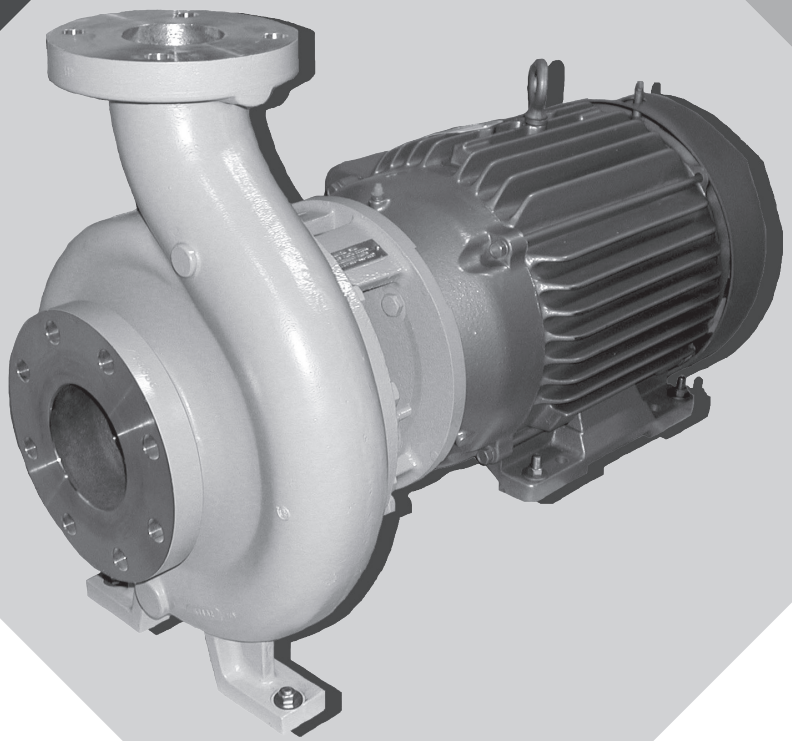
GOULDS PUMPS

Installation, Operation, and Maintenance Manual

Model 3196CC



ITT

Table of Contents

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, Electrical, and ATEX are used to indicate where special operator attention is required.

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

WARNING:
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Example: Pump shall never be operated without coupling guard installed correctly.

CAUTION:
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
Example: Throttling flow from the suction side may cause cavitation and pump damage.

Electrical Hazard:

WARNING:
Indicates the possibility of electrical risks if directions are not followed.
Example: Lock out driver power to prevent electric shock, accidental start-up, and physical injury.

ATEX:

WARNING:
When installed in potentially explosive atmospheres, the instructions that follow the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact an ITT Goulds Pumps representative before proceeding.
Example: Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.

1.4 General precautions

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

Table 1: General Precautions

WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		Safety Apparel: • 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		Receiving: 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.
WARNING		Alignment: Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.
WARNING		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
CAUTION		Piping: Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
WARNING		Flanged Connections: Use only fasteners of the proper size and material.
WARNING		Replace all corroded fasteners.
WARNING		Ensure all fasteners are properly tightened and there are no missing fasteners.
WARNING		Startup and Operation: When installing in a potentially explosive environment, please ensure that the motor is properly certified.
WARNING		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
WARNING		Lock out driver power to prevent accidental start-up and physical injury.
WARNING		The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
WARNING		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
WARNING		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
WARNING		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.

WARNING		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
CAUTION		The mechanical seal used in an ATEX classified environment must be properly certified. Prior to start up, ensure all points of potential leakage of process fluid to the work environment are closed.
CAUTION		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
WARNING		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
WARNING		Dynamic seals are not allowed in an ATEX classified environment.
WARNING		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		Shutdown, Disassembly, and Reassembly: Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.
WARNING		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
WARNING		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

WARNING		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 130ºF (54ºC) 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 ATEX Considerations and Intended Use

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

Description of ATEX

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

Guidelines for compliance

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

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

The ATEX conformance is only applicable when the pump unit is operated within its intended use. Operating, installing or maintaining the pump unit in any way that is not covered in the Instruction, Operation, and Maintenance manual (IOM) can cause serious personal injury or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT Goulds Pumps. If there is any question regarding the intended use of the equipment, please contact an ITT Goulds representative before proceeding.

Current IOMs are available at https://www.gouldspumps.com/en-US/Tools-and-Resources/Literature/IOMs/ or from your local ITT Goulds Pumps Sales representative.

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

Figure 1: Typical ATEX pump nameplate

Table 2: Temperature class definitions

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

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

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

II - Group – Non Mining Equipment

2 = Category 2

G/D = Gas and Dust present

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

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

1.6 Parts

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

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

2 General Information

2.1 Pump description

Model	Pump Description	Size Groups	No. of Sizes
 3196 CC	This model has five (5) hydraulic pump sizes. It has a casing which is ANSI B73 dimensionally compliant and open impeller design.	MTX	5
 CV 3196 CC	This model has two (2) pump sizes. It is a horizontal overhung, recessed impeller, centrifugal pump specifically designed to handle bulky or fibrous solids, air, gas or shear sensitive liquids.	MTX	2
 3796	This model has three (3) hydraulic pump sizes. The 3796 is a horizontal overhung, self priming, open impeller, centrifugal pump.	MTX	3

2.2 ANSI Family Parts Commonality

All of Goulds Pumps horizontal ANSI pumps share the same stuffing box covers and seal chambers. The non-metallic units all have unique casings, impellers, and seal chambers. The chart on the following pages demonstrates the parts commonality and the relationship between the model lines.

Model	**Casing**	**Impeller**
3196 CC	The casing is top centerline discharge and self-venting. The gasket is fully confined. ANSI class 150 flanges are standard. The pump is mounted on the casing feet as well as the motor for solid support. Flange-to-flange dimensions meet ANSI B73.	The impeller is fully open and threaded to the shaft. Threads are sealed from the pumpage by an 0-ring (PTFE). The impeller is the same as used in the conventional Models 3196 and 3796 with the exception it has an anti-rotation option.
3796 CC	The casing is top centerline discharge and self-venting. It has an integrally cast priming chamber that allows the pump to evacuate air to prime itself. The gasket is fully confined. An integral foot support is used for maximum resistance to misalignment and distortion from piping loads. ANSI class 150 raised face serrated flanges are available as an option. The casing comes with a provision to accept an immersion heater to keep the liquid in the priming chamber from freezing in outdoor applications.	
CV 3196 CC	The casing is tangential discharge and has a fully confined gasket. ANSI flat faced 150 # flanges are standard. The pump is mounted on	The impeller is fully open and recessed from the casing. It has curved vanes and is threaded to the shaft. The threads are sealed from the pumpage

Model	Casing	Impeller
	the casing feet as well as the motor feet for solid support.	by a PTFE ring. The impeller is the same as used in the CV 3196 with the exception it has an anti-rotation option.
	The 3196 CC, CV 3196 CC, and 3796 use the same seal chambers. These are also inter-changeable with the following other Goulds Models: 3196, CV 3196, HT 3196, and LF 319.	Frame Adapter - The frame adapters for the 3196 CC, CV 3196 CC, and 3796 are each machined specifically for the pump / motor combinations.

2.3 Nameplate information

Every pump has a Goulds nameplate that provides information about the pump. The nameplate is located on the casing.

Pump Casing Tag - provides information about the pump's hydraulic characteristics. Note the format of the pump size: Discharge x Suction - Nominal maximum Impeller Diameter in inches. (Example: 2x3-8) (Figs. 2 & 3).

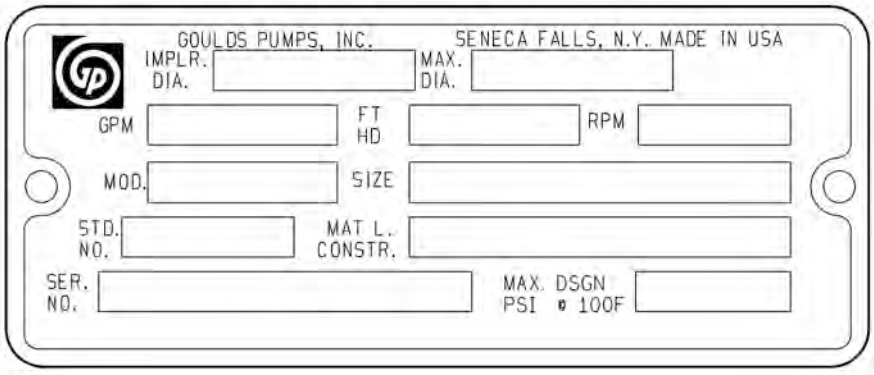


Figure 2: English nameplate

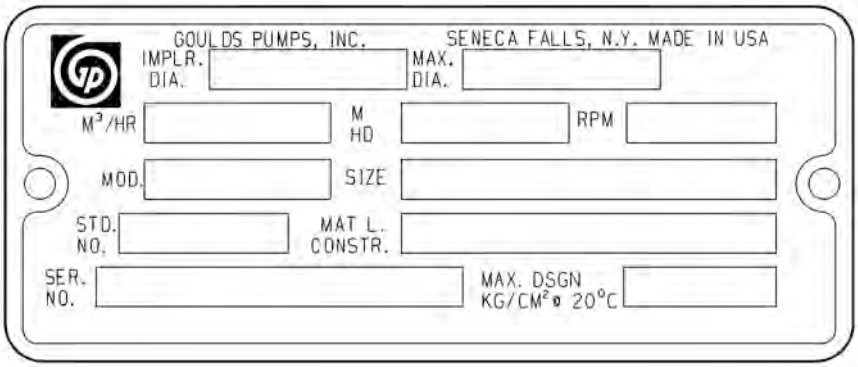


Figure 3: Metric nameplate

2.4 Receiving the pump

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

2.4.1 Storage requirements

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

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

NOTICE:

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

2.4.2 Handling

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

Use care when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pump using a suitable sling, under the suction flange and motor. Baseplate mounted units can also be moved with slings under the pump casing and driver. See and Figure 5: Proper lifting of pump using slings on page 13 for examples of proper lifting techniques.

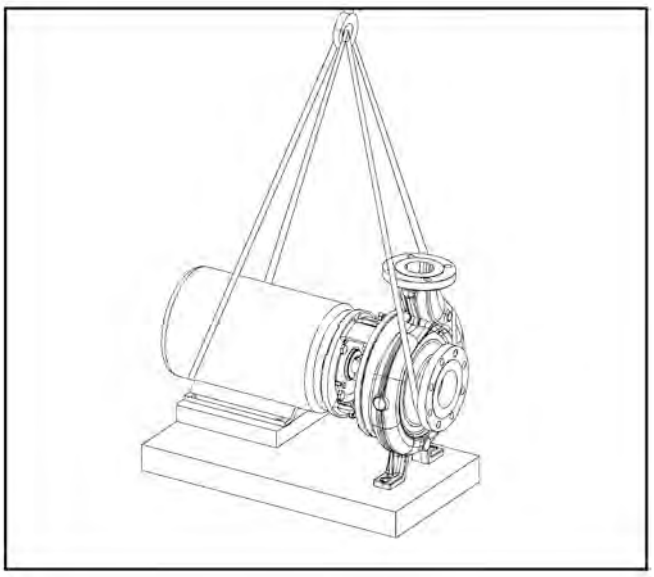


Figure 4: Proper lifting of pump mounted on baseplate using slings

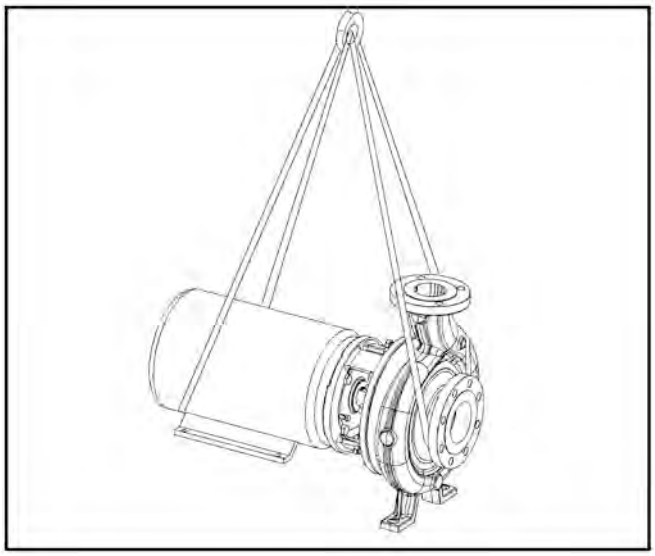


Figure 5: Proper lifting of pump using slings

3 Installation

3.1 Baseplate inspection

1. Remove all equipment.
2. Completely clean the underside of baseplate. It is sometimes necessary to coat the underside of the baseplate with an epoxy primer. This may have been purchased as an option.
3. Remove the rust preventative solution from the machined pads with an appropriate solution.

3.2 Site / foundation

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

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

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

Foundation bolts commonly used are sleeve type Figure 6: Sleeve type foundation bolts on page 14 and J type Figure 7: J type foundation bolts on page 15. Both designs permit movement for final bolt adjustment.

1. Inspect foundation for dust, dirt, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it.

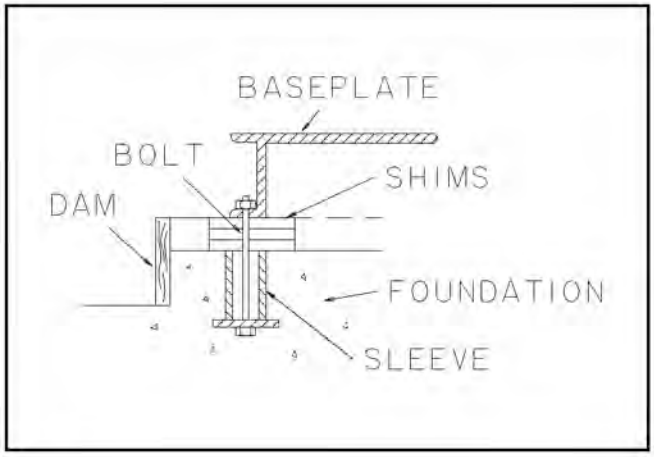


Figure 6: Sleeve type foundation bolts

2. Prepare the foundation in accordance with the grout manufacturer's recommendations.

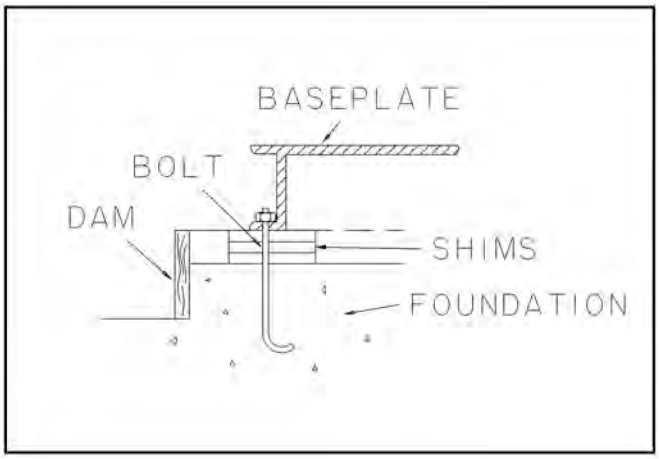


Figure 7: J type foundation bolts

3.3 Level baseplate

3.3.1 Fabricated steel

1. Place two sets of wedges or shims on the foundation, one set on each side of every foundation bolt (Fig. 8 & 9). The wedges should extend 20mm | .75 in. to 40mm | 1.50 in. above foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.
2. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

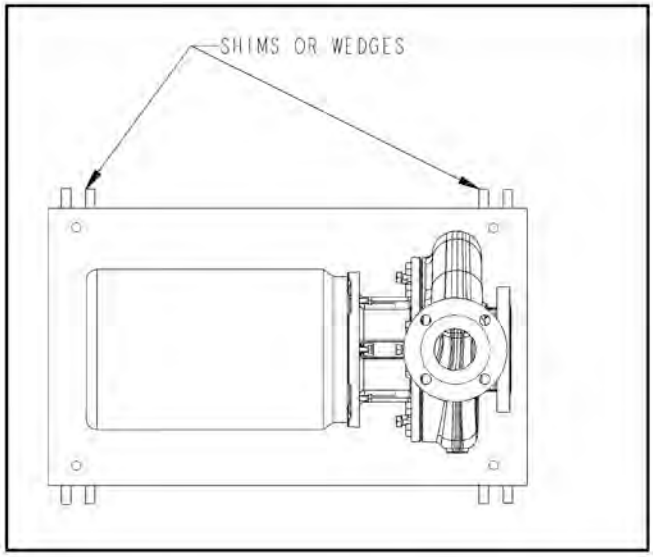


Figure 8:

3. Carefully lower baseplate onto foundation bolts.
4. Level baseplate to within 3.2mm | .125 in. over length of the baseplate and to within 1.5mm | .088 in. over the width of the base by adjusting wedges.
5. A level should be placed across the pump mounting pads and the motor mounting pads.
6. Hand tighten the bolts.

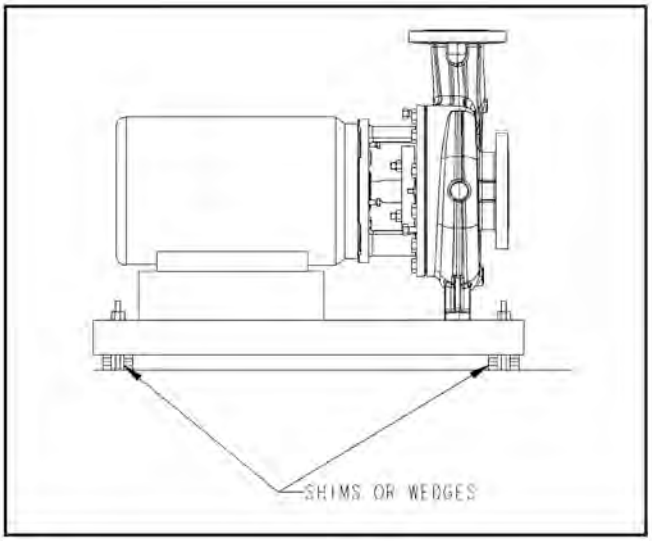
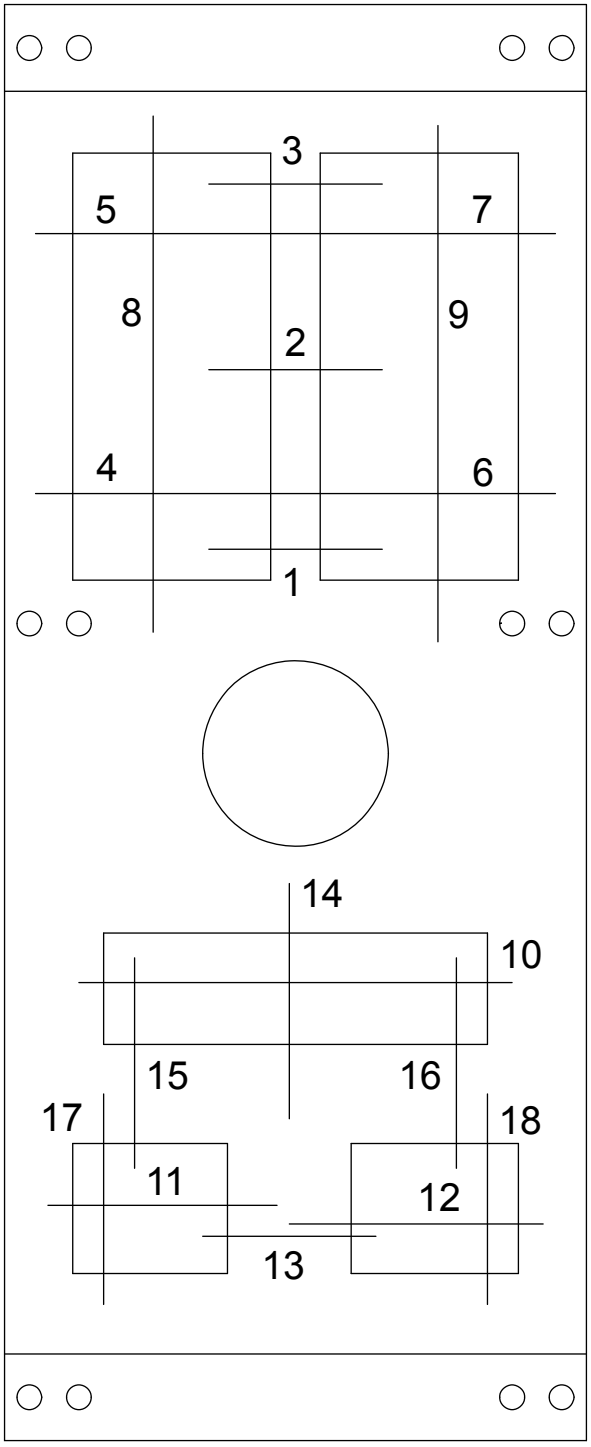


Figure 9:

3.4 Baseplate-leveling worksheet

Level measurements



1)_____

2)_____

3)_____

4)_____

5)_____

6)_____

7)_____

8)_____

9)_____

10)_____

11)_____

12)_____

13)_____

14)_____

15)_____

16)_____

17)_____

18)_____

3.5 Grout baseplate

1. Clean areas of baseplate that will contact grout. Do not use oil-based cleaners because grout will not bond to it. Refer to grout manufacturer's instructions.
2. Build dam around foundation. Thoroughly wet foundation (Fig. 10).

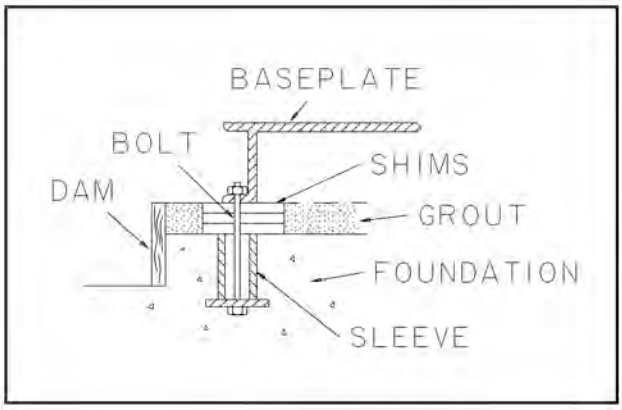


Figure 10:

3. Pour grout through grout hole in baseplate, up to level of dam. Remove air bubbles from grout as it is poured by puddling, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.
4. Allow grout to set.
5. Fill remainder of baseplate with grout. Remove air as before (Fig. 11).

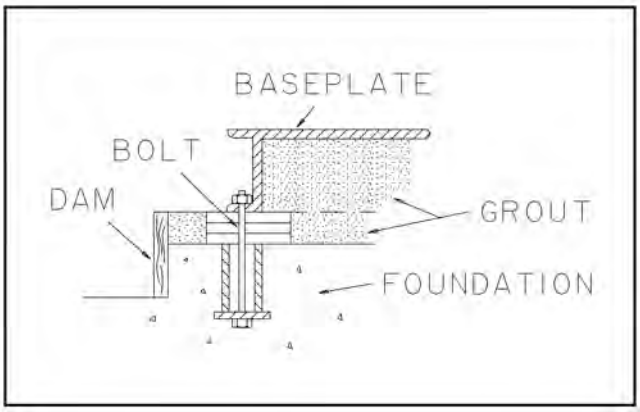


Figure 11:

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

3.5.1 Alignment check

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

3.6 Piping

3.6.1 General

Guidelines for piping are given in the "Hydraulic Institute Standards" available from: Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802 and must be reviewed prior to pump installation.

WARNING:
Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.

1. All piping must be supported independently of, and line up naturally with, the pump flanges.
2. Piping runs should be as short as possible to minimize friction losses.

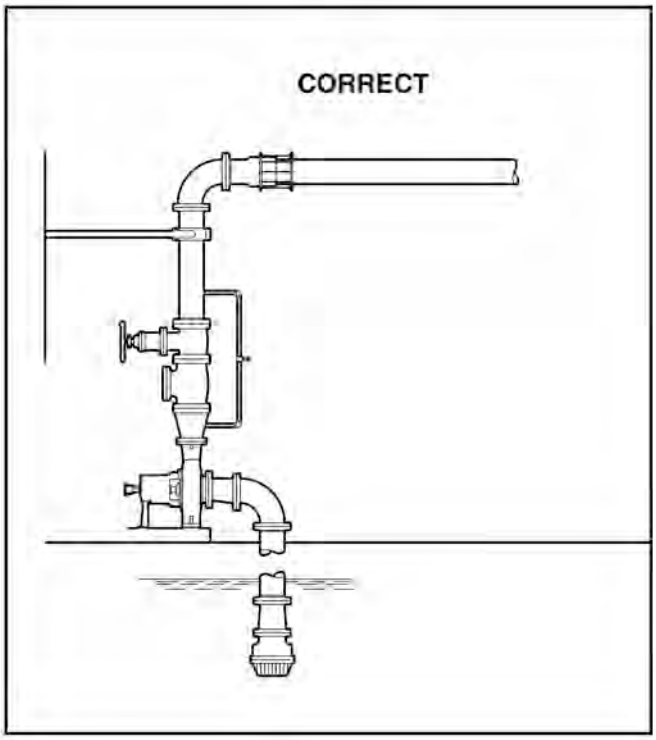


Figure 12: Correct

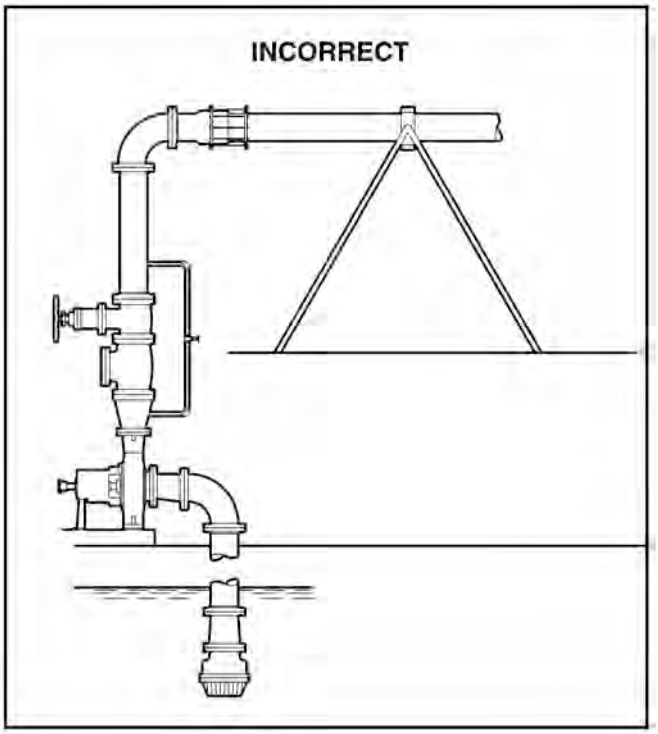


Figure 13: Incorrect

3. Do not connect piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.
4. It is suggested that expansion loops or joints, if used, be properly installed in suction and/or discharge lines when handling liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment (Fig. 12 & 13).
5. The piping should be arranged to allow pump flushing prior to removal of the unit on services handling corrosive liquids.
6. Carefully clean all pipe parts, valves and fittings, and pump branches prior to assembly.

3.6.2 Suction piping

WARNING:
NPSHA must always exceed NPSHR as shown on Goulds performance curves received with order. Reference Hydraulic Institute for NPSH and pipe fraction values needed to evaluate suction piping.

Properly installed suction piping is a necessity for trouble-free pump operation. Suction piping should be flushed before connection to the pump.

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of two pipe diameters of straight pipe between the elbow and suction inlet. Where used, elbows should be long radius (Fig. 14).

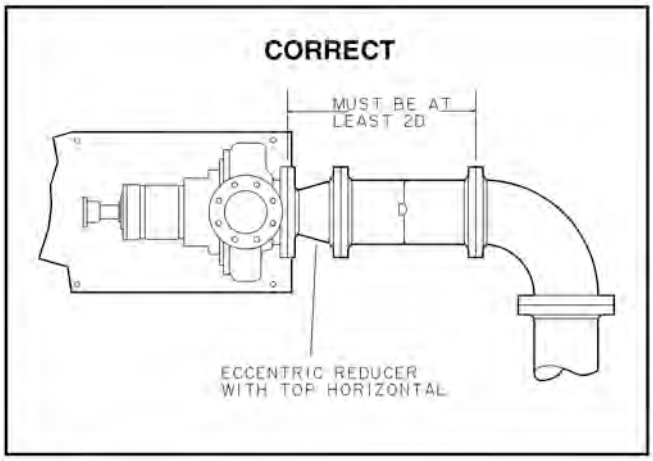


Figure 14: Correct

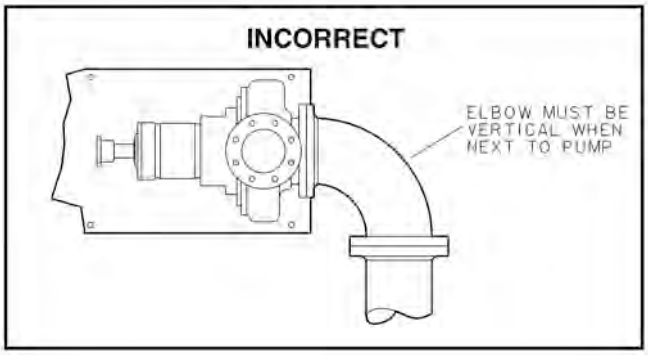


Figure 15: Incorrect

2. Use suction pipe one or two sizes larger than the pump suction, with a reducer at the suction flange. Suction piping should never be of smaller diameter than the pump suction.
3. Reducers should be eccentric at the pump suction flange with sloping side down and horizontal side at the top (Fig. 16, 17, 18).

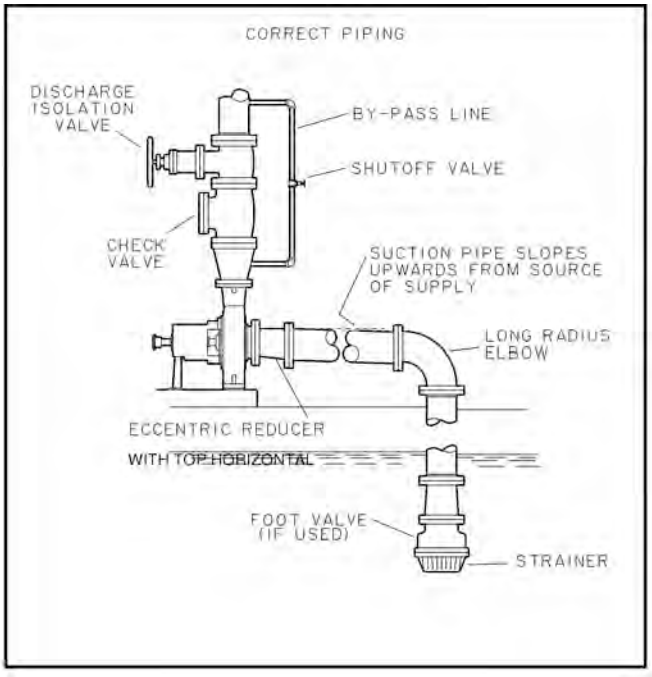


Figure 16:

CAUTION:
Pump must never be throttled on suction side.

4. Suction strainers, when used, must have a net "free area" of at least three times the suction pipe area.
5. Separate suction lines are recommended when more than one pump is operating from the same source of supply.

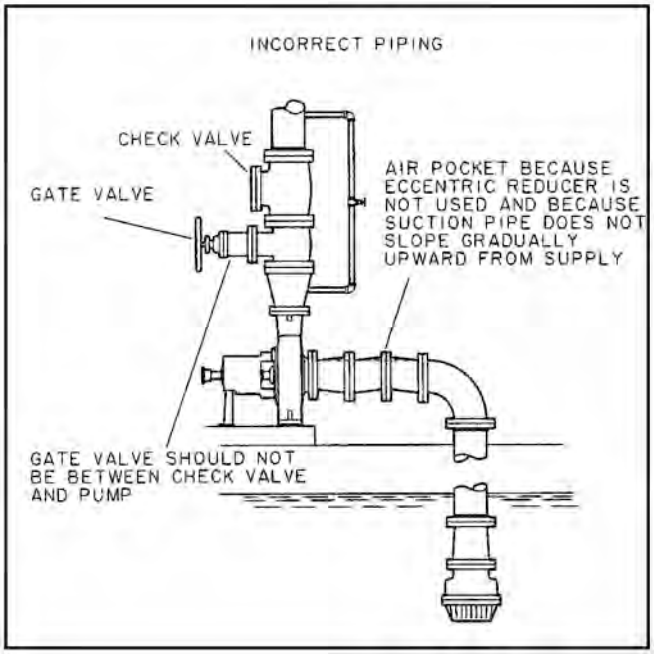


Figure 17:

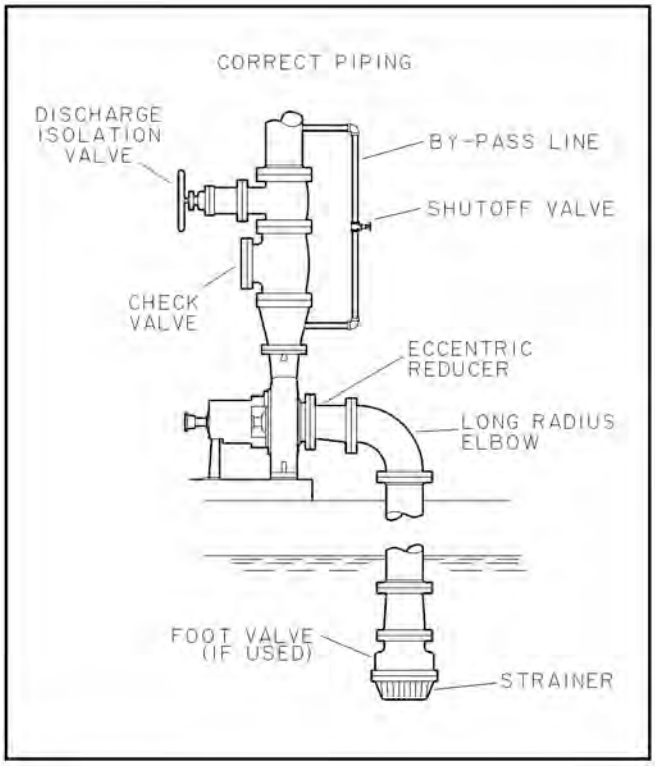


Figure 18:

Suction Lift Conditions

1. Suction pipe must be free from air pockets.
2. Suction piping must slope upwards to pump.
3. All joints must be air tight.
4. A means of priming the pump must be provided, such as a foot valve, except for the 3796 self priming pump.

Suction Head / Flooded Suction Conditions

1. An isolation valve should be installed in the suction line at least two pipe diameters from the suction to permit closing of the line for pump inspection and maintenance.
2. Keep suction pipe free from air pockets.
3. Piping should be level or slope gradually downward from the source of supply.
4. No portion of the piping should extend below pump suction flange.
5. The size of entrance from supply should be one or two sizes larger than the suction pipe.
6. The suction pipe must be adequately submerged below the liquid surface to prevent vortices and air entrainment at the supply.

3.6.3 Discharge piping

1. Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump. This will permit inspection of the check valve. The isolation valve is required for priming, regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.
2. Increasers, if used, should be placed between pump and check valves.

3. Cushioning devices should be used to protect the pump from surges and water hammer if quick-closing valves are installed in system.

3.7 Final piping check

After connecting the piping to pump:

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment, per the alignment procedure outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.

4 Operation

4.1 Preparation for Start-up

4.2 Checking rotation

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

1. Unlock driver power.
2. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation must correspond to arrow on bearing housing.
3. Correct if necessary.

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

4.2.1 Check impeller clearance

Refer to 5 Preventive Maintenance on page 33 for details.

4.2.2 Shaft sealing

Cartridge Mechanical Seals:

1. Slide the cartridge seal onto the shaft or sleeve until it contacts the inboard labyrinth oil seal.
2. Assemble the seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
3. Slide the cartridge seal into the seal chamber and secure using the four studs and nuts.
4. Continue the pump reassembly per the instructions in 6 Disassembly & reassembly on page 38.
5. Tighten the set screws in the seal locking ring to secure the seal to the shaft.
6. Remove the centering clips from the seal.

Conventional Inside Component Mechanical Seal:

1. Assemble the seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
2. Apply bluing to the shaft/sleeve at the face of the seal chamber.
3. Continue the complete reassembly of the pump, less the mechanical seal.
4. Set the impeller clearance per the instructions in 5 Preventive Maintenance on page 33.
5. Scribe a line on the blued shaft/sleeve at the face of the seal chamber.
6. Remove the casing, impeller, and seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
7. Slide the gland (with the stationary seat and gland gasket installed) onto the shaft until it contacts the inboard labyrinth oil seal.

Table 3: Impeller Clearances

Cold Temcerature Clearances for Various Service Temceratures, inches(mm)

Service Temperature	3196						LF3196		CV3196*1		3796	
	STX		MTX/LTX		XLTX/X17		STXMTX/LTX		STX MTX/LTX XLTX		STXMTX/LTX	
	inches	mm	inches	mm	inches	mm	inches	mm	In-ches	mm	in-ches	mm
-20 to 150°F (-29 to 66°C)	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Up to 175°F (79°C)	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Uo to 200°F /93°Cl	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Uo to 250°F (121°C)	0.006	0.16	0.009	0.23	0.016	0.41	0.016	0.41	0.06	1.52	0.016	0.41

8. Install the mechanical seal rotary unit per the manufacturer's instructions using the scribed line and the seal reference dimension.
9. Reassemble the seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
10. Slide the gland on the seal chamber studs and secure with the gland nuts. Be sure to tighten the nuts evenly such that the gland is seated on the seal chamber pilot and is perpendicular to the shaft.
11. Complete the reassembly of the pump per the instructions in 6 Disassembly & reassembly on page 38.

*1 For Model CV3196, clearance is set from the back of the impeller to the stuffing box cover/ seal chamber/ backplate.

Conventional Outside Component Mechanical Seal:

1. Assemble the seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
2. Apply bluing to the shaft/sleeve at the face of the seal chamber.
3. Continue the complete reassembly of the pump, less the mechanical seal.
4. Set the impeller clearance per the instructions in 4 Operation on page 25.
5. Scribe a line on the blued shaft/sleeve at the face of the seal chamber.
6. Remove the casing, impeller, and seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
7. Install the mechanical seal rotary unit per the manufacturer's instructions using the scribed line and the seal reference dimension. Be sure to secure the rotary unit in place using the set screws in the locking ring.
8. Install the gland (with the stationary seat and gland gaskets installed) on the seal chamber.
9. Reassemble the seal chamber per the instructions in 6 Disassembly & reassembly on page 38.
10. Complete the reassembly of the pump per the instructions in 6 Disassembly & reassembly on page 38.

Connection of Sealing Liquid:

For satisfactory operation, there must be a liquid film between seal faces to lubricate them. Refer to the seal manufacturer's drawing for the location of the taps. Some methods which may be used to flush/cool the seal are:

1. Product Flushing- In this arrangement, the pumpage is piped from the casing (and cooled in an external heat exchanger, when required) then injected into seal gland.

2. External Flush - A clean, cool compatible liquid is injected from an outside source directly into the seal gland. The flushing liquid must be at a pressure of 5-15 psi (0.35-01 kg/cm2) greater than the seal chamber pressure. Injection rate should be ½-2 GPM (2-8 LPM).
3. Other methods may be used which make use of multiple gland connections and/or seal chamber connections. Refer to the documentation supplied with the pump, mechanical seal reference drawing, and piping diagrams.

Packed Stuffing Box Option:

Models 3196 CC and CV 3196 CC pumps are shipped without packing, lantern ring or split gland installed. These are included with the box of fittings shipped with the pump and must be installed before start-up.

Installation of Packing:

1. Carefully clean stuffing box bore.
2. Twist the packing just enough to get it around the shaft (Fig. 19, 20).

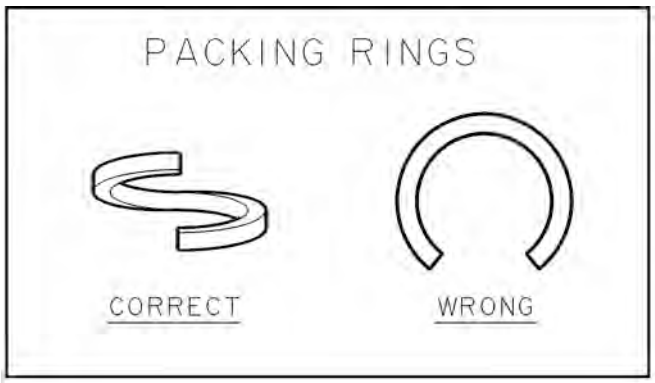


Figure 19:

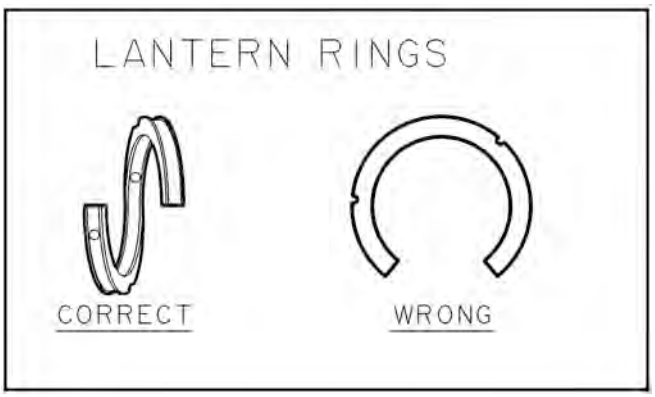


Figure 20:

3. Insert packing, staggering the joints in each ring by 90°.
4. The stuffing box arrangement in order of installation is: 2 packing rings, lantern ring (two-piece), then 3 packing rings.

CAUTION:
Follow instructions to ensure the lantern ring is located at the flushing connection (Fig. 21). Otherwise, no flush will be obtained.

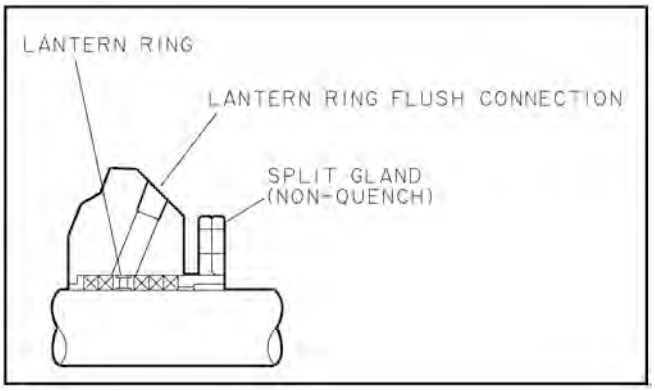


Figure 21:

5. Install the gland halves and evenly hand tighten the nuts.

Connection of Sealing Liquid:

If the stuffing box pressure is above atmospheric pressure and the pumpage is clean, normal gland leakage of 40-60 drops per minute is usually sufficient to lubricate and cool the packing and sealing liquid is not required.

NOTICE:
Otherwise, a product flush can be used if a clean pumpage exists.

An external sealing liquid is required when:

1. Abrasive particles in the pumpage could score shaft sleeve.
2. Stuffing box pressure is below atmospheric pressure due to the pump running with a suction lift, or when the suction source is under a vacuum. Under these conditions, packing will not be cooled and lubricated and air will be drawn into the pump.

If an outside source of clean compatible liquid is required, the pressure should be 15 psi (1.0 kg/cm2) above the suction pressure. The piping should be connected to the lantern ring connection with a 40-60 drops-per-minute leak rate.

NOTICE:
Most packing requires lubrication. Failure to lubricate packing may shorten the life of the packing and pump.

4.2.3 Priming pump

(3196 CC and CV 3196 CC)

Never start the pump until it has been properly primed. Several different methods of priming can be used, depending upon type of installation and service involved.

Suction Supply Above Pump

1. Slowly open the suction valve (Fig. 22).

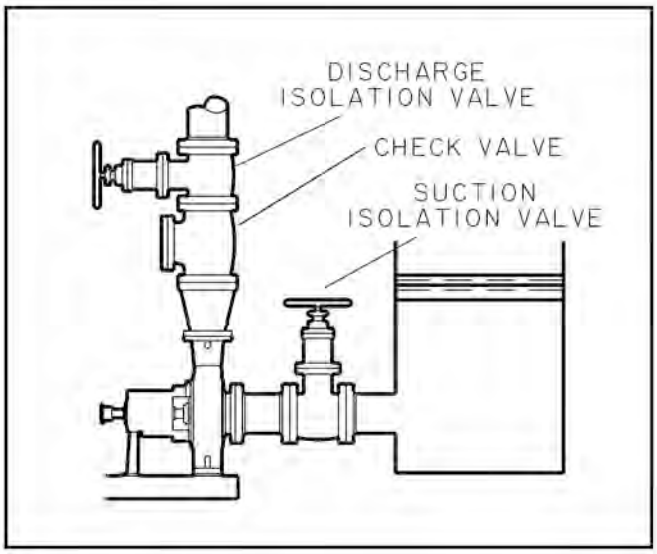


Figure 22:

2. Open air vents on the suction and discharge piping until water flows out.
3. Close the vent valves.

Suction Supply Below Pump (Except 3796)

A foot valve and outside source of liquid may be used to prime the pump. Outside source of liquid can come from a priming pump, pressurized discharge line, or other outside supply (Fig. 23 and 24).

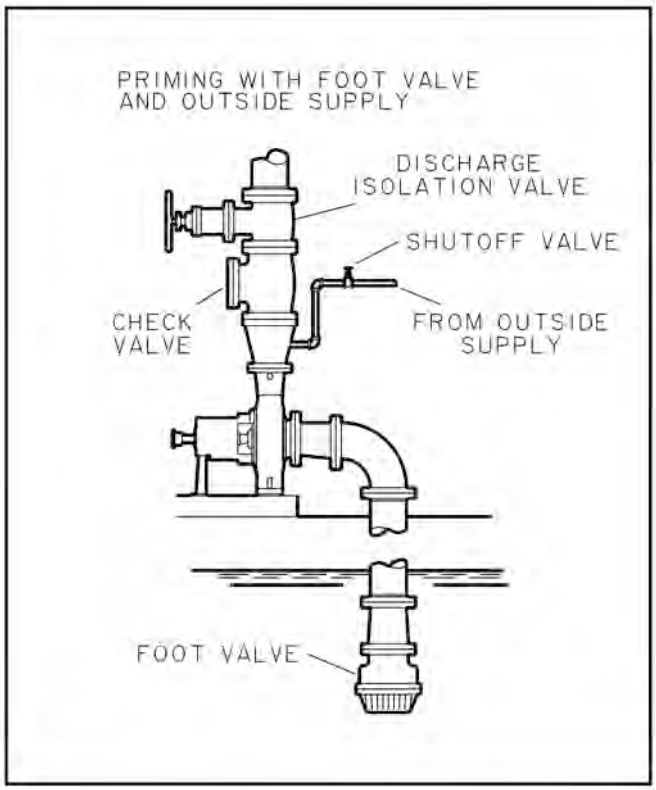


Figure 23:

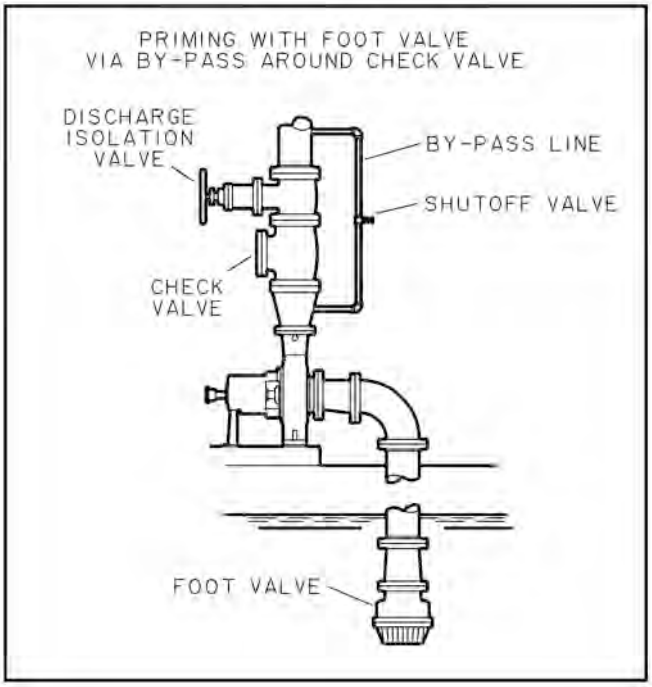


Figure 24:

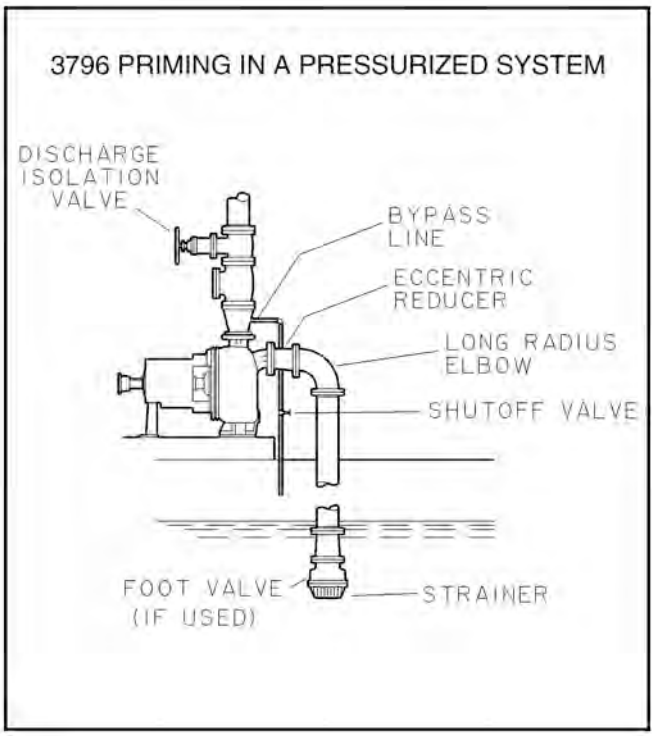


Figure 25:

NOTICE:

Model 3796 is a self-priming pump and does not require the use of a foot valve in the suction line. Refer to the pump's performance curve to determine the time required for priming.

1. Close discharge valve and open air vents in casing.

2. Open valve in outside supply line until only liquid escapes from vent valves.
3. Close the vent valves and then the outside supply line.

Suction Supply Below Pump - 3796

NOTICE:
The 3796 is a self priming pump and does not require manual priming prior to start-up (except for the initial charge). However, in a pressurized system, the pump requires an air vent or a permanent bypass line in the discharge piping to vent the evacuated air.

4.2.4 Other methods of priming:

1. Priming by Ejector.
2. Priming by Automatic Priming Pump.

4.2.5 Start-up precautions

1. All equipment and personal safety related devices and controls must be installed and operating properly.
2. To prevent premature pump failure at initial start-up due to dirt or debris in the pipe system, ensure the pump can be run continuously at full speed and flow for 2 to 3 hours.
3. Variable speed drivers should be brought to rated speed as quickly as possible.
4. Variable speed drivers should not be adjusted or checked for speed governor or overspeed trip settings while coupled to the pump at initial start-up. If settings have not been verified, uncouple the unit and refer to driver manufacturer's instructions for assistance.
5. Running a new or rebuilt pump at slow speeds may not provide enough flow to adequately flush and cool the stuffing box bushing's close running surfaces.
6. Pumpage temperatures in excess of 200° F (93° C) will require warm-up of pump prior to operation. Circulate a small amount of pumpage through the pump until the casing temperature is within 100° F (38° C) of the pumpage temperature and evenly heated.

NOTICE:
Warm-up rate should not exceed 1.4° C (5° F) per minute.

4.3 Starting pump

1. Make sure suction valve and any recirculation or cooling lines are open.
2. Fully close or partially open discharge valve as dictated by system conditions.
3. Start Driver.

CAUTION:
Immediately observe pressure gauges. If discharge pressure is not quickly attained – stop driver, reprime and attempt to restart.

Slowly open discharge valve until the desired flow is obtained.

CAUTION:
Observe pump for vibration levels, bearing temperature and excessive noise. If normal levels are exceeded, shut down and resolve.

4.4 Operation

4.4.1 General considerations

Always vary capacity with regulating valve in the dis charge line. Never throttle flow from the suction side.

Driver may overload if the pumpage specific gravity (density) is greater than originally assumed, or the rated flow rate is exceeded.

Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.

4.4.2 Operating at reduced capacity

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.

Damage occurs from:

1. Increased vibration levels - Affects bearings, stuffing box or seal chamber, and mechanical seal.
2. Increased radial loads - Stresses on shaft and bearings.
3. Heat build up - Vaporization causing rotating parts to score or seize.
4. Cavitation - Damage to internal surfaces of pump.

4.4.3 Operating under freezing conditions

Exposure to freezing conditions, while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside pump should be drained. Liquid inside cooling coils, if supplied, should also be drained.

4.5 Shutdown

1. Slowly close discharge valve.
2. Shut down and lock driver to prevent accidental rotation.

WARNING:
When handling hazardous and/or toxic fluids, proper personal protective equipment should be worn. If pump is being drained, precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.

5 Preventive Maintenance

5.1 General comments

A routine maintenance program can extend the life of your pump. Well maintained equipment will last longer and require fewer repairs. You should keep maintenance records, this will help pinpoint potential causes of problems.

5.2 Maintenance schedule

5.3 Routine maintenance

- Seal monitoring
- Vibration analysis
- Discharge pressure
- Temperature monitoring

5.4 Routine inspections

- Check for unusual noise and vibration.
- Inspect pump and piping for leaks.
- Check seal chamber/stuffing box leakage.
-
  - Mechanical Seal: Should be no leakage.
  - Packing: Excessive leakage requires adjustment or possible packing replacement. Refer to 5.7.2 Packed stuffing box on page 34 for packing gland adjustment.

5.5 Three month inspections

- Check the foundation and the hold-down bolts for tightness.
- If the pump has been left idle, check the packing. Replace if required

5.6 Annual inspections

- Check the pump capacity, pressure and power. If pump performance does not satisfy your process requirements, and the process requirements have not changed, the pump should be disassembled, inspected, and worn parts should be replaced. Otherwise, a system inspection should be done.

5.7 Maintenance of shaft seals

5.7.1 Mechanical seals

When mechanical seals are furnished, a manufacturer's reference drawing is supplied with the data package. This drawing should be kept for future use when performing maintenance and adjusting the seal. The seal drawing will also specify required flush liquid and attachment points. The seal and all flush piping must be checked and installed as needed prior to starting the pump.

The life of a mechanical seal depends on various factors such as cleanliness of the liquid handled and its lubricating properties. Due to the diversity of operating conditions it is, however, not possible to give definite indications as to its life.

WARNING:
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.

5.7.2 Packed stuffing box

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

The stuffing box is not packed at the factory and must be packed properly before operation of the pump. The packing is furnished in a box of fittings which accompany the pump. The packing used must be suitable for the pumpage. Make sure the stuffing box is clean. Examine shaft-sleeve for wear or scoring, replace if necessary.

Starting from the innermost ring, the packing is usually arranged as two packing rings, lantern ring, three packing rings, followed by the split gland. Insert single packing rings by twisting as shown in Figure 19: on page 27. Press each ring to ensure proper compression in the stuffing box. Stagger joints 90°.

Lightly and evenly tighten the gland. Excessive tightening will result in premature failure of the packing and shaft sleeve. After packing, it must be possible to rotate shaft by hand. Final adjustment of packing gland is made after pump is started.

5.8 Impeller clearance setting

WARNING:
Lock out driver power to prevent accidental startup and physical injury.

A change in pump performance may be noted over time by a drop in head or flow or an increase in power required. Performance can usually be renewed by adjusting the impeller clearance.

5.9 Feeler gauge method (all but CV)

1. If shims are already installed, loosen motor lock bolts (3708) and remove shims.
2. Loosen the jacking bolts (370D) and back out about four turns.
3. Begin tightening the motor lock bolts (3708) evenly, drawing the motor (338) towards the pump until the impeller contacts the casing. Turn shaft to ensure contact is made.
4. Use a feeler gauge to measure the gap between the motor face and the frame adapter (Fig. 26).

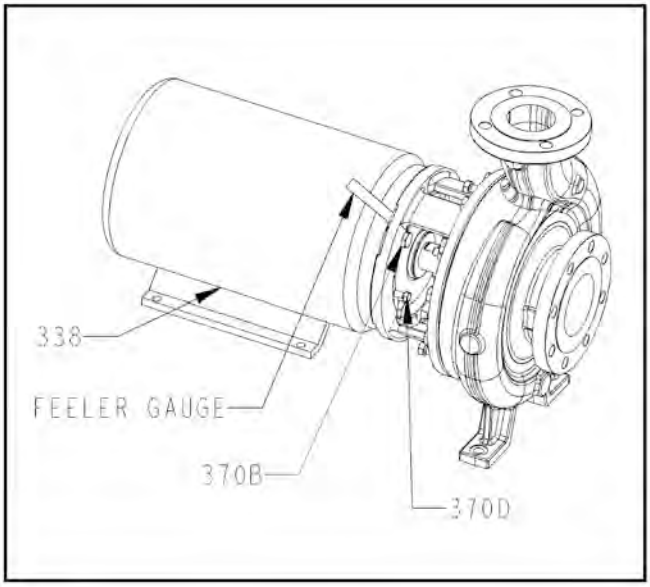


Figure 26:

5. Add to this measurement the impeller clearance required from Table 4: Impeller Clearances on page 36.

   Select four (4) sets of shim(s) (329B) equal to this thickness.

NOTICE:
In some cases, finding an exact match may not be possible. In this case, select the next closest size greater.

6. Loosen the motor locking bolts (370B). Using the jacking bolts (370D) back the motor (338) away from the pump until enough space is available to insert the shim(s) (329B).
7. Insert the shim(s) (329B) around the motor locking bolts (Fig. 27).

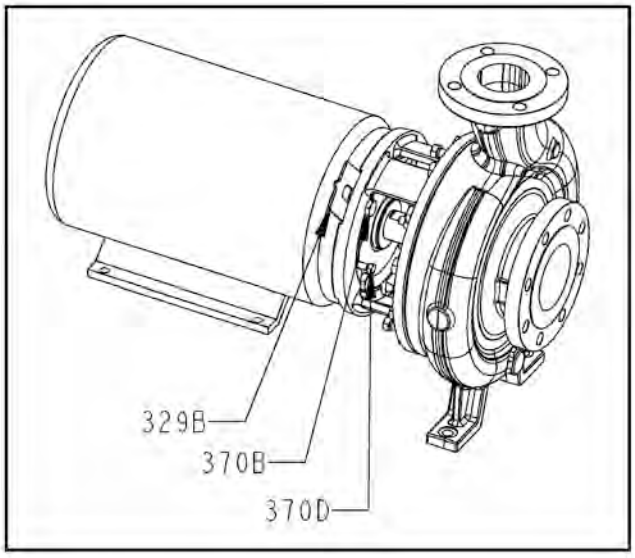


Figure 27:

8. Loosen the jacking bolts (370D).
9. Tighten the motor (338) locking bolts securely.
10. Check shaft for free turning.

5.10 Feeler gauge method (CV)

1. Loosen the motor locking bolts (370B).
2. Begin tightening the jacking bolts (370D) evenly, pushing the motor (338) away from the pump until the impeller contacts the cover. Turn shaft to ensure contact is made.
3. Use a feeler gauge to measure the gap between the motor (338) face and the frame adapter (Fig. 28).

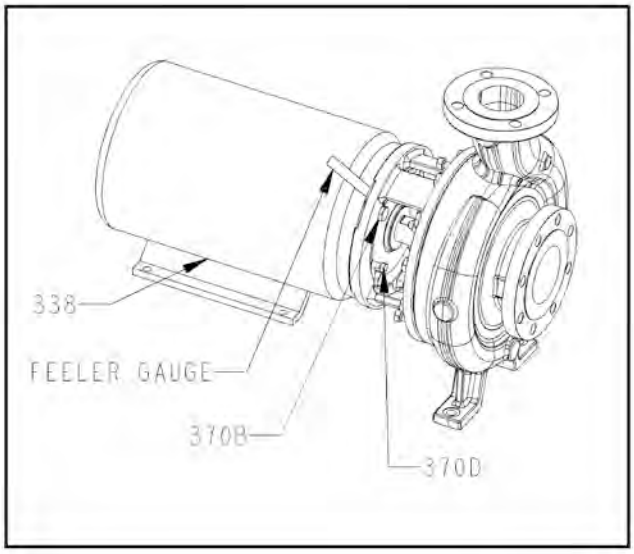


Figure 28:

4. Subtract from this measurement the impeller clearance required from Table 4: Impeller Clearances on page 36.
5. Select four (4) sets of shim(s) (329B) equal to this thickness.

NOTICE:
In some cases, finding an exact match may not be possible. In this case, select the next closest size greater.

6. Loosen the jacking bolts (370D). Tighten motor locking bolts (370B) securely.
7. Check shaft for free turning.

Table 4: Impeller Clearances

Cold Temoerature Clearances for Various Service Temoeratures inches Imm)												
Service Temoerature	3196						LF3196		CV3196*1		3796	
	STX		MTX/LTX		XLTX/X17		STXMTX/LTX		STX MTX/LTX XLTX		STXMTX/LTX	
	inches	mm	inches	mm	inches	mm	inches	mm	Inches	mm	inches	mm
-20 to 150°F (-29 to 66°C)	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Up to 175°F (79°C)	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Up to 200°F (93°C)	0.005	0.13	0.008	0.20	0.015	0.38	0.015	0.38	0.06	1.52	0.015	0.38
Up to 250°F (121°C)	0.006	0.16	0.009	0.23	0.016	0.41	0.016	0.41	0.06	1.52	0.016	0.41

*1

5.11 Troubleshooting

Problem	Probable Cause	Remedy
No liquid delivered.	Pump not primed.	Reprime pump, check that pump and suction line are full of liauid.
	Suction line cloqqed.	Remove obstructions.
	Impeller cloqqed with foreiqn material.	Back flush pump to clean impeller.
	Wrong direction of rotation.	Change rotation to concur with direction indicated by arrow on bearing housing or pump casing.
	Foot valve or suction pipe opening not submerqed enouqh.	Consult factory for proper depth. Use baffle to eliminate vortices.
	Suction lift too hiqh.	Shorten suction pipe.
No liquid delivered {3796)	Vent line not connected.	Pipe in vent line to expel air.
Pump not producing rated flow or head.	Air leak thru oasket.	Replace oasket.
	Air leak thru stuffinq box	Replace or readjust packinq/mechanical seal.
	Impeller partly cloqqed.	Back flush pump to clean impeller.
	Excessive impeller-to-casino clearance.	Adjust impeller clearance.
	Insufficient suction head.	Ensure that suction line shutoff valve is fully open and line is unobstructed.
	Worn or broken imoeller.	Insoect and reolace if necessarv.
Pump starts then stops pumping.	Improperly primed pump.	Reprime pump.
	Air or vapor pockets in suction line.	Rearranqe pipinq to eliminate air pockets.
	Air leak in suction line.	Repair {plua) leak.
Pump is noisy or vibrates.	Improper pump/driver alionment.	Alion shafts.
	Partly cloqqed impeller causinq imbalance.	Back-flush pump to clean impeller.
	Broken or bent impeller or shaft.	Replace as required.
	Foundation not rigid.	Tighten hold down bolts of pump and motor or adjust stilts.
	Worn bearinos.	Replace.
	Suction or discharge piping not anchored or properly supported.	Anchor per Hydraulic Institute Standards Manual recommendations
	Pump is cavitatino.	Locate and correct system problem.
Excessive leakage from stuffing box.	Packinq qland improperly adjusted.	Tiqhten qland nuts.
	Stuffinq box improperly packed.	Check packinq and repack box.
	Worn mechanical seal parts.	Replace worn parts.
	Overheatina mechanical seal.	Check lubrication and coolina lines.
	Shaft sleeve scored.	Remachine or replace as reauired.
Motor requires excessive power.	Head lower than rating. Pumps too much liquid.	Consult factory. Install throttle valve, trim impeller diameter.
	Liauid heavier than expected.	Check specific aravitv and viscositY.
	Stuffinq box packinq too tioht.	Readjust packino. Replace if worn.
	Rotating parts bind.	Check internal wearing parts for proper clearances.

6 Disassembly & reassembly

6.1 Required tools

- Wrenches
- Screwdriver
- Lifting Sling
- Rubber Mallet
- Dial Indicator
- Torque Wrench with Sockets
- Allen Wrenches
- Micrometer
- Cleaning Agents
- Feeler Gauges
- Leveling Blocks

6.2 Disassembly

WARNING:
Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.

WARNING:
The pump may handle hazardous and/or toxic fluids. 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.

NOTICE:
Before disassembling the pump for overhaul, ensure all replacement parts are available.

WARNING:
Lock out power supply to driver motor to prevent accidental startup and physical injury.

1. Shut off all valves controlling flow to and from pump

WARNING:

Operator must be aware of pumpage and safety precautions to prevent physical injury

2. Drain liquid from piping, flush pump if necessary

WARNING:

Allow all system and pump components to cool before handling them to prevent physical injury/

3. Disconnect all auxiliary piping and tubing.

4. Place sling from hoist through frame adapter (108) or frame and around bottom of motor (Fig. 29).

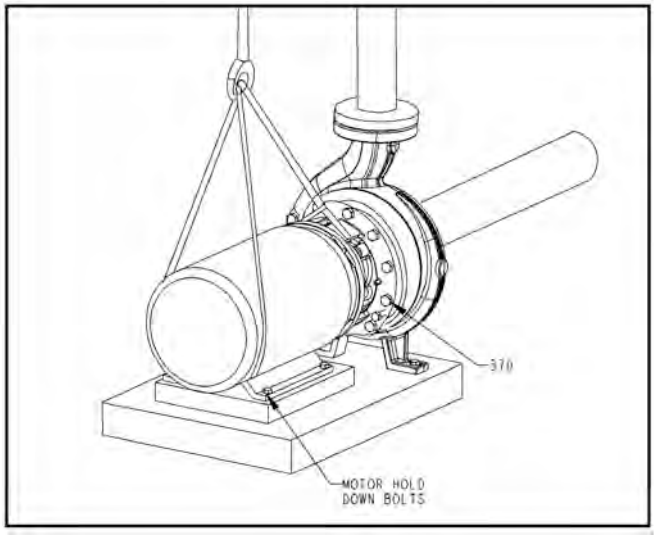


Figure 29:

5. Remove motor foot hold down bolts (see Figure 29: on page 39).
6. Remove casing bolts (370) (see Figure 29: on page 39).

WARNING:
Never apply heat to remove parts. Use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.

7. Remove back pull-out assembly from casing (100). Tighten jack screws evenly to remove back pull-out assembly.

NOTICE:
Penetrating oil can be used if adapter to casing joint is excessively corroded.

NOTICE:
Remove and then mark shims from under motor foot. Save for reassembly.

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

8. Remove casing gasket (351) and discard. (Replace with new gasket during reassembly.)
9. Remove jack screws (418).

NOTICE:
Casing gasket (351) may partially adhere to casing due to binders and adhesives in the gasket material. Clean all gasket surfaces.

10. Move back pull-out assembly to clean workbench.
11. Support frame adapter (108) securely to workbench.

6.2.1 Removal of impeller

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.

WARNING:
Wear heavy work gloves when handling impellers (101) as sharp edges may cause physical injury.

STX, MTX, & LTX

1. Remove impeller anti-rotation nut (458Y) from front of impeller. (This part will need to be replaced for proper sealing) (Fig. 30).

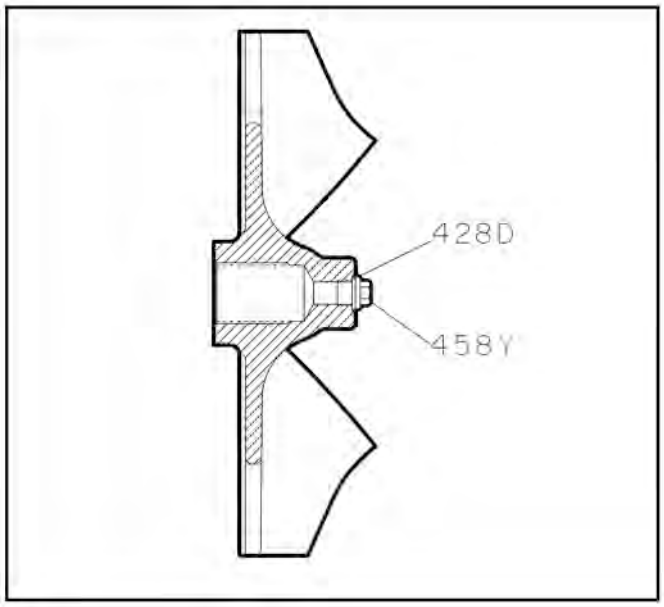


Figure 30:

2. Spray penetrating oil through the plug hole into the cavity at the end of the shaft. Wait 15 minutes. Rotate the shaft several times while waiting to distribute the oil.
3. Slide wrench over the shaft at location of flats (Fig. 31).

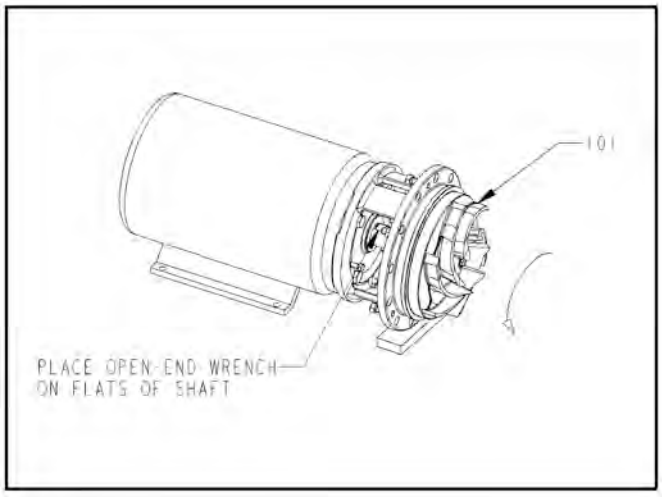


Figure 31:

4. Rotate the impeller clockwise (viewed from the impeller end of the shaft), raising the wrench.
5. Quickly turn the impeller counterclockwise (viewed from the impeller end of the shaft), impacting the wrench handle until the impeller loosens (Fig. 30).
6. Remove impeller 0-ring (412A) and discard. Replace with a new o-ring during reassembly (Fig. 32 and 33).

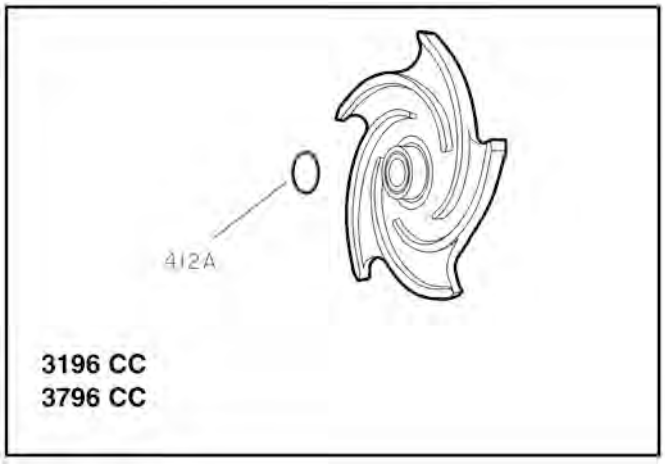


Figure 32:

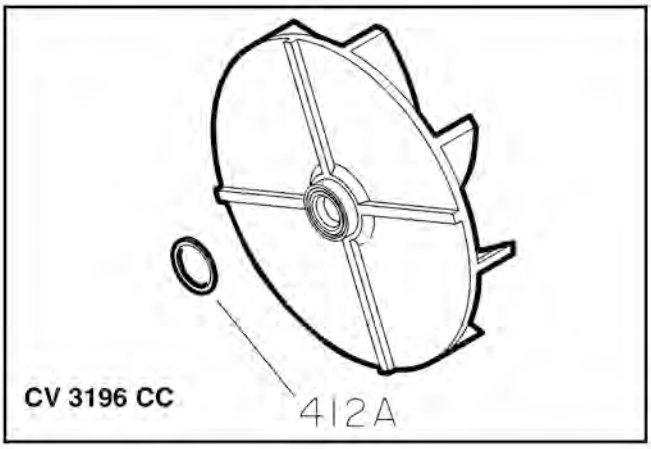


Figure 33:

NOTICE:
It is recommended that the motor foot be clamped to the workbench when using this method to remove the impeller.

6.3 Removal of seal chamber cover (mechanical seal)

1. Remove gland stud nuts (355).
2. Remove seal chamber stud nuts (370H).
3. Remove seal chamber (184) (Fig.34).

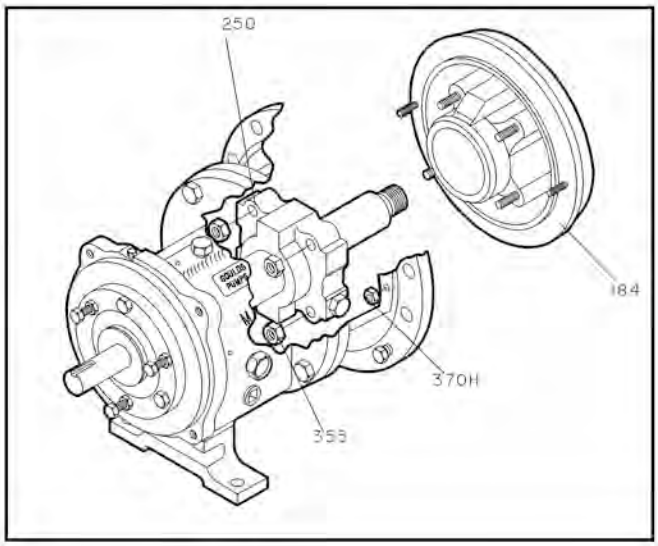


Figure 34:

4. Remove shaft sleeve (126), if used.

NOTICE:
Mechanical seal is attached to sleeve (126). Rotary portion of seal needs to be removed from sleeve by loosening set screws and sliding it off the sleeve. Refer to mechanical seal instructions.

5. Remove gland (250) with stationary seat and 0-ring (360Q).

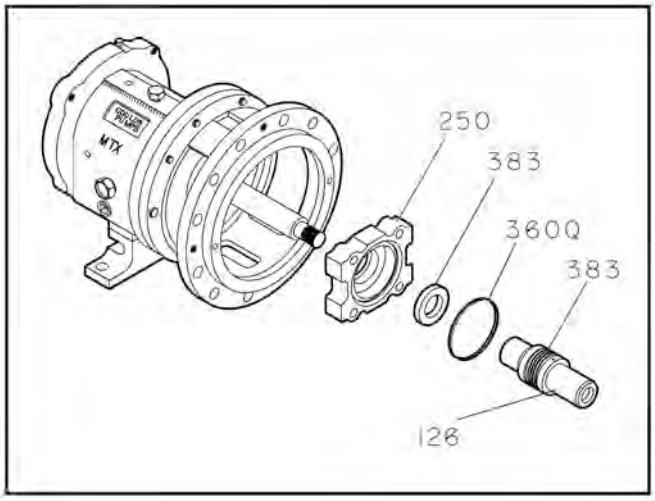


Figure 35:

NOTICE:
Be careful not to damage the stationary portion of the mechanical seal. It is seated in the gland bore.

6.4 Removal of stuffing box cover (packed box)

1. Remove gland stud nuts (355), and gland (107).
2. Remove stuffing box cover stud nuts (370H).
3. Remove stuffing box cover (184) (Fig. 36).

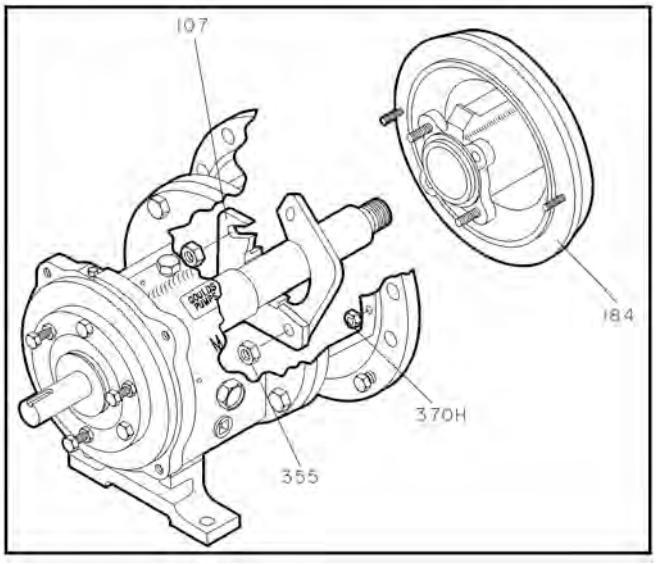


Figure 36:

4. Remove shaft sleeve (126) (Fig. 37).

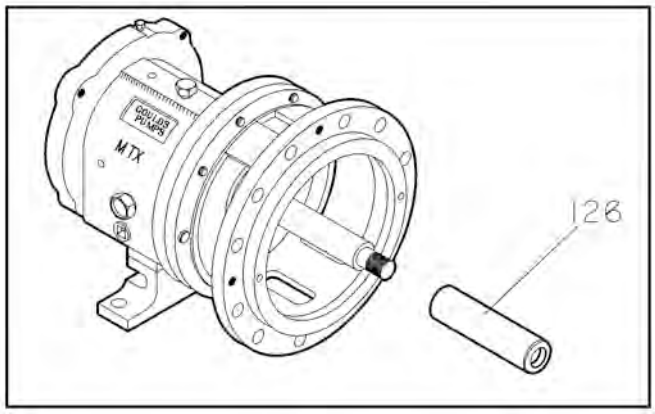


Figure 37:

5. Remove packing (106) and lantern ring (105) from stuffing box cover (184). No lantern ring is provided with self-lubricating graphite packing.

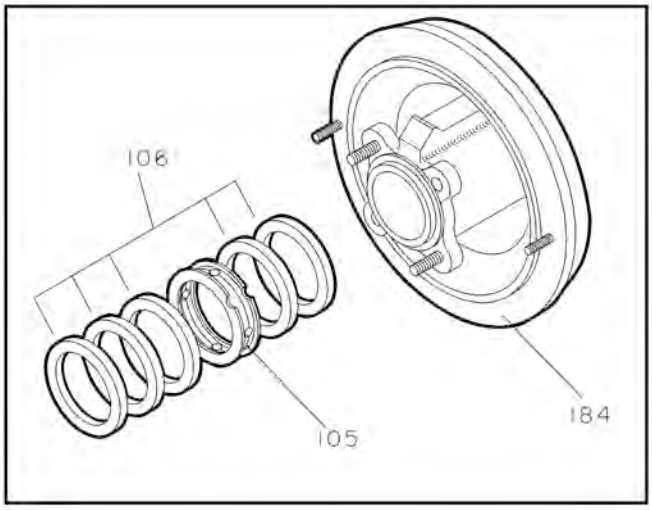


Figure 38:

6.5 Remove frame adapter

1. Remove motor lock bolts (3708) and shims.
2. Carefully, remove frame adapter (108) (Fig. 40).

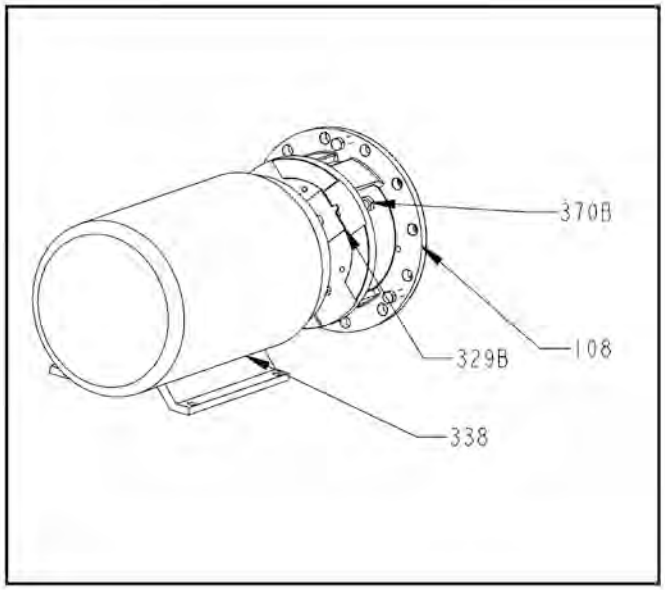


Figure 39:

WARNING:
Frame adapter (108) is heavy. Use proper lifting equipment when handling.

6.6 Remove inboard labyrinth oil seal (333A)

1. It is an O-ring fit into the bearing frame (228A) for STX, frame adapter (108) for MTX, LTX, XLT-X and X17. Remove 0-rings (497H), (497J) if necessary.

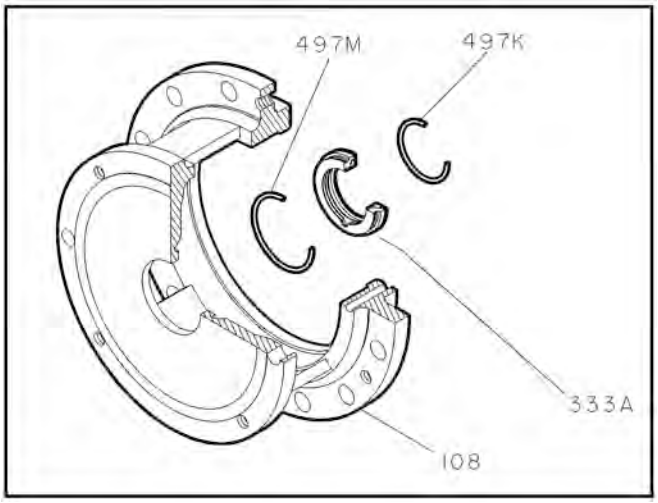


Figure 40:

NOTICE:
Labyrinth oil seal O-rings (497H, J) are part of 3196 maintenance kits or can be obtained separately.

6.7 Inspections

The pump parts must be inspected to the following criteria before they are reassembled to insure the pump will run properly. Any part not meeting the required criteria should be replaced.

NOTICE:
Clean parts in solvent to remove oil, grease or dirt. Protect machined surfaces against damage during cleaning.

6.7.1 Casing

The casing (100) should be inspected for cracks and excessive wear or pitting. It should be repaired or replaced if it exceeds the following criteria (Fig. 41, Fig. 42, and Fig. 43).

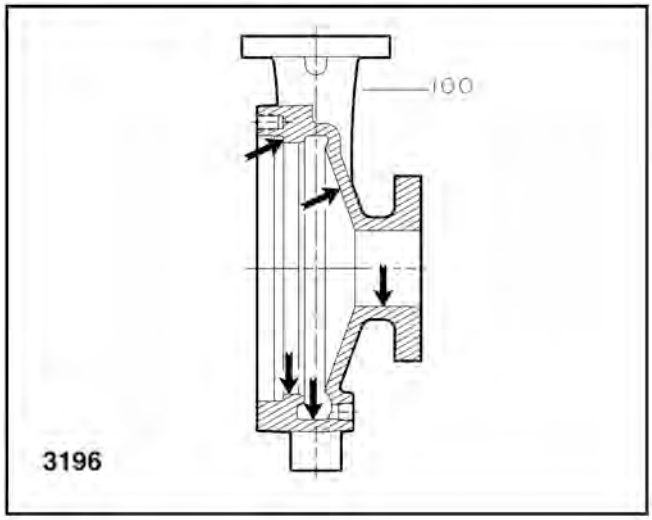


Figure 41:

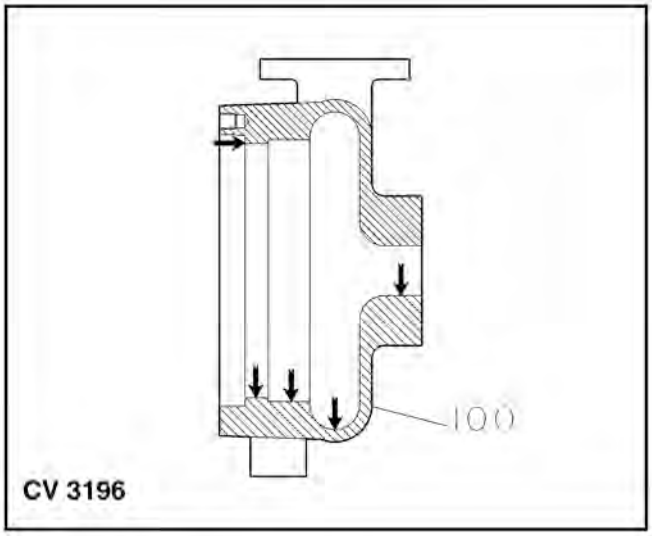


Figure 42:

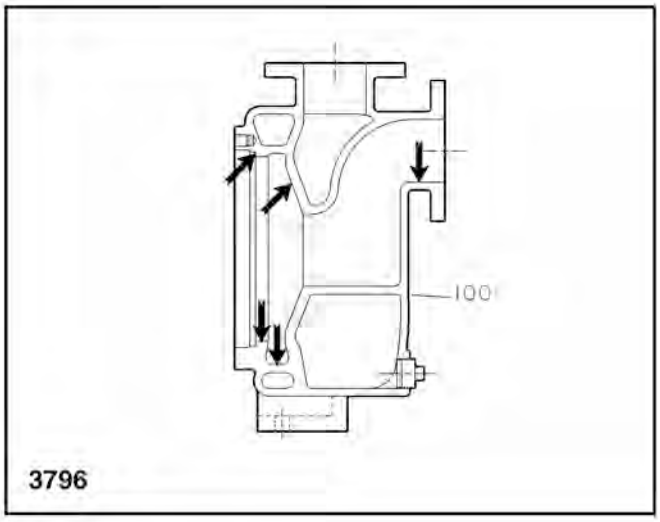


Figure 43:

1. Localized wear or grooving greater than 1/8 in. (2 mm) deep.
2. Pitting greater than 1/8 in. (2 mm) deep.
3. Inspect case gasket seat surface for irregularities.

6.7.2 Impeller

1. Inspect impeller (101) vanes for damage. Replace if grooved deeper that 1/16 in. (1.6 mm) or if worn evenly more than 1/32 in. (8 mm).

   (Area "a" in Fig 44)

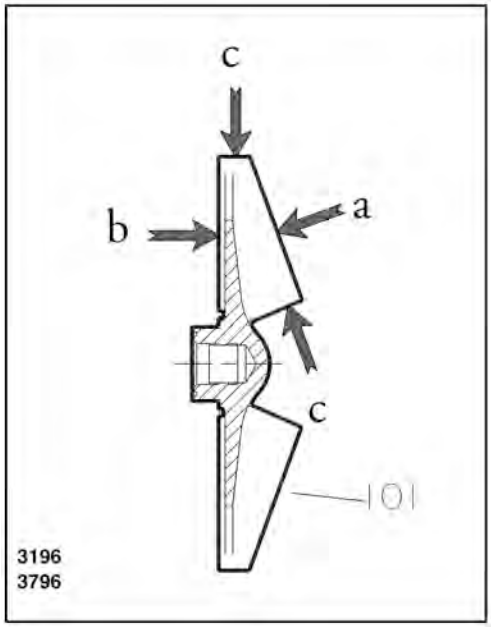


Figure 44:

2. Inspect pumpout vanes for damage. Replace if worn more than 1/32 in. (8 mm).

   (Area "b" in Fig. 44 & 45).

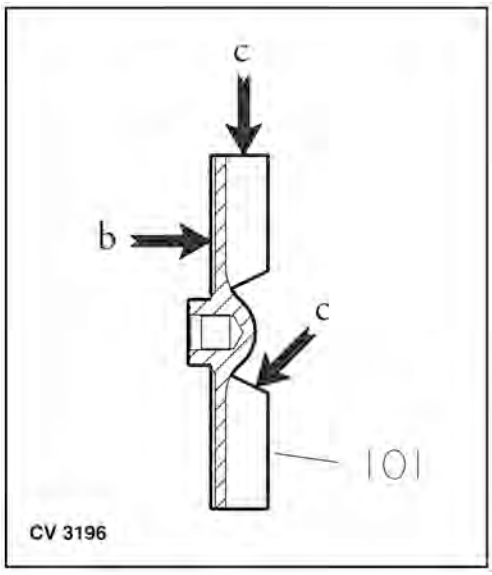


Figure 45:

3. Inspect leading and trailing edges of the vanes for cracks, pitting, and erosion or corrosion damage. (Area "c" in Fig. 44 & 45).

NOTICE:
For CV 3196 impeller, the face of the impeller is cast, not machined. The face runout need not be checked.

6.7.3 Seal Chamber/Stuffing Box Cover

1. Make sure seal chamber/stuffing box cover (184) gasket surface is clean at adapter face (Figs. 46, 47, 48).

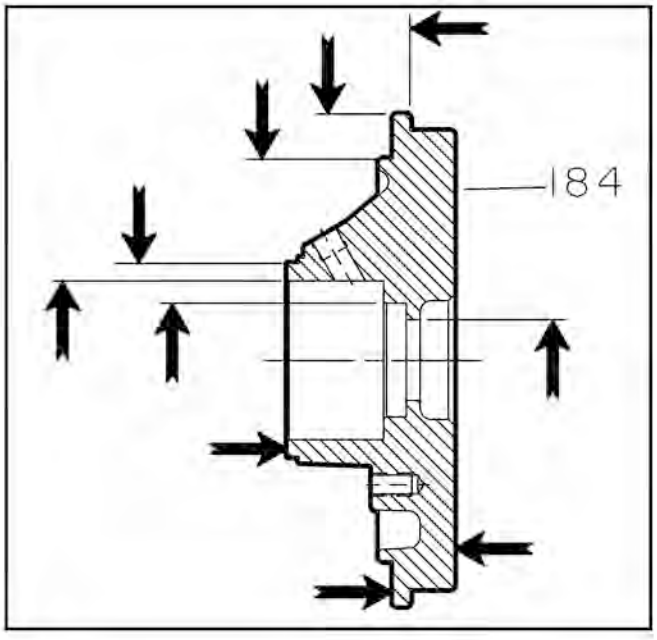


Figure 46:

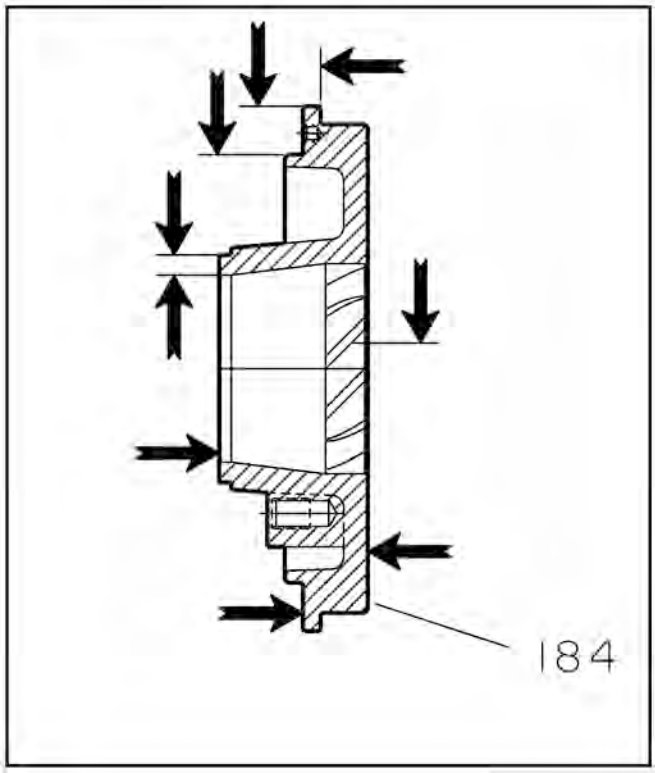


Figure 47:

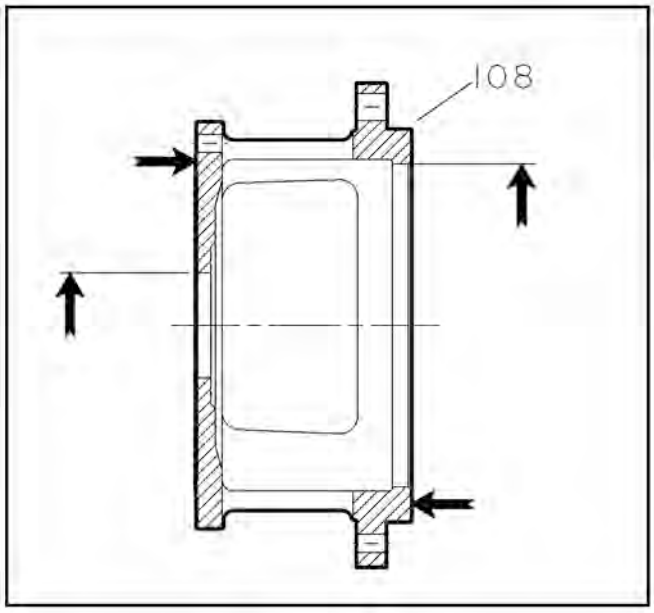
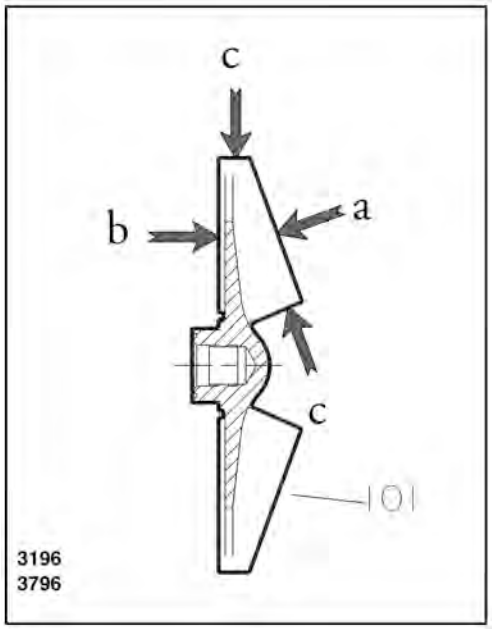


Figure 48:

2. Replace if there is any pitting or wear greater than 1/8 in. (2 mm) deep.

6.7.4 Frame adapter

1. Check frame adapter (108) for cracks or excessive corrosion damage. Replace if any of these conditions exist, see Figure 44: 

on page 47.
2. Make sure gasket surface is clean.

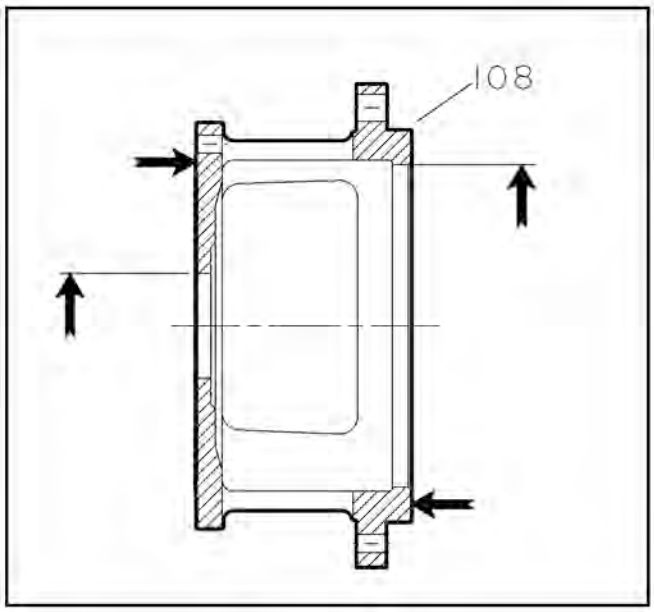


Figure 49:

6.8 Reassembly

Refer to following table for torque values while reassembling pump.

Table 5: Maximum Torque Values in ft.-lb. (Nm) for Casing Bolts (370)

	Models 3196, CV 3196 LF 3196, 3796 with 150 lb. Casing flanges	Model HT 3196 and all Models

						with 300 lb. Casing flanges	
		Material Specification					
		Ductile Iron Casing with A 307 Grade B casing bolts		Alloy Casing with (30455) F593 Grade 1 or (31655 F593) Grade 2 casinn bolts		Ductile Iron and Alloy Casings with A193 grade 87 casing bolts	
Frame	Casing Bolt Diameter (in.)	Lube	Dry	Lube	Dry	Lube	Dry
8"STX	1/2"	20 (27)	30 (41)	35 (47)	54 (73)	58 (79)	87 (118)
6"STX MTX LTX XLT-X	5/8"	39 (53)	59 (80)	71 (96)	107 (145)	115 (156)	173 (235)
X17	7/8"	113 (153)	170 (231)	141 (191)	212 (287)	330 (447)	495 (671)
Motor-to-Adapter	-	20 (27)	30 (40)	20 (27)	30 (40)	-	-

Values are in inch-Lbs (Nm)

6.9 Reassembly

1. Insert jacking bolts (370D).
2. Install frame adapter (108) onto motor. Align bolt holes with those on frame (Fig. 49).

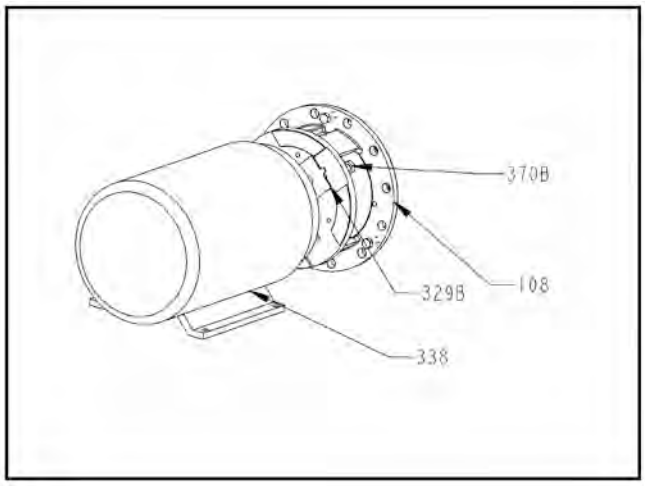


Figure 50:

3. Install motor locking bolts (370B). Hand tighten bolts with a wrench.

CAUTION:
Do not overtighten at this point!

4. Check adapter fits. Rotate shaft through 360°. If total indicator reading is greater than 0.005 in (0.13 mm), determine the cause and correct before proceeding (Fig. 50).

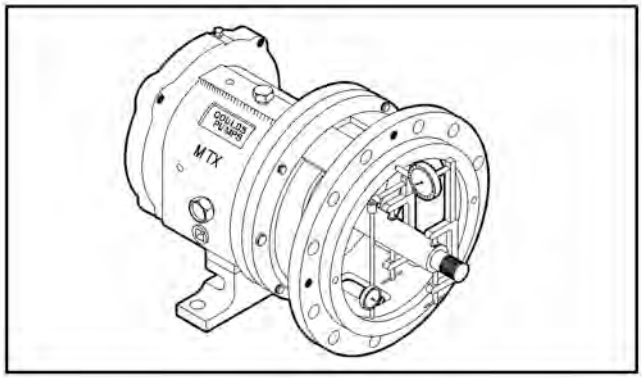


Figure 51:

5. Install inboard labyrinth oil seal (333A) into adapter (108) / bearing frame (228). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom (6 o'clock) position. (Fig. 51).

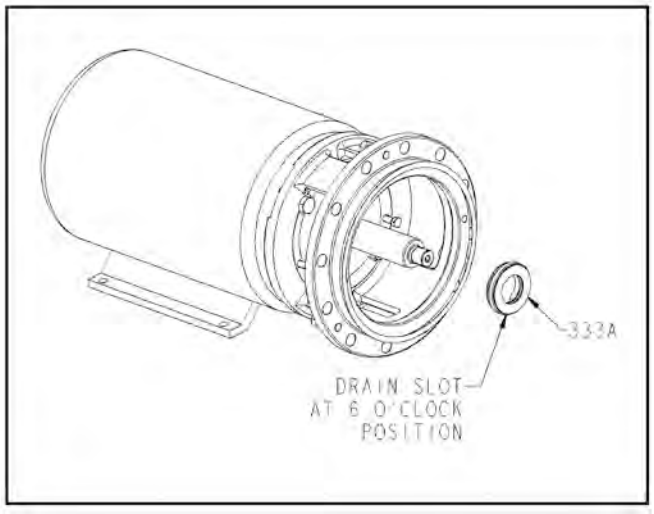


Figure 52:

NOTICE:
For detailed labyrinth seal installation instructions, see Appendix, Labyrinth Seal Installation Instructions.

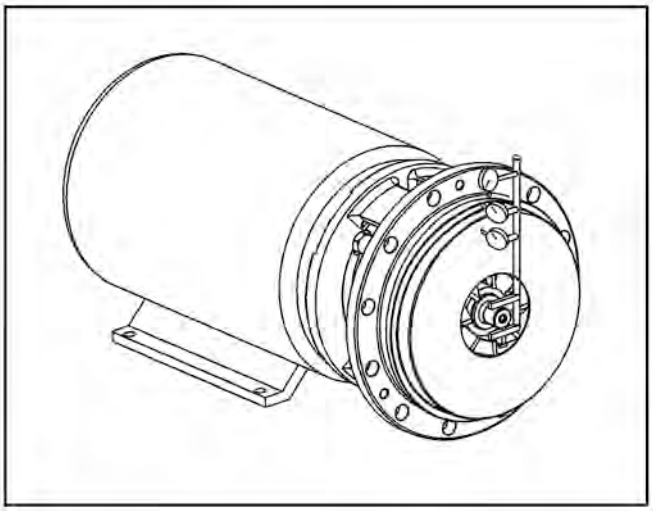


Figure 53:

6. Install seal chamber cover or backplate (184) with nuts (370H) Fig. 52).

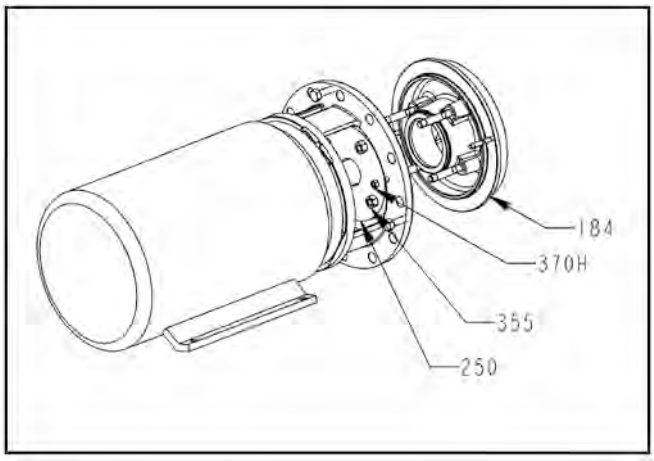


Figure 54:

7. Check seal chamber cover run-out. Rotate indicator through 360 degrees. If total indicator reading is greater than 0.005 in. (.13 mm), determine cause and correct before proceeding (Fig. 53).
8. Install shaft sleeve (126) if used (Fig. 54 & 55).

NOTICE:
Make sure sleeve is fully seated.

WARNING:
Wear a heavy set of work gloves when handling impeller (101) as sharp edges may cause physical injury.

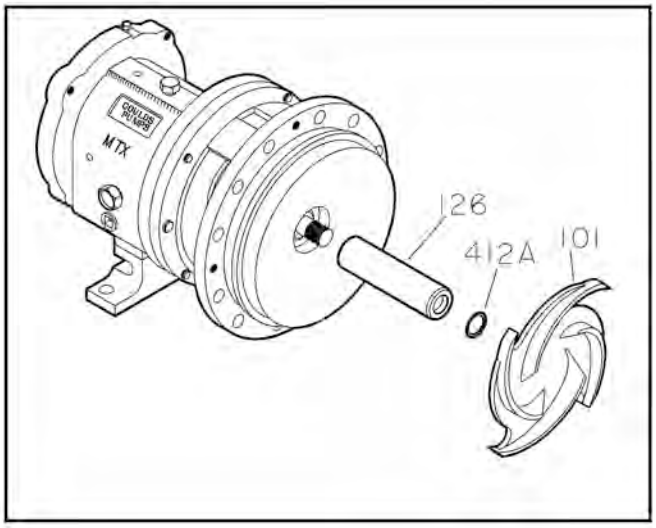


Figure 55:

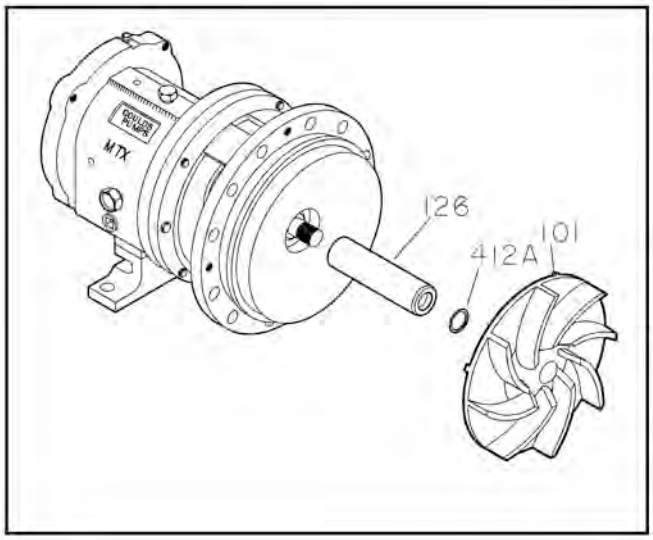


Figure 56:

9. STX, MTX, LTX - Install impeller (101) with 0-ring (Fig. 54 & 55).
10. Put wrench on shaft to stop rotation. When impeller (101) makes firm contact with sleeve (126), turn the wrench counterclockwise (viewed from impeller end of shaft) and slam it down. A few sharp raps will tighten impeller (101) properly (Fig. 56).

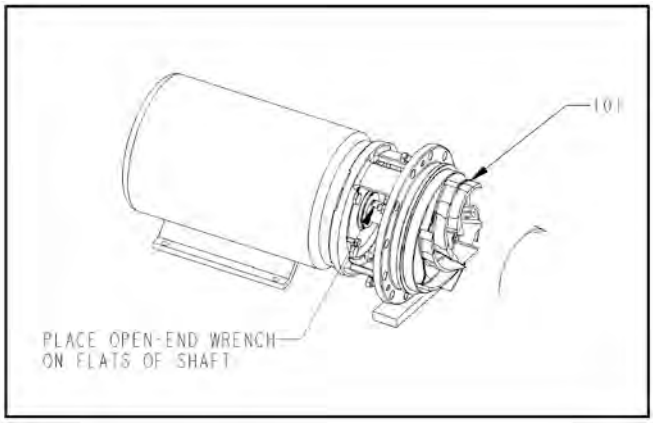


Figure 57:

NOTICE:

The face of the CV 3196 CC impeller is not machined. Checking the face runout on the CV 3196 CC impeller is not required.

Pumps with Mechanical Seals

11. For pumps with non-cartridge mechanical seals, it is necessary to temporarily install spacer shims (329B) before scribing shaft / sleeve.
12. To do this, measure the gap between the face of the seal chamber (184) and the back of the impeller pumpout vanes (101) (Fig. 57).

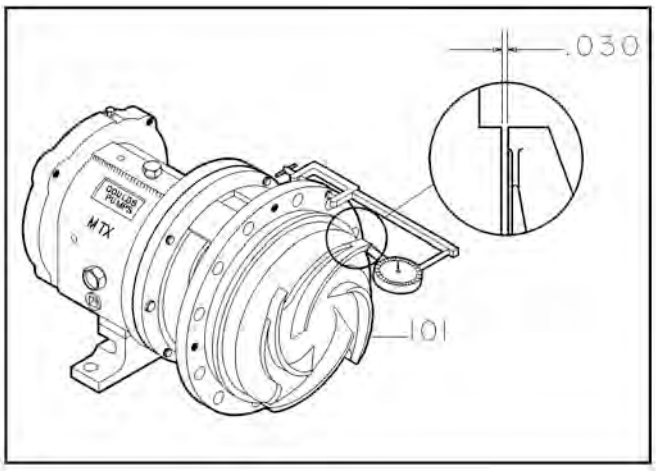


Figure 58:

13. Take the measurement just attained and subtract
14. 0.030 in. (0.76mm) from it. Select shim(s) equal to or next greater to this number.
15. The goal is to have a gap of "as close to" 0.030 in. (0.76 mm) as possible between the seal chamber and back of the impeller pumpout vanes.
16. Blue the shaft sleeve (126) or shaft (122) if no sleeve is used. Scribe a mark at gland gasket face of seal chamber/stuffing box cover (184). This will be the datum for installation of mechanical seal (Fig. 58).

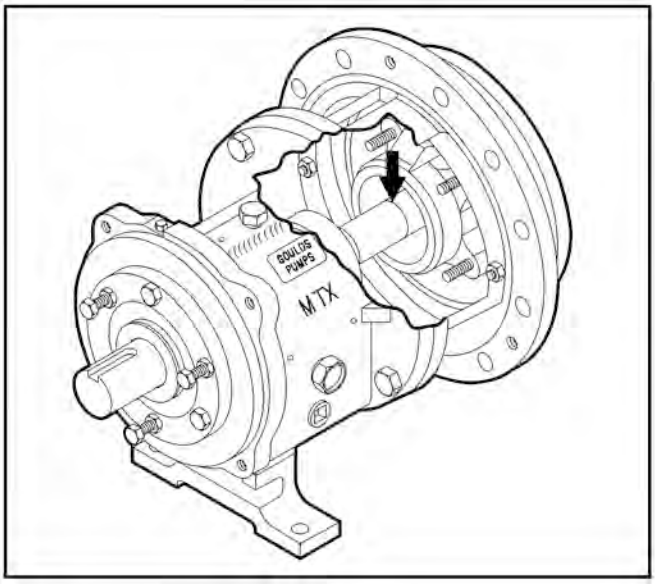


Figure 59:

NOTICE:
If installing a cartridge mechanical seal, the shaft or sleeve does not need to be marked. The seal is self setting.

17. Check impeller (101) runout. Check vane tip to vane tip. If total indicator reading is greater than 0.005 in. (.13 mm), determine cause and correct before proceeding (Fig. 57).

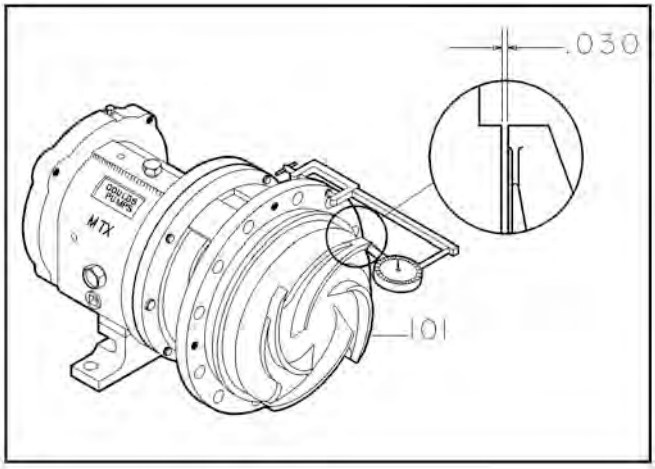


Figure 60:

18. Remove impeller (101), and shaft sleeve (126) if used (Fig. 59).

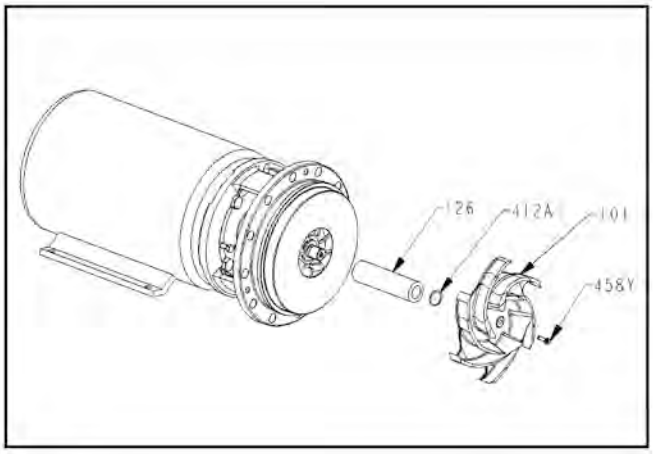


Figure 61:

19. Remove the seal chamber cover or the backplate (Fig. 60).

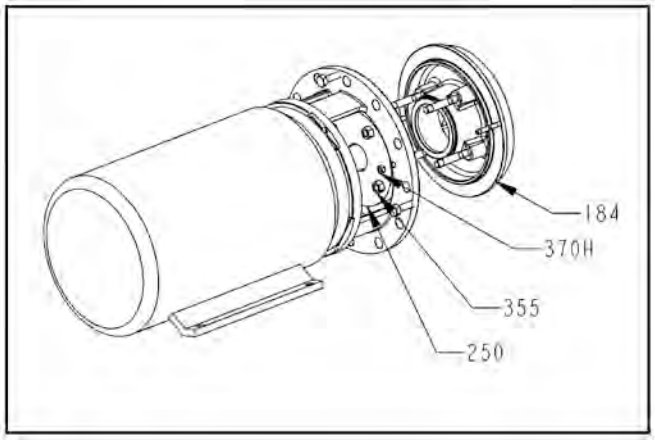


Figure 62:

20. Install mechanical seal on shaft (122) or shaft sleeve (126) per seal manufacturer's instructions. Install shaft sleeve (126) if used (with seal).

NOTICE:
Anti-galling compound can be applied to the sleeve bore to aid in disassembly.

21. Install seal chamber cover (184) with nuts (370H) (Fig. 62).

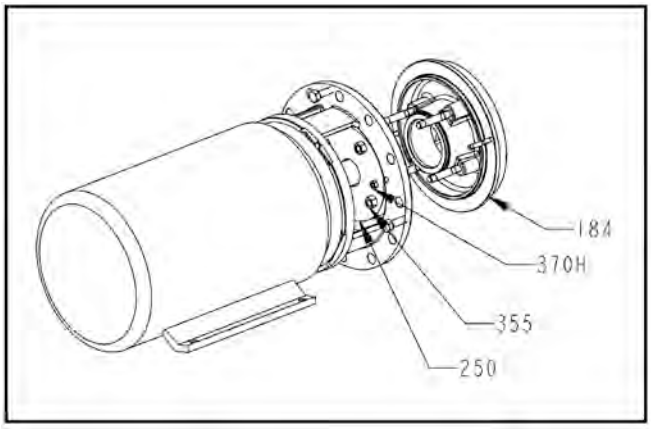


Figure 63:

22. Install stationary seat into gland (107) per seal manufacturer's instructions.
23. Slide gland (107) with stationary seat over shaft, up to adapter face (Fig . 61).

WARNING:

Wear a heavy set of work gloves when handling impeller (101) as sharp edges may cause physical injury.

24. Install impeller (101) with new 0-ring (412A). Put wrench on shaft. When impeller (101) makes firm contact with sleeve (126), raise shaft wrench (counterclockwise when viewed from impeller end of shaft) and slam it down {clockwise when viewed from impeller end of shaft). A few sharp raps will tighten impeller (101) properly (Fig. 63).

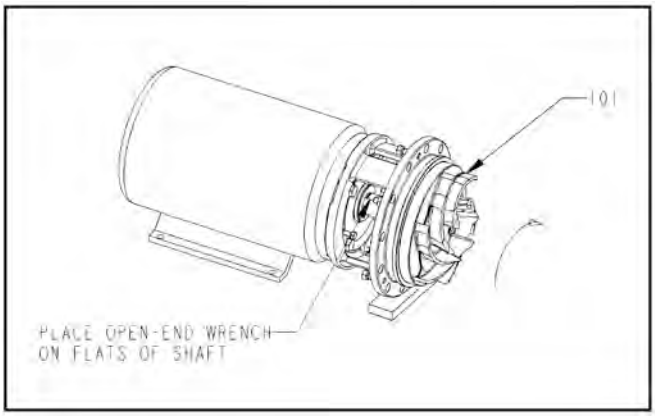


Figure 64:

25. Install Impeller anti-rotation device (458Y) making sure the 0-ring (428D) is in good condition. Replace if needed (Fig. 64).

NOTICE:
Be sure to use a properly balanced impeller.

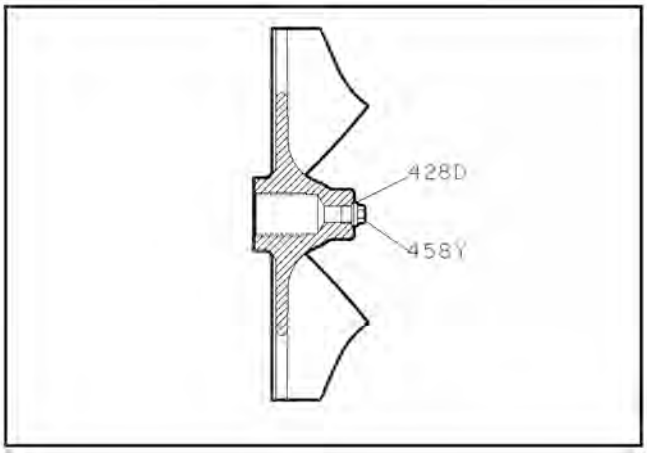


Figure 65:

26. 13. Install gland (107) with nuts (355) (Fig. 65).

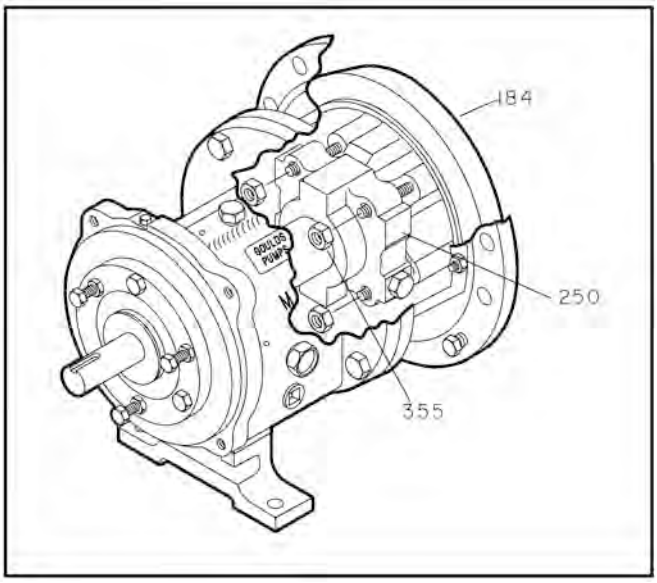


Figure 66:

For outside mounted seals:

27. Install the mechanical seal on the shaft (122) or sleeve, if used (126) per the seal manufacturer's instructions. Install the sleeve with the seal, if used.
28. Slide gland and then stationary seat, with gaskets, on the shaft or sleeve (Fig. 66).

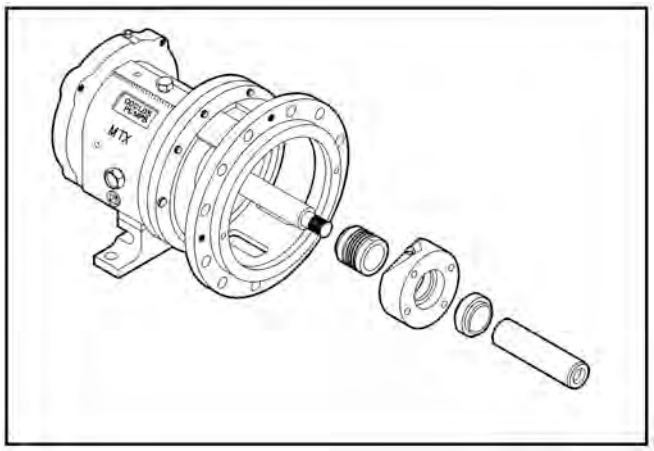


Figure 67:

29. Install the seal chamber or backplate (184) with hex nuts (370H). Be sure that the gland studs line up with the holes in the gland (Fig. 67).

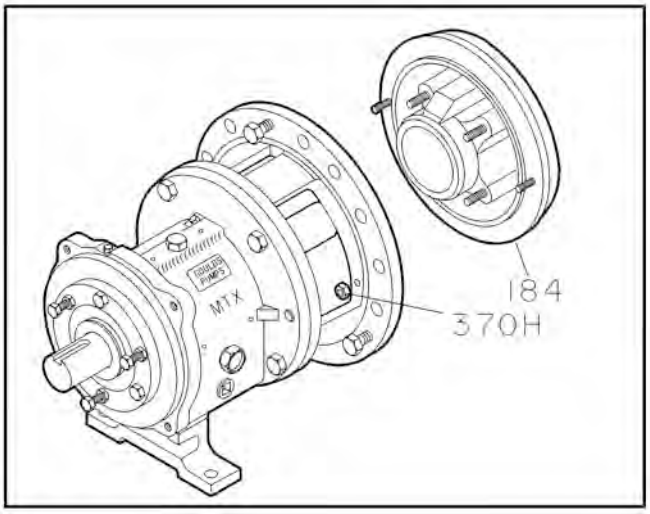


Figure 68:

30. Install the impeller (101) with a new 0-ring (412A). Put the wrench and on the shaft. When the impeller makes firm contact with the sleeve, raise the shaft wrench (counterclockwise when viewed from the impeller end of the shaft) and slam it down (clockwise when viewed from the impeller end of the shaft). A few sharp raps will tighten the impeller properly (Fig. 68).

NOTICE:
Be sure to use a properly balanced impeller.

31. Install Impeller anti-rotation device (458Y) making sure the 0-ring (428D) is in good condition. Replace if needed (Fig. 69).

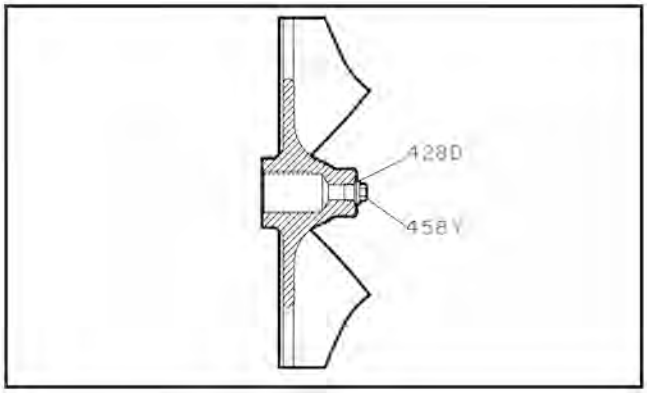


Figure 69:

NOTICE:
Be sure to use a properly balanced impeller.

32. Install the gland (107) with hex nuts (355).

Pumps With Packing:

33. Install stuffing box cover (184) with nuts (370H) (Fig 70).

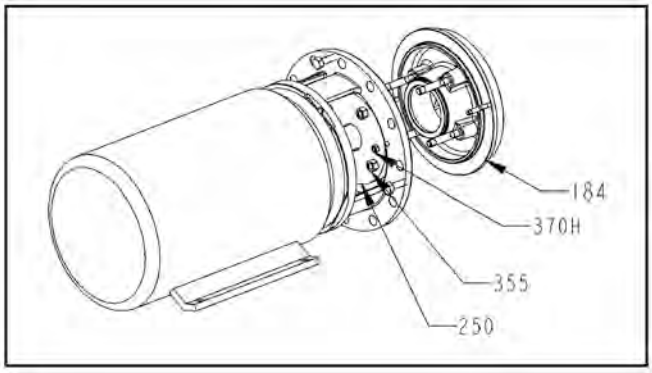


Figure 70:

34. Install shaft sleeve (126) (Fig. 71).

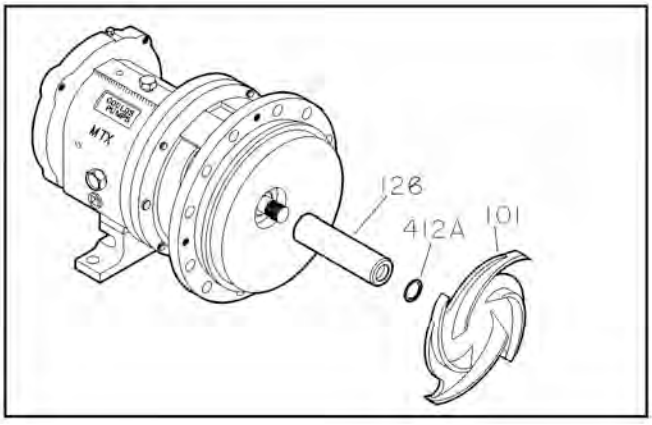


Figure 71:

NOTICE:
Anti-galling compound can be applied to the sleeve bore to aid in disassembly.

NOTICE:
Make sure sleeve is fully seated.

WARNING:
Wear a heavy set of work gloves when handling impeller (101) as sharp edges may cause injury.

35. Install impeller (101) with 0-ring (412A). Put shaft wrench shaft. When impeller (101) makes firm contact with sleeve (126), raise shaft wrench (counterclockwise when viewed from impeller end of shaft) and slam it down (clockwise when viewed from impeller end of shaft). A few sharp raps will tighten impeller properly (Fig. 72).

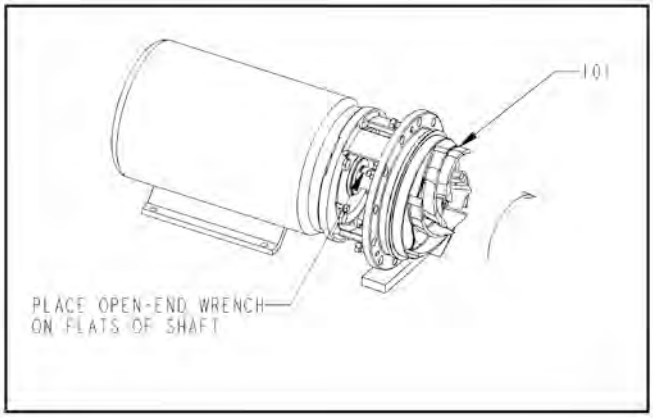


Figure 72:

36. Install Impeller anti-rotation device (458Y) making sure the 0-ring (428D) is in good condition. Replace if needed (Fig. 73).

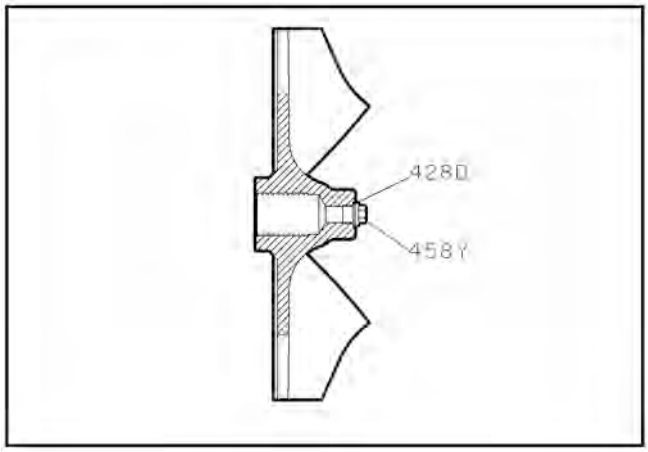


Figure 73:

NOTICE:
Be sure to use a properly balanced impeller.

NOTICE:
The face of the CV 3196 impeller is not machined. Checking the face runout on the CV 3196 is note required.

37. Install packing and gland according to 4 Operation on page 25.

6.10 All models STX, MTX, LTX, XLT-X, X17

6.11 Reinstall Back Pull-Out Assembly

WARNING:
Back pull-out assembly weighs more than 50 lbs. Do not handle unassisted as physical injury may occur.

1. Clean casing fit and install casing gasket (351) in place on seal chamber/stuffing box cover.
2. Install back pull-out assembly in casing (Fig. 74).

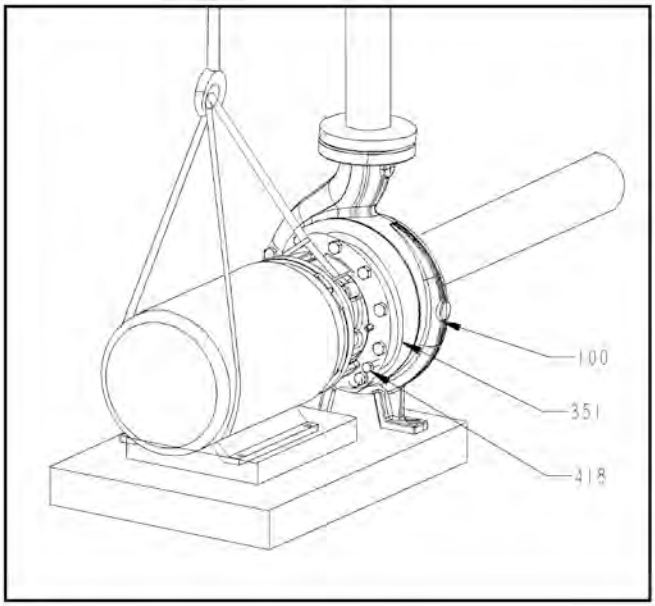


Figure 74:

3. Install casing bolts (370), finger tight. Casing bolts (370) may be coated with anti-galling compound to aid disassembly. Tighten the casing bolts per Table 5: Maximum Torque Values in ft.-lb. (Nm) for Casing Bolts (370) on page 50 torque values. Install casing jack screws (418), snug tight Figure 73: on page 62.

NOTICE:
Do not overtighten casing jack screws (418).

4. Replace shims under motor frame foot and tighten frame foot to baseplate. To ensure that the proper shim is used, a dial indicator should be mounted to measure distance between top of frame and baseplate. This distance should not change as frame foot bolting is tightened.
5. Replace auxiliary piping at this time.

6.12 Impeller Adjustment

Once the pump has been re-assembled, it is important to perform the correct impeller adjustment prior to start-up.

1. Refer to 5.8 Impeller clearance setting on page 34 for the proper procedure.

6.13 Assembly Troubleshooting

Symptom	Cause	Remedy
Excessive shaft/sleeve runout.	Sleeve worn. Shaft bent.	Replace Replace.
Excessive frame adapter runout.	Corrosion. Adapter to frame gasket not seated properly.	Replace. Reseat.
Excessive seal chamber/stuffing box cover runout.	Seal chamber/stuffing box cover not properly seated in frame adapter. Corrosion or wear.	Reseat. Replace.
Excessive impeller vane tip runout.	Bent vane(s).	Replace impeller.

Material cross reference chart					
Material	Goulds Pumps Material Code	ASTM	DIN	ISO	JIS
Cast Iron	1001	A48CLASS20			
Ductile Iron	1012	A395 Gr60-40-18			
Ductile Iron	1013	A536 Gr60-42-10			
CD4MCu	1041	A744 CD4MCU			
Monel	1119	A494 GrM-35-1			
316SS	1203	A744 CF-8M	1.4408		G5121 /SC514)
Alloy 20	1204	A744CN-7M	1.4500		
317SS	1209	A744CG-8M	1.4448		
Hastellov C	1215	A494 CW-6M			
CD4MCu	1216	A744CD4MCU	9.4460		
Hastellov B	1217	A494 N-7M			
Titanium	1220	B367 GrC-3			
Nickel	1601	A494 GrCZ100			
Monel	2150	B164 UNS N04400			
Nickel	2155	B160 UNS N02200			
Titanium	2156	B348 Gr2			
Carbon Steel	2210	A108Gr1211			
304SS	2228	A276 Tvoe 304			
316SS	2229	A276 Tvoe 316			
Allov 20	2230	B473 /N08020l			
317SS	2232	A276			
4150 Steel	2237	A322Gr4150			
4140 Steel	2238	A434Gr4140			
Allov B-2	2247	B335 /N10665l			
Allov C-276	2248	B574 /N10276)			
GMP-2000	6929	N/A			

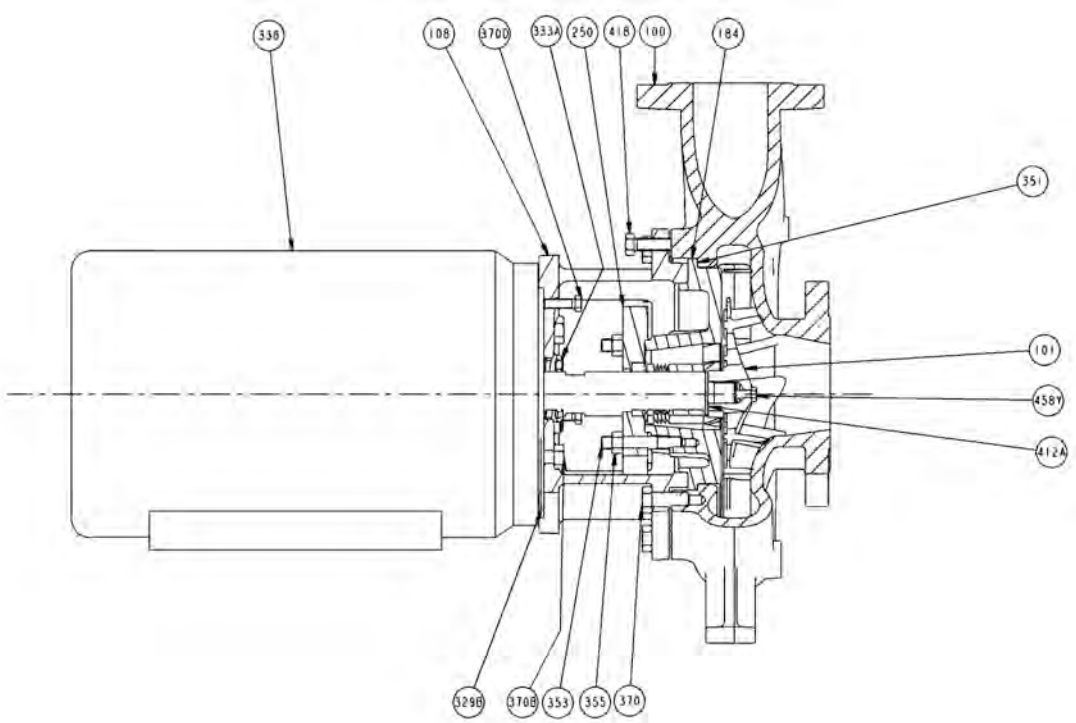
PFA Lined Steel	6944	N/A			
PFA Lined 316SS	6947	N/A			
PFA Lined Ductile Iron	9639	N/A			

Fasteners/Plugs		
Material	Goulds Pumos Material Code	ASTM
Carbon Steel	2210	A307Gr.B.
Stainless Steel	2228	F593Gr1
316 Stainless Steel	2229	F593Gr2

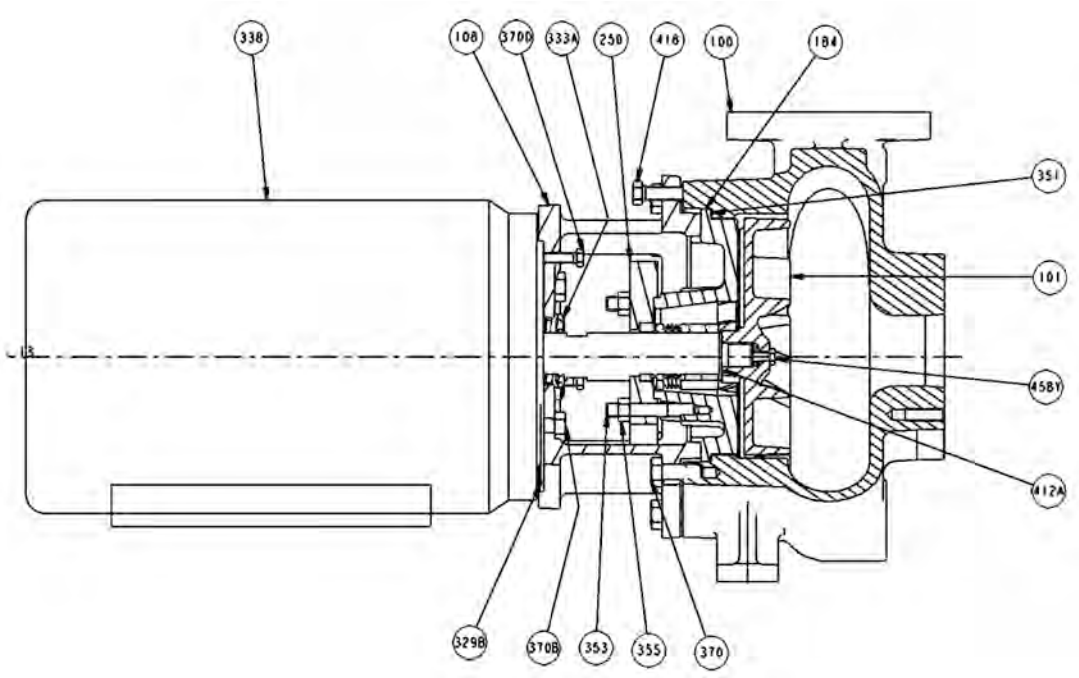
6.14 Parts list with materials of construction

Item	Part Description	Material Code 316SS
100	Casing	1203
101	Impeller	1203
108	Frame Adapter	1013
184	Cover, Stuffing Box (Packed Box)	1203
184M	Chamber Seal (Mechanical Seal)	1203
250	Gland	1203
329B	Shim Pack	3215
333A	Seal, Labyrinth (Inboard)	6842
351	Gasket, Casing	5127
353	Stud, Gland	2228
355	Nut, Gland Stud	2228
357K	Nut, Stud Cover to Adapter	2228
358	Plug, Drain - Casing (Optional)	2229
358A	Plug, Pipe - Flush	2229
360Q	Gasket, Gland	5108
370	Screw, H. Cap Adapter to Casing	2228
370B	Screw, H.H. Cap-Adapt-Motor	2228
370D	Screw, H.H. Cap-Adapt-Motor-Jacking	2228
370H	Stud, Cover to Adapter	2228
412A	0-Rina, Impeller	6359
418	Screw, H.H. Cap-Adapt-Case-Jacking	2228
497H	O-Ring Seal Rotating	5304
497J	O-Ring Seal Stationary	5304
549	Nameplate, Data	-
549A	Nameplate, Logo	-
958	Bolt Assembly (Anti-Rot.)	2229

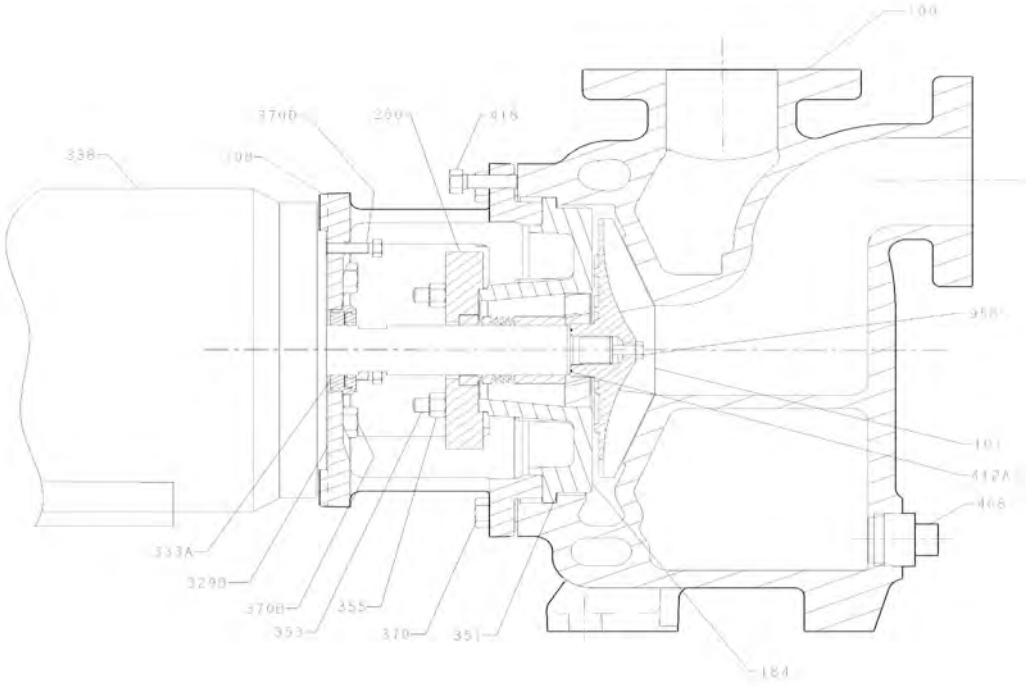
6.15 Model 3196 Cross Sectional



6.16 Model CV 3196 Cross Sectional



6.17 Model 3796 Cross Sectional



7 Spare Parts

When ordering spare parts, always state Goulds Serial No. and indicate part name and item number from relevant sectional drawing. It is imperative for service reliability to have a sufficient stock of readily available spares.

7.1 Recommended spare parts

- Impeller (101)
- Shaft Sleeve (126), if applicable
- Casing Gasket (351)
- Impeller 0-Ring (412A}
- Inboard Labyrinth Seal Rotary 0-Ring (497H)
- Inboard Labyrinth Seal Stationary 0-Ring (497J)
- Lantern Ring Half (105) (Packed Stuffing Box)
- Stuffing Box Packing (106) (Packed Stuffing Box), if applicable
- Packing Gland (107) (Packed Stuffing Box), if applicable
- Impeller Gasket (428D) XLT-X & X17
- Impeller Anti-Rotation Bolt
- Shim Packs (4)

8 Appendix

8.1 Labyrinth Seal Installation Instructions

8.1.1 Description of Operation

The labyrinth oil seal serves two functions. The first being to exclude environmental contamination from the power-end. This is accomplished with a series of tight clearance fits between the stationary and rotor. Any water that manages to enter the seal is eliminated from the seal through a drain slot located at the six o'clock position when installed.

On the oil side, a series of oil grooves are present to direct any oil between the shaft and stationary back into the oil sump through a drain slot at the six o'clock position.

Viton® 0-rings are supplied as standard due to their chemical resistance. The stationary uses an 0-ring to fit the labyrinth seal to the housing. The stator uses an 0-ring to fit the labyrinth to the housing. The rotor uses an 0-ring to seal along the shaft and to serve as the drive.

8.2 Installation Procedures

CAUTION:
The Goulds labyrinth oil seal is a one piece assembly. Do not attempt to separate the rotor and stator. Damage to the seal may result.

1. Assemble the power end per the instructions in Section 6 - Disassembly & Reassembly.

CAUTION:
The edges of the keyway can be sharp. Failure to cover the keyway may result in a cut o-ring and a damaged seal.

2. Wrap tape around the coupling end of the shaft to cover the keyway.

NOTICE:
The smooth surface of electrical tape provides an excellent surface to slide the rotor o-ring over.
Press the seal over the shaft into the thrust bearing housing or thrust bearing end cover by hand until the shoulder of the seal is seated against the housing/cover.\

NOTICE:
As O-ring lubricant is note required, but can be used if desired. If used, be sure the lubricant is compatible with the o-ring material and plant standards.

3. Press the seal over the shaft into the trust bearing housing or thrust bearing end cover by hand unti he shoulder of the seal is seated against the housing/cover.

NOTICE:
An o-ring lubricant is not required, but can be used if desired. If used, be sure the lubricant is compatible with the o-ring material and plant standards.

4. Once the frame adapter is installed on the motor, press the seal over the shaft into the frame adapter by hand until the shoulder of the seal is seated against the adapter.

NOTICE:

During start-up when the parts of the labyrinth oil seal establish a voluntary running clearance, a small amount of wear is experienced as the parts are in contact. This wear produces a carbon filled PTFE residue, visible at the outside diameter of the seal and at the drain slot. This is the result of the two surfaces being smoothed, similar to burnishing. A lubricant should not be applied between the faces at installation. Once the running clearance has been established, no further wear is experienced and no decrease in seal performance occurs as a result of the carbon/PTFE residue.

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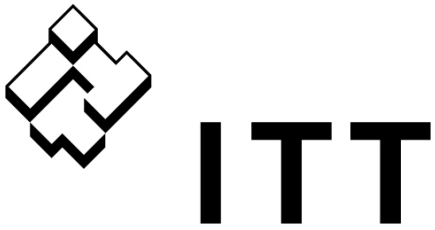

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