 and 184 to Item 100.

## 5.2 Disassembly of bearing housing and shaft assembly

1. Press inboard bearing (168) off shafts.
2. Remove deflector (123) and outboard end cover (109).
3. Remove bearing housing (134) from bearing and slide off bottom of shaft.
4. Remove outboard bearing locknut (136) and lockwasher (382A) and press outboard bearings (112) off shaft.

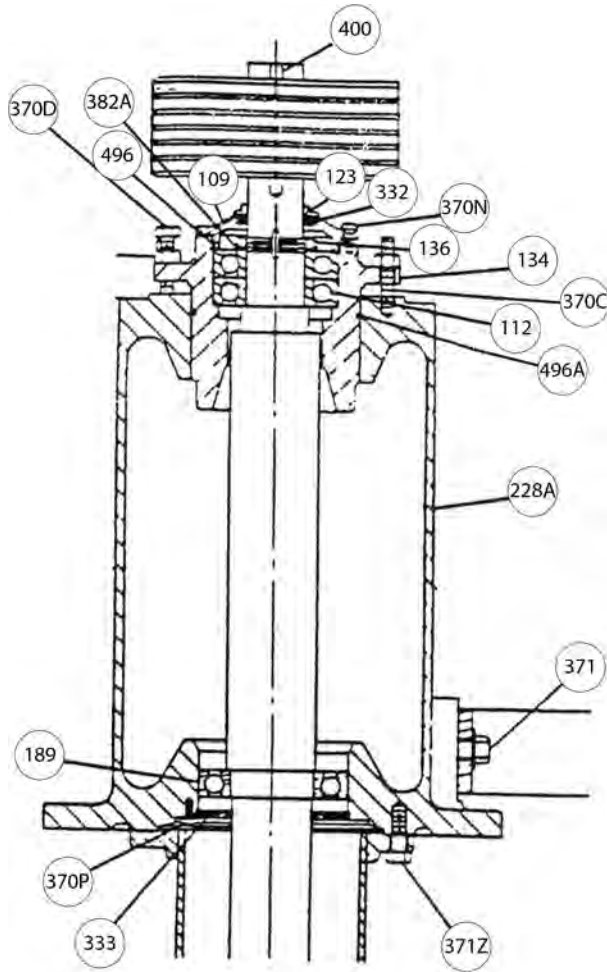


Figure 4: Bearing housing and shaft disassembly

## 5.3 Inspection and parts replacement guidelines

1. Impeller - Replace if impeller shows excessive erosion, corrosion, extreme wear or vane breakage. Impeller hub must be in good condition. Reduction in hydraulic performance may be caused by excessive impeller wear.
2. Shaft Sleeve - Sleeve surface and throttle area must be smooth. If badly grooved or cut, replace sleeve.
3. Casing - Replace if worn.
4. Shaft - Check for runout (0.1524mm | .006" max.) to see that shaft has not been bent. Bearing seats and oil seal area must be smooth and free of scratches or grooves. Shaft threads must be in good condition. Replace if necessary.
5. Bearings - Replace if worn, loose or rough and noisy when rotated.
6. Oil Seals - Replace if worn or otherwise damaged.
7. General - All parts should be clean before assembly. All burrs should be removed.

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### NOTICE:

Standard bearing manufacturer fits and tolerance dimensions are used in the manufacture of SPD vertical pumps.

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## 5.4 Reassembly of bearing housing and shaft assembly

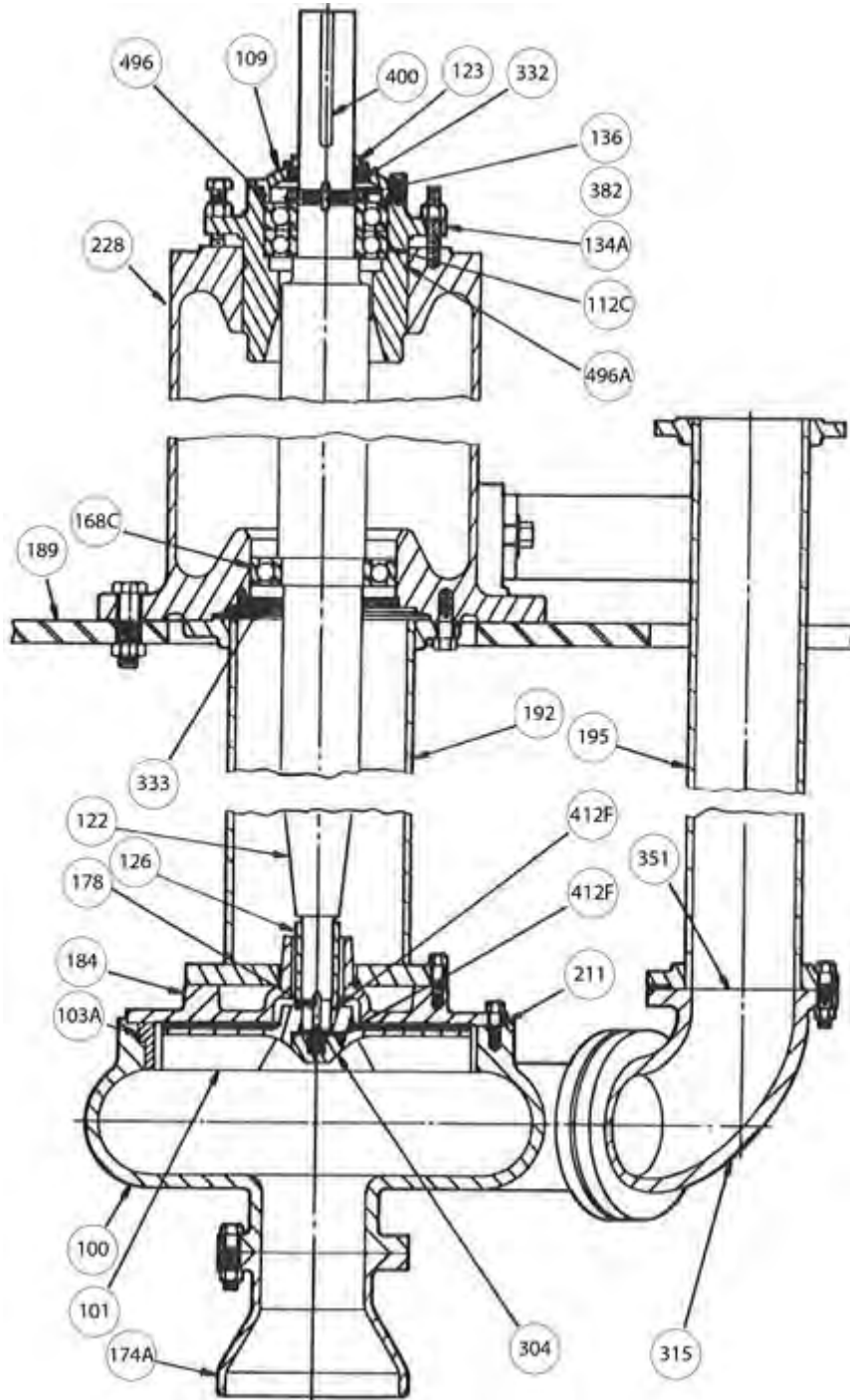
1. Clean shaft (122) thoroughly, checking for nicks or worn areas.
2. Press outboard seal (332) into outboard end cover (109), positioning the seal so that the lip points upward when installed with the pump. Press inboard seal (333) into frame (228A) with the lip pointing downward and secure with capscrews (370P).
3. Position outboard bearing locknut (136) and lockwasher (382A) against the bearing shoulder and tighten firmly. Bend "tang" of lockwasher into slot in locknut.
4. Hand pack outboard bearing with recommended grease (Refer to Operating and Maintenance Instructions). Mound a small amount of grease above bearing to ensure sufficient lubrication.
5. Insert bearing housing (134) over the impeller end of shaft and pull over outboard bearing. Attach end cover (109) with O-Ring (496). Tighten bolts evenly so outboard bearing seats properly. A gap of approximately .06" should exist between the end cover flange and the bearing housing. This gap ensures the bearing is tight into the bearing housing.
6. Press inboard bearing (168) onto shaft until inner race seats onto shaft shoulder.
7. Hand pack radial bearing with recommended grease. (Refer to Operating and Maintenance Instructions). Mound a small amount of grease above bearing to ensure sufficient lubrication.

## 5.5 Pump reassembly - vertical bottom suction - VHS

1. Install O-Ring (496A) onto bearing housing (134), (Not on CI frame).
2. Remove impeller nut (304) and key (178) from shaft and tape shaft threads for protection.
3. Insert bearing housing and shaft assembly into frame (228A).
4. Reassemble column pipe (192), frame (228A), and stuffing box cover (184).
5. Position bearing housing shaft assembly so that the shaft is as far into the water end as possible. This will ensure proper placement of the impeller (101) on the shaft.
6. Install nuts on bearing housing locking studs (370C). On CI frame, install outboard end cover (109) with O-ring (496) and screws (370N). Tighten bolts evenly. A gap of approximately 1.524mm | 0.06" should exist between the end cover flange and the frame (228A). Place deflector (123) above outboard end cover (109).
7. Slide shaft sleeve (126) on shaft after coating shaft with an anti-seizing compound such as *Never Seez* or equal.
8. Remove protective tape from shaft threads. Place gasket (211) against end of impeller (101). Position impeller key (178) in shaft.
9. Dress shaft and impeller bore fit.
10. Slide impeller (101) onto shaft (122) engaging impeller key. Make sure impeller contacts sleeve (126).
11. Place gasket (360R) on impeller nut (304). Apply a light coating of grease on the gasket to eliminate tearing during tightening.
12. Screw impeller nut on threaded portion of shaft. The threads are right-hand. Tighten impeller nut (304).
13. Reassemble casing (100), discharge elbow (315), and discharge pipe (195).
14. Rotate shaft to ensure that all parts are free.
15. Turn impeller clearance adjusting bolts to move the bearing housing up until the impeller (101) touches the stuffing box cover (184). Turn in the opposite direction to lower the bearing housing 0.762mm | 0.03" which is the recommended operating clearance. Make sure the impeller turns freely through the entire rotation. Lock adjusting bolts in place. (Adjustment is not provided on the CI frame.)
16. Tighten housing locking studs (370C). (Not on C1 frame.)
17. Attach motor mount if a direct connected pump.
18. Connect V-belt drive or coupling.
19. Follow procedures for installation of vertical pumps.

# 6 Sectional Drawings

## 6.1 VHS sectional drawing with C1 bearing assembly



**Figure 5: Sectional drawing**

Item	Qty per pump	Part Name
100	1	Casing

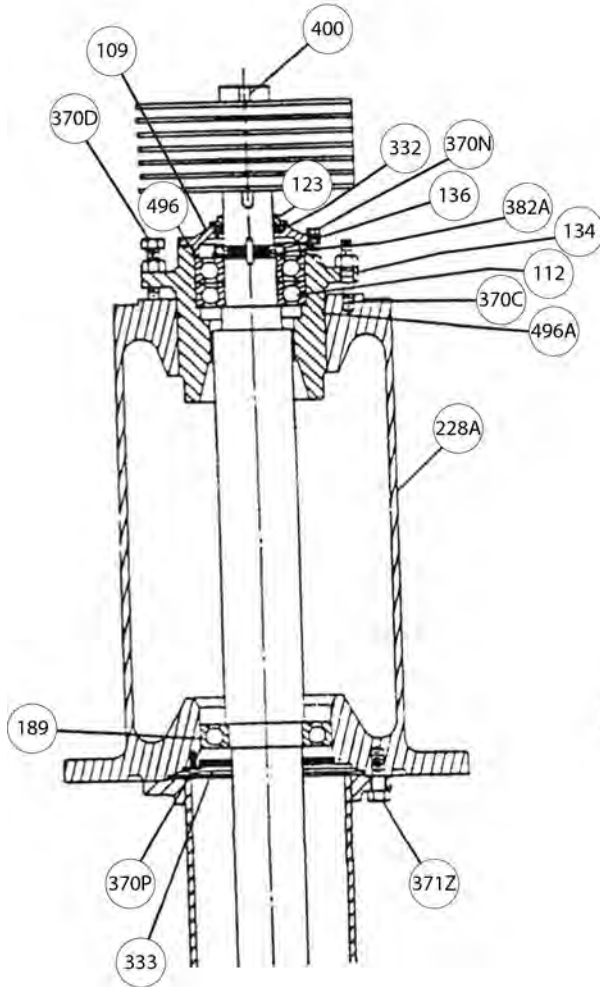
Item	Qty per pump	Part Name
101	1	Impeller
103A	1	Casing Ring - OPTIONAL
109	1	End Cover - Thrust Bearing
112C	1	Thrust Bearing
122	1	Shaft
123	1	Deflector
126	1	Shaft sleeve
134A	1	Bearing housing
136	1	Lock Nut - Outboard Bearing
168C	1	Radial Bearing
174A	1	Tailpipe - OPTIONAL
178	1	Impeller Key
184	1	Stuffing box cover
189	1	Pit Cover - OPTIONAL
192	1	Column pipe
195	1	Discharge pipe
211	1	Gasket St box - Casing
228	1	Frame
304	1	Impeller nut
315	1	Discharge elbow
332	1	Oil Seal - Outboard
333	1	Labyrinth Oil Seal - Inboard
351	2	Gasket - Discharge Elbow
382	1	Lockwasher - Outboard Bearing
400	1	Shaft-Coupling Key
412	1	O-Ring - Impeller Nut
412F	1	O-Ring
496	1	O-Ring - Brg Eng cover
496A	1	O-Ring - Thrust Brg Hsg to Frame

Refer to specific pump bill of material for detailed part description.

## 6.2 Sectional drawing

C-2, C-3, C-4

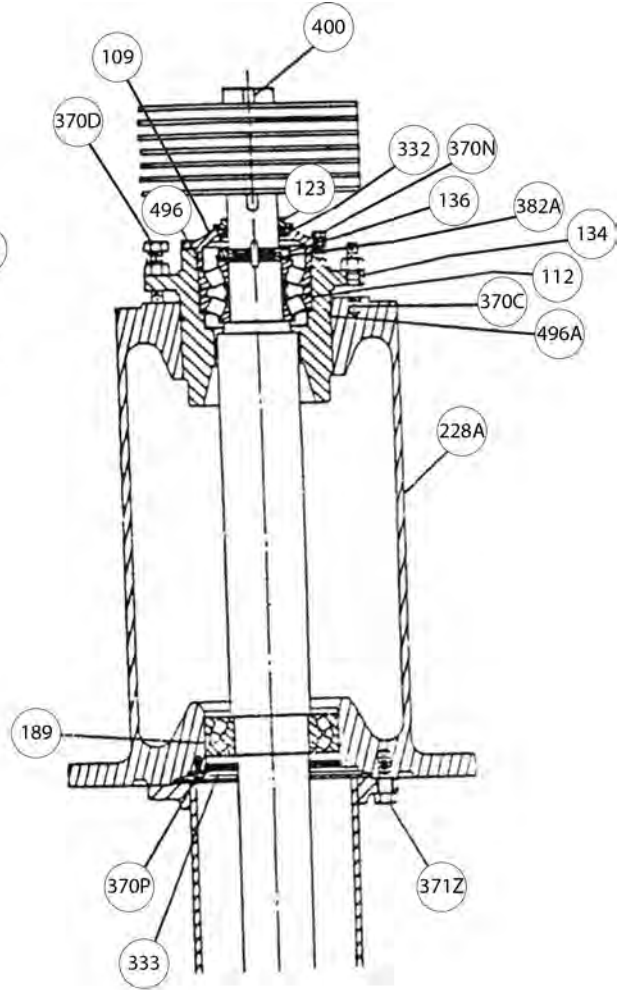
Bearing assembly



Pumps manufactured with Ci-C4 bearing assemblies are supplied with ball bearings.

C-5, C-6

Bearing assembly



Pumps manufactured with C5 and C6 bearing assemblies use spherical rocker bearings (Item 168) and taper roller bearings (Item 112)

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**NOTICE:**

Consult Page 1 of specific pump bill of material for bearing assembly used in your pump.

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# 7 Checklist for Locating TRouble

## 7.1 Insufficient capacity

1. Pump not primed, ensure sump level above casing.
2. Speed too low.
3. Total head higher than pump rating.
4. Suction lift too great or insufficient NPSH of system.
5. Impeller passages partially blocked.
6. Suction line partially blocked.
7. Wrong direction of rotation.
8. Mechanical defects: Impeller worn or damaged; defective gasket causing leakage.

## 7.2 Insufficient pressure

1. Speed too low.
2. Air in slurry.
3. Wrong direction of rotation.
4. Mechanical defects: Impeller worn or damaged; defective gasket causing leakage.

## 7.3 Motor overload

1. Speed too high.
2. Total head lower than pump rating (pump will attempt to pump too much water).
3. Slurry being pumped has higher specific gravity than that for which pump is rated.
4. Mechanical defects: Shaft bent; worn bearings; worn impeller or other water end parts.

## 7.4

### Pump vibration

1. Foundation not sufficiently rigid.
2. Impeller partially blocked causing unbalance.
3. Misalignment.
4. Mechanical defects: Shaft bent, worn bearings; impeller worn.

# 8 Ordering Spare Parts

## 8.1 Vertical bottom suction pump

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 of material.
3. Give the number of parts required.
4. Give complete shipping instructions.

## 8.2

### Recommended spares

The following are pump application categories and their recommended spare parts.

#### **Light Duty - Random mildly abrasive particles:**

Recommended spare parts:

- 1 Shaft Sleeve
- 1 Gasket Set

#### **Medium Duty - Light slurries up to 1.2 S.G. w/moderately abrasive materials:**

- 1 Impeller
- 1 Shaft Sleeve
- 1 Gasket Set
- 1 Set Bearings

#### **Heavy Duty - Slurries over 1.2 S.G. w/highly abrasive materials:**

- 1 Casing
- 1 Impeller
- 1 Bearing Assembly
- 2 Shaft Sleeves
- 3 Gasket Sets

#### **Severe Duty - Key process equipment on heavy slurries over 1.2 S.G w/high heads and highly abrasive particles:**

- 1 Casing
- 2 Impellers
- 2 Shaft Sleeves
- 3 Gasket Sets

1 Spare pump

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