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 www.gouldspumps.com/literature_ioms.html 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 www.gouldspumps.com.

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 www.gouldspumps.com/literature.

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 this 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
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.

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.

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.

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.

General Precautions		
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.

General Precautions		
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.

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:

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

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

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

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

II	=	Group 2
2	=	Category 2
G/D	=	Gas and Dust present
T4	=	Temperature class, can be T1 to T6 (see Table 1)

Table 1

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

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.

SPARE PARTS

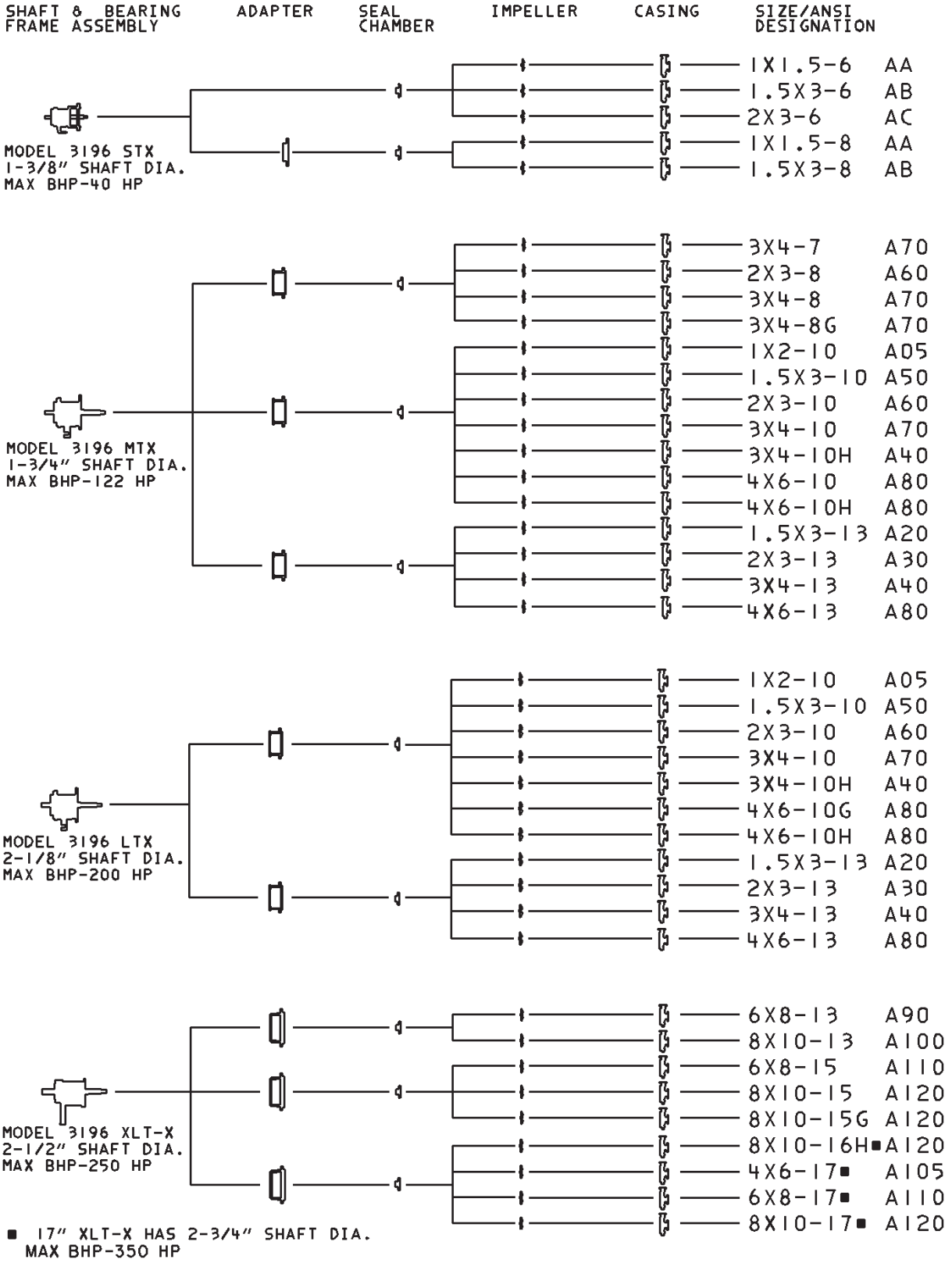
When ordering spare parts, always state ITT Goulds Serial No. and indicate part name and item number from relevant sectional drawing. It is imperative for service reliability to have a sufficient stock of readily available spares.

RECOMMENDED SPARE PARTS

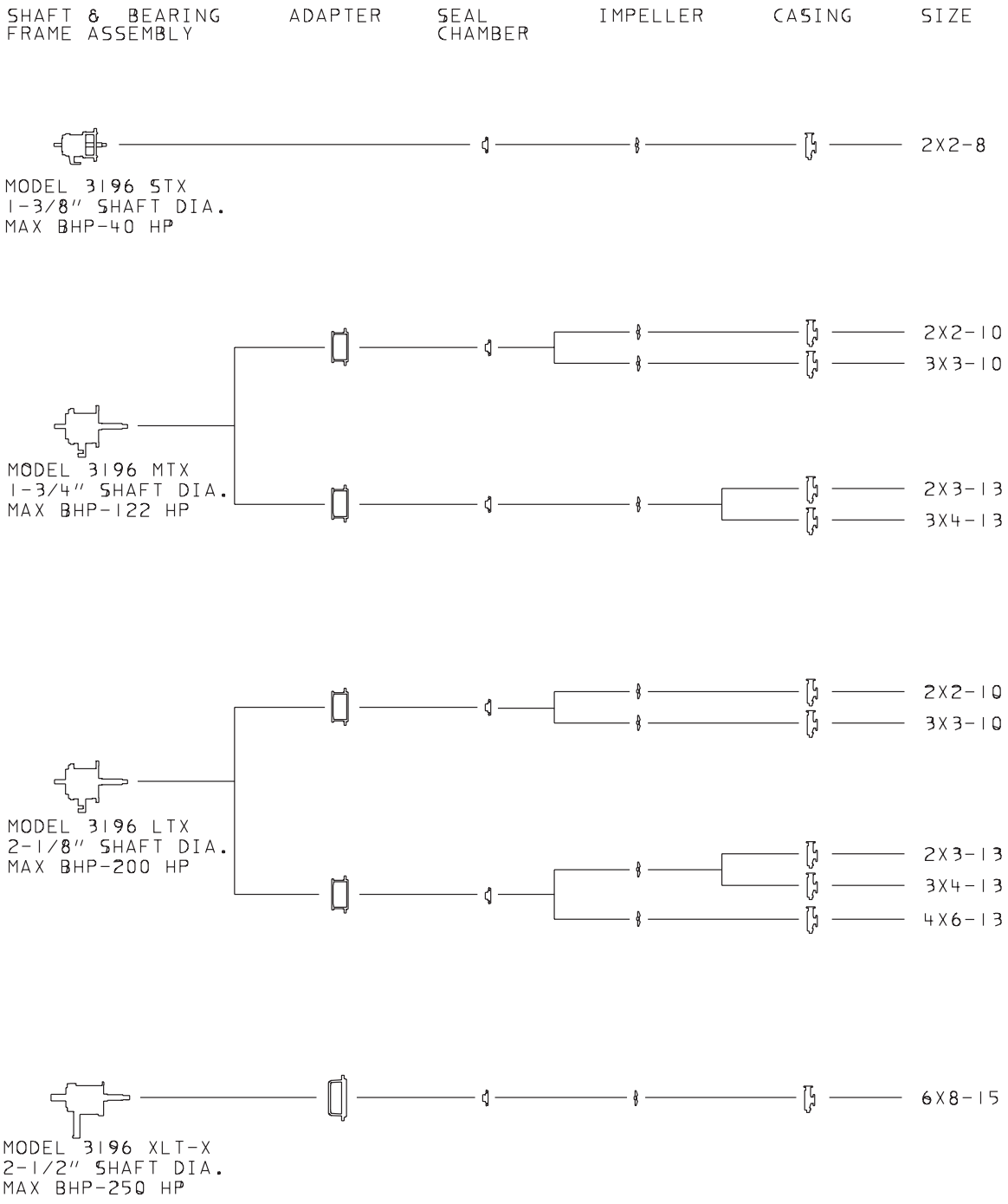
- Impeller (101)
- Shaft (122A)
- Shaft Sleeve (126)
- Outboard Bearing (112A)
- Inboard Bearing (168A)
- Casing Gasket (351)
- Frame-to-Adapter Gasket (360D)
- Bearing Housing Retaining Ring (361A)
- Bearing Lockwasher (382)
- Bearing Locknut (136)
- Impeller O-Ring (412A)
- Bearing Housing O-Ring (496)
- Outboard Labyrinth Seal Rotary O-Ring (497F)
- Outboard Labyrinth Seal Stationary O-Ring (497G)
- Inboard Labyrinth Seal Rotary O-Ring (497H)
- Inboard Labyrinth Seal Stationary O-Ring (497J)
- Lantern Ring Half (105) (Packed Stuffing Box)
- Stuffing Box Packing (106) (Packed Stuffing Box)
- Packing Gland (107) (Packed Stuffing Box)
- Impeller Gasket (428D) XLT-X & X17

INTERCHANGEABILITY

3196
MODULAR/DIMENSIONAL INTERCHANGEABILITY



CV 3196
MODULAR/DIMENSIONAL INTERCHANGEABILITY



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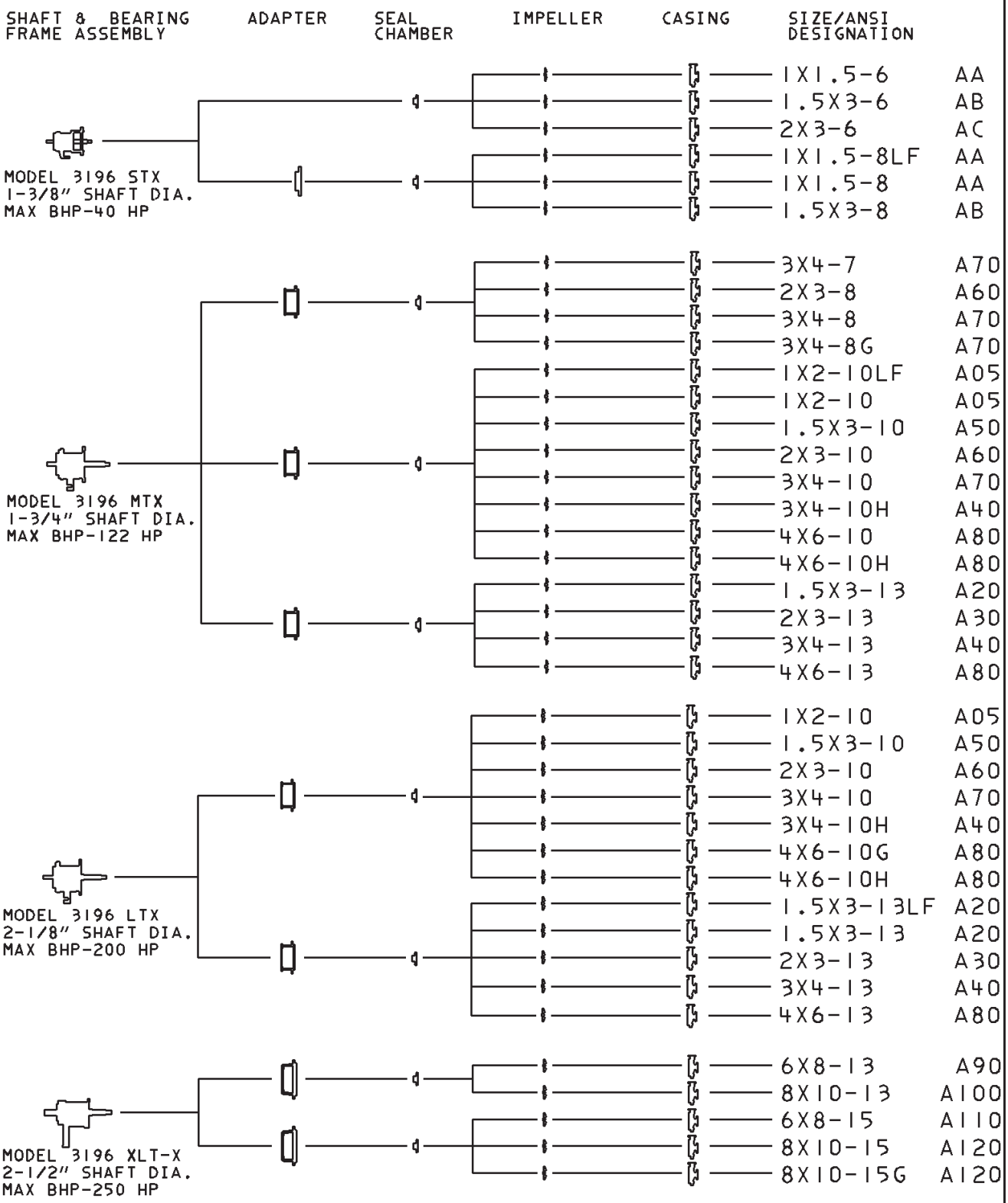
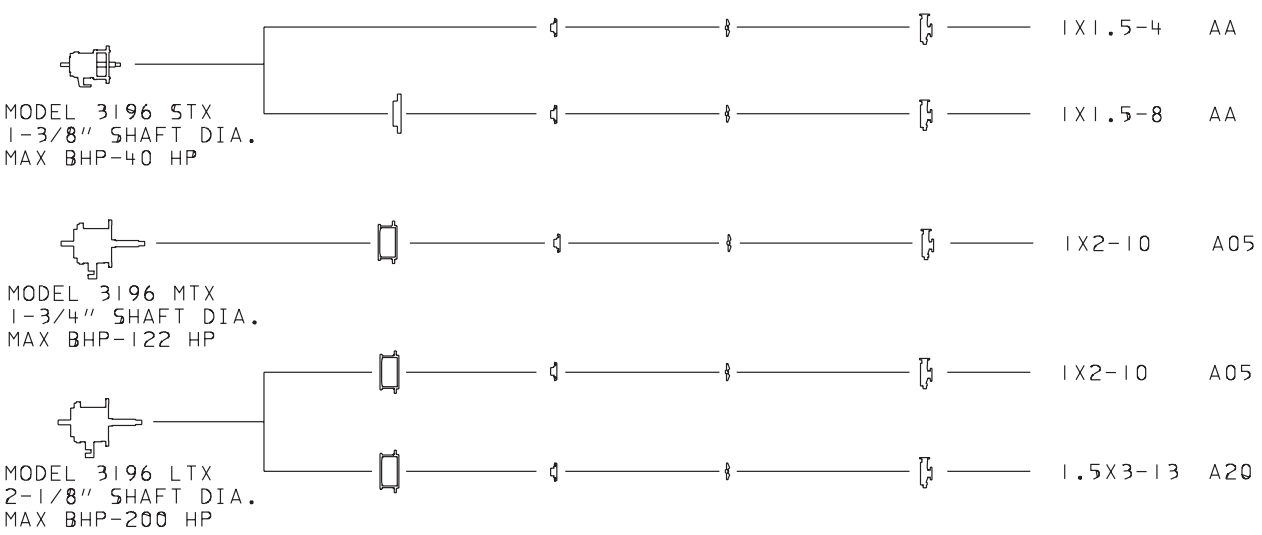
INTERCHANGEABILITY

HT3196
MODULAR/DIMENSIONAL INTERCHANGEABILITY



LF 3196
MODULAR/DIMENSIONAL INTERCHANGEABILITY



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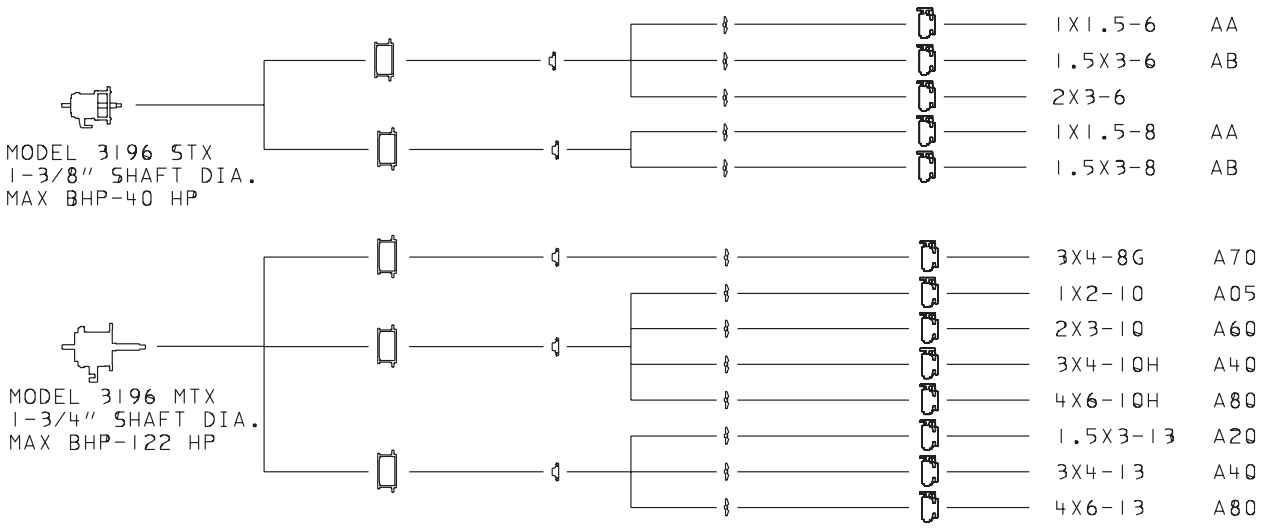
NM 3196
MODULAR/DIMENSIONAL INTERCHANGEABILITY



3198
MODULAR/DIMENSIONAL INTERCHANGEABILITY

SHAFT & BEARING FRAME ASSEMBLY	ADAPTER	BACKPLATE/ SEAL CHAMBER	IMPELLER	CASING	SIZE/ANSI DESIGNATION	
					1.5X3-7	AB

MODEL 3196 STX
1-3/8" SHAFT DIA.
MAX BHP-40 HP

					1.5X3-10	A50
					3X4-10	A70
					3X4-13	A40

MODEL 3196 MTX
1-3/4" SHAFT DIA.
MAX BHP-122 HP

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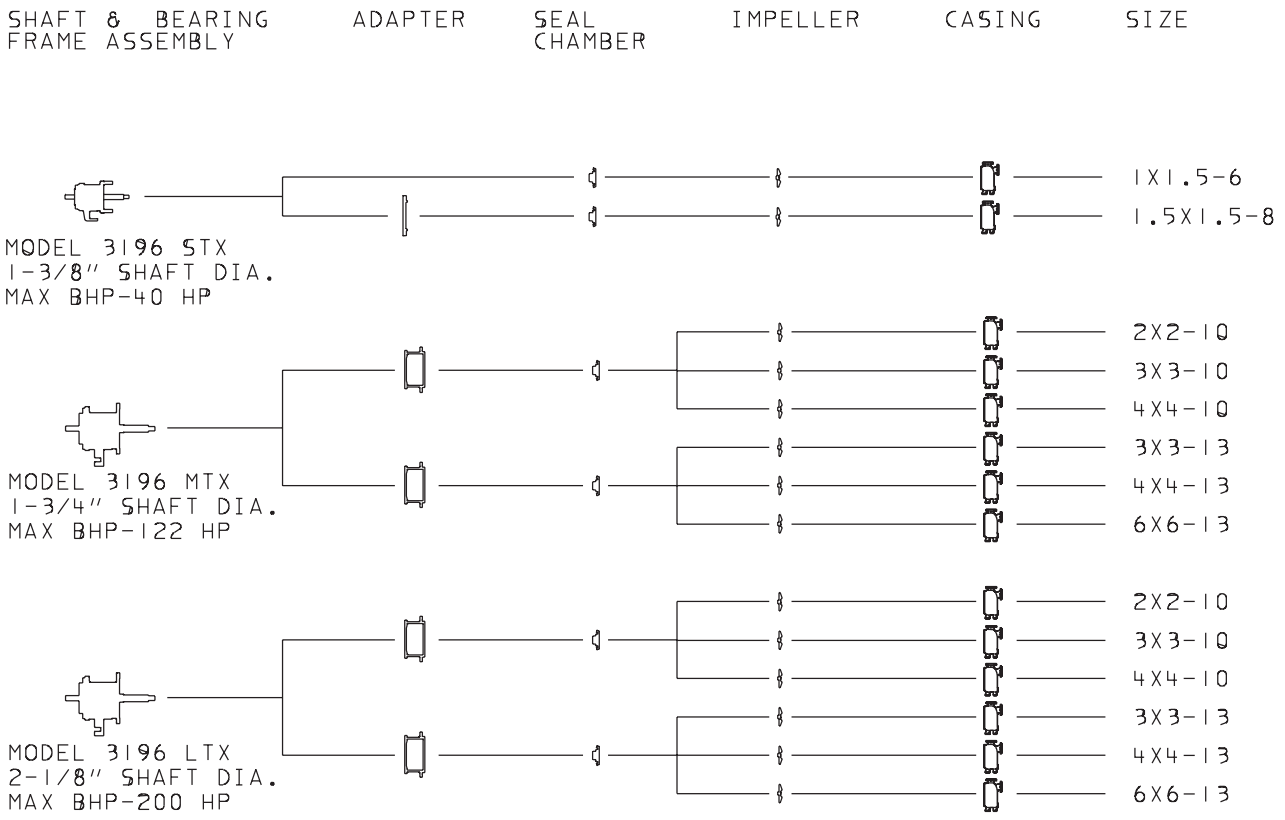
3796
MODULAR/DIMENSIONAL INTERCHANGEABILITY



APPENDIX I

Frame Lubrication Conversion

Lubrication Conversion		
	Pumpage Temperature below 350°F (177°C)	Pumpage Temperature above 350°F (177°C)
NLGI Consistency	2	3
Mobil	Mobilux EP2	SCH32
Exxon	Unirex N2	Unirex N3
Sunoco	Multipurpose 2EP	
SKF	LGMT 2	LGMT 3

Pumpage temperatures above 350°F (177°C) should be lubricated by a high temperature grease. Mineral oil greases should have oxidation stabilizers and a consistency of NLGI 3.

NOTE: If it is necessary to change grease type or consistency, the bearings must be removed and the old grease removed.

! CAUTION

Never mix greases of different consistency (NLGI 1 or 3 with NLGI 2) or different thickener soaps (sodium or calcium with lithium). The consistency usually becomes softer and will not provide adequate lubrication to the bearings.

FRAME LUBRICATION CONVERSION

Conversion from Flood Oil to Pure Oil Mist

There are several ways to apply oil mist. ITT Goulds has designed X-Series Power Ends to accept a variety of oil mist configurations. The following instructions are written for two popular systems in use.

NOTE: Make sure that pipe threads are clean and apply thread sealant to plugs & fittings.

NOTE: The LTX requires that the bearing housing be changed when making the conversion from flood oil to oil mist lubrication. After the proper bearing housing has been installed follow the instructions as they apply to STX, MTX, XLT-X, X17.

A. Non-Vented Oil Mist System

1. Attach oil mist inlet to ¼" NPT connection at top, outboard end of frame (plugged with 408H allen head plug), and top, center of frame (plugged with 113A hex head plug).
2. Attach drain at bottom center of frame ⅜" NPT hole (plugged with 408A magnetic drain plug).
3. Follow oil mist generator manufacturer's instructions for oil mist volume adjustment, and operation.

B. Vented Oil Mist System

1. Attach oil mist inlet connection to ¼" NPT connections at outboard and inboard ends of frame.
2. Attach vent connection at ½" NPT hole located in top center of frame.
3. Attach drain connection at ⅜" NPT hole located at bottom center of frame (plugged with 408A magnetic drain plug).
4. Follow oil mist generator manufacturer's instructions for oil mist volume adjustment and operation.

! CAUTION

Oil mist falls under Title III of the Clean Air Act and must be controlled or the user will be subject to penalty.

Conversion from Flood Oil to Regreaseable

NOTE: Make sure that pipe threads are clean and apply thread sealant to plugs and fittings.

NOTE: LTX regreaseable power end requires a changeout of the bearing housing and bearing clamp ring. This housing provides a grease path to the bearings.

1. Plug inboard oil return in bearing frame.
   STX: Use epoxy, keep drilled hole clear.

   MTX, LTX, XLT-X, X17: Use set screw, install from adapter side, bottom in hole.
2. Plug outboard oil return slot in bearing housing, keep through holes clear. (does not apply to LTX)
3. Replace both bearings with single shield type. Refer to Assembly Section for installation guidelines.(Ref. Bearing Chart Table 11)
4. Install grease fittings at top, inboard and top, outboard ¼" NPT connections in bearing frame (plugged with 408H allen head plug).
5. Remove 2 (408H) Allen head plugs from bottom side of frame prior to greasing bearings. Reinstall hex head plugs (113) after bearings have been greased.

X-Series Conversion from Greased for Life or Regreaseable to Oil Lubricated Bearings

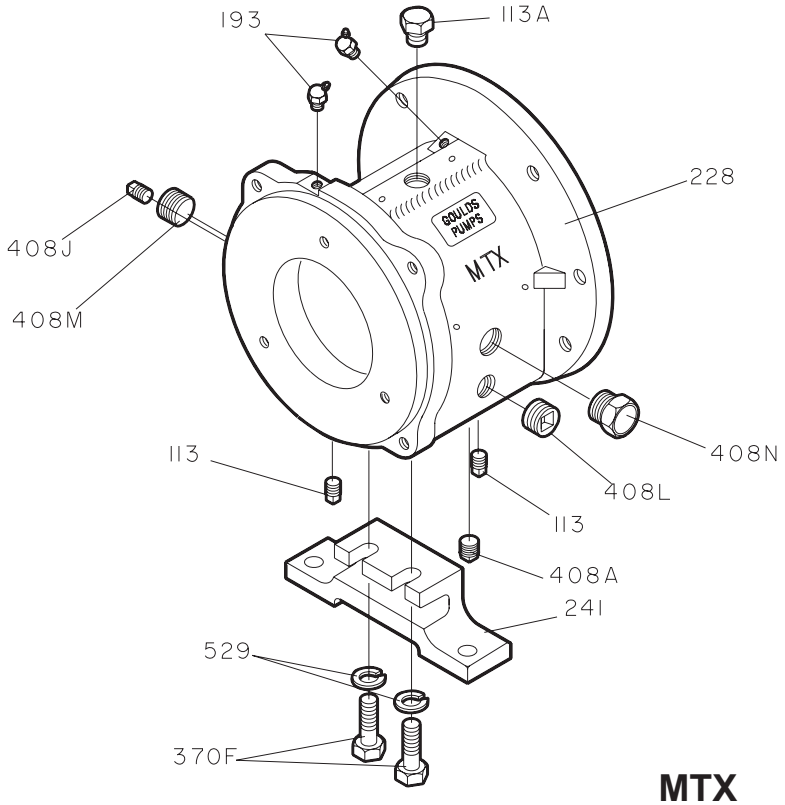
NOTE: LTX bearing housing and clamp ring are not interchangeable between oil and grease lubrication.

1. Remove plug from oil return slot in the frame, under the radial bearing.

   STX: Remove epoxy from return slot.

   MTX, LTX, XLT-X, X-17: Remove set screw installed in the oil return hole.
2. Remove plug from oil return hole in the bearing housing (134). For LTX only, housing (134) and clamp ring (253B) require replacement. Contact ITT Goulds for price and availability.
3. Replace both bearings with unshielded, oil lube bearings. Refer to Assembly Section for installation guidelines. (Ref. Bearing Chart, Table 11).
4. Grease fittings should be removed to prevent accidental greasing. Quantity of two (2) plugs (408H) are required to replace the two (2) grease fittings (193).

Item No.	Size	Description	Qty.
113	1/4"-18 NPT	Ext. Hex/square Head Pipe Plug	2
113A	1/2"-14 NPT	Ext. Hex/square Head Pipe Plug	1
193	1/4"-18 NPT	Grease Fitting	2
228	- - - -	Bearing Frame	1
241	- - - -	Frame Foot	1
370F	1/2"	Hex Cap Screw	2
408A	3/8"-18 NPT	Ext. Square Head Pipe Plug (magnetic)	1
408J	1/4"-18 NPT	Ext. Hex/square Head Pipe Plug	1
408L	1/2"-14 NPT	Square Countersunk Headless Pipe Plug	1
408M	1" 11-1/2" NPT	Square Countersunk Headless Pipe Plug	1
319	1" 11-1/2" NPT	Sight Window	1
529	1/2"	Light Helical Spring Lock Washer	2



MTX
Grease Lube

APPENDIX II

Installation Instructions for ITT Goulds ANSI B15.1 Coupling Guards

The coupling guard used in an Atex classified environment must be constructed from a non-sparking material.

WARNING

Before assembly or disassembly of the coupling guard is performed the motor must be de-energized, the motor controller/starter put in a locked-out position and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump. ITT Goulds Pumps assumes no liability for avoiding this practice.

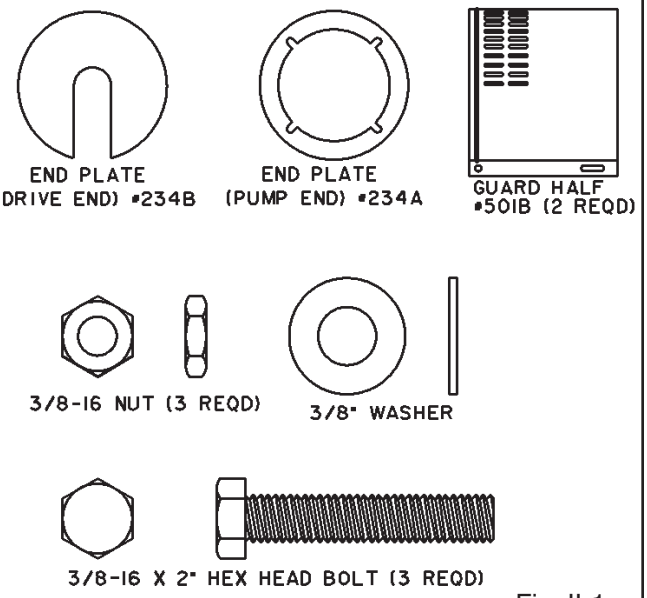


Fig. II-1

Simplicity of design allows complete assembly of the coupling guard, including the end plate (pump end), in about fifteen minutes. If the end plate is already in place, assembly can be accomplished in about five minutes.

Assembly:

NOTE: If end plate (pump end) is already installed, make any necessary coupling adjustments and then proceed to Step 2.

1. **STX, MTX, LTX** - Align end plate (pump end) to the Bearing Frame. (No impeller adjustment required.)

XLT-X Align the end plate (pump end) to the pump bearing housing so that the large slots on the end plate clear the bearing housing tap bolts and the small slots are aligned to the impeller adjusting bolts. Attach the end plate to the bearing housing using the jam nuts on the impeller adjusting bolts as shown in Fig. II-3.

After the end plate is attached to the bearing housing, the impeller clearance must be checked and reset as explained in *Section V - Preventive Maintenance*.

NOTE: Coupling adjustments should be completed before proceeding with coupling guard assembly.

STX, MTX, LTX

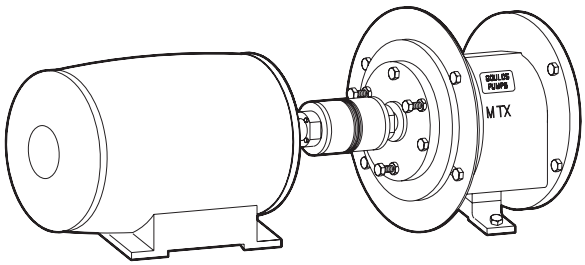
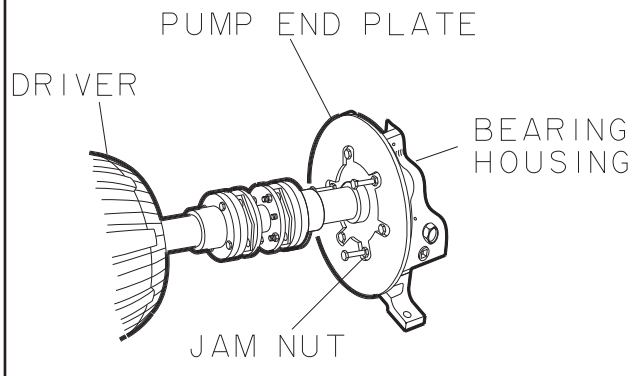


Fig. II-2



XLT-X

Fig. II-3

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2. Spread bottom of coupling guard half (pump end) slightly and place over pump end plate as shown in Fig. II-4. The annular groove in the guard half is located around the end plate (Fig. II-5).

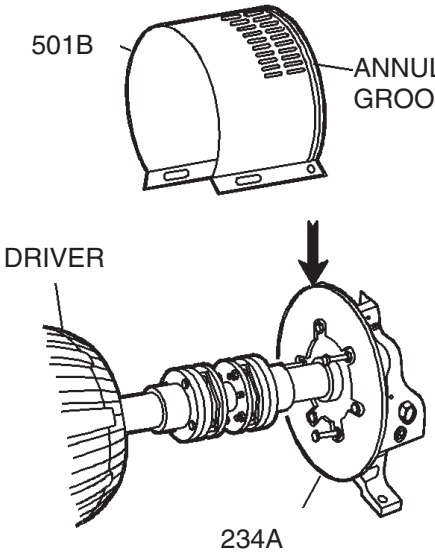


Fig. II-4

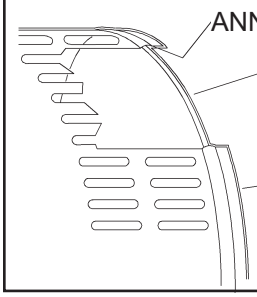


Fig. II-5

3. After the coupling guard half (pump end) is located around the end plate, secure it with a bolt, nut and two (2) washers through the round hole at the front end of the guard half as shown in Fig. II-6. Tighten securely (Fig. II-7).

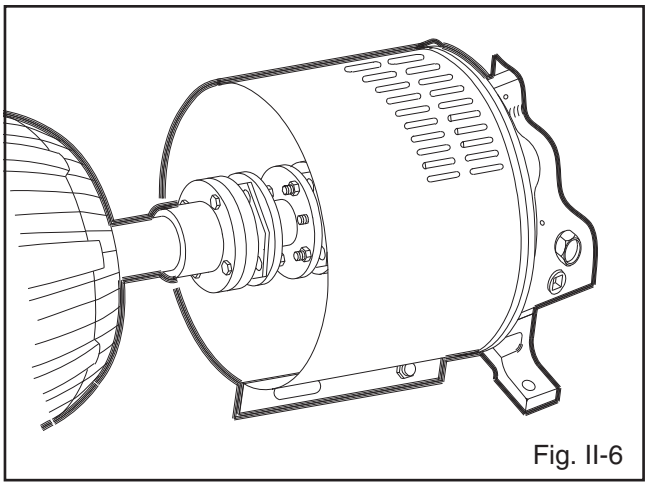


Fig. II-6

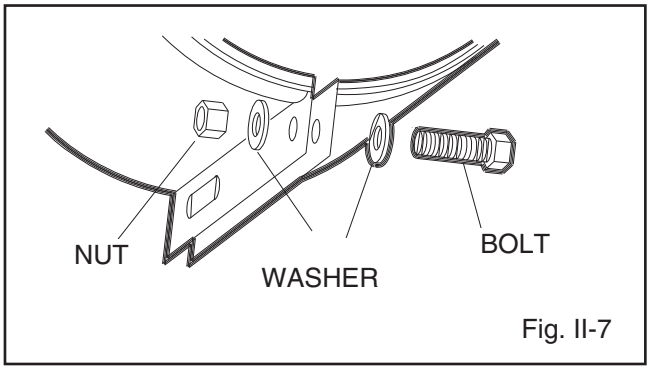


Fig. II-7

4. Spread bottom of coupling guard half (driver end) slightly and place over coupling guard half (pump end) so that annular groove in coupling guard half (driver end) faces the motor as shown in Fig. II-8.

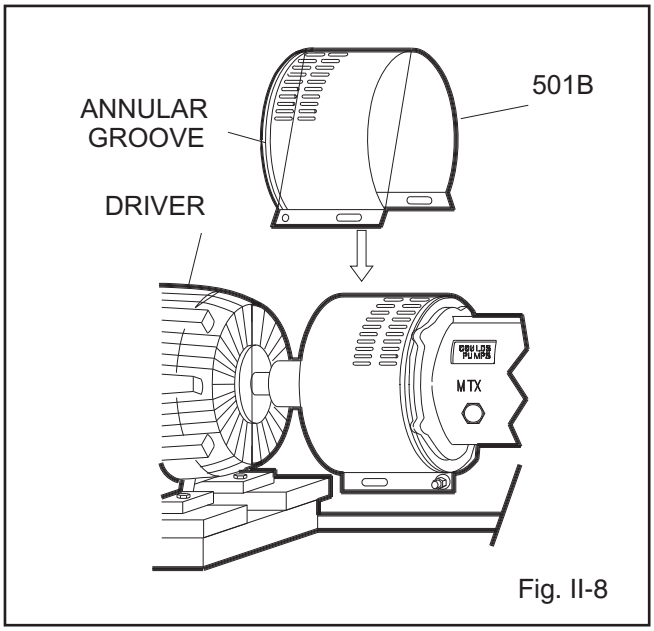


Fig. II-8

5. Place end plate (driver end) over motor shaft as shown in Fig. II-9. Locate the end plate in the annular groove at the rear of the coupling guard half (driver end) and secure with a bolt, nut, and two (2) washers through the round hole at the rear of the guard half. Finger tighten only.

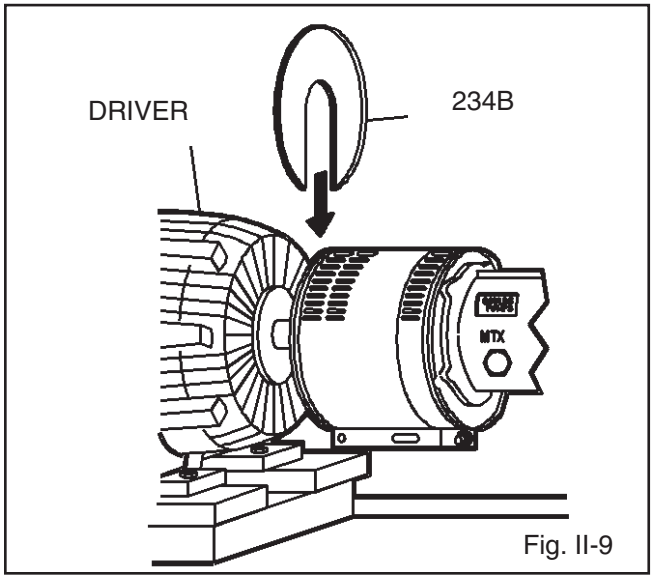


Fig. II-9

6. Adjust length of coupling guard to completely cover shafts and coupling as shown in Fig. II-10 by sliding coupling guard half (driver end) towards motor. After adjusting guard length, secure with bolt, nut and two (2) washers through the slotted holes at the center of the guard and tighten. Check all nuts on the guard assembly for tightness.

WARNING

Before assembly or disassembly of the coupling guard is performed, the motor must be de- energized, the motor controller/starter put in a locked-out position and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation if the pump. ITT Goulds Pumps assumes no liability for avoiding this practice.

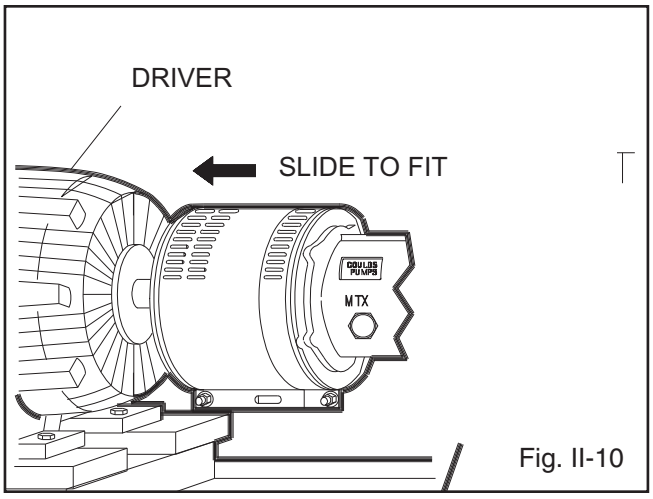


Fig. II-10

Disassembly

The coupling guard must be removed for certain maintenance and adjustments to the pump, such as adjustment of the coupling, impeller clearance adjustment, etc. The coupling guard should be replaced after maintenance is completed.

DO NOT resume normal pump operation with the coupling guard removed.

NOTE: Refer to illustrations for assembly in reverse order.

1. Remove nut, bolt, and washers from center slotted hole in the coupling guard. Slide motor end coupling guard half towards pump. Fig. II-10.
2. Remove nut, bolt, and washers from coupling guard half (driver end), and remove end plate. Fig. II-9.
3. Spread bottom of coupling guard half slightly and lift off. Fig. II-8.
4. Remove remaining nut, bolt, and washers from coupling guard half (pump end). Spread bottom of coupling guard half slightly and lift off. Fig. II-4.

This completes disassembly of the coupling guard.

NOTE: It is not necessary to remove the end plate (pump end) from the pump bearing housing. The bearing housing tap bolts are accessible without removing the end plate in case maintenance of internal pump parts is necessary. Before removing the pump bearing housing, refer to Section 6 - Disassembly & Reassembly.

APPENDIX III

Alignment

Alignment procedures must be followed to prevent unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.

SET UP

1. Mount two dial indicators on one of the coupling halves (X) so they contact the other coupling half (Y) (Fig. III-1).
2. Check setting of indicators by rotating coupling half X to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.

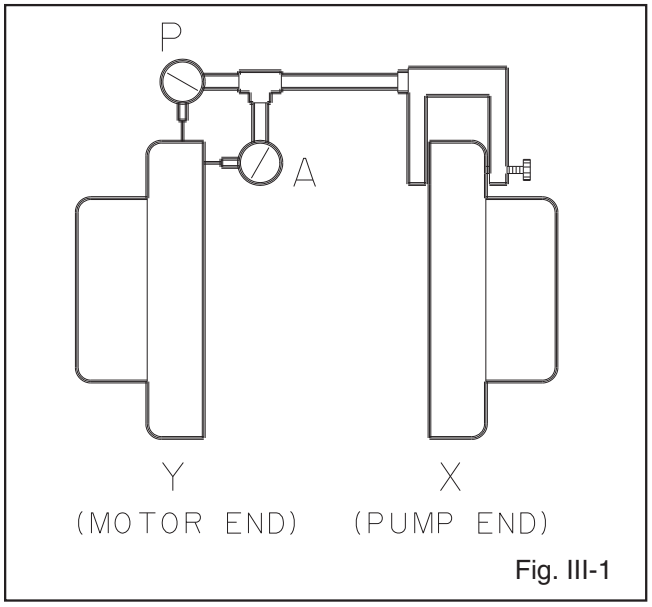


Fig. III-1

MEASUREMENT

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

ANGULAR ALIGNMENT

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

Vertical Correction (Top-to-Bottom)

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

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

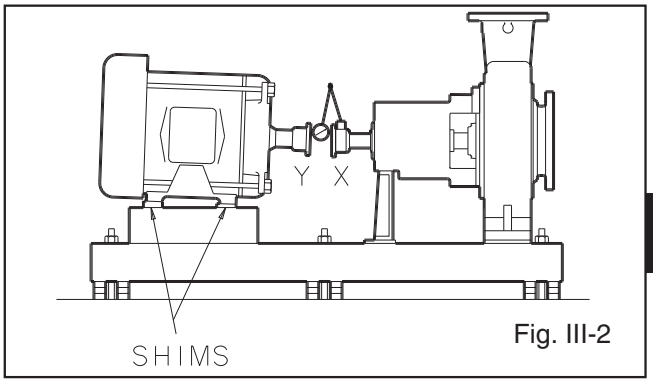


Fig. III-2

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

Horizontal Correction (Side-to-Side)

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

3. **Positive Reading** - The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. III-3).

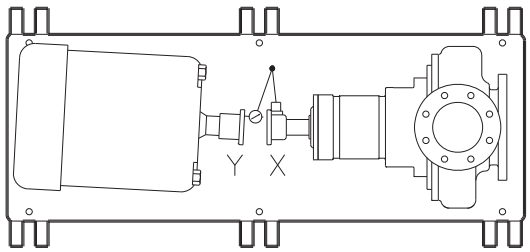


Fig. III-3

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

5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

PARALLEL ALIGNMENT

A unit is in parallel alignment when indicator P (parallel indicator) does not vary by more than .002 in. (.05 mm) as measured at four points 90° apart at operating temperature. Note the preliminary vertical cold setting criteria, Table 1.

Vertical Correction (Top-to-Bottom)

1. Zero indicator P at top dead center of coupling (12 o'clock) half Y (Fig. III-1).

2. Rotate indicator to bottom dead center (6 o'clock). Observe needle and record reading.

3. **Negative Reading** - Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of the indicator reading under each driver foot.

   Positive Reading - Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of the indicator reading from each driver foot (Fig. III-4).

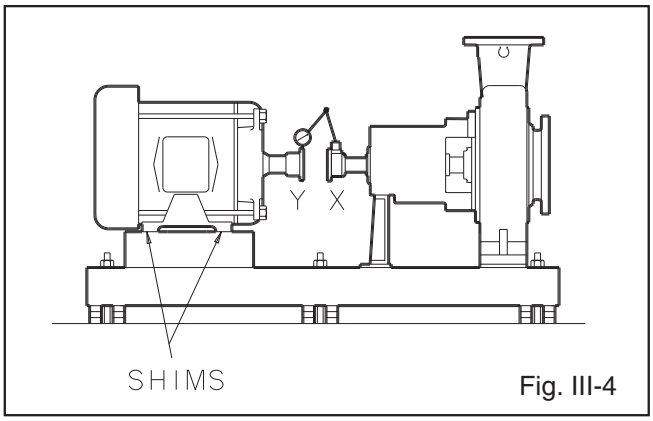


Fig. III-4

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

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

Horizontal Correction (Side-to-Side)

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

2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.

3. **Negative Reading** - Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. III-5).

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

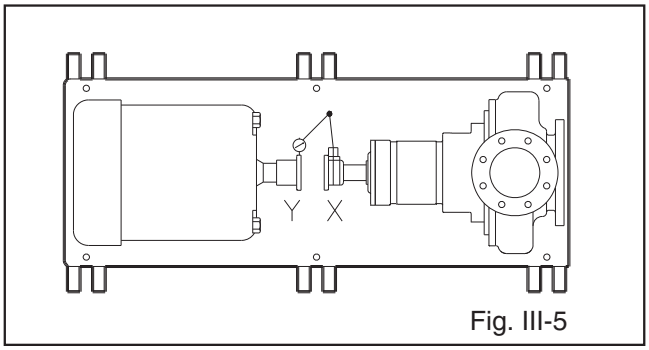


Fig. III-5

NOTE: Failure to slide motor evenly will affect horizontal angular correction.

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

5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

COMPLETE ALIGNMENT

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

Vertical Correction (Top-to-Bottom)

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

Horizontal Correction (Side-to-Side)

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

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

APPENDIX IV

Old JM Clipper CFT Design Labyrinth Seal Installation Instructions

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

Installation Procedures

! CAUTION

The ITT 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.

NOTE: The smooth surface of electrical tape provides an excellent surface to slide the rotor O-ring over.

3. 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.

NOTE: 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. ***For STX units:*** Press the seal over the shaft into the bearing frame by hand until the shoulder of the seal is seated against the frame.

   For all other units: Once the frame adapter is installed on the bearing frame, press the seal over the shaft into the frame adapter by hand until the shoulder of the seal is seated against the adapter.

NOTE: 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.

NOTE: 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 Teflon® 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/ Teflon® residue.

Labyrinth Oil Seal Conversion (After Oct. '03)

As of October 2003 ITT Goulds has standardized on INPRO VBXX-D Brass Labyrinth Oil Seals over the old JM Clipper CFT design. As a result of this change, new part numbers have been assigned to the old JM Clipper CFT design as follows:

Table IV-1
Labyrinth Oil Seal Conversion
Part Numbers

	Old Part #	New Part #
STX Frame (Outboard)	D08717A01	D08717A44
STX Frame (Inboard)	D08717A02	D08717A45
MTX (Outboard)	D08717A03	D08717A46
MTX (Itboard)	D08717A04	D08717A47
LTX (Outboard)	D08717A05	D08717A48
LTX (Inboard)	D08717A06	D08717A49
XLTX (Outboard)	D08717A07	D08717A50
XLTX (Inboard)	D08717A08	D08717A51
* 3198 MTX (Inboard)	D08717A31	D08717A52

APPENDIX V

C-Face Adapter Installation Instructions

Disassembly

1. Remove the motor by loosening the motor mounting bolts (371). Refer to *Table V-1* for the number of bolts.

Table V-1
Number of Motor Bolts

Pump Frame	Motor frame	No. of Bolts
STX	All	4
MTX	143-286	4
	324-365	8

! CAUTION

The motor may be heavy and should be properly supported with a clean, uncorroded eye bolt or a strap under both end bells.

NOTE: Use of a C-Face adapter will result in one of the following configurations — a foot mounted adapter with an overhung motor or an unsupported adapter and a foot mounted motor.

2. Remove the C-Face adapter (340) from the pump bearing frame (228A) by loosening the four bolts (371N) attached to the bearing frame flange.

NOTE: Both coupling hubs do not need to be removed.

Inspections

1. Visually inspect the C-face adapter (340) for cracks. Check surfaces for rust, scale, or debris. Remove all loose or foreign material (Fig. V-1).
2. Check for corrosion or pitting.

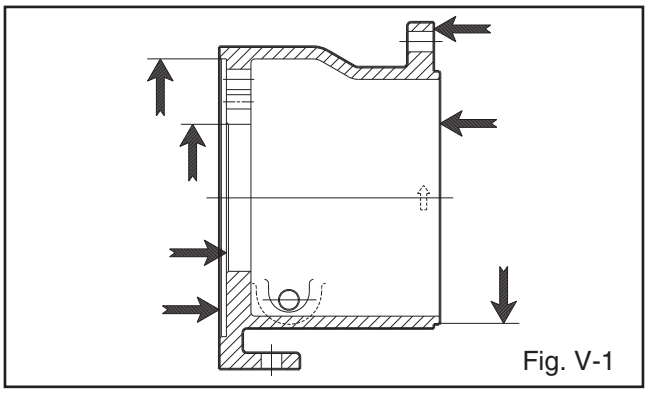


Fig. V-1

Reassembly

1. Mount both the pump and motor coupling hubs if not already mounted.
2. Slide the C-Face adapter (340) over the pump shaft (122) and mount against the pump bearing frame (228A) flange using four bolts (371N). Torque bolts to the values shown in *Table V-2*.
3. Mount the motor to the C-Face adapter (340) using the four or eight motor bolts (371). Torque bolts to the values shown in *Table V-2.*

Table V-2
Bolt Torque

Location	Frame	Lubricated Threads	Dry Threads
C-face adapter-to-frame	STX	20 ft-lbs (27 N-m)	30 ft-lbs (40 Nm)
	MTX	20 ft-lbs (27 N-m)	30 ft-lbs (40 Nm)
	LTX	20 ft-lbs (27 N-m)	30 ft-lbs (40 Nm)
C-face adapter-to-motor	143TC-145TC	8 ft-lbs (11 N-m)	12 ft-lbs (16 Nm)
	182TC-286TC	20 ft-lbs (27 N-m)	30 ft-lbs (40 Nm)
	324TC-365TC	39 ft-lbs (53 N-m)	59 ft-lbs (80 Nm)

Alignment

A shaft alignment is not required when using the C-Face adapter. The rabbetted fits of the motor to the adapter and the adapter to the bearing frame automatically aligns the shaft to within the specified limits below.

The C-face motor adapter is intended for end users who need fast pump installation. A C-face adapter can attain a nominal alignment of 0.007 inches TIR. However, due to the stack up of machining tolerances of the various parts, the alignment can be as high as 0.015 inches TIR. Using a flexible, elastomer coupling like a Rexnord ES or Wood's Sureflex will provide acceptable pump and motor life under these alignment conditions.

To achieve the best Mean Time Between Pump Maintenance (MTBPM) requires shaft alignments of less than 0.002 inches (0.05mm). End users who require high pump and motor reliability are better served by using a foot mounted motor on a precision machined baseplate and performing a conventional alignment.

APPENDIX VI

3198 Teflon® Sleeve Field Replacement Procedure

The Model 3198 Teflon® sleeve is field replaceable, provided a controlled oven capable of heating the sleeve to 550° F (228° C) and a method of machining the sleeve after installation on the shaft are available.

CAUTION

Do not heat the sleeve with an open flame. Irreparable damage will occur to the sleeve.

For those users who do not have the above facilities, shaft/sleeve sub-assemblies are available from ITT Goulds.

1. Remove the old or damaged sleeve (126) from the shaft (122). The sleeve may be cut lengthwise with a sharp knife.
2. Thoroughly clean the shaft. Pay particular attention to the knurled area of the shaft under the sleeve.

NOTE: The replacement sleeve will not have the same dimensions as the sleeve which was removed until it is mounted on the shaft and machined.

3. Heat the replacement sleeve in a controlled oven at 550° F (288° C) for 40 minutes.

CAUTION

Do not heat the sleeve with an open flame — irreparable damage will occur to the sleeve.

WARNING

The oven and sleeve are hot. Use insulated gloves to prevent burn injuries.

4. Remove the sleeve from the oven.
5. Slide the sleeve onto the shaft immediately after removing it from the oven. Push the sleeve onto the shaft until the sleeve bottoms out on the shoulder of the shaft (Fig. VI-1). The hook end of the sleeve will extend beyond the knurled portion of the shaft.

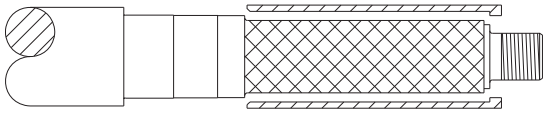


Fig. VI-1

6. As the sleeve cools, it will shrink in length. Apply light pressure to keep the sleeve against the shaft shoulder. Maintain pressure until the hook portion of the sleeve seats itself against the shoulder under the hook (Fig. V-2).

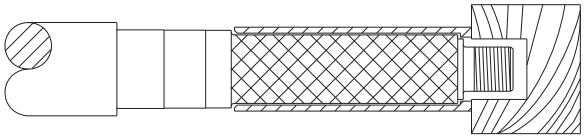


Fig. VI-2

CAUTION

Care must be taken not to damage the end of the sleeve.

7. Allow the shaft and sleeve to cool completely.

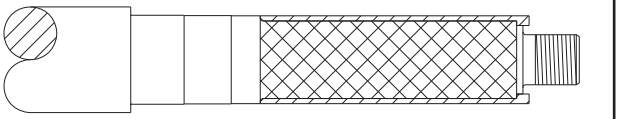


Fig. VI-3

8. Machine the Teflon® sleeve to the dimensions and finish shown in *Table VI-1.*

Table VI-1

3198 Teflon® Sleeve Diameter and Finish

Frame	Sleeve OD	Surface Finish
STX	1.375 / 1.373	16 µ in.
MTX	1.750 / 1.748	16 µ in.

9. Face off the sleeve shoulder even with and parallel to the shaft shoulder (Fig. VI-4).

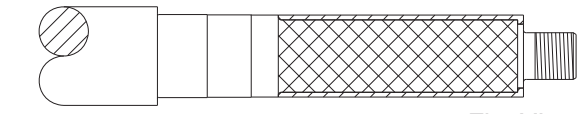


Fig. VI-4

8

APPENDIX VII-1

Double Row Angular Contact Bearing Installation Instructions

1. Inspect the shaft (122) to ensure that it is clean, dimensionally correct, and is free of nicks, burrs, etc.
2. Lightly coat the bearing seating with a thin film of oil.
3. Remove the bearing (112) from its packaging.
4. Wipe the preservative from the bearing (112) bore and outer diameter.
5. Use an induction heater with a demagnetizing cycle to heat bearing (112) to an inner ring temperature of 230 °F (110 °C).

⚠ WARNING

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

6. Position the bearing (112) on the shaft (122) against the shoulder and snug the locknut (136) against the bearing until it is cool. The locknut prevents the bearing from moving away from the shaft shoulder as it cools.

NOTE: Regreasable bearing has a single shield. The outboard bearing is installed with shield toward impeller.

7. Remove bearing locknut (136) after bearing (112) has cooled.
8. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft.
9. Thread locknut (136) onto shaft (122). Tighten locknut one-eighth (1/8) to one-quarter (1/4) turn beyond snug. Bend any tang of lockwasher (382) into a slot of locknut.

NOTE: Tighten locknut if necessary to align the closest tab of lockwasher with slot on locknut, but do not overtighten. See Table VII-1 for maximum locknut torque.

Table VII-1
Maximum Bearing Locknut Torque

Group	Bearing Size	Locknut Size	Torque Ft-Lb (Nm)
STX	5306	N-06	20 (27)
MTX	5309	N-09	50 (68)
XLT-X, X17	5313	N-13	140 (190)

Table VII-2
Maximum Bearing Locknut Torque

Group	Bearing Size	Locknut Size	Maximum Torque Ft-Lb (N•m)
STX	7306	N-06	20 (27)
MTX	7309	N-09	50 (68)
LTX	7310	N-10	70 (95)
XLT-X, X17	7313	N-13	140 (190)

APPENDIX VII-2

Duplex Angular Contact Bearing Installation Instructions

1. Inspect the shaft (122) to ensure that it is clean, dimensionally correct, and is free of nicks, burrs, etc. (Fig. VII-1).

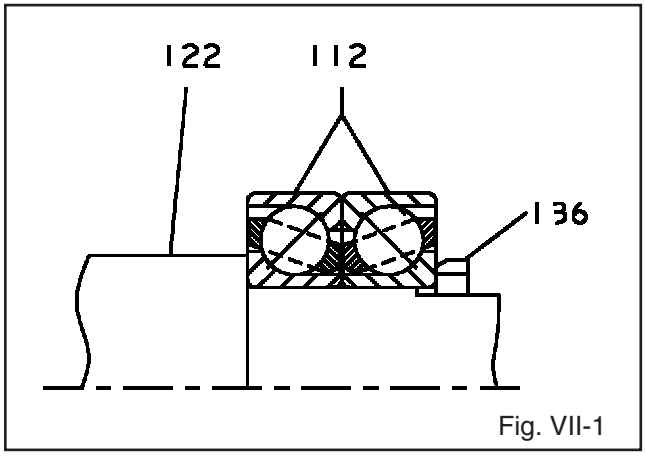


Fig. VII-1

2. Lightly coat the bearing seating with a thin film of oil.
3. Remove the bearings (112) from their packaging.
4. Wipe the preservative from the bearing (112) bore and outer diameter.
5. Use an induction heater with a demagnetizing cycle to heat both bearings (112) to an inner ring temperature of 230 °F (110 °C).
6. Place both bearings (112) on the shaft (122) with the large outer races together (back to back).

! CAUTION

Duplex bearings are mounted back to back. Make sure orientation of bearings is correct.

⚠ WARNING

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

7. Position the bearings (112) on the shaft (122) against the shoulder and snug the locknut (136) against the bearings until they are cool. The locknut prevents the bearings from moving away from the shaft shoulder as they cool. It is best to rotate the outer bearing rings relative to each other as they are placed on the shaft to assure good alignment.
8. Remove bearing locknut (136) after bearings (112) have cooled.
9. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft. (Fig. VII-2).

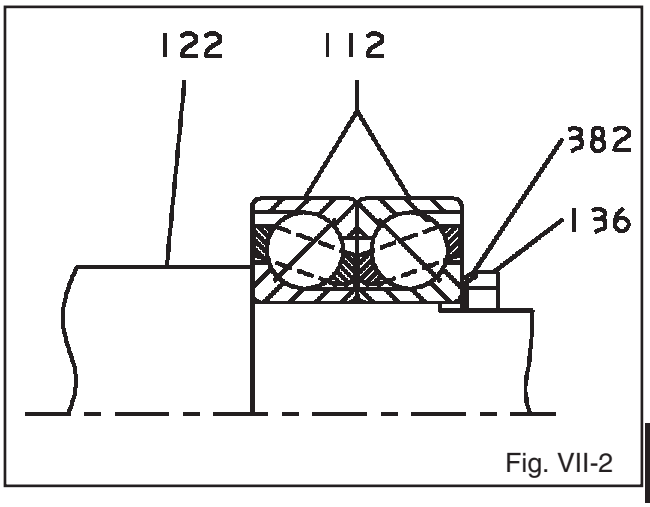


Fig. VII-2

10. Thread locknut (136) onto shaft (122). Tighten locknut one-eighth (1/8) to one-quarter (1/4) turn beyond snug. Bend any tang of lockwasher (382) into a slot of locknut.

NOTE: Tighten locknut if necessary to align the closest tab of lockwasher with slot on locknut, but do not overtighten. Refer to Table VII-2 for maximum locknut torque.

8

APPENDIX VIII

INPRO Labyrinth Oil Seal Installation Instructions

Description of Operation

The INRP VBXX-D® Labyrinth Oil Seal is specially designed to protect pump bearings from lubrication starvation as well as environmental contamination. The bearing is made up of three basic parts: the rotor (1), stator (2), and VBX® Ring (3). The rotor (1) fits over the shaft and is held in place by an elastomeric drive ring (4). The drive ring causes the rotor to turn with the shaft and provides a positive, static seal against the shaft. There is no metal-to-metal contact, therefore, no friction or wear concerns.

Intallation Procedures

! CAUTION

The INPRO VBX is a one piece design. Do not attempt to separate the rotor (1) from the stator (2) prior to or during installation.

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

! CAUTION

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

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

NOTE: The smooth surface of the electrical tape provides an excellent surface to slide the rotor O-ring over.

3. Lightly lube the shaft and rotor drive ring (4) with supplied lubricant.

NOTE: Lubricant will aid in the installation process. If used, be sure the lubricant is compatible with the O-ring material and plant standards.

4. Use an arbor press to install the outboard INPRO VBXX-D® into the bearing cover with the expulsion port (6) at the 6 o'clock position. Press it only as far as the beginning of the stator location ramp (9) and avoid angular misalignment. There is nominal 0.002" interference fit. Discard any residual material from the stator gasket (5).

For STX Units

5. Press the inboard seal over the shaft into the bearing frame as described in Step 4 above.

For All Other Units

5. Once the frame adapter is installed on the bearing frame, press the inboard seal over the shaft and into the adapter as descbied in Step 4 above.

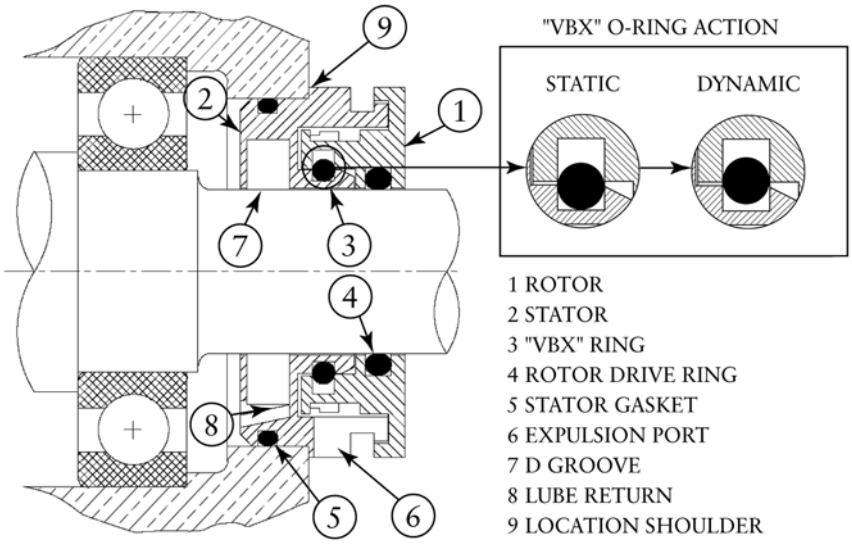


Fig. VIII-1

NOTES

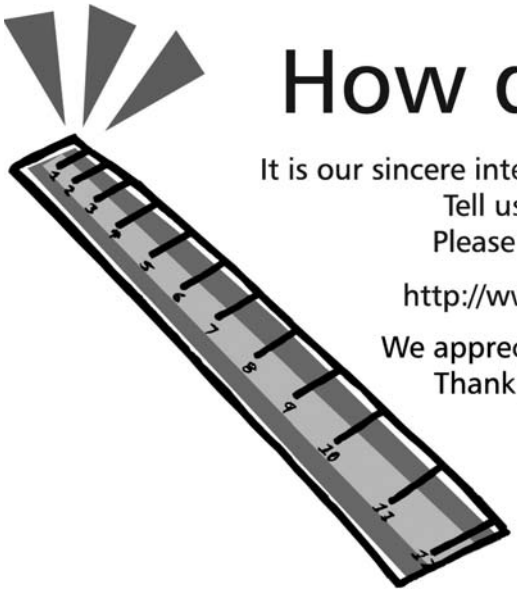
NOTES

HOW TO ORDER

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

EMERGENCY SERVICE

Emergency parts service is available
24 hours/day, 365 days/year . . .
Call 1-800-446-8537



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We appreciate you taking the time to provide your feedback.
Thank you for buying ITT pumps, parts, and controls.

ITT