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.

DISASSEMBLY & REASSEMBLY

REQUIRED TOOLS

- Wrenches
- Screwdriver
- Lifting Sling
- Rubber Mallet
- Induction Bearing Heater
- Bearing Puller
- Brass Drift Punch
- Snap-Ring Pliers
- Torque Wrench with Sockets
- Allen Wrenches
- Dial Indicator
- Micrometer
- Cleaning Agents
- Feeler Gauges
- Hydraulic Press
- Leveling Blocks

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.

NOTE: 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.

If pump is a Model NM3196 or a 3198 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

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

3. Disconnect all auxiliary piping and tubing.
4. Remove coupling guard. Refer to Coupling Guard Installation and Disassembly Section in *Appendix II*.
5. Disconnect Coupling.

NOTE: Refer to Appendix V for C-Face adapter disassembly instructions, if required.

6. Remove coupling guard pump endplate.
7. If oil lubricated, drain oil from bearing frame by removing bearing frame drain plug (408A). Replace plug after oil is drained. Remove oil reservoir, if equipped (Fig. 40).

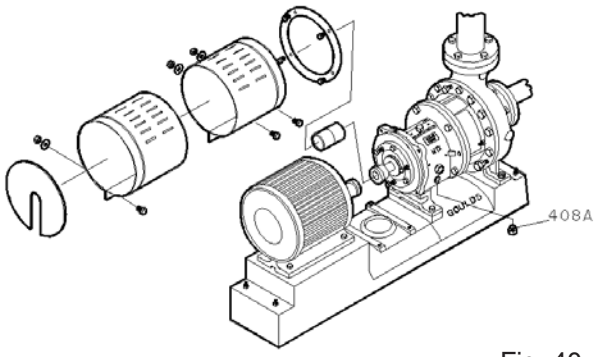


Fig. 40

NOTE: Oil analysis should be part of a preventive maintenance program and is helpful to determine cause of a failure. Save oil in a clean container for inspection.

8. *All, except with C-Face adapter:* Place sling from hoist through frame adapter (108) or frame (228A) for STX (Fig. 41).

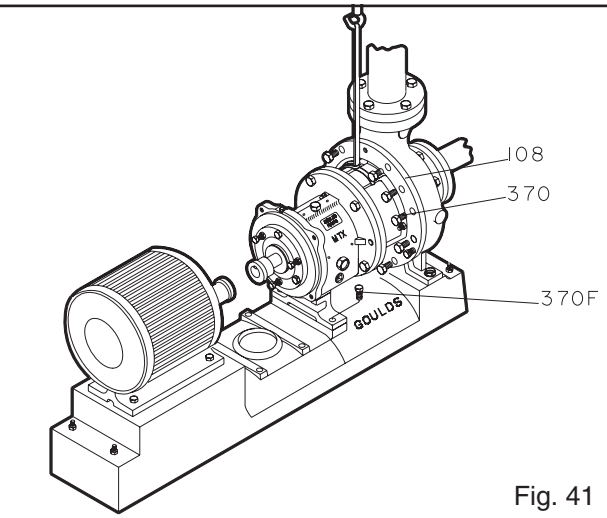


Fig. 41

C-Face adapter: Place one sling from hoist through frame adapter (108) or frame (228A) for STX and a second sling from hoist through the C-Face adapter (Fig. 42).

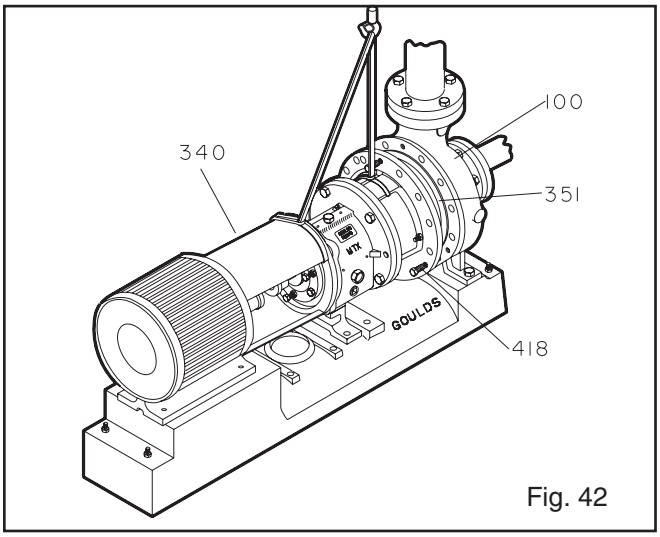


Fig. 42

9. Remove bearing frame foot hold down bolts.
10. Remove casing bolts (370).

⚠ 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.

11. Remove back pull-out assembly from casing (100). Tighten jack screws (418) evenly to remove back pull-out assembly (Fig. 43).

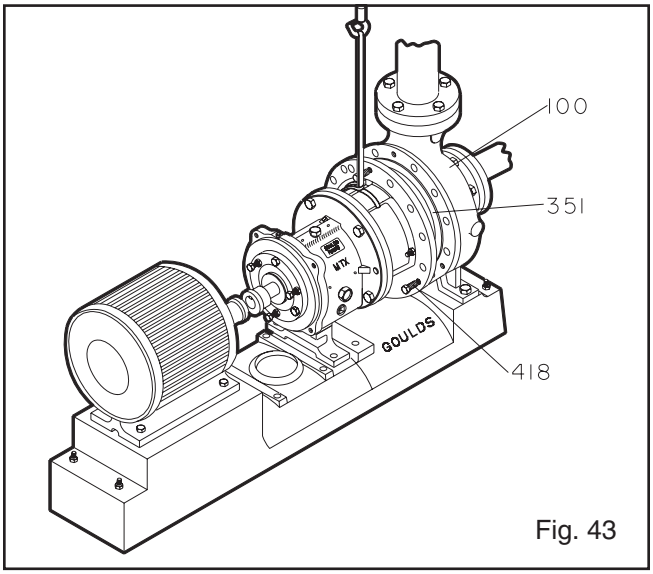


Fig. 43

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

NOTE: Remove and then mark shims from under frame foot. Save for reassembly.

⚠ WARNING

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

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

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

14. Move back pull-out assembly to clean workbench.
15. Support frame adapter (108) securely to workbench.
16. Remove coupling hub (Fig. 44).

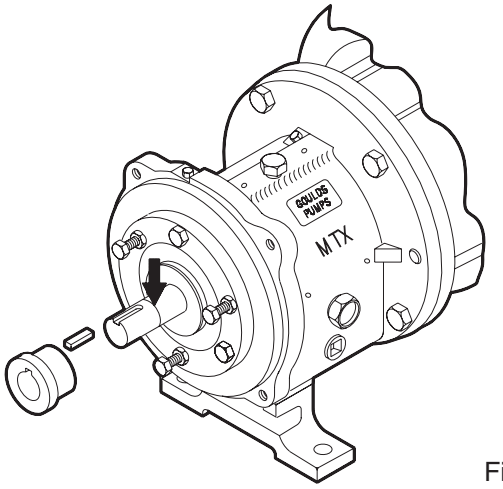


Fig. 44

NOTE: Blue and scribe shaft for relocating coupling hub during reassembly.

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. Slide ITT Goulds shaft wrench (A05107A or A01676A) over the shaft (122) and key.
2. Rotate the impeller clockwise (viewed from the impeller end of the shaft), raising the wrench off of the work surface.
3. Quickly turn the impeller counterclockwise (viewed from the impeller end of the shaft), impacting the wrench handle on the workbench or a solid block until the impeller loosens (Fig. 45).

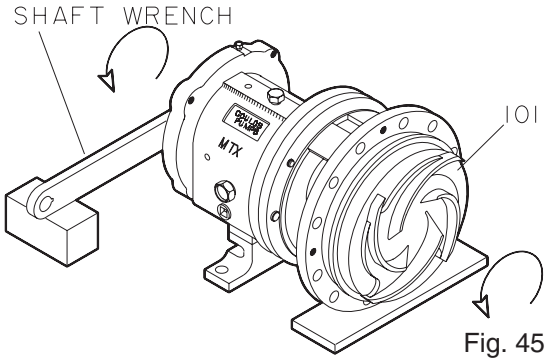
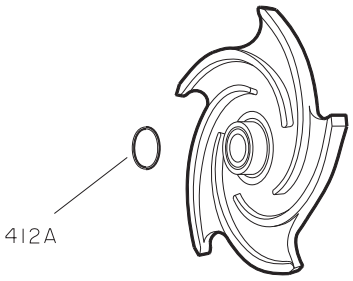


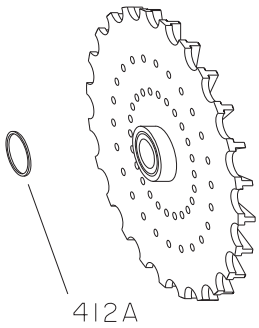
Fig. 45

4. Remove impeller O-ring (412A) and discard (Fig. 46, 47, 48). Replace with a new o-ring during reassembly.



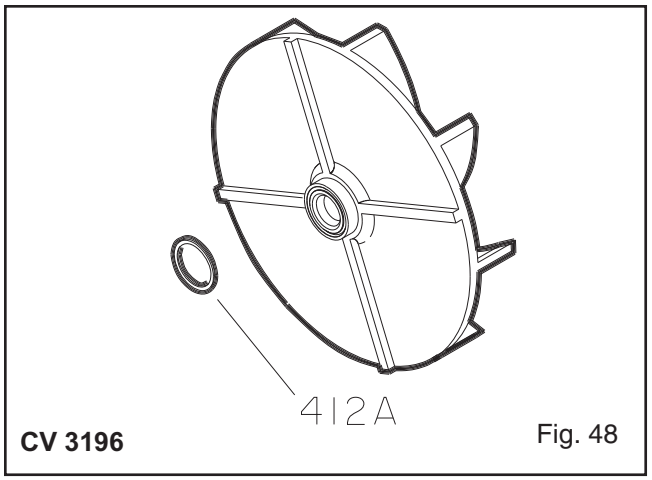
3196, HT 3196,
NM 3196, 3198, 3796

Fig. 46



LF 3196

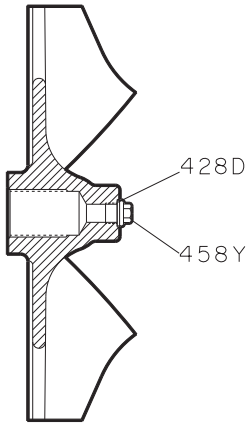
Fig. 47



CV 3196 Fig. 48

XLT-X & X17

1. Remove impeller plug (458Y) from the front of the impeller (101) and discard the Teflon® gasket (428D) (Fig. 49).



3196 XLT-X and X-17
HT 3196 XLTX

Fig. 49

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 ITT Goulds shaft wrench (A05107A) over the shaft (122) and key.
4. Rotate the impeller clockwise (viewed from the impeller end of the shaft), raising the wrench off of the work surface.
5. Quickly turn the impeller counterclockwise (viewed from the impeller end of the shaft), impacting the wrench handle on the workbench or a solid block until the impeller loosens (Fig. 45).
6. If the impeller cannot be loosened after several attempts, place a socket wrench over the cast nut on the impeller hub and turn the impeller counterclockwise (viewed from the impeller end of the shaft). Be sure the impeller wrench is resting on the workbench or a solid block and the power end is secure on the work surface.
7. Remove impeller O-ring (412A) and discard (Fig. 46, 47, 48). Replace with a new o-ring during reassembly.

NOTE: It is recommended that the frame foot (241) be clamped to the workbench when using this method to remove the impeller.

NOTE FOR ALL MODELS: If the impeller cannot be removed by the previous methods, cut the shaft between the gland and the frame, remove the impeller, stuffing box cover, gland, sleeve and shaft end as a unit. Do not use heat.

REMOVAL OF SEAL CHAMBER COVER (MECHANICAL SEAL) - 3196, CV 3196, HT 3196, LF 3196, 3796

1. Remove gland stud nuts (355).
2. Remove seal chamber stud nuts (370H).
3. Remove seal chamber (184). (Fig. 50)

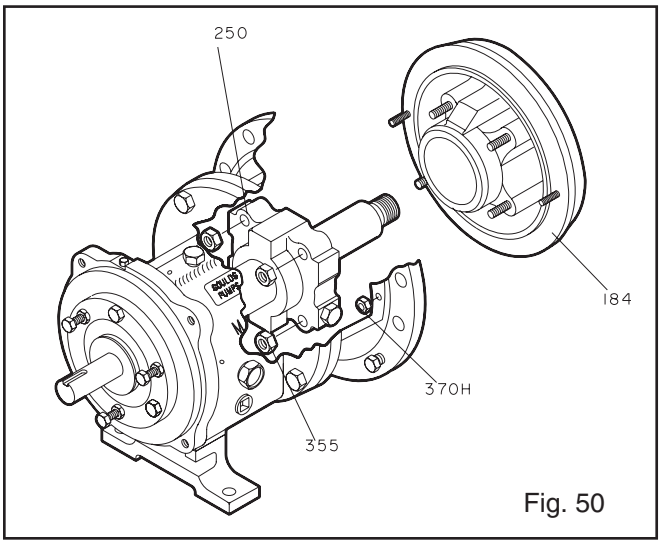


Fig. 50

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

NOTE: 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 O-ring (360Q) (Fig. 51).

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

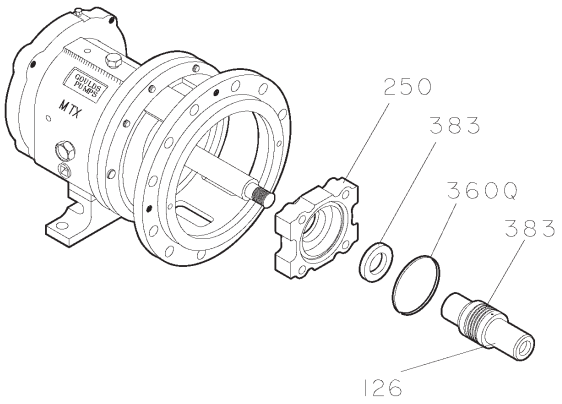


Fig. 51

REMOVAL OF SEAL CHAMBER COVER AND/OR BACKPLATE - NM 3196 & 3198

1. Remove the gland or seal chamber stud nuts (355).
2. Remove the backplate and stud nuts (370H).
3. Remove the backplate (184) (Fig. 52).

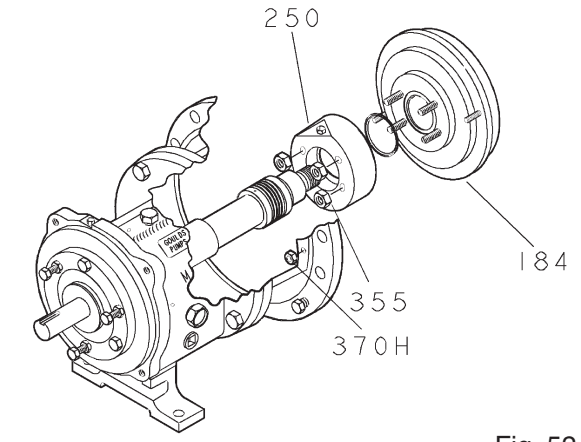


Fig. 52

4. Remove the shaft sleeve (126).

NOTE: The mechanical seal is attached to the sleeve (126). The rotary portion of the seal needs to be removed from the sleeve by loosening the set screws and sliding off the sleeve. Refer to the mechanical seal instructions.

NOTE: The Teflon® sleeve on the 3198 must be cut off the shaft to be removed. First remove the mechanical seal from the sleeve. Now, the sleeve can be removed by slicing the sleeve lengthwise with a sharp knife.

5. Remove the stationary seat and the gland or seal chamber with the gland gaskets (Figs. 53 & 54).

NOTE: Be careful not to damage the stationary portion of the mechanical seal. It is either clamped between the backplate and the gland or seated in the seal chamber bore.

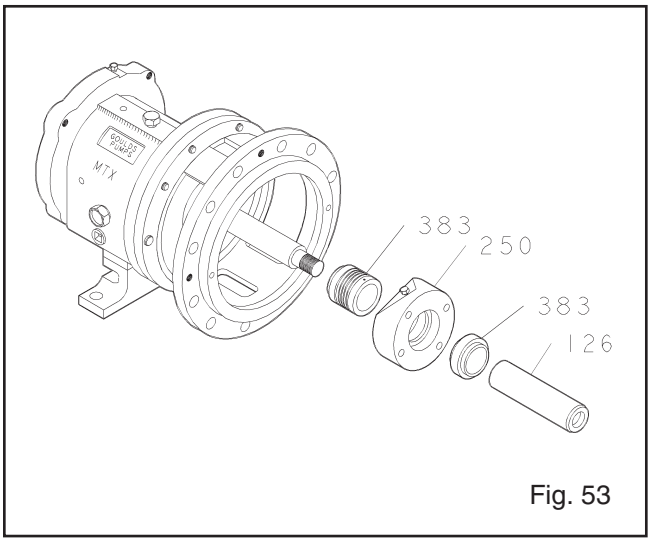
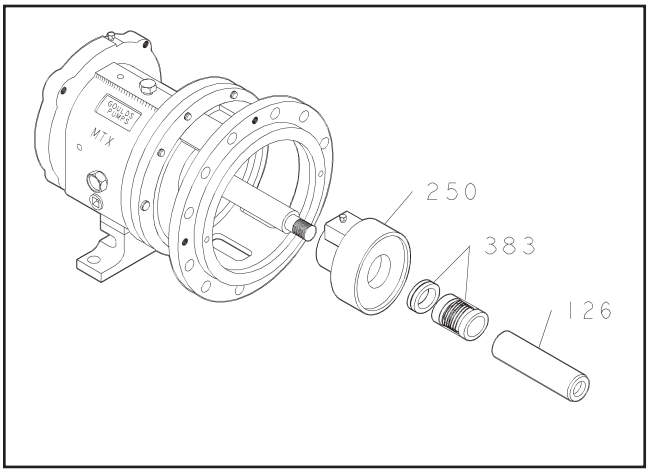


Fig. 53



REMOVAL OF STUFFING BOX COVER (PACKED BOX) - 3196, CV 3196, HT 3196, LF 3196, & 3796

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

3. Remove stuffing box cover (184). (Fig. 55).

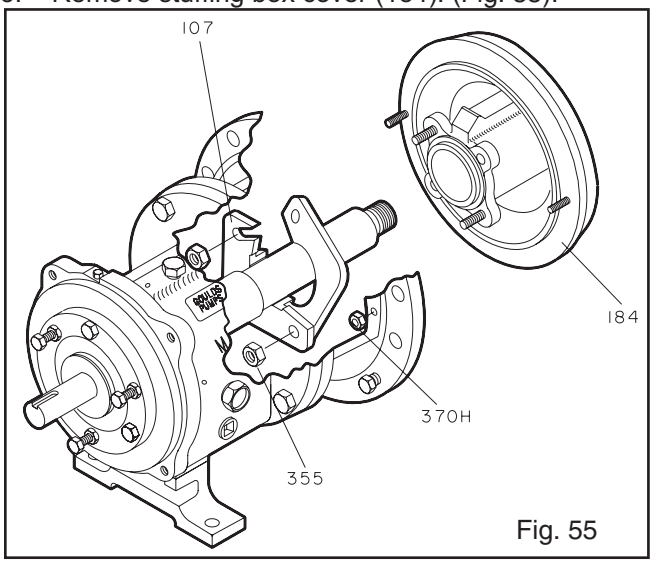


Fig. 55

4. Remove shaft sleeve (126) (Fig. 56).

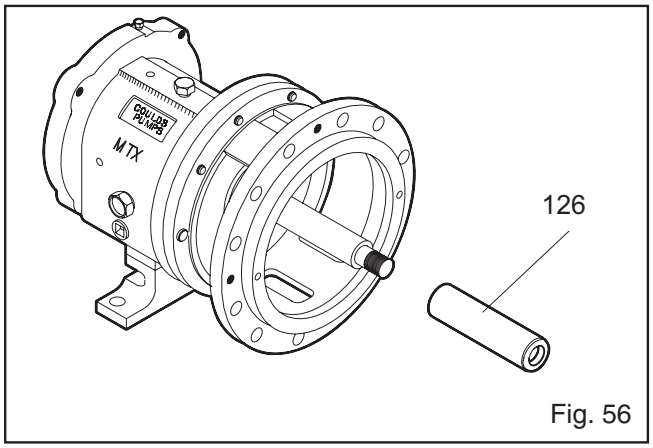


Fig. 56

5. Remove packing (106) and lantern ring (105) from stuffing box cover (184) (Fig. 57). No lantern ring is provided with self-lubricating graphite packing.

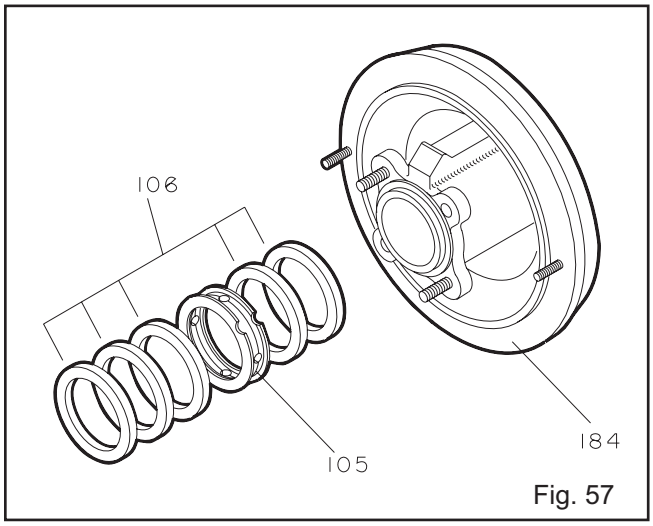


Fig. 57

REMOVAL OF DYNAMIC SEAL - 3196, CV 3196, LF 3196

1. Remove stud nuts (370H).
2. Remove dynamic seal assembly (Fig. 58).

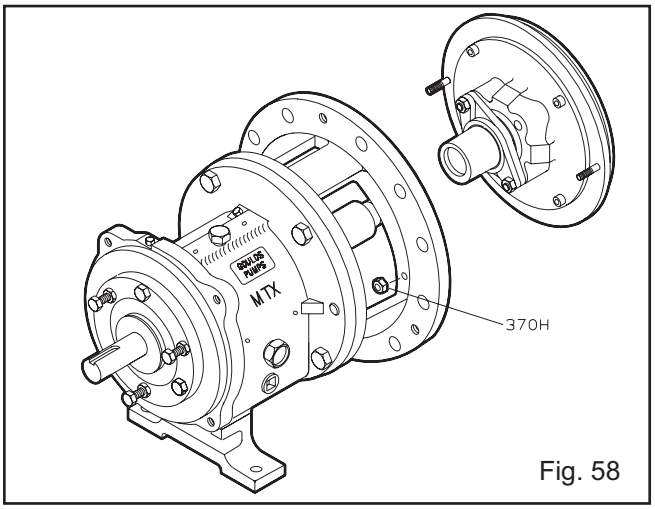


Fig. 58

3. Remove socket head cap screws (265) (Fig. 59).
4. Remove stuffing box cover (184) and gasket (264).
5. Remove repeller (262) from backplate (444).

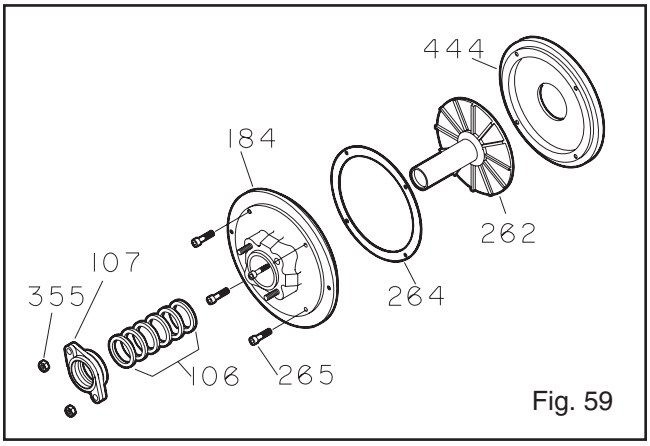


Fig. 59

REMOVE FRAME ADAPTER - MTX, LTX, XLT-X, X17

1. Remove dowel pins (469B), and bolts (370B).
2. Remove frame adapter (108) (Fig. 60).
3. Remove and discard gasket (360D). Replace with new gasket during reassembly.

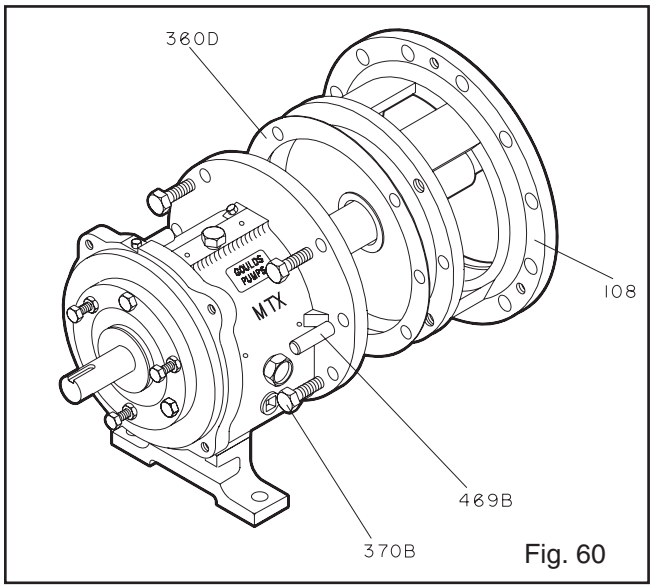


Fig. 60

NOTE: The 3198 frame adapter is not interchangeable with any other model's adapter.

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 O-rings (497H), (497J) if necessary (Fig. 61).

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

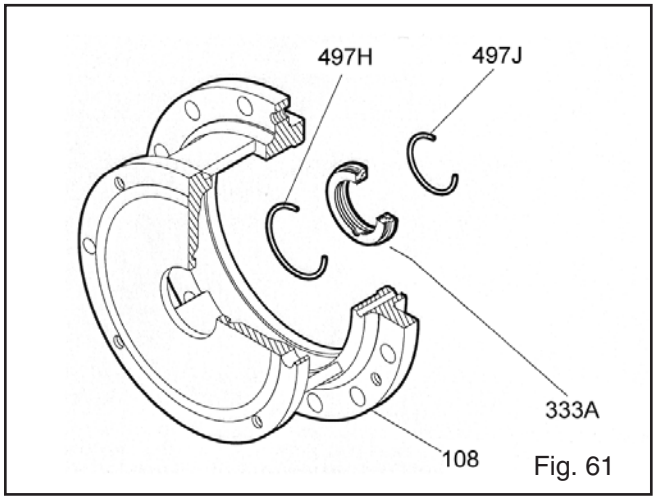


Fig. 61

DISASSEMBLY OF POWER END - STX, MTX

1. Remove clamp screws (370C). Back off jam nuts (423). Tighten jack screws (370D) evenly, this will start bearing housing (134) out of bearing frame (228A) (Fig. 62).
2. Remove the shaft assembly from the bearing frame (228A).

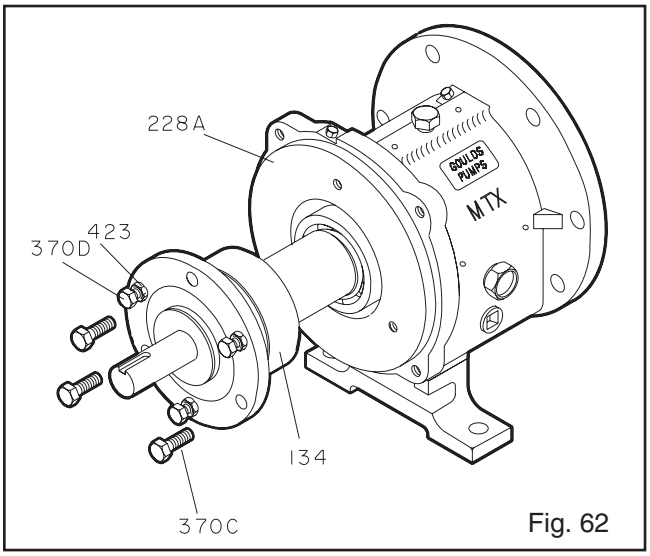


Fig. 62

3. Remove jack screws (370D) with nuts (423) (Fig. 63).
4. Remove bearing housing O-ring (496).
5. Remove outboard bearing retaining snap ring (361A).

NOTE: Snap ring cannot be removed from the shaft until bearings are removed.

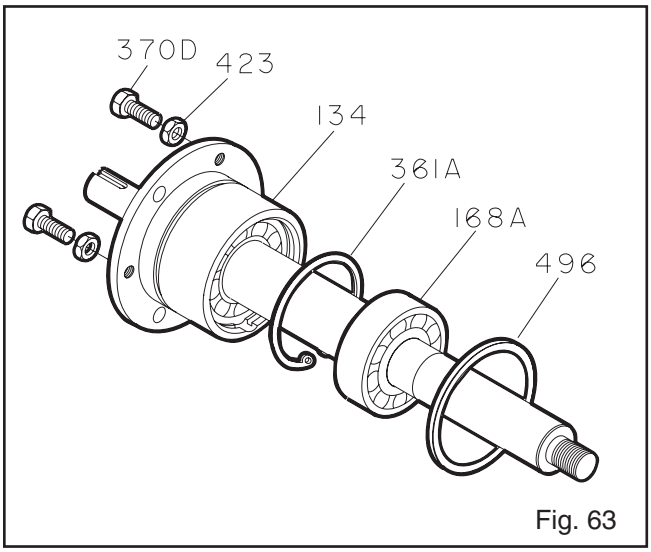


Fig. 63

6. Remove bearing housing (134) from shaft (122) with bearings (112A, 168A) (Fig. 64).

6

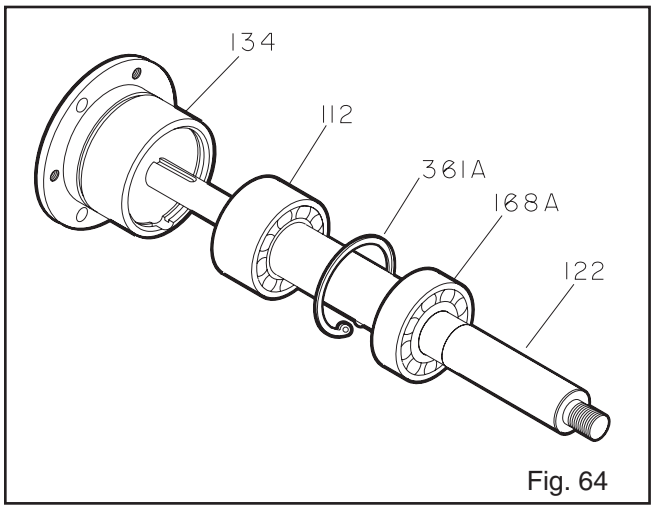


Fig. 64

7. Remove outboard labyrinth seal (332A) from bearing housing (134). Remove O-rings (497F), (497G) if necessary (Fig. 65).

NOTE: Labyrinth oil seal O-rings (497F, G) are part of 3196 maintenance kits or can be obtained separately.

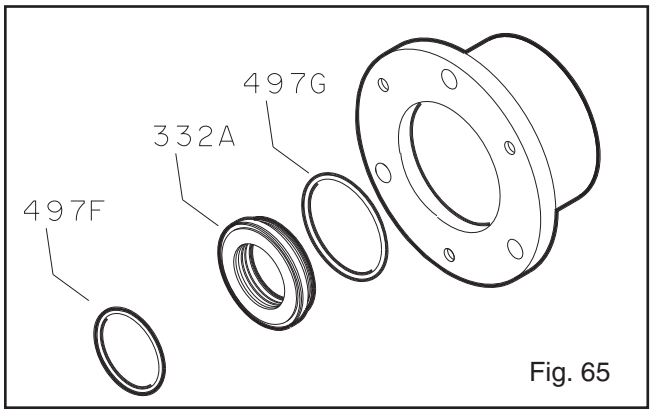


Fig. 65

8. Remove bearing locknut (136) and bearing lock washer (382) (Fig. 66).
9. Remove inboard bearing (168A).
10. Remove outboard bearing (112A).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection.

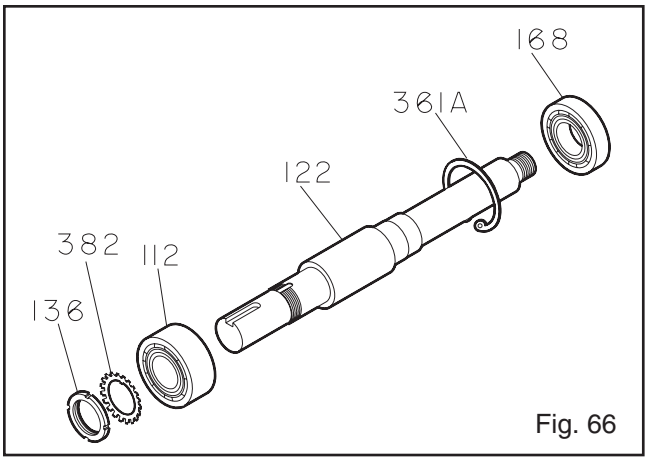


Fig. 66

DISASSEMBLY OF POWER END - LTX

1. Remove clamp screws (370C). Back off jam nuts (423). Tighten jack screws (370D) evenly, this will start bearing housing (134) out of bearing frame (228A) (Fig. 67).
2. Remove shaft assembly from bearing frame (228A).

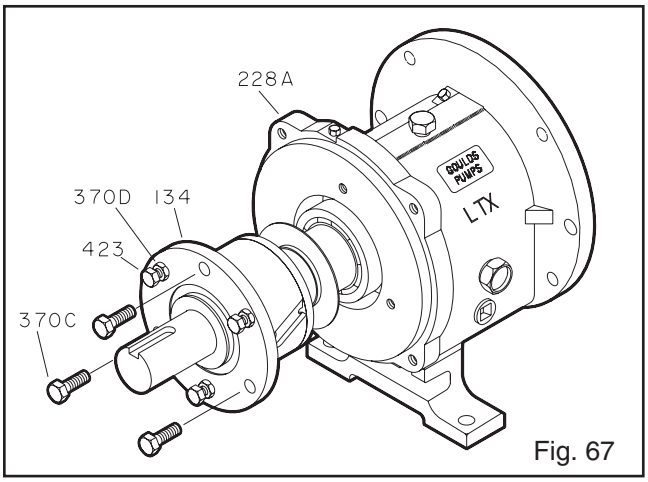


Fig. 67

3. Remove jack screws (370D) with nuts (423) (Fig. 68).

4. Remove clamp ring screws (236A). Separate clamp ring (253B) from bearing housing (134).

NOTE: Clamp ring cannot be removed from the shaft until bearings are removed.

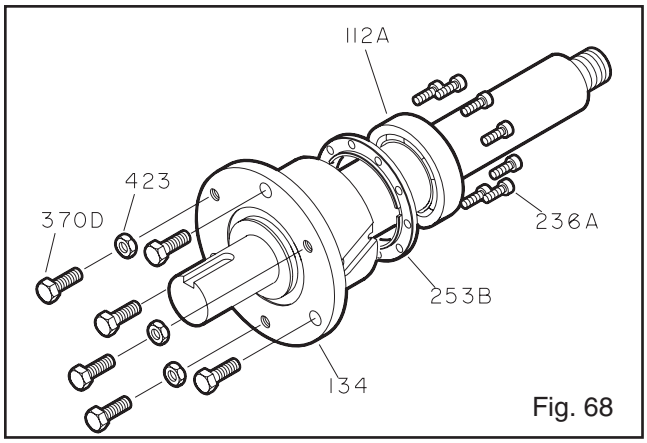


Fig. 68

5. Remove bearing housing (134) from shaft (122) with bearings (112A, 168A) (Fig. 69).

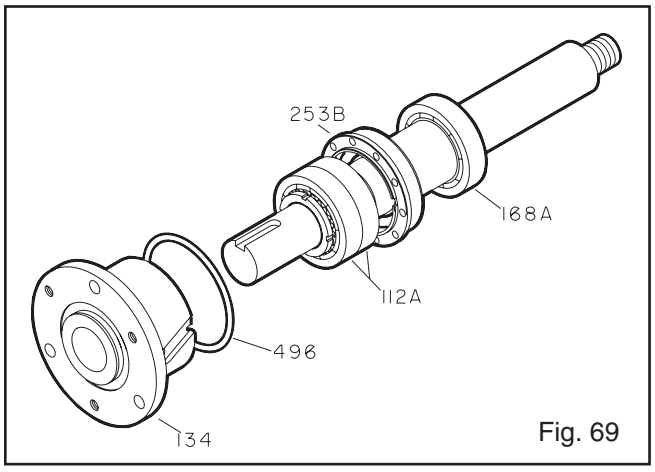


Fig. 69

6. Remove bearing housing O-ring (496).

7. Remove inboard bearing (168A) (Fig. 70).

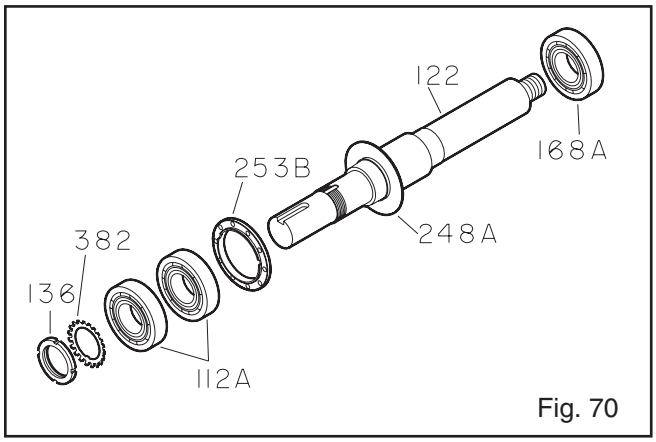


Fig. 70

8. Remove bearing locknut (136) and bearing lockwasher (382).

9. Remove outboard bearings (112A). Remove clamp ring (253B).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection. Do not reuse bearings.

NOTE: Do not remove oil flinger (248A) unless it is damaged.

10. Remove outboard labyrinth seal (332A) from bearing housing (134). Remove O-rings (497F), (497G) if necessary (Fig. 71).

NOTE: Labyrinth oil seal O-rings (497F, G) are part of 3196 maintenance kits or can be obtained separately.

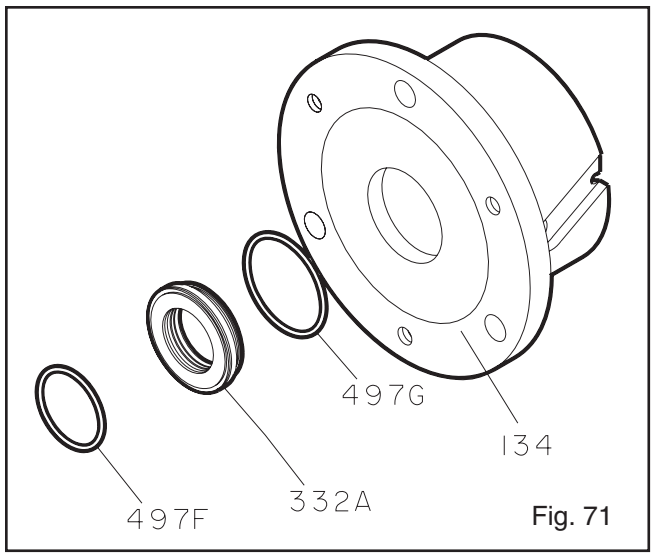


Fig. 71

DISASSEMBLY OF THE POWER END - XLT-X, X17

1. Remove bearing frame to frame foot bolts (370F) and frame foot (241) (Fig. 72).

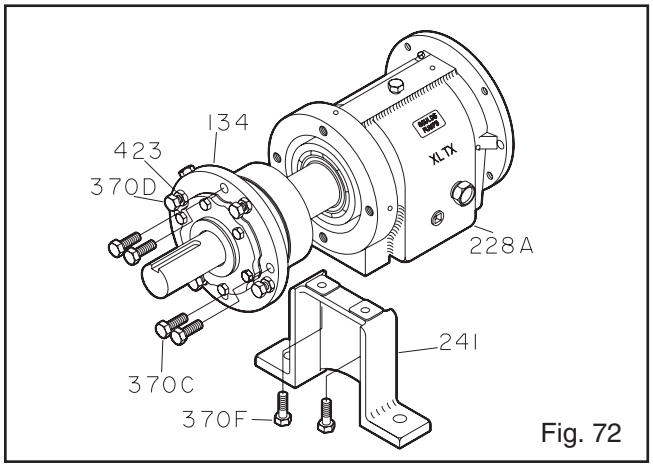


Fig. 72

2. Remove clamp screws (370C). Back off jam nuts (423). Tighten jack screws (370D) evenly, this will start bearing housing (134) out of bearing frame (228A).
3. Remove shaft assembly from bearing frame (228A).
4. Remove jack screws (370D) with nuts (423) (Fig. 73).
5. Remove bearing housing O-ring (496).
6. Remove inboard bearing (168A).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection.

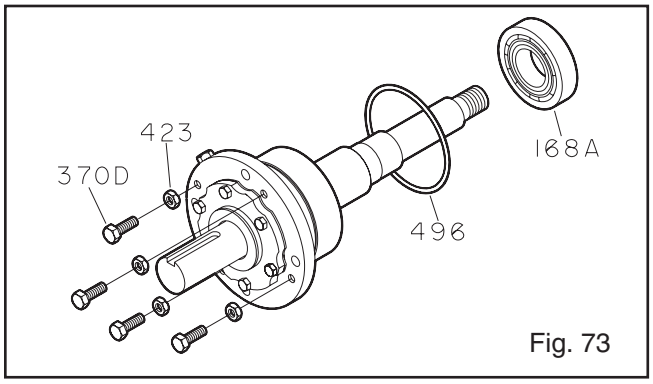


Fig. 73

7. Remove bolts (371C), bearing end cover (109A) and gasket (360C) (Fig. 74).
8. Remove outboard labyrinth seal (332A) from end cover (109A). Remove O-rings (497F), (497G) if necessary.

NOTE: Labyrinth oil seal O-rings (497F, G) are part of 3196 maintenance kits or can be obtained separately.

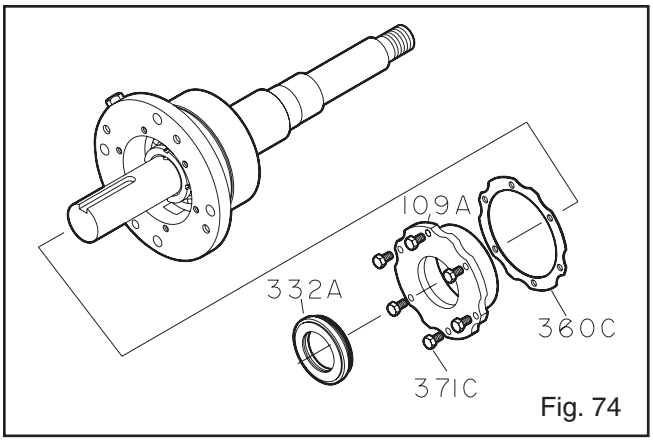


Fig. 74

9. Remove bearing housing (134) from shaft (122) with bearing (112A) (Fig. 75).

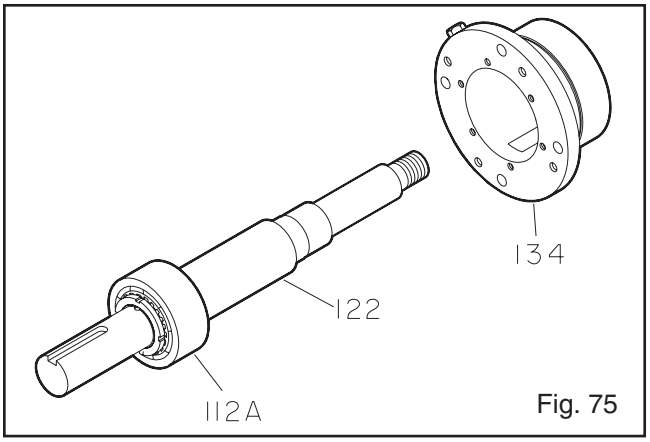


Fig. 75

10. Remove bearing locknut (136) and bearing lockwasher (382) (Fig. 76).

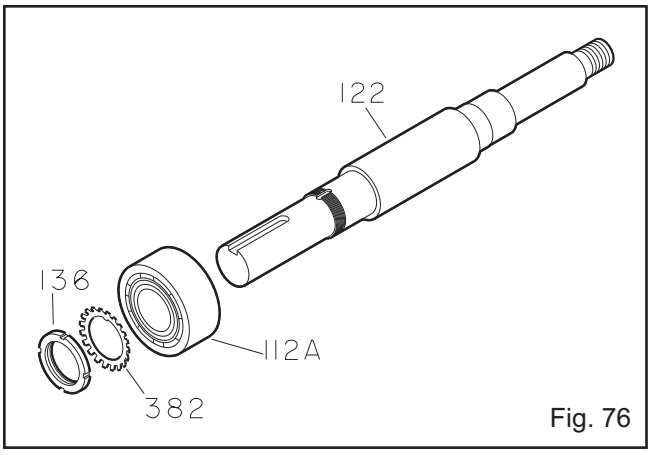


Fig. 76

11. Remove outboard bearing (112A).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection.

DISASSEMBLY OF POWER END - STX, MTX with Duplex Bearings

1. Remove clamp screws (370C). Back off jam nuts (423). Tighten jack screws (370D) evenly, this will start bearing housing (134) out of bearing frame (228A) (Fig. 77).
2. Remove shaft assembly from bearing frame (228A).

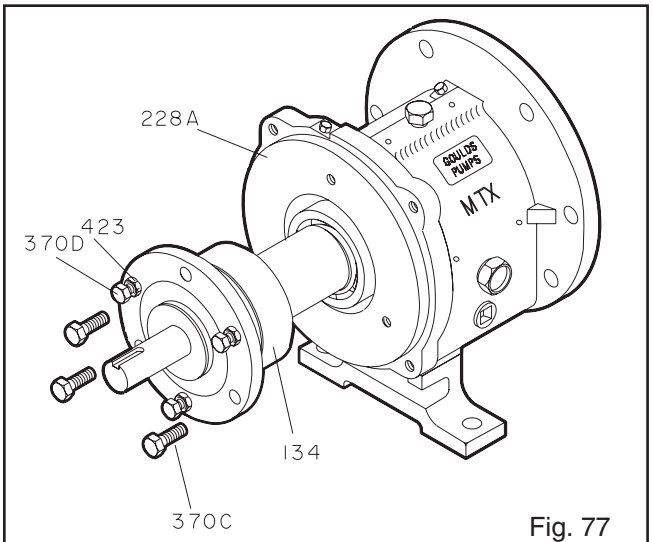


Fig. 77

3. Remove jack screws (370D) with nuts (423) (Fig. 78).

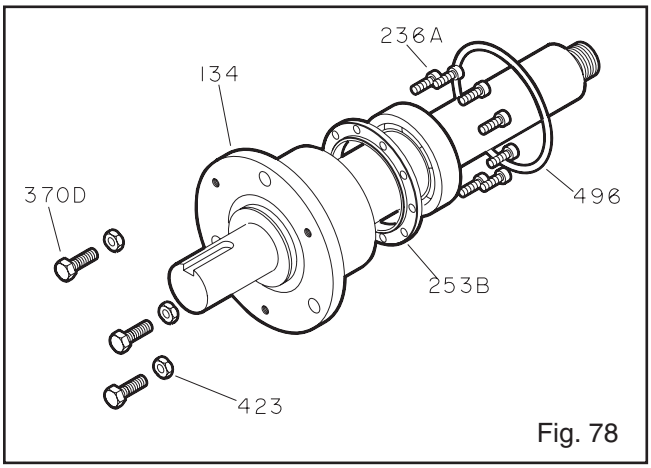


Fig. 78

4. Remove bearing housing O-ring (496).
5. Remove clamp ring screws (236A). Separate clamp ring (253B) from bearing housing (134).

NOTE: Clamp ring cannot be removed from the shaft until bearings are removed.

6. Remove bearing housing (134) from shaft (122) with bearings (112A, 168A) (Fig. 79).

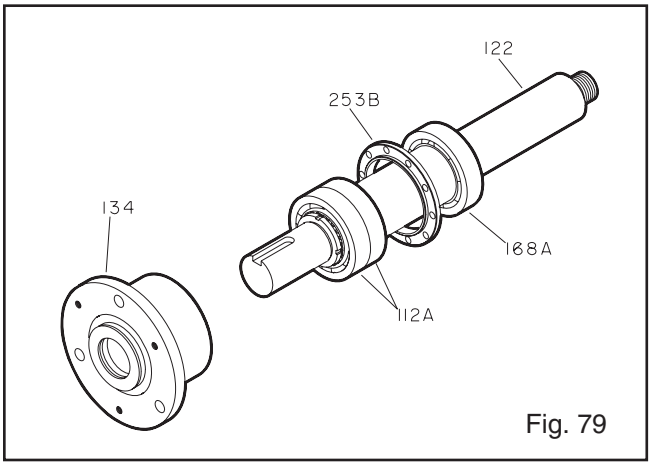


Fig. 79

7. Remove inboard bearing (168A) (Fig. 80).

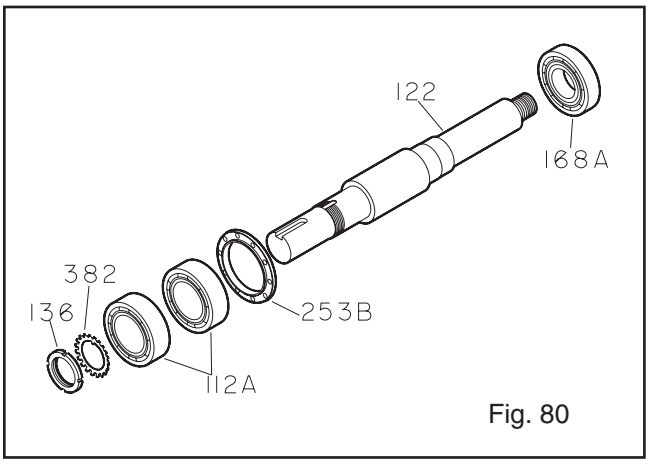


Fig. 80

8. Remove bearing locknut (136) and bearing lockwasher (382).
9. Remove outboard bearings (112A).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection.

6

10. Remove outboard labyrinth seal (332A) from bearing housing (134). Remove O-rings (497F), (497G) if necessary (Fig. 81).

NOTE: Labyrinth oil seal O-rings (497F, G) are part of 3196 maintenance kits or can be obtained separately.

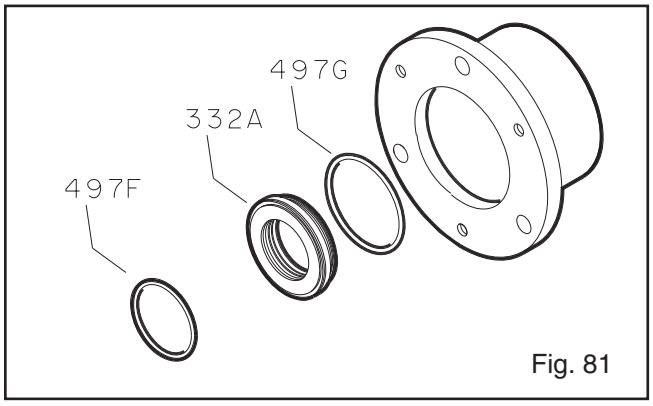


Fig. 81

DISASSEMBLY OF POWER END - XLT-X, X17 With Duplex Bearings

1. Remove bearing frame to frame foot bolts (370F) and frame foot (241) (Fig. 82).

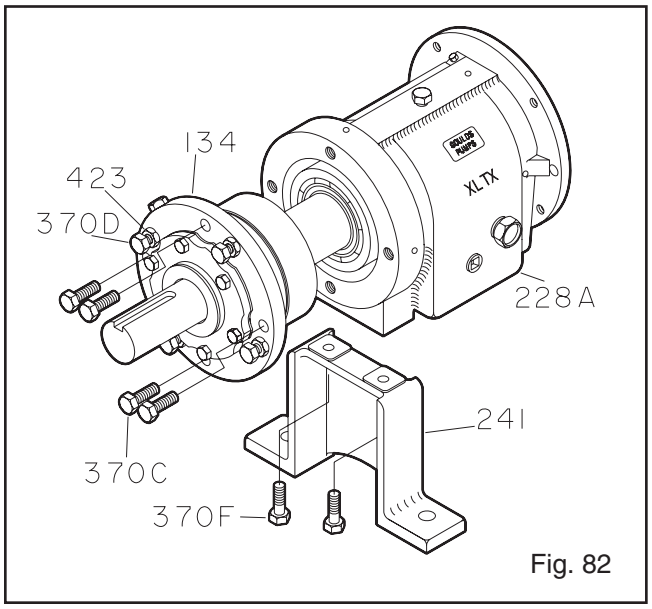


Fig. 82

2. Remove clamp screws (370C). Back off jam nuts (423). Tighten jack screws (370D) evenly, this will start bearing housing (134) out of bearing frame (228A).

3. Remove shaft assembly from bearing frame (228A).

4. Remove jack screws (370D) with nuts (423) (Fig. 83).

5. Remove bearing housing O-ring (496).

6. Remove inboard bearing (168A).

NOTE: When pressing bearings off shaft, use force on inner race only.

NOTE: Save bearings for inspection.

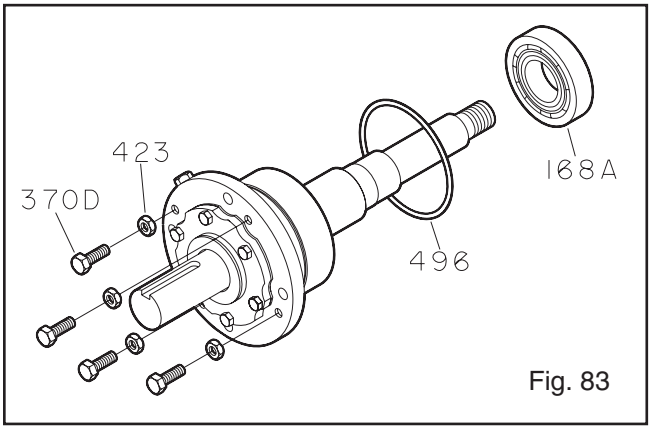


Fig. 83

7. Remove bolts (371C), end cover (109A) and gasket (360C) (Fig. 84).

8. Remove outboard labyrinth seal (332A) from end cover (109A). Remove O-rings (497F), (497G) if necessary.

NOTE: Labyrinth oil seal O-rings (497F, G) are part of 3196 maintenance kits or can be obtained separately.

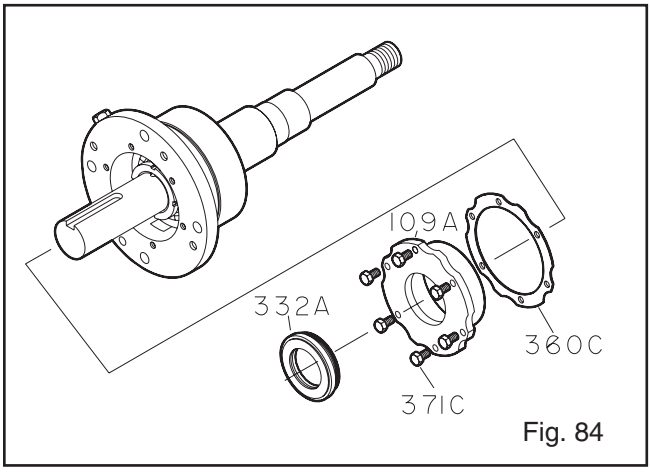


Fig. 84

9. Remove bearing housing (134) from shaft (122) with bearings (112A) (Fig. 85).

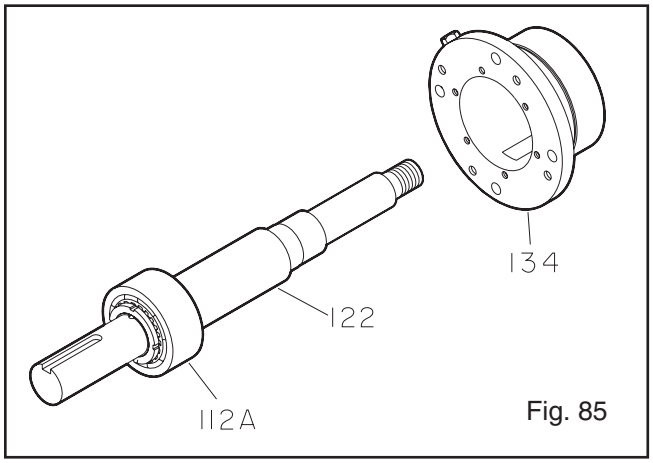


Fig. 85

10. Remove bearing locknut (136) and bearing lockwasher (382) (Fig. 86).

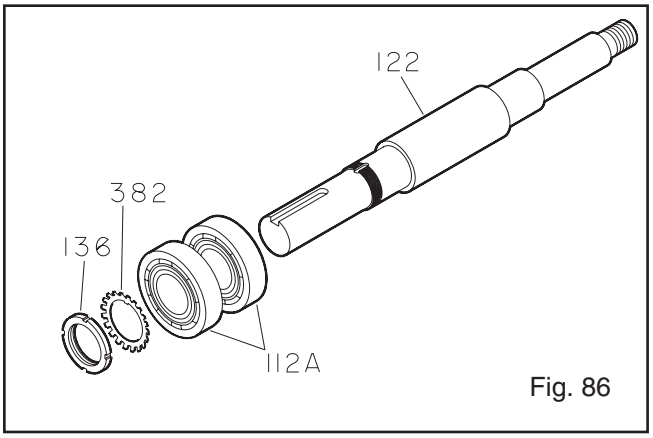


Fig. 86

11. Remove outboard bearing (112A).

NOTE: When pressing bearings off the shaft, use force on the inner race only.

NOTE: Save bearings for inspection.

ALL MODELS

DISASSEMBLY OF BEARING FRAME

1. Remove oil fill plug (113A), oil drain plug (408A), sight glass (319), sight oiler plug (408J), four (4) oil mist/grease connection plugs (408H), and oil cooler inlet and outlet plugs (408L, 408M) or oil cooler from bearing frame (228A).
2. MTX, LTX: Remove bearing frame foot-to-frame bolts (370F), and frame foot (241).

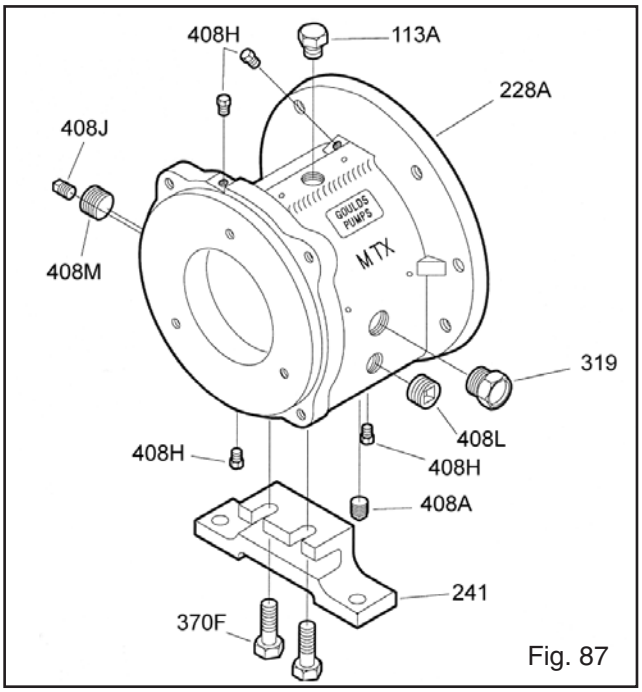


Fig. 87

INSPECTIONS

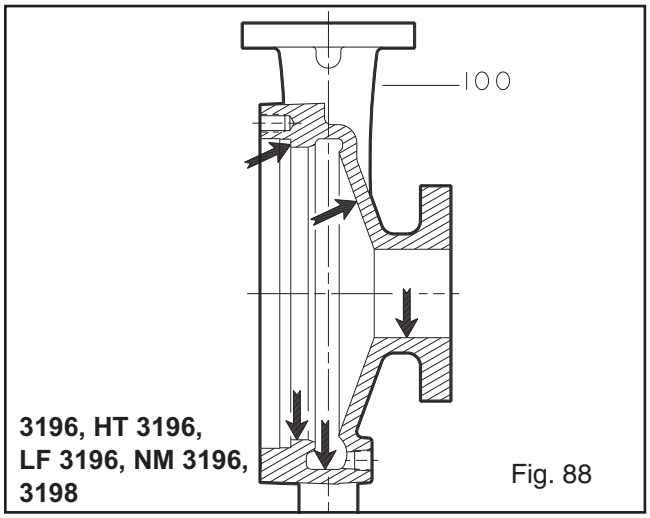
The pump parts must be inspected to the following criteria before they are reassembled to insure the pump will run properly. Any part not meeting the required criteria should be replaced.

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

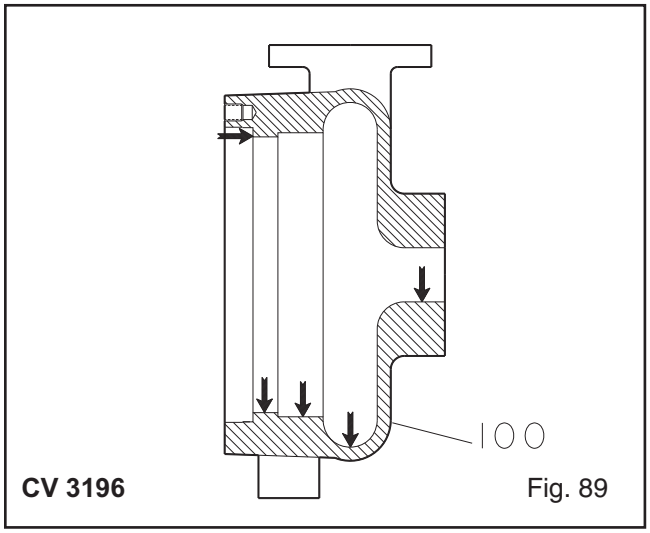
Casing

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 (Figs. 88, 89 & 90).

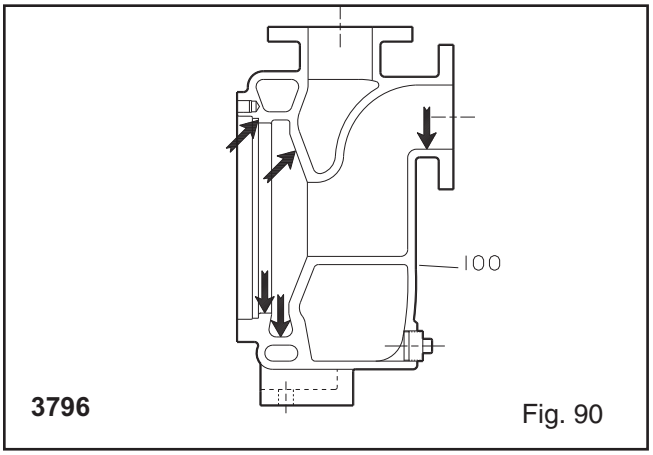
1. Localized wear or grooving greater than 1/8 in. (3.2 mm) deep.
2. Pitting greater than 1/8 in. (3.2 mm) deep.
3. Inspect case gasket seat surface for irregularities.



3196, HT 3196, LF 3196, NM 3196, 3198 Fig. 88



CV 3196 Fig. 89



3796 Fig. 90

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. (0.8 mm). (Area “a” in Fig. 91).
2. Inspect pumpout vanes for damage. Replace if worn more than 1/32 in. (0.8 mm). (Area “b” in Fig. 91).
3. Inspect leading and trailing edges of the vanes for cracks, pitting, and erosion or corrosion damage. (Area “c” in Fig. 91.).

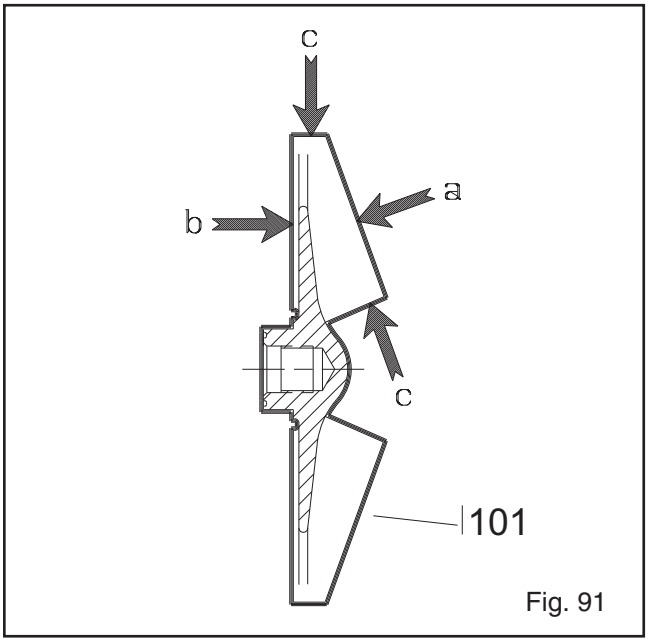


Fig. 91

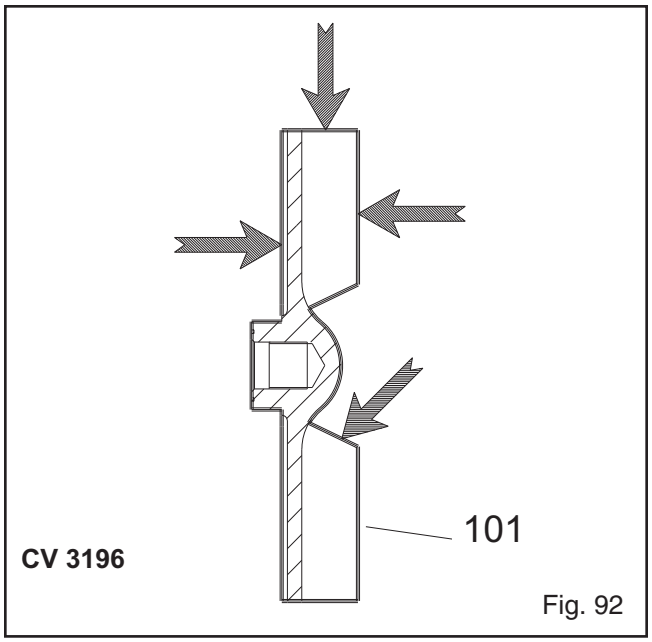


Fig. 92

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

Frame Adapter

1. Check frame adapter (108) for cracks or excessive corrosion damage. Replace if any of these conditions exist (Fig. 93).
2. Make sure gasket surface is clean.

NOTE: The 3198 frame adapter is not interchangeable with any other model's adapter.

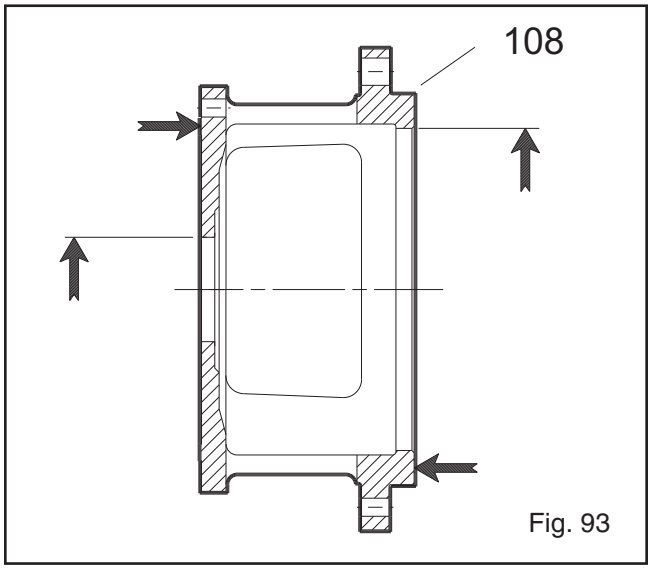


Fig. 93

Shaft and Sleeve - All Except 3198

1. Check bearing fits. If any are outside the tolerance in *Table 8*, replace the shaft (122) (Fig. 94).
2. Check shaft straightness. Replace shaft if runout exceeds values in *Table 12*.
3. Check shaft and sleeve (126) surface for grooves, pitting. Replace if any are found (Fig. 95).

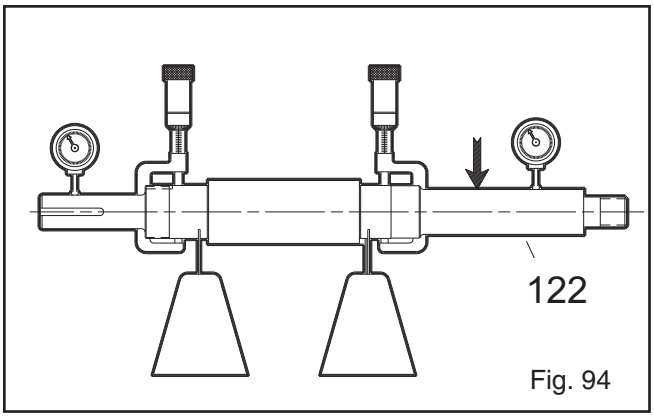


Fig. 94

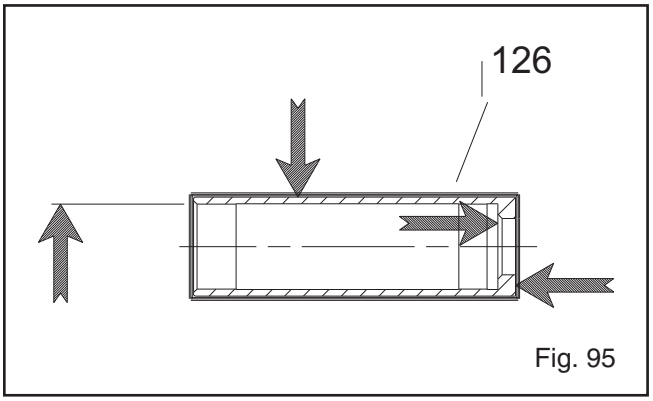


Fig. 95

Shaft and Sleeve - 3198

The 3198 is offered with a metallic sleeve which uses the standard 3196 (ANSI products) shaft. It is also offered with a Teflon® sleeve. The use of the Teflon® sleeve requires a special shaft and a different inboard labyrinth oil seal. The inspection procedures are the same as those listed above for the balance of the products.

Bearing Frame

1. Visually inspect bearing frame (228) and frame foot (241) for cracks. Check frame inside surfaces for rust, scale or debris. Remove all loose and foreign material (Figs. 96, 97).
2. Make sure all lubrication passages are clear.
3. If frame has been exposed to pumpage, inspect for corrosion or pitting.
4. Inspect inboard bearing bore according to Table 8.

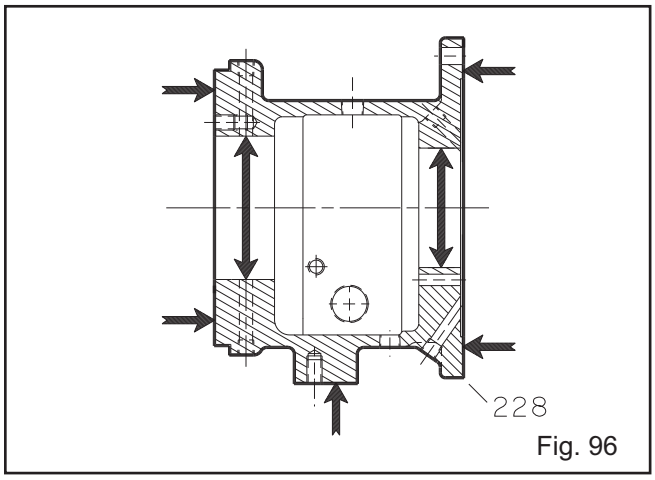


Fig. 96

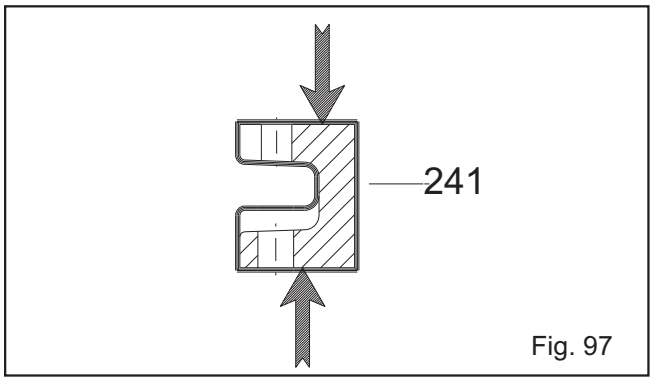


Fig. 97

C-Face Adapter

For C-Face adapter inspections, See *Appendix V.*

Dynamic Seal Repeller

(3196, CV 3196, LF 3196 only)

1. Inspect dynamic seal repeller (262) vanes for damage. Replace if grooved deeper than 1/16 in. (1.6 mm) or if worn evenly more than 1/32 in. (0.8 mm) (Fig. 98).
2. Inspect sleeve surface for grooves, pitting or other damage. Replace if damaged.

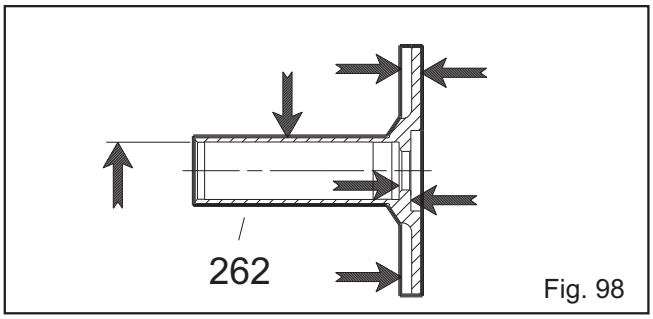


Fig. 98

Seal Chamber/Stuffing Box Cover and Dynamic Seal Backplate

1. Make sure seal chamber/stuffing box cover (184) and dynamic seal backplate (444) gasket surfaces, and mounting surfaces, are clean (Figs. 99 - 107).
2. Replace if there is any pitting or wear greater than 1/8 in. (3.2 mm) deep.
3. Inspect machined surfaces and mating faces noted on Figures 99-107, and clean as necessary.

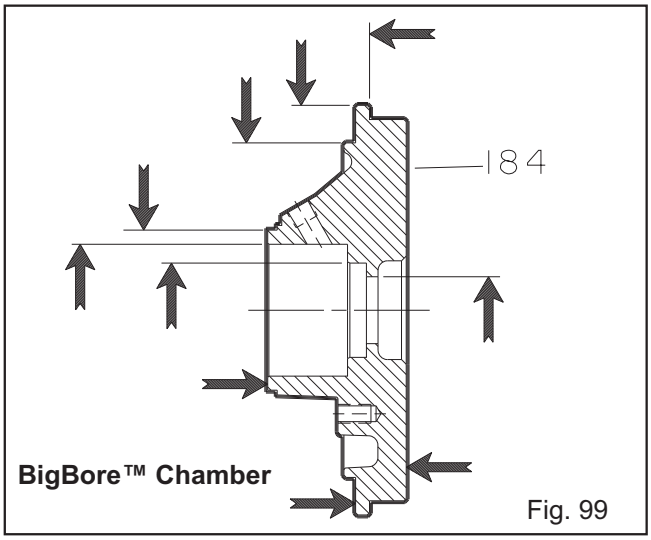


Fig. 99

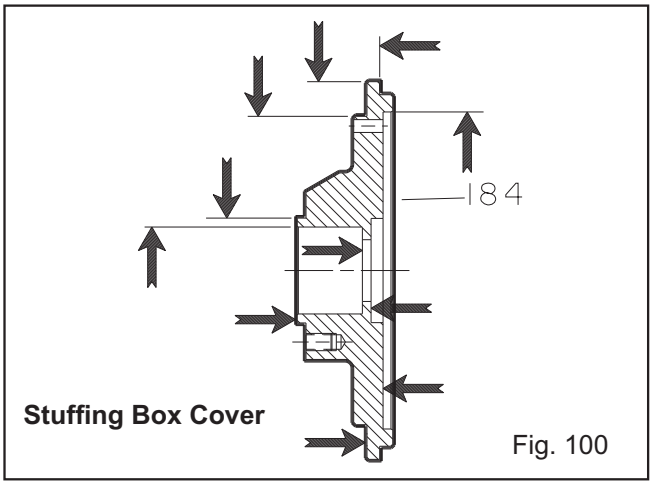
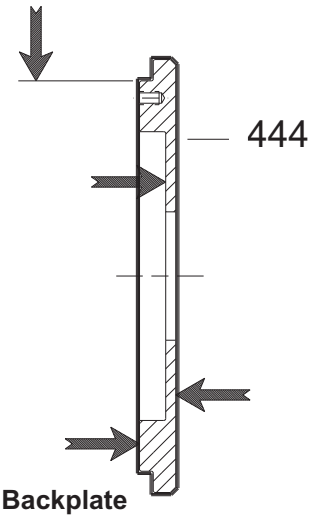
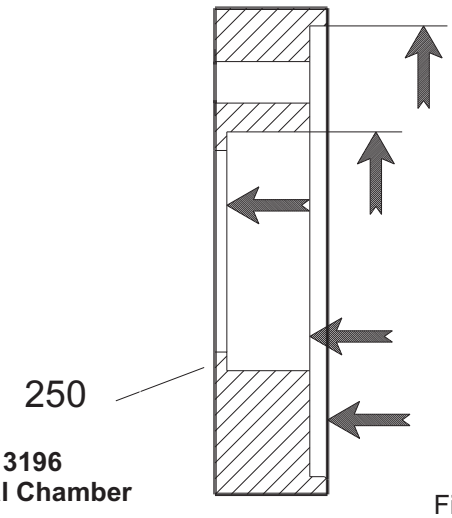


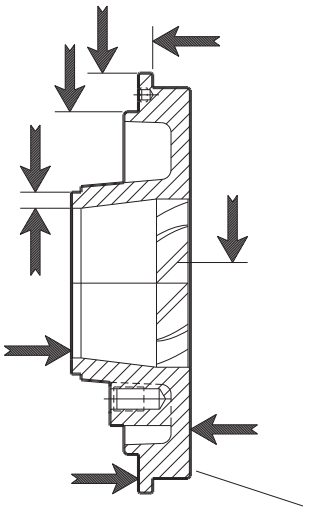
Fig. 100



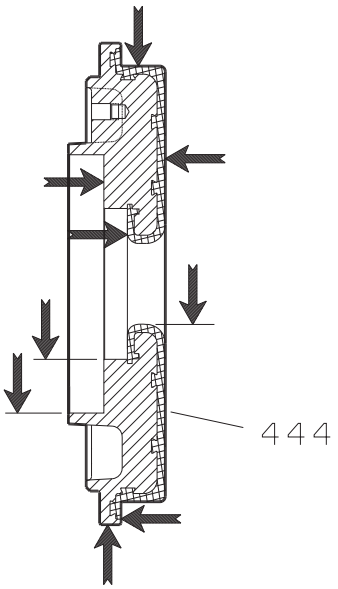
Dynamic Seal Backplate Fig. 101



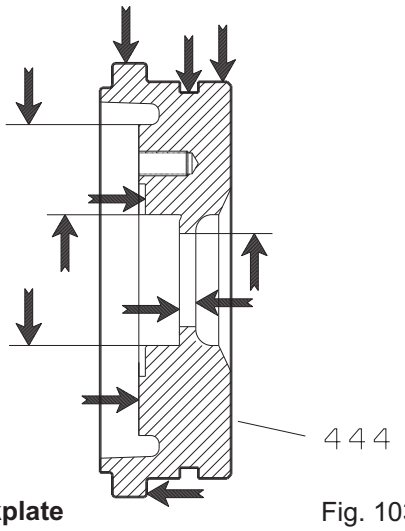
NM 3196
Seal Chamber Fig. 104



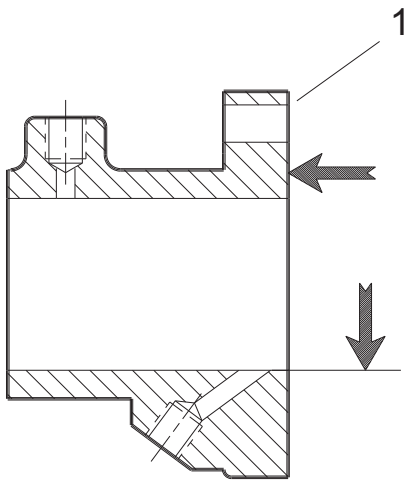
TaperBore™ *PLUS* Fig. 102



3198
Backplate Fig. 105

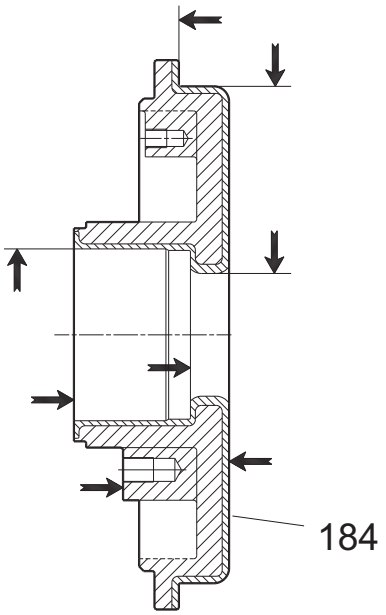


NM 3196 Backplate Fig. 103

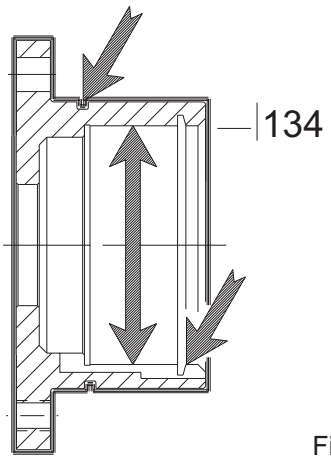


3198 Seal Chamber Fig. 106

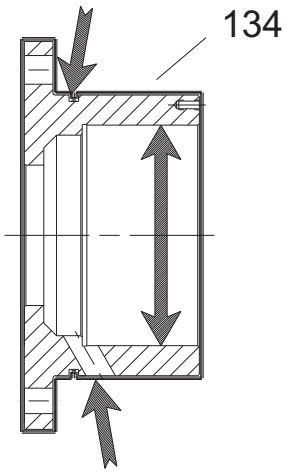
6



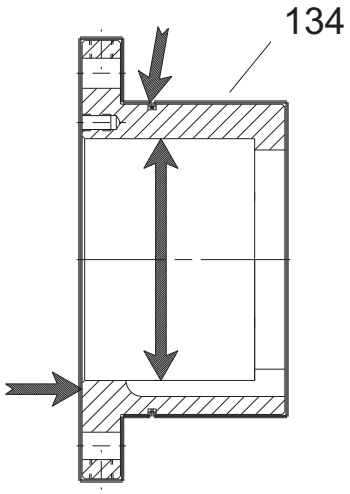
3198 BigBore™ Fig. 107



STX/MTX Fig. 108



LTX Fig. 109



XLTX/X17 Fig. 110

Bearings

1. Ball bearings (112A, 168A) should be inspected for contamination and damage. The condition of the bearings will provide useful information on operating conditions in the bearing frame. Lubricant condition and residue should be noted, oil analysis is often helpful. Bearing damage should be investigated to determine cause. If cause is not normal wear, it should be corrected before pump is returned to service.

DO NOT RE-USE BEARINGS.

Bearing Housing

1. Inspect bearing housing (134) bore according to *Table 8*. Replace if dimensions exceed *Table 8* values.

2. Visually inspect for cracks and pits.

   STX, MTX - Snap ring groove must not be cracked (Fig. 108).

   LTX - Grooves and holes must be clear (Fig. 109).

   XLT-X, X17 - Gasket surface must be clean (Fig. 110).

Labyrinth Seals

1. Labyrinth seal (332A, 333A) O-rings should be inspected for cuts and cracks. Replace as needed.

Table 8
Bearing Fits & Tolerances

According to ABEC I standard

	STX in. (mm)	MTX in. (mm)	LTX in. (mm)	XLT-X, X-17 in. (mm)
Shaft O.D. Inboard	1.3785 (35.013) 1.3781 (35.002)	1.7722 (45.013) 1.7718 (45.002)	2.1660 (55.015) 2.1655 (55.002)	2.5597 (65.015) 2.5592 (65.002)
Clearance	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight
Bearing I.D. Inboard	1.3780 (35.000) 1.3775 (34.988)	1.7717 (45.000) 1.7712 (44.988)	2.1654 (55.000) 2.1648 (54.985)	2.5591 (65.000) 2.5585 (64.985)
Frame I.D. Inboard	2.8346 (72.000) 2.8353 (72.019)	3.9370 (100.000) 3.9379 (100.022)	4.7244 (120.000) 4.7253 (120.022)	5.5118 (140.000) 5.5128 (140.025)
Clearance	0.0012 (0.032) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0017 (0.043) loose 0.0000 (0.000) loose
Bearing O.D. Inboard	2.8346 (72.000) 2.8341 (71.987)	3.9370 (100.000) 3.9364 (99.985)	4.7244 (120.000) 4.7238 (119.985)	5.5118 (140.000) 5.5111 (139.982)
Shaft O.D. Outboard	1.1815 (30.011) 1.1812 (30.002)	1.7722 (45.013) 1.7718 (45.002)	1.9690 (50.013) 1.9686 (50.002)	2.5597 (65.015) 2.5592 (65.002)
Clearance	0.0008 (0.021) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0010 (0.025) tight 0.0001 (0.002) tight	0.0012 (0.030) tight 0.0001 (0.002) tight
Bearing I.D. Outboard	1.1811 (30.000) 1.1807 (29.990)	1.7717 (45.000) 1.7712 (44.988)	1.9685 (50.000) 1.9680 (49.988)	2.5591 (65.000) 2.5585 (64.985)
Housing I.D. Outboard	2.8346 (72.000) 2.8353 (72.019)	3.9370 (100.000) 3.9379 (100.022)	4.3307 (110.000) 4.3316 (110.022)	5.5118 (140.000) 5.5128 (140.025)
Clearance	0.0012 (0.032) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0015 (0.037) loose 0.0000 (0.000) loose	0.0017 (0.043) loose 0.0000 (0.000) loose
Bearing O.D. Outboard	2.8346 (72.000) 2.8341 (71.987)	3.9370 (100.000) 3.9364 (99.985)	4.3307 (110.000) 4.3301 (109.985)	5.5118 (140.000) 5.5111 (139.982)