REASSEMBLY

Refer to *Table 9 and 9a* for torque values while reassembling pump.

Table 9
Bolt Torque, Ft-Lbs (Nm)

Location	Frame	3196, CV 3196, LF 3196, 3796		NM 3196		3198	
		Lube	Dry	Lube	Dry	Lube	Dry
Casing Bolts (370) or Casing Nuts (425)	6" STX	Refer to Table 9a		27 (36)	40 (53)	N/A	N/A
	8" STX			20 (27)	30 (40)	35 (47)	53 (71)
	MTX, LTX			27 (36)	40 (53)	35 (47)	53 (71)
	XLT-X, X17			N/A	N/A	N/A	N/A
Frame-to-Adapter	All	20 (27)	30 (40)	20 (27)	30 (40)	20 (27)	30 (40)
Bearing Clamp Ring Bolts (236A) Duplex Bearing Only	STX, MTX	10* (1.1)	17* (1.9)	10* (1.1)	17* (1.9)	10* (1.1)	17* (1.9)
	LTX	55* (6.2)	83* (9.4)	55* (6.2)	83* (9.4)	55* (6.2)	83* (9.4)
Bearing End Cover Bolts (371C)	XLT-X, X17	9 (12)	12 (16)	N/A	N/A	N/A	N/A
Dynamic Seal Capscrews (265)	STX, MTX, LTX	55* (6.2)	83* (9.4)	N/A	N/A	N/A/	N\A
	XLT-X, X17	9 (12)	12 (16)	N/A	N/A	N/A	N/A

Table 9a
Maximum Torque Values in ft.-lb. (Nm) for Casing Bolts (370)

		Models 3196, CV 3196 LF 3196, 3796 with 150 lb. Casing flanges				Model HT 3196 and all Models with 300 lb. Casing flanges	
		Material Specification					
		Ductile Iron Casing with A 307 Grade B casing bolts		Alloy Casing with (304SS) F593 Grade 1 or (316SS F593) Grade 2 casing bolts		Ductile Iron and Alloy Casings with A193 grade B7 casing bolts	
Frame	Casing Bolt Diameter (in.)	Lube	Dry	Lube	Dry	Lube	Dry
8" STX	1/2"	20 (27)	30 (41)	35 (47)	54 (73)	58 (79)	87 (118)
6" STX MTX LTX XLT-X	5/8"	39 (53)	59 (80)	71 (96)	107 (145)	115 (156)	173 (235)
X17	7/8"	113 (153)	170 (231)	141 (191)	212 (287)	330 (447)	495 (671)

*** Values are in inch-lbs (Nm)**

Refer to *Table 10* for shaft end play while reassembling pump.

Table 10
Shaft End Play

	STX in. (mm)	MTX in. (mm)	LTX in. (mm)	XLT-X in. (mm)
Double Row	.0011 (.028) .0019 (.047)	.0013 (.033) .0021 (.054)	not applicable	.0014 (.036) .0023 (.058)
Duplex	.0007 (.018) .0010 (.026)	.0009 (.022) .0012 (.030)	.0010 (.026) .0015 (.038)	.0010 (.026) .0015 (.038)

Table 11
Bearing Type

Frame	Inboard	Outboard	
		Double Row	Duplex
STX	6207	5306A / C3	7306 BECBM
MTX	6309	5309A / C3	7309 BECBM
LTX	6311	not applicable	7310 BECBM
XLT-X, X17	6313	5313A / C3	7313 BECBY

Table 12
Shaft Runout Tolerances

	Sleeve Fit in. (mm)	Coupling Fit in. (mm)
With Sleeve	.001 (.026)	.001 (.026)
Less Sleeve	.002 (.051)	.001 (.026)

NOTE: Bearing type is based on SKF/MRC designation.

Assembly of Rotating Element and Bearing Frame

STX, MTX

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

1. Install oil fill plug (113A), oil drain plug (408A), sight window (319), sight oiler plug (408J), four oil mist connection plugs (408H) or grease fittings (193) and relief plugs (113), and oil cooler inlet and outlet plugs or oil cooler (408L, 408M) in bearing frame (228) (Fig. 111).
2. Attach bearing frame foot (241) with bolts (370F). Hand tighten.

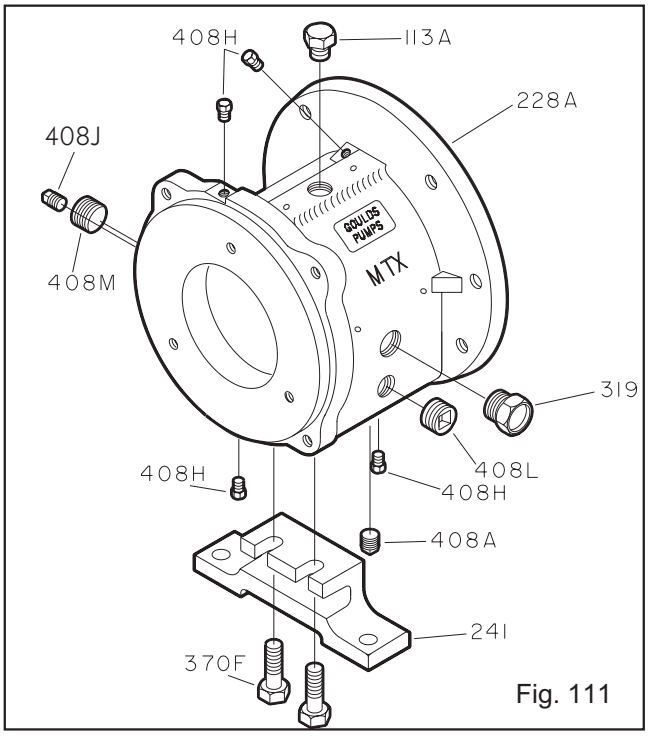


Fig. 111

3. Install outboard bearing (112A) on shaft (122) (Fig. 112).

NOTE: Refer to Appendix VII-1 for detailed outboard bearing installation instructions.

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

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

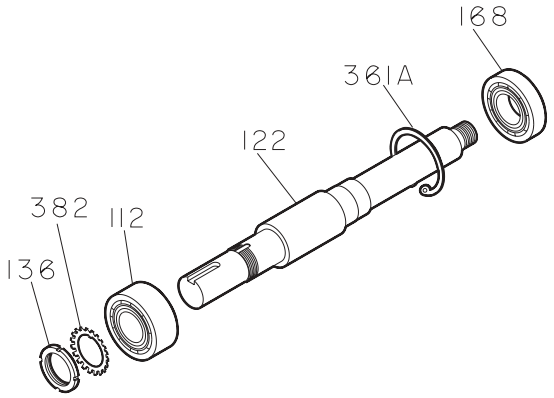


Fig. 112

4. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft.

5. Thread locknut (136) onto shaft (122). Tighten locknut until snug. Bend any tang of lockwasher into a slot of locknut.

NOTE: Tighten locknut if necessary to align the closest tab of lockwasher with slot on locknut.

6. Place bearing retaining ring (361A) over shaft (122), flat side facing bearing.

7. Install inboard bearing (168A) on shaft (122).

NOTE: Regreaseable bearing has a single shield. The inboard bearing is installed with shield away from impeller.

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

NOTE: Coat internal surfaces of bearings with lubricant to be used in service.

8. Install new O-ring (496) (Fig. 113).

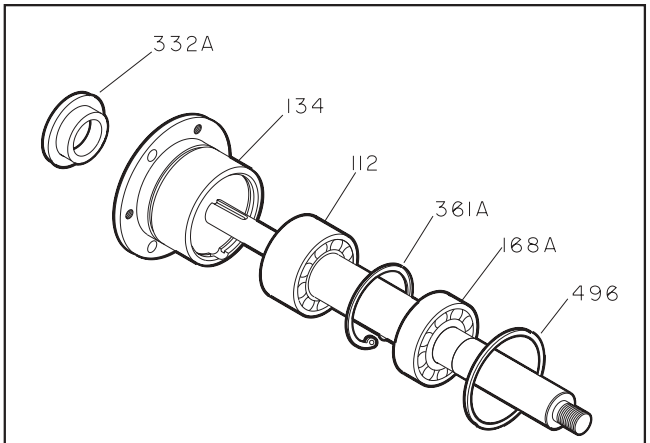


Fig. 113

9. Coat outside of outboard bearing (112A) and bearing housing (134) bore with oil.

10. Install bearing housing (134) onto shaft/bearing assembly.

NOTE: Do not force assembly together.

11. Insert retaining ring (361A) into groove in housing (134) bore. Check shaft for free turning.

NOTE: The space between the ends of retaining ring should be located in the oil return groove so as not to obstruct oil flow.

12. Install outboard labyrinth oil seal (332A) into bearing housing (134). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom (6 o'clock) position.

NOTE: Refer to Appendix IV or VIII for detailed labyrinth seal installation instructions.

NOTE: Make sure the keyway edges are free of burrs.

NOTE: Cover the keyway lengthwise with a piece of electrical tape prior to installing the labyrinth seal. This will protect the O-rings.

13. Coat outside of bearing housing (134) with oil (Fig. 114).

14. Coat all internal surfaces of bearing frame (228A) with oil.

15. Install shaft assembly into frame (228A). Check shaft for free turning.

16. Install clamping bolts (370C) into bearing housing (134). Hand tighten.

17. Install jacking bolts (370D) with locking nuts (423) into housing (134). Hand tighten.

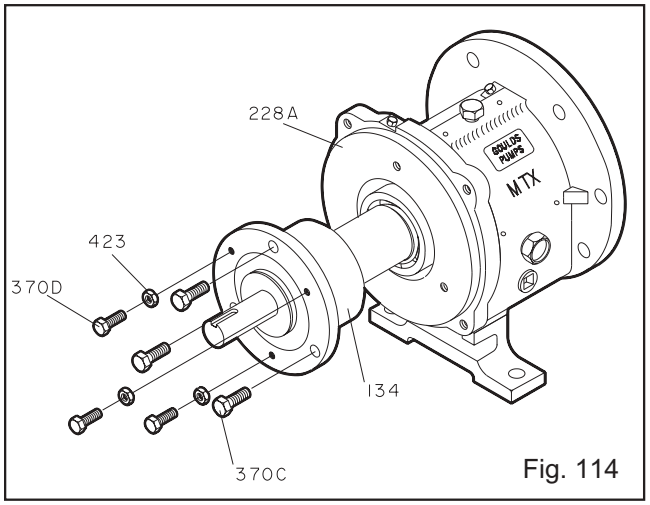


Fig. 114

LTX

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

1. Install the oil fill plug (113A), oil drain plug (408A), sight window (319), sight oiler plug (408J), four oil mist connection plugs (408H) or grease fittings (193) and grease relief plugs (113), and oil cooler inlet and outlet plugs or oil cooler (408L, 408M) in bearing frame (228) (Fig. 115).

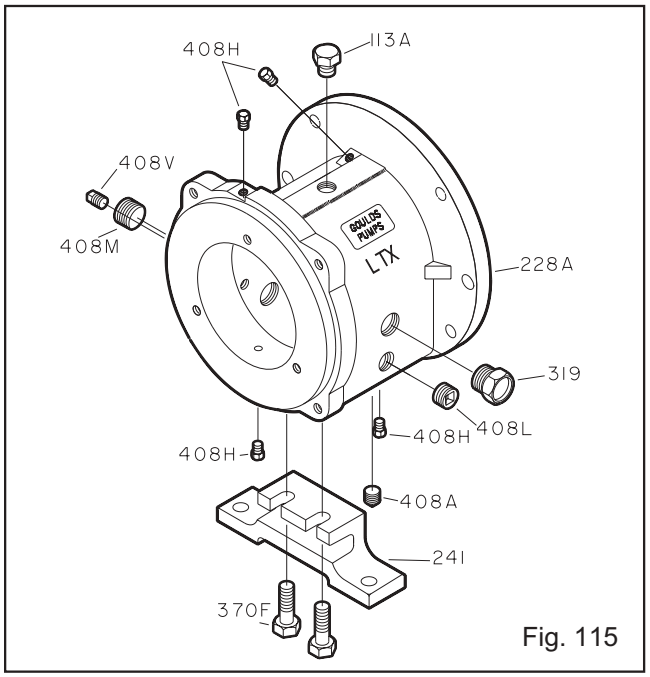


Fig. 115

2. Attach bearing frame foot (241) with bolts (370F). Hand tighten.

3. Install oil flinger (248A) on shaft (122) if removed (Fig. 116).

NOTE: The oil flinger is a press fit onto shaft. Use a driver of proper size to prevent damage to oil flinger.

4. Place bearing clamp ring (253B) over shaft (122). Note orientation.

5. Install outboard bearings (112A) on shaft (122).

NOTE: Refer to Appendix VII-2 for detailed outboard bearing installation instructions.

! CAUTION

The LTX uses duplex bearings mounted back to back. Make sure orientation of the bearings is correct.

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

! WARNING

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

6. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft.

7. Thread locknut (136) onto shaft (122). Tighten locknut until 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.

8. Install inboard bearing (168A) on shaft (122).

NOTE: Regreaseable bearing has a single shield. The inboard bearing is installed with shield away from impeller.

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

! WARNING

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

NOTE: Coat internal surfaces of bearings with lubricant to be used in service.

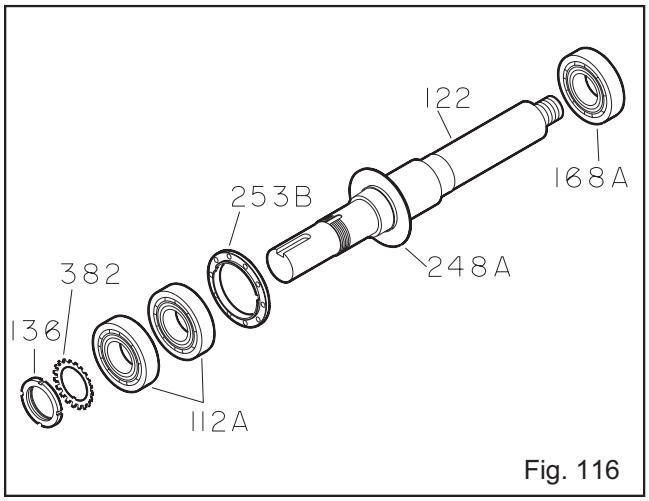


Fig. 116

9. Coat outside of outboard bearing (112A) and bearing housing (134A) bore with oil.

10. Install bearing housing (134) onto shaft/bearing assembly (Fig. 117).

NOTE: Do not force assembly together.

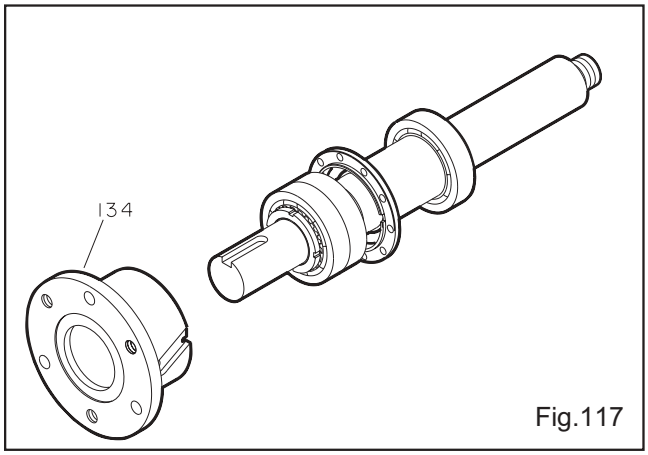


Fig.117

11. Install clamp ring bolts (236A). Check shaft for free turning. Refer to *Table 9* for bolt torque values (Fig. 118).

! CAUTION

Tighten clamp ring bolts (236A) in a criss cross pattern.

12. Install new O-ring (496).

13. Install outboard labyrinth oil seal (332A) into bearing housing (134). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom (6 o'clock) position.

NOTE: See Appendix IV or VIII for further instructions on Labyrinth Seal installation.

NOTE: Make sure the keyway edges are free of burrs.

NOTE: Cover the keyway lengthwise with a piece of electrical tape prior to installing the labyrinth seal. This will protect the O-rings.

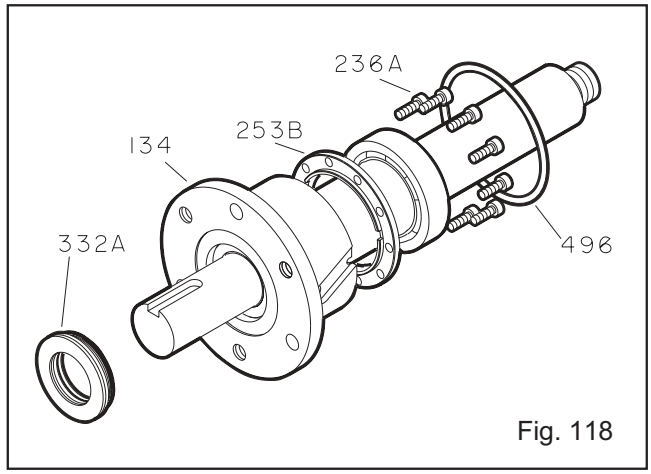


Fig. 118

14. Coat outside of bearing housing (134A) with oil.

15. Coat all internal surfaces of bearing frame (228) with oil.

16. Install shaft assembly into frame (228A). Check shaft for free turning (Fig. 119).

17. Install clamping bolts (370C) into bearing housing (134A). Hand tighten.

18. Install jacking bolts (370D) with locking nuts (423) into housing (134A). Hand tighten.

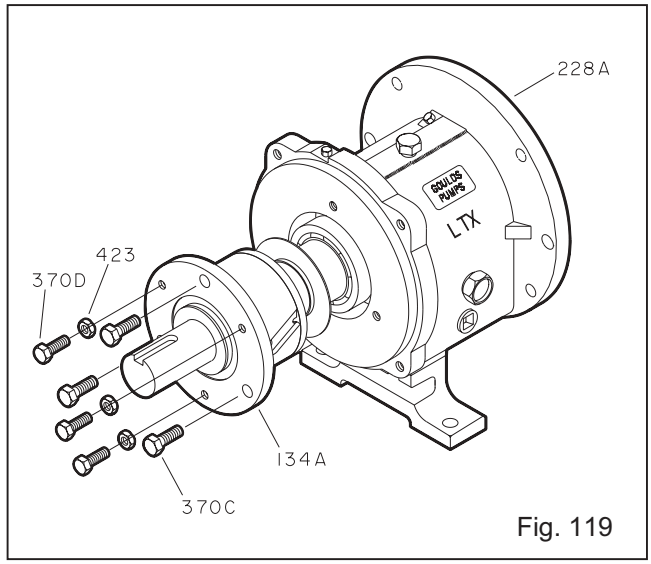


Fig. 119

XLT-X, X17

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

1. Install oil fill plug (113A), oil drain plug (408A), sight glass (319), sight oiler plug (408J), four oil mist connection plugs (408H), or grease fittings (193) and grease relief plugs (113), and oil cooler inlet and outlet plugs or oil cooler (408L, 408M) in bearing frame (228A) (Fig. 120).

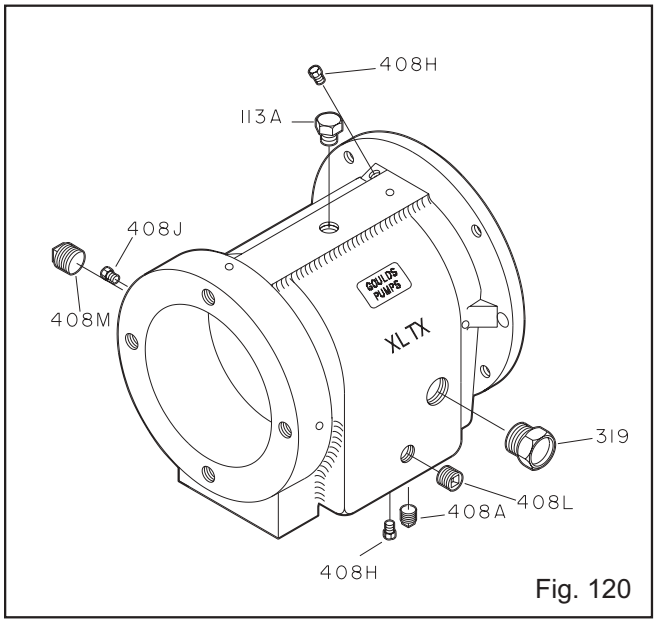


Fig. 120

2. Install outboard bearing (112A) on shaft (122) (Fig. 121).

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

NOTE: There are several methods used to install bearings, The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

⚠ WARNING

Shaft (122) may be heavy. Use care when handling.

3. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft.

4. Thread locknut (136) onto shaft (122). Tighten locknut until 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.

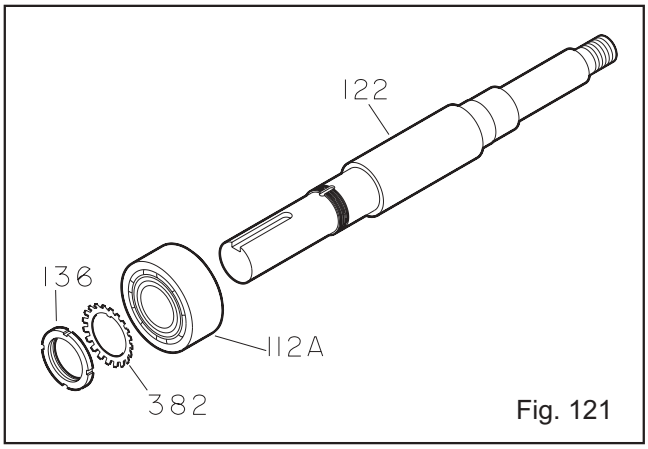


Fig. 121

5. Coat outside of outboard bearing (112A) and bore of bearing housing (134) with oil.

6. Install bearing housing (134) onto shaft/bearing assembly (Fig. 122).

NOTE: Do not force assembly together.

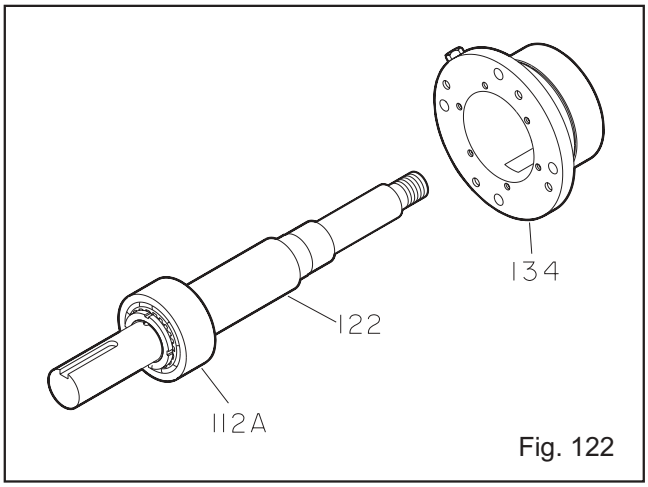


Fig. 122

7. Install gasket (360C), end cover (109A), bolts (371C). Refer to *Table 9* for bolt torque values. Check shaft for free turning (Fig. 123).

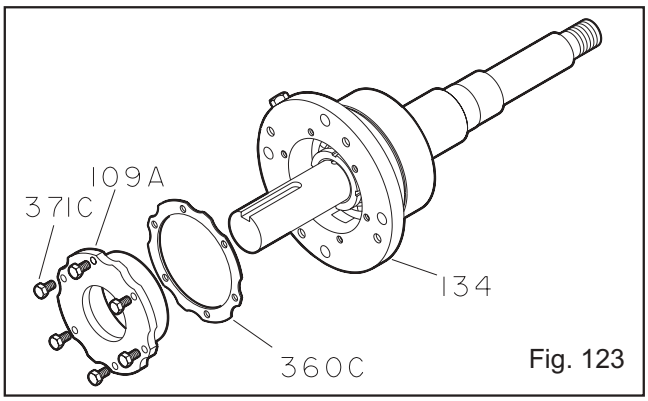


Fig. 123

8. Install inboard bearing (168A) on shaft (122) (Fig. 124).

NOTE: Refer to Appendix VII-1 for detailed outboard bearing installation instructions.

NOTE: Regreaseable bearing has a single shield. The inboard bearing is installed with shield away from impeller.

NOTE: There are several methods used to install bearings, The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

NOTE: Coat internal surfaces of bearings with lubricant to be used in service.

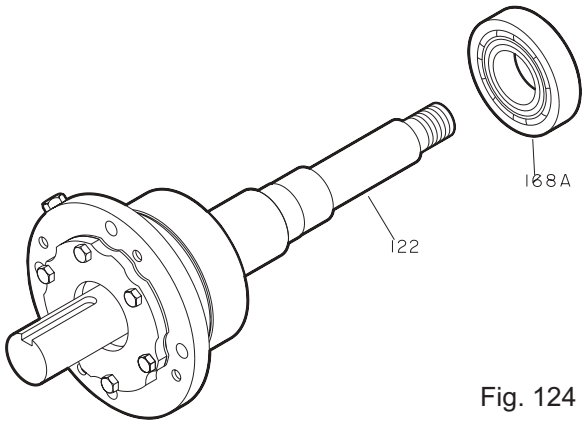


Fig. 124

9. Install new O-ring (496) (Fig. 125).

10. Install outboard labyrinth oil seal (332A) into end cover (109A). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom 6 o'clock position (Fig. 125).

NOTE: See Appendix IV or VIII for further instructions on Labyrinth Seal installation.

NOTE: Make sure the keyway edges are free of burrs.

NOTE: Cover the keyway lengthwise with a piece of electrical tape prior to installing the labyrinth seal. This will protect the O-rings.

11. Coat outside of bearing housing (134) with oil.

12. Coat all internal surfaces of bearing frame (228A) with oil.

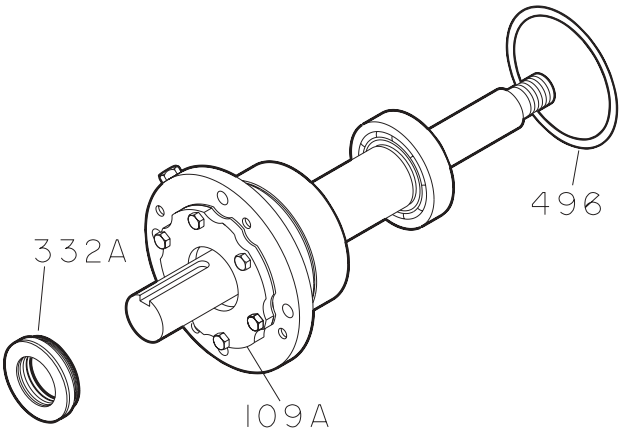


Fig. 125

13. Install shaft assembly into frame (228A). Check shaft for free turning (Fig. 126).

14. Install clamping bolts (370C) into bearing housing (134). Hand tighten.

15. Install jacking bolts (370D) with locking nuts (423) into housing (134). Hand tighten.

16. Attach bearing frame foot (241) with bolts (370F). Hand tighten.

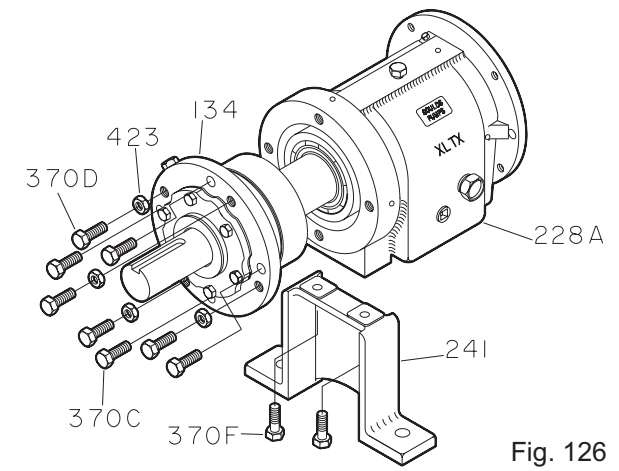


Fig. 126

STX, MTX with Duplex Bearings

1. Install the oil fill plug (113A), oil drain plug (408A), sight window (319), sight oiler plug (408J), four oil mist connection plugs (408H), or grease fittings (193) and grease relief plugs (113), and oil cooler inlet and outlet plugs or oil cooler (408L, 408M) in bearing frame (228) (Fig. 127).
2. Attach bearing frame foot (241) with bolts (370F). Hand tighten (Fig. 127).

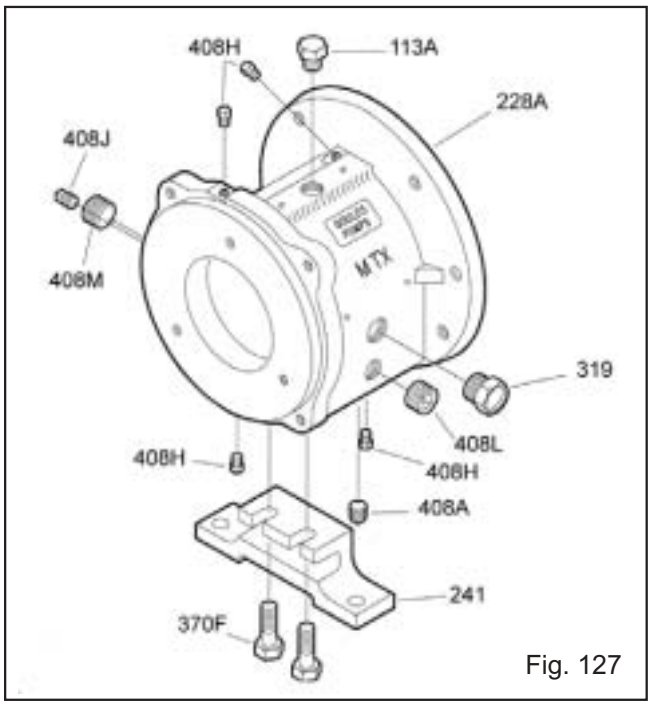


Fig. 127

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

3. Install outboard bearings (112A) on shaft (122).

NOTE: Refer to Appendix VII-2 for detailed outboard bearing installation instructions.

! CAUTION

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

4. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft (Fig. 128).
5. Thread locknut (136) onto shaft (122). Tighten locknut until 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.

6. Place bearing clamp ring (253B) over shaft (122). Note orientation.
7. Install inboard bearing (168A) on shaft (122).

NOTE: Regreaseable bearing has a single shield. The inboard bearing is installed with shield away from impeller.

NOTE: Coat internal surfaces of bearings with lubricant to be used in service.

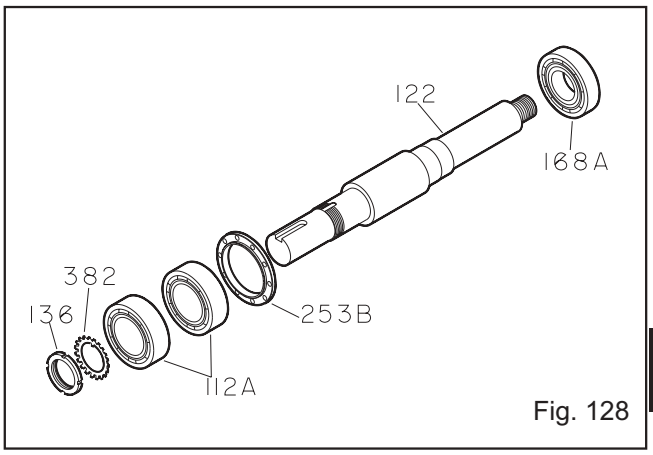


Fig. 128

8. Coat outside of outboard bearing (112A) and bore of bearing housing (134) with oil.
9. Lower shaft/bearing assembly into bearing housing (134) (Fig. 129).

NOTE: Do not force assembly together.

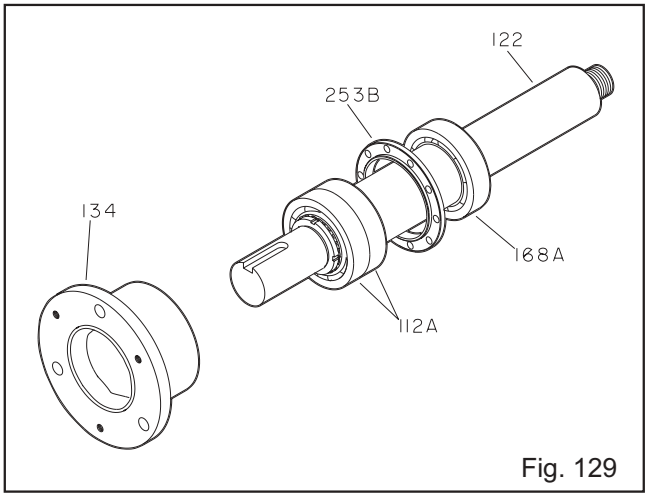


Fig. 129

6

10. Install clamp ring (253B) with bolts (236A). Tighten bolts in a crisscross pattern. Check shaft for free turning. Refer to *Table 9* for bolt torque values (Fig. 130).

11. Install new O-ring (496).

12. Install outboard labyrinth oil seal (332A) into bearing housing (134). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom 6 o'clock position (Fig. 130).

NOTE: See Appendix IV or VIII for further instructions on Labyrinth Seal installation.

NOTE: Make sure the keyway edges are free of burrs.

NOTE: Cover the keyway lengthwise with a piece of electrical tape prior to installing the labyrinth seal. This will protect the O-rings.

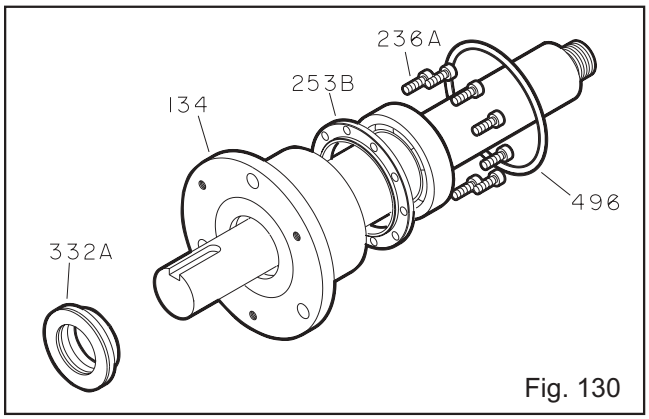


Fig. 130

13. Coat outside of bearing housing (134) with oil.

14. Coat all internal surfaces of bearing frame (228A) with oil.

15. Install shaft assembly into frame (228A). Check shaft for free turning (Fig. 131).

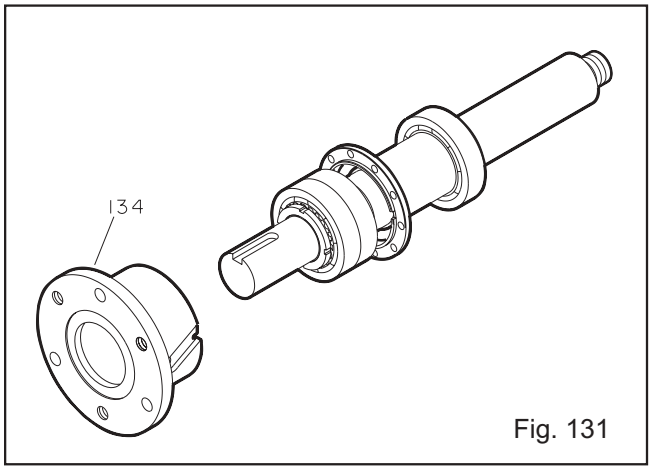


Fig. 131

16. Install clamping bolts (370C) into bearing housing (134A). Hand tighten.

17. Install jacking bolts (370D) with locking nuts (423) into housing (134A). Hand tighten.

XLT-X, X17 with Duplex Bearings

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

1. Install the oil fill plug (113A), oil drain plug (408A), sight window (319), sight oiler plug (408J), four oil mist connection plugs (408H), or grease fittings (193) and grease relief plugs (113), and oil cooler inlet and outlet plugs or oil cooler (408L, 408M) in bearing frame (228) (Fig. 132).

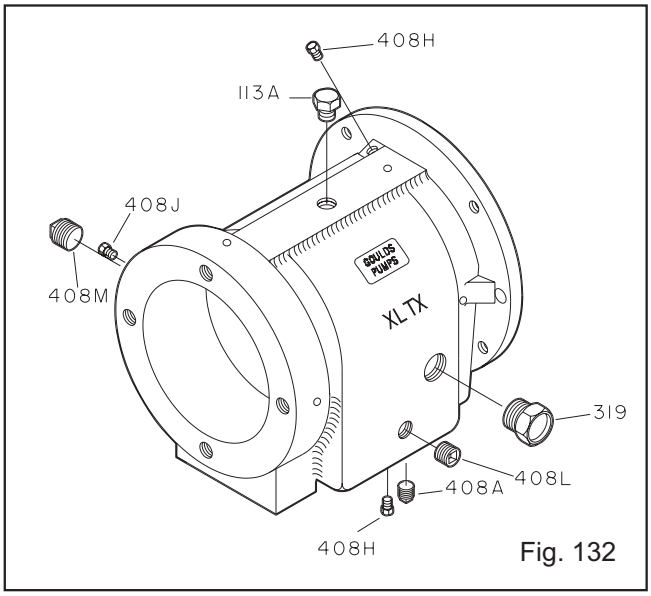


Fig. 132

2. Install outboard bearings (112A) on shaft (122) (Fig. 133).

NOTE: Refer to Appendix VII-2 for detailed outboard bearing installation instructions.

NOTE: There are several methods used to install bearings, The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

! CAUTION

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

3. Place lockwasher (382) on shaft (122). Place tang of lockwasher in keyway of shaft.

4. Thread locknut (136) onto shaft (122). Tighten locknut until 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.

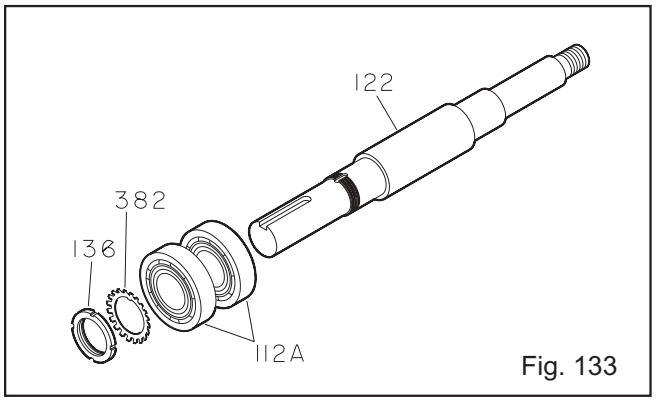


Fig. 133

5. Coat outside of outboard bearing (112A) and bore of bearing housing (134) with oil.

6. Install bearing housing (134) onto shaft/bearing assembly (Fig. 134).

NOTE: Do not force assembly together.

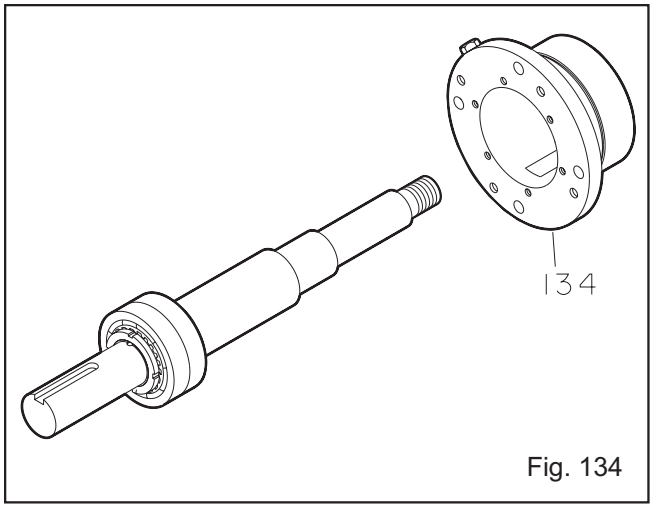


Fig. 134

7. Install gasket (360C), end cover (109A), and bolts (371C). Refer to *Table 9* for bolt torque values. Check shaft for free turning (Fig. 135).

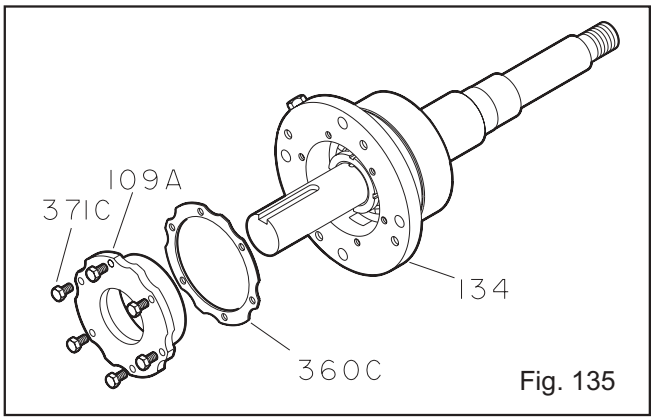


Fig. 135

8. Install inboard bearing (168A) on shaft (122) (Fig. 136).

NOTE: Regreaseable bearing has a single shield. The inboard bearing is installed with shield away from impeller.

NOTE: There are several methods used to install bearings. The recommended method is to use an induction heater that heats as well as demagnetizes the bearings.

⚠ WARNING

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

NOTE: Coat internal surfaces of bearings with lubricant to be used in service.

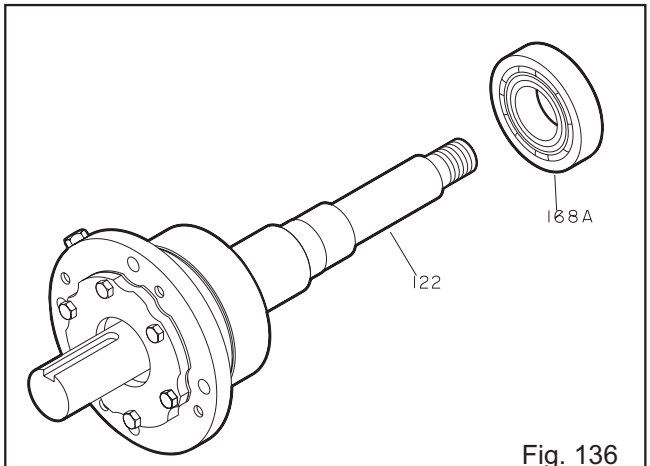


Fig. 136

6

9. Install new O-ring (496) (Fig. 137).

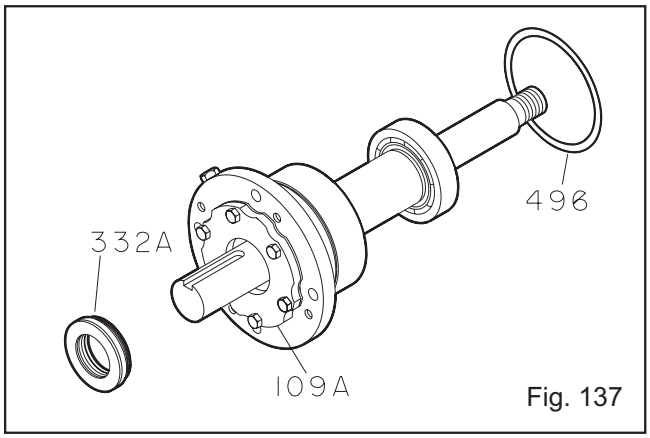


Fig. 137

10. Install outboard labyrinth oil seal (332A) into end cover (109A). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom 6 o'clock position.

NOTE: Make sure the keyway edges are free of burrs.

NOTE: Cover the keyway lengthwise with a piece of electrical tape prior to installing the labyrinth seal. This will protect the O-rings.

11. Coat outside of bearing housing (134) with oil.

12. Coat all internal surfaces of bearing frame (228A) with oil.

13. Install shaft assembly into frame (228A). Check shaft for free turning (Fig. 138).

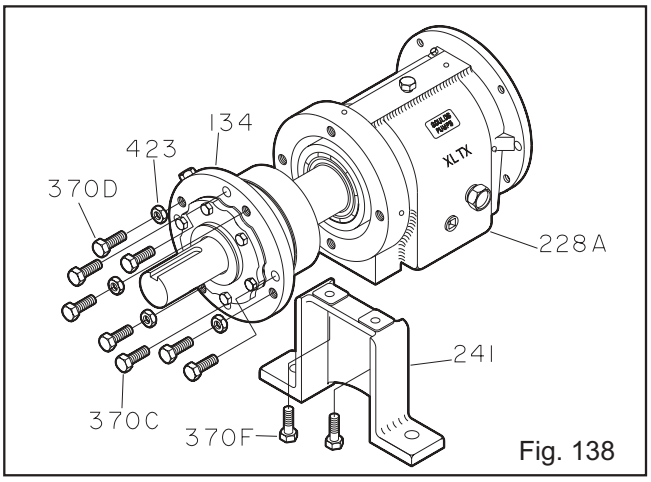


Fig. 138

14. Install clamping bolts (370C) into bearing housing (134). Hand tighten.

15. Install jacking bolts (370D) with locking nuts (423) into housing (134). Hand tighten.

16. Attach bearing frame foot (241) with bolts (370F). Hand tighten.

ALL MODELS

1. Support frame assembly in horizontal position.

2. Check shaft end play. Move shaft forward then backward by hand, noting indicator movement. If total indicator reading is greater than *Table 10* values, disassemble and determine cause (Fig. 139).

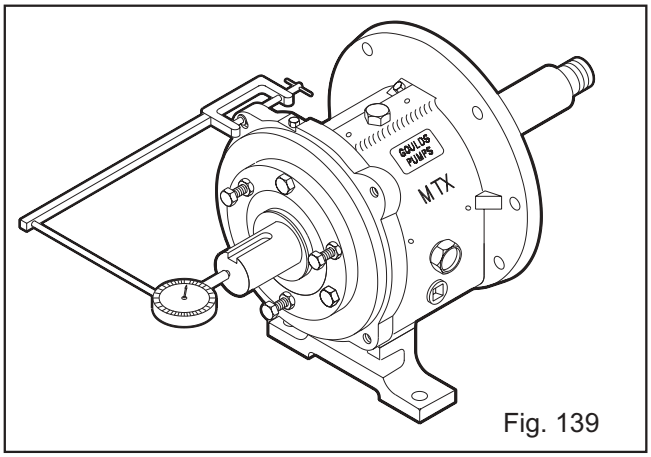


Fig. 139

3. Check shaft/sleeve runout. Put on shaft sleeve (126) if used, and thread on impeller, hand tight. Rotate shaft 360 degrees. If total indicator reading is greater then .002 in., disassemble and determine cause. Remove impeller and shaft sleeve (Fig. 140).

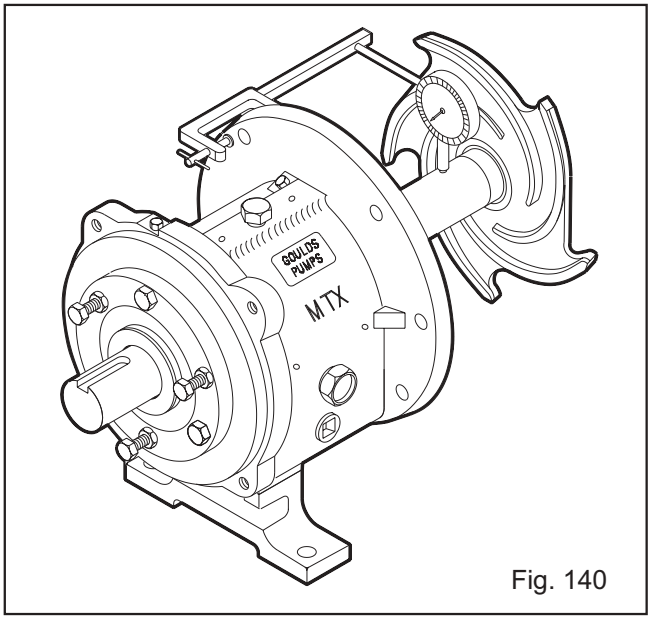


Fig. 140

4. Check frame face run out. Rotate shaft so indicator rides along the fit for 360 degrees. If total indicator reading is greater than 0.001 in. (.025 mm) disassemble and determine cause (Fig. 141).

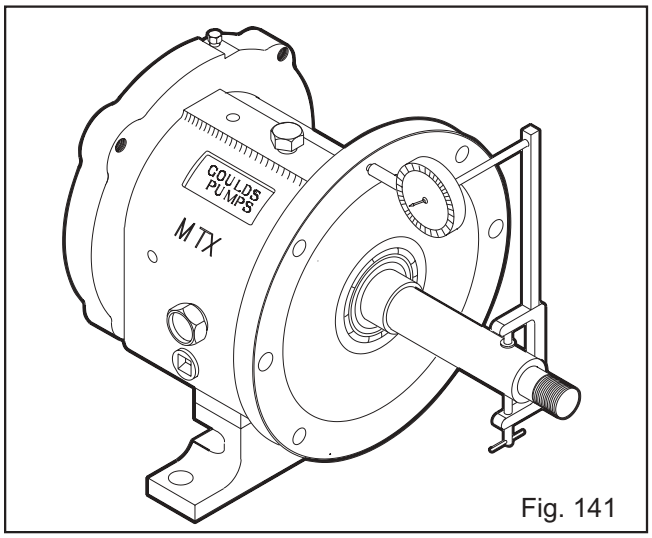


Fig. 141

5. Place manila gasket (360D) on frame (228) (Fig. 142).

NOTE: The gasket is designed to fit one way only. The dowel pins (469B) may be started in their holes to hold the gasket in place.

6. Install frame adapter (108), onto frame assembly. Align bolt holes and dowel locations with those on frame (Fig. 142).

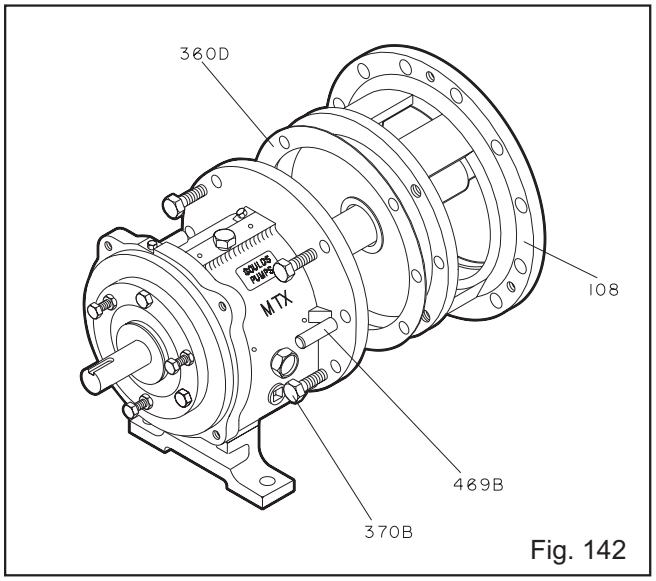


Fig. 142

7. Install dowel pins (469B) and bolts (370B). Tighten bolts to *Table 9* torque specifications in a crisscross pattern.

8. Check adapter fits. Rotate shaft through 360 degrees. If total indicator reading is greater than .005 in. (.13 mm), determine the cause and correct before proceeding (Fig. 143).

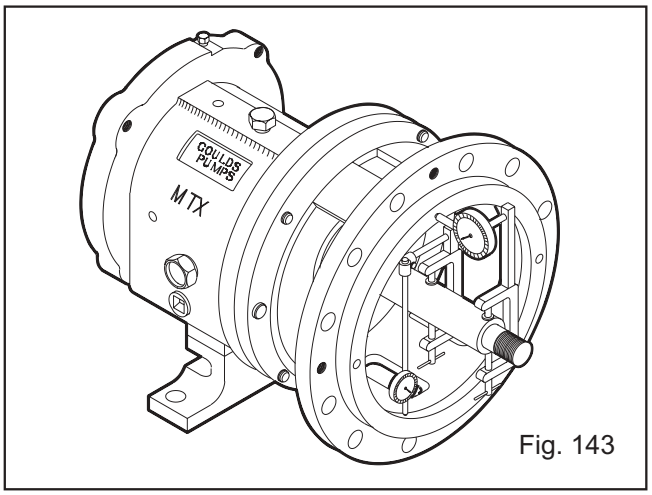
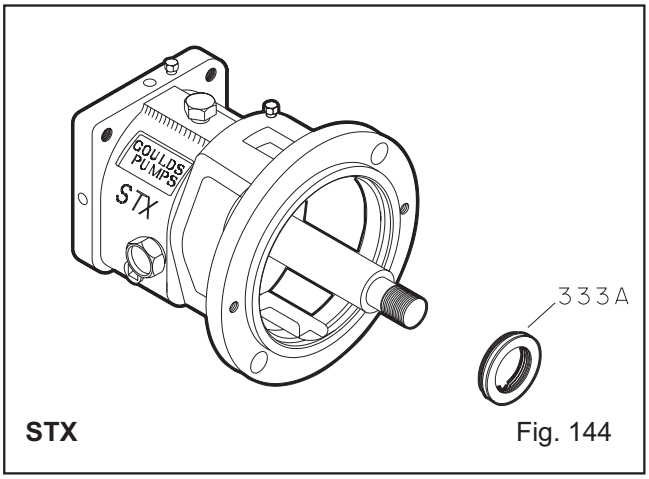


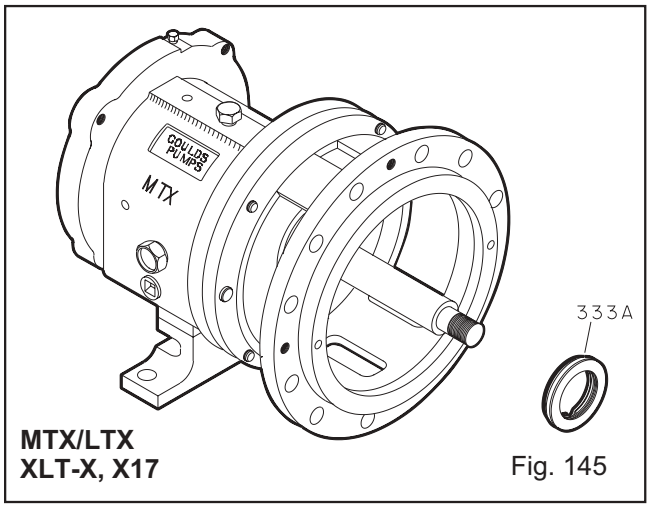
Fig. 143

9. Install inboard labyrinth oil seal (333A) into adapter (108) / bearing frame (228). It is an O-ring fit. Position the labyrinth seal drain slots at the bottom (6 o'clock) position. (Fig. 144).

NOTE: For detailed labyrinth seal installation instructions, see Appendix IV or VIII, Labyrinth Seal Installation Instructions.



STX Fig. 144



MTX/LTX
XLT-X, X17

Fig. 145

Pumps With Mechanical Seals:

1. Install seal chamber cover or backplate (184) with nuts (370H) (Fig. 146).

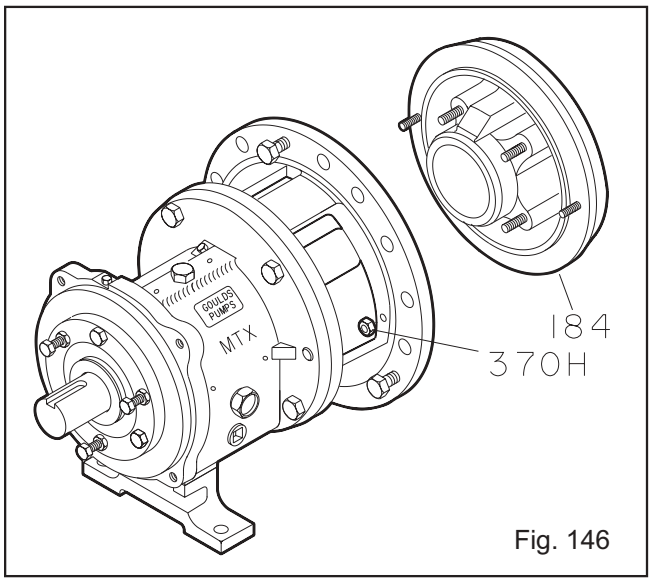


Fig. 146

2. Check seal chamber cover run-out. Rotate indicator through 360 degrees. If total indicator reading is greater than 0.005 in. (.13 mm), determine cause and correct before proceeding (Fig. 147).

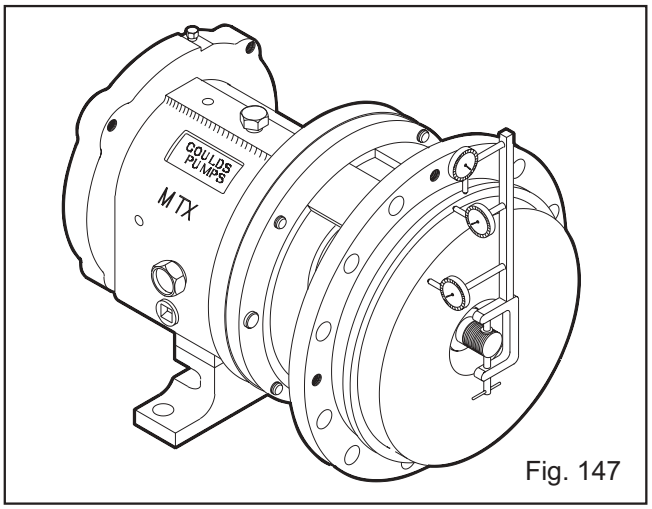


Fig. 147

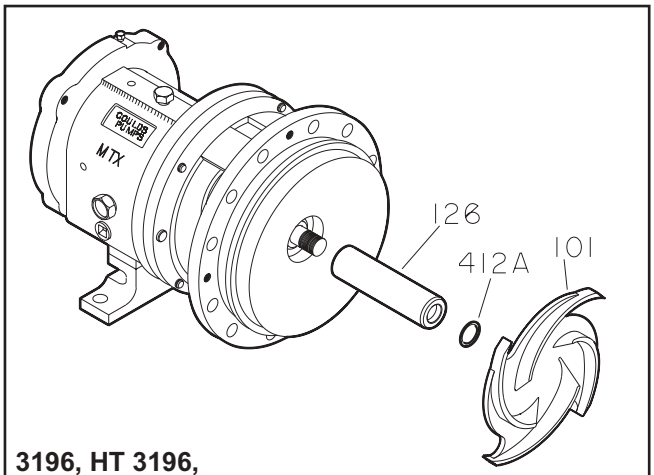
3. Install shaft sleeve (126) if used (Fig. 148).

NOTE: If using 3198 with a Teflon® sleeve, the sleeve should already be installed and finish machined.

NOTE: Make sure sleeve is fully seated.

⚠ WARNING

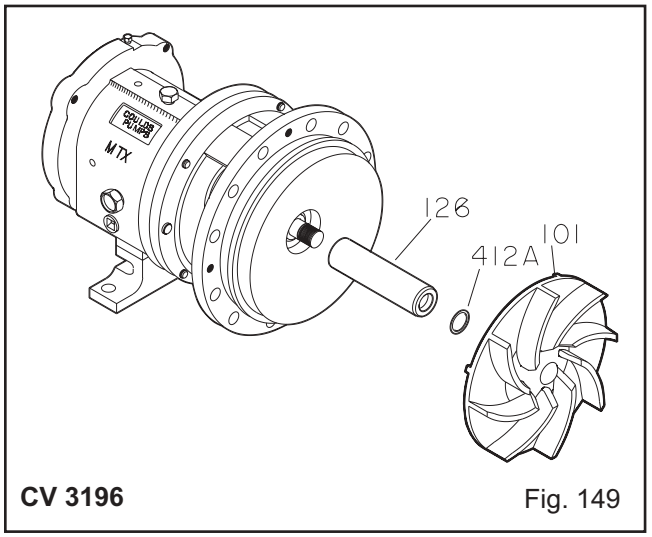
Wear a heavy set of work gloves when handling impeller (101) as sharp edges may cause physical injury.



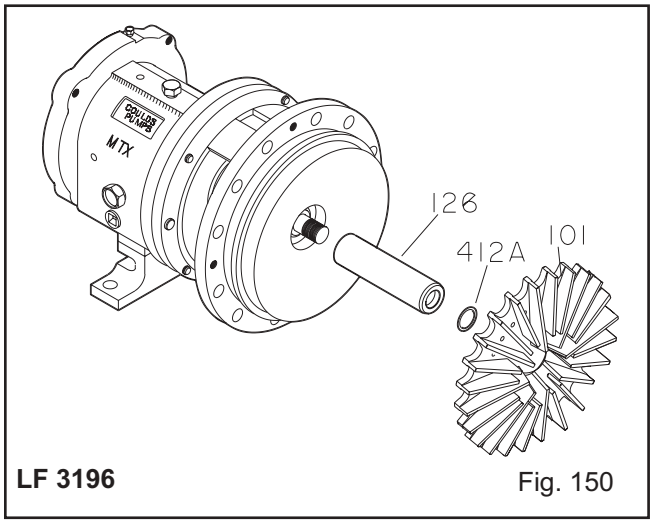
3196, HT 3196,
NM 3196, 3198, 3796

Fig. 148

4. **STX, MTX, LTX -** Install impeller (101) with O-ring (412A).



CV 3196 Fig. 149



LF 3196 Fig. 150

XLT-X & X17 - Install the impeller (101) without the O-ring (412A) and Teflon® washer (428D) on plug (458Y).

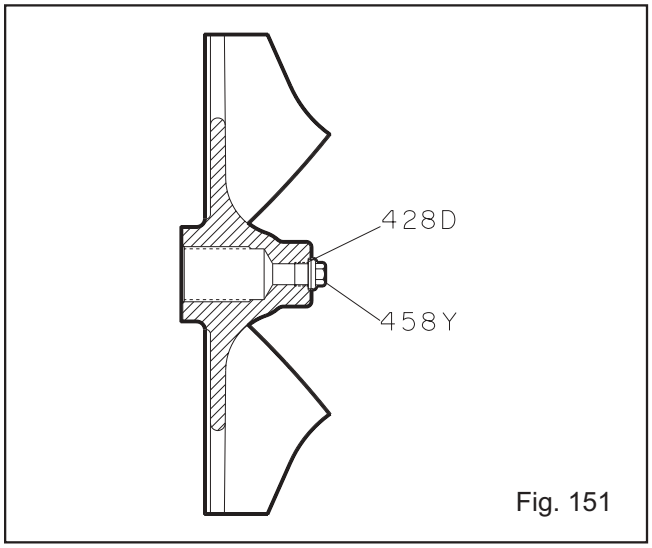


Fig. 151

5. Put shaft wrench and coupling key on shaft. When impeller (101) makes firm contact with sleeve (126), raise shaft wrench (counterclockwise, viewed from impeller end of shaft) off bench and slam it down (clockwise, viewed from impeller end of shaft). A few sharp raps will tighten impeller (101) properly (Fig. 152).

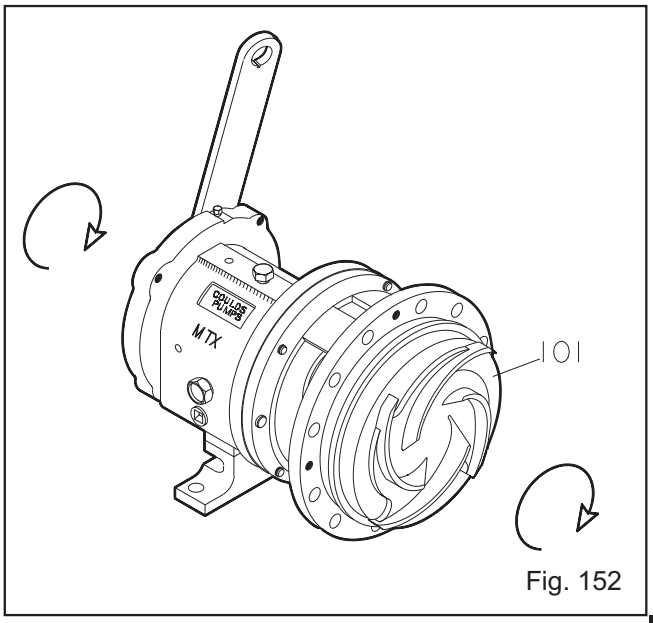


Fig. 152

6. Loosen clamp bolts (370C), and jacking bolts (370D). Measure gap between impeller (101) and seal chamber/stuffing box cover (184) with a feeler gauge. When 0.030 in. clearance is reached, tighten clamp bolts (370C), jacking bolts (370D), and locking nuts (423) (Fig. 153)

NOTE: This approximates the impeller position when set at 0.015 in. (.38 mm) from casing. Final impeller adjustment must be made after installation into casing.

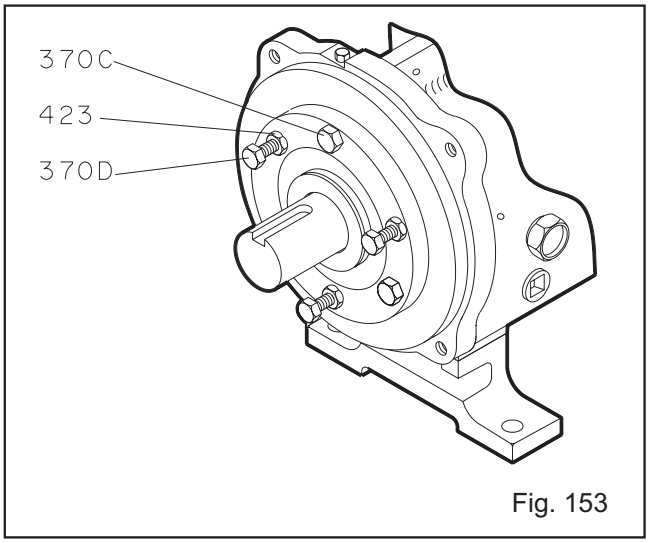


Fig. 153

7. Check impeller (101) runout. Check vane tip to vane tip. If total indicator reading is greater than 0.005 in. (.13 mm), determine cause and correct before proceeding (Fig. 154).

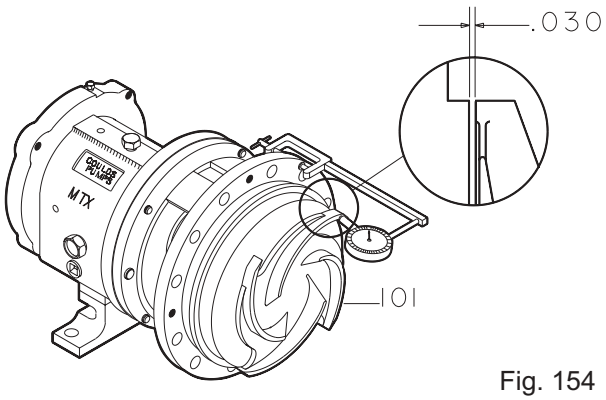


Fig. 154

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

8. Blue the shaft sleeve (126) or shaft (122) if no sleeve is used. Scribe a mark at gland gasket face of seal chamber/stuffing box cover (184). This will be the datum for installation of mechanical seal (Fig. 155).

NOTE: The mechanical seal reference dimension for the NM 3196 and the 3198 is based on the gland seat face of the backplate.

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

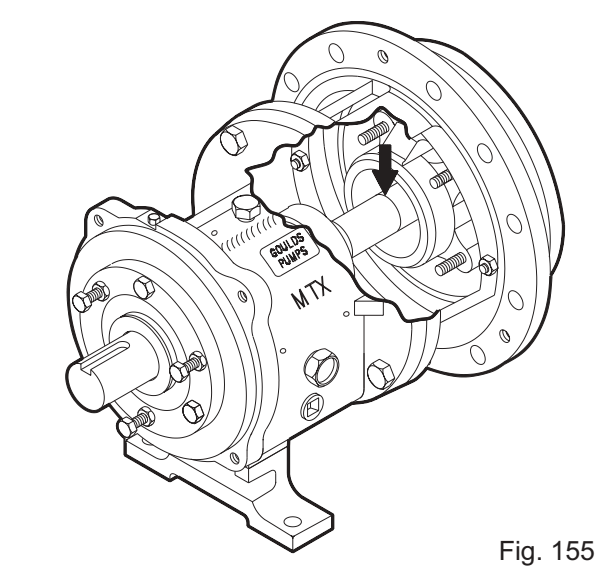


Fig. 155

9. Remove the impeller (101), and shaft sleeve (126) if used.

NOTE: Do not remove a Teflon® sleeve from a knurled 3198 shaft.

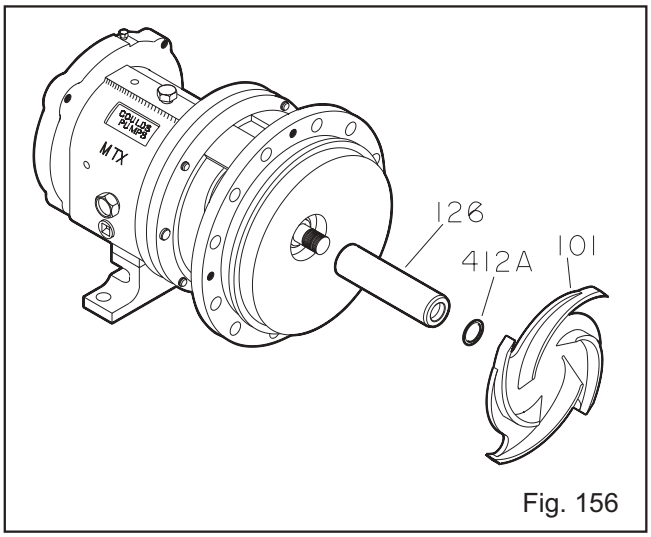


Fig. 156

10. Remove the seal chamber cover or the backplate (184).

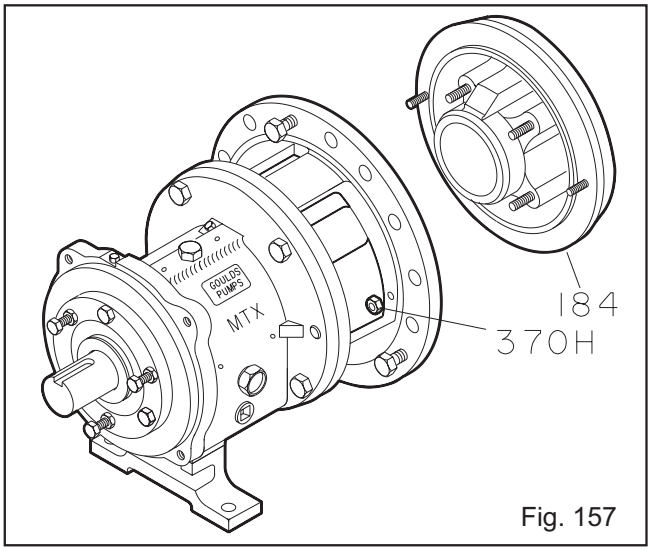


Fig. 157

For inside mounted seals:

11. Install stationary seat into gland (107) per seal manufacturer's instructions.

12. Slide gland (107) with stationary seat over shaft, up to adapter face (Fig. 158).

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

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

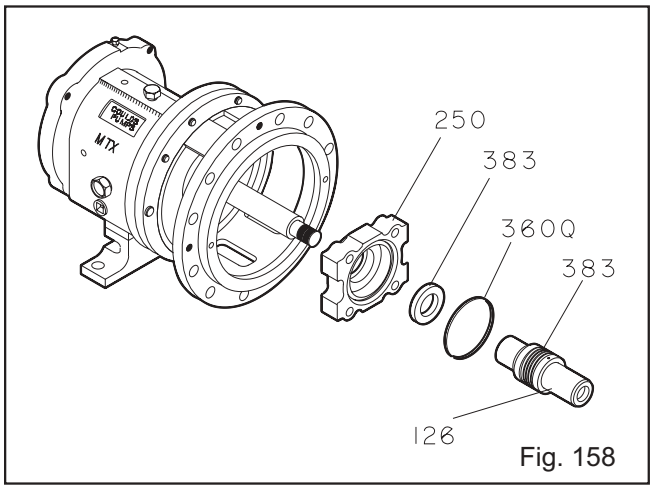


Fig. 158

14. Install seal chamber cover (184) with nuts (370H) (Fig. 159).

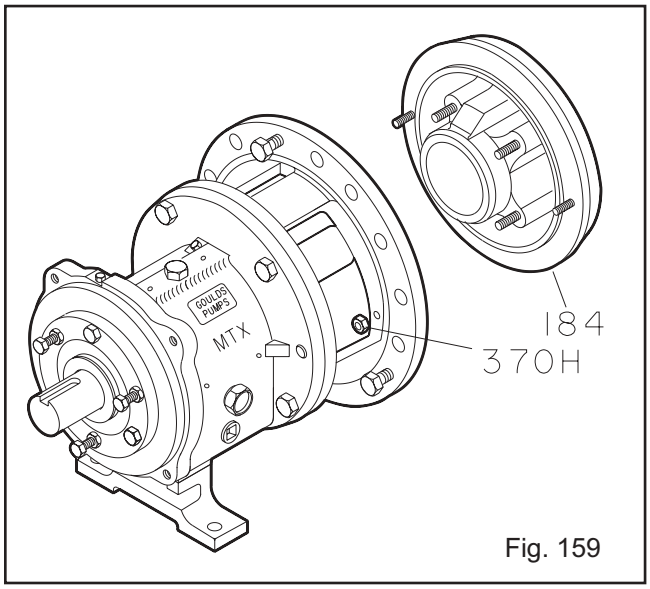


Fig. 159

⚠ WARNING

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

15. Install impeller (101) with new O-ring (412A). Put shaft wrench and coupling key on shaft. When impeller (101) makes firm contact with sleeve (126), raise shaft wrench (counterclockwise when viewed from impeller end of shaft) off bench and slam it down (clockwise when viewed from impeller end of shaft). A few sharp raps will tighten impeller (101) properly (Fig. 160).

NOTE: Be sure to use a properly balanced impeller.

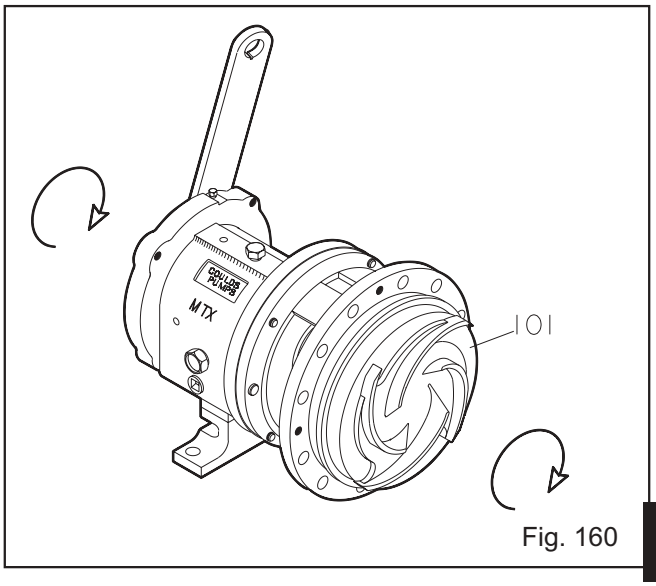


Fig. 160

16. Install gland (107) with nuts (355) (Fig. 161).

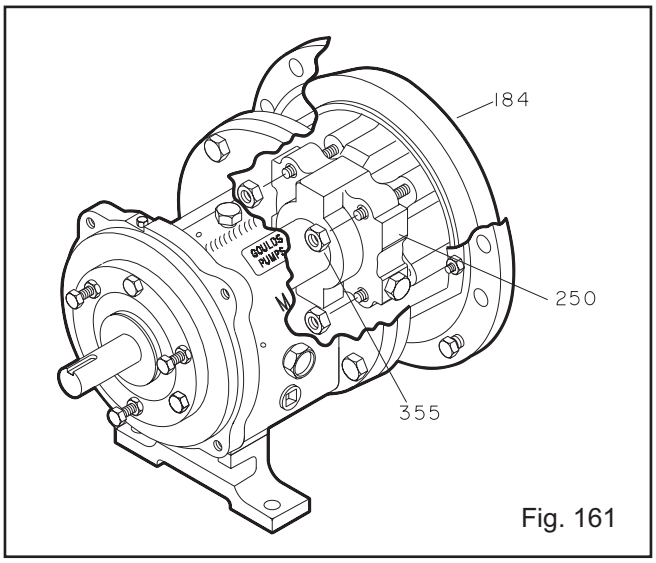


Fig. 161

For outside mounted seals:

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

12. Slide gland and then stationary seat, with gaskets, on the shaft or sleeve (Fig. 162).

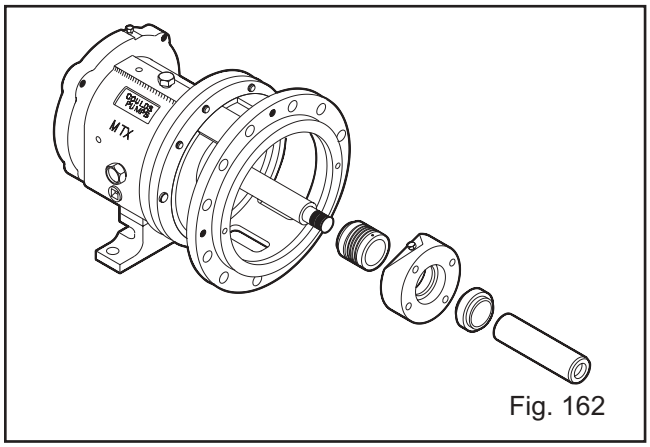


Fig. 162

13. Install the seal chamber or backplate (184) with hex nuts (370H). Be sure that the gland studs line up with the holes in the gland (Fig. 163).

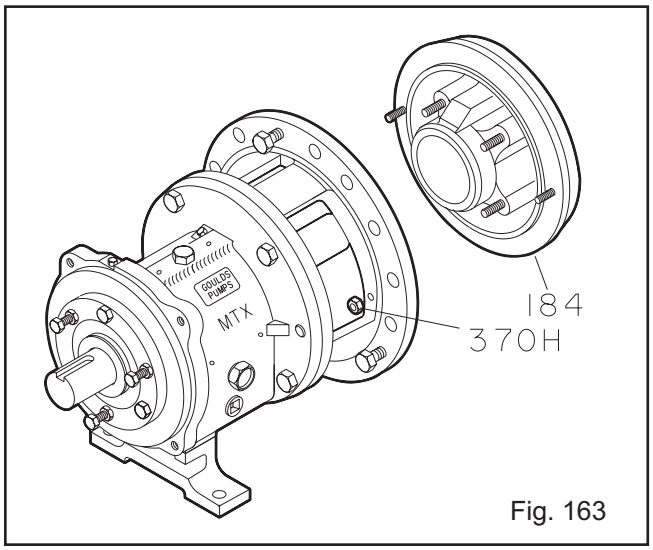


Fig. 163

14. Install the impeller (101) with a new o-ring (412A). Put the shaft wrench and coupling key on the shaft. When the impeller makes firm contact with the sleeve, raise the shaft wrench (counter-clockwise when viewed from the impeller end of the shaft) off the bench and slam it down (clockwise when viewed from the impeller end of the shaft). A few sharp raps will tighten the impeller properly (Fig. 164).

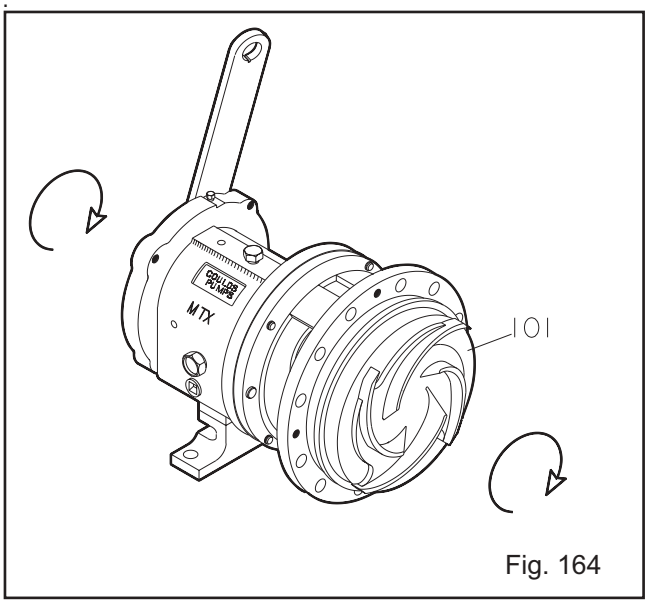


Fig. 164

NOTE: Be sure to use a properly balanced impeller.

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

Pumps With Packing:

1. Install stuffing box cover (184) with nuts (370H) (Fig 165).

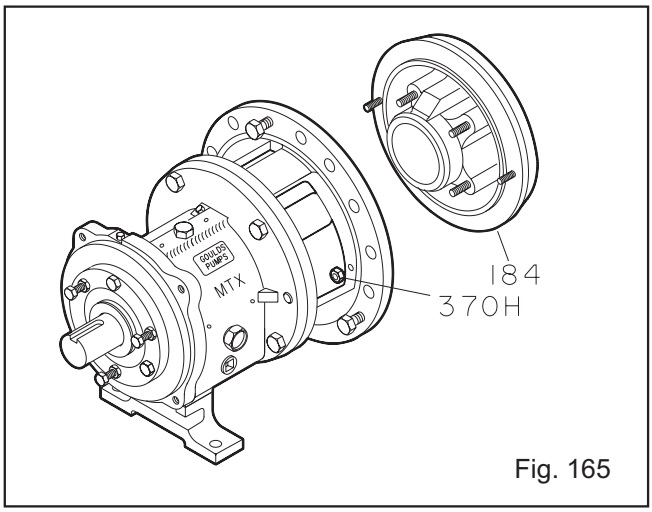


Fig. 165

2. Check stuffing box cover run-out. Rotate indicator through 360 degrees. Total indicator reading greater than 0.005 in. (.13 mm) indicates a problem (Fig. 166).

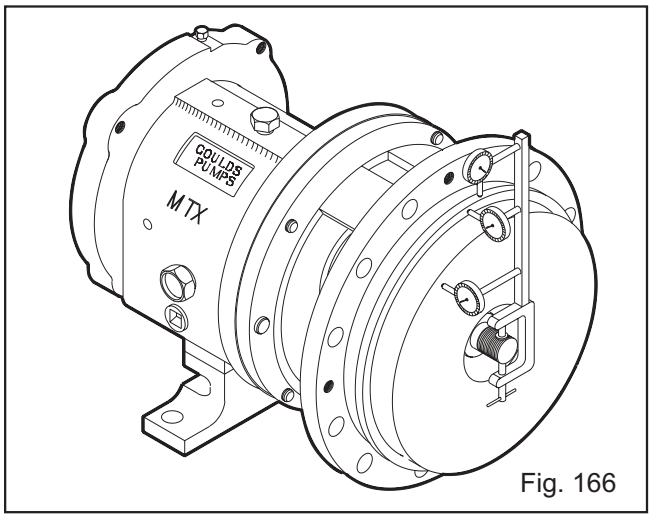


Fig. 166

3. Install shaft sleeve (126) (Fig. 167).

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

NOTE: Make sure sleeve is fully seated.

⚠ WARNING

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

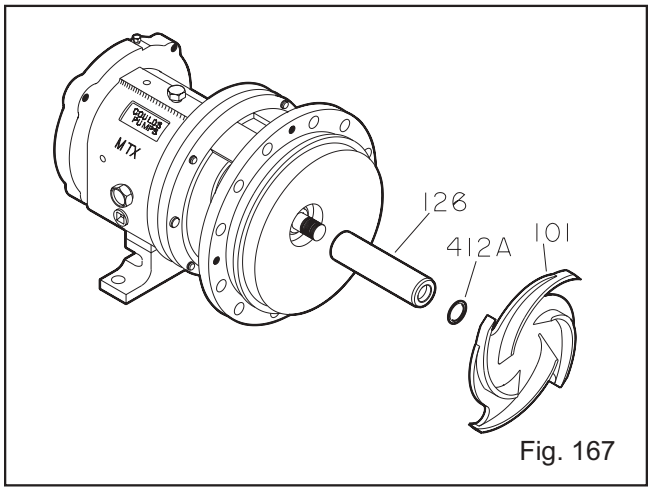


Fig. 167

4. Install impeller (101) with O-ring (412A). Put shaft wrench and coupling key on shaft. When impeller (101) makes firm contact with sleeve (126), raise shaft wrench (counterclockwise when viewed from impeller end of shaft) off bench and slam it down (clockwise when viewed from impeller end of shaft). A few sharp raps will tighten impeller properly (Fig. 168).

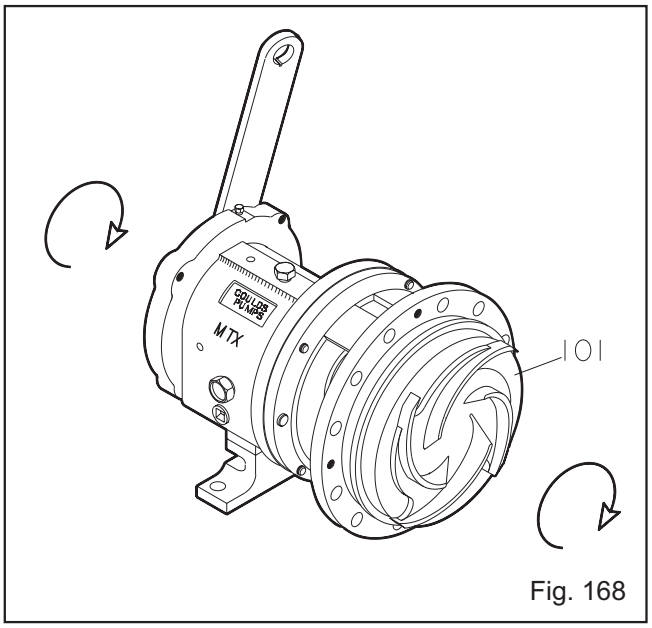


Fig. 168

5. Loosen clamp bolts (370C), and jacking bolts (370D) (Fig. 169). Measure gap between impeller (101) and seal chamber/stuffing box cover (184) with a feeler gauge. When 0.030 in. (.76 mm) clearance is reached, tighten clamp bolts (370C), jacking bolts (370D), and locking nuts (423) (Fig. 169).

NOTE: This approximates the impeller position when set at 0.015 in. (.38 mm) from casing.

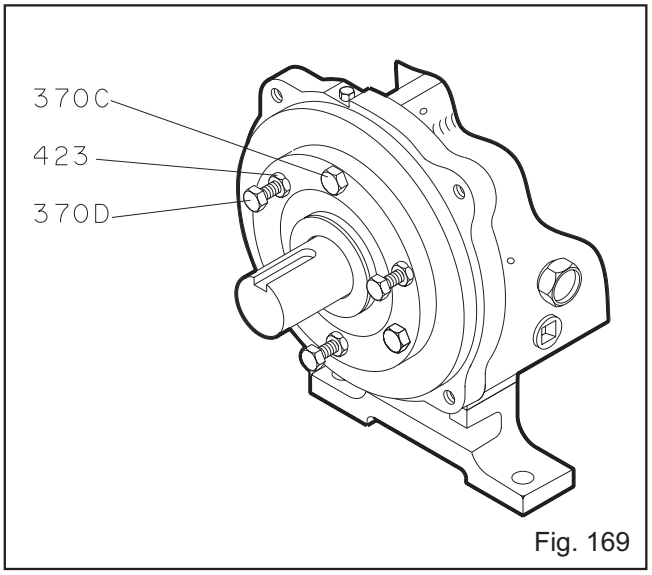


Fig. 169

6. Check impeller runout. Check vane tip to vane tip. Total indicator reading greater than 0.005 in. (.13 mm) indicates a problem (Fig. 170).

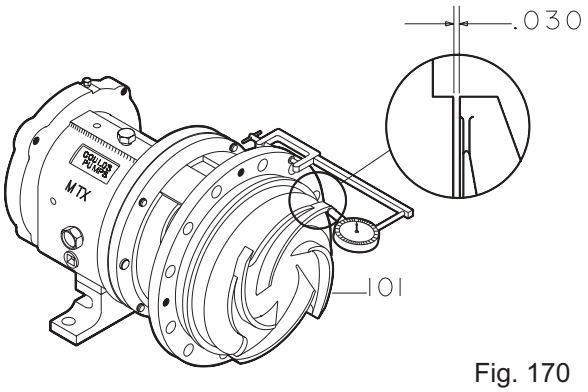


Fig. 170

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

7. Install packing and gland according to *Section 4, Operation.*

Pumps With Dynamic Seals:

(3196, CV 3196, LF 3196 only)

1. Place backplate (444) flat side down on the bench (Fig. 171).

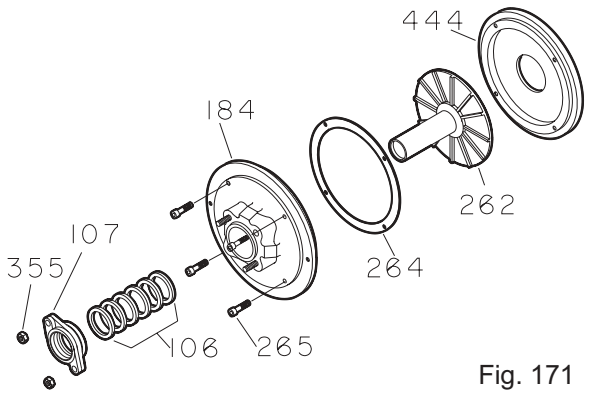


Fig. 171

2. Place repeller (262) in backplate (444), sleeve side up.
3. Place Teflon gasket (264) on backplate (444), lining up holes.
4. Place stuffing box cover (184) on backplate (444), lining up holes.
5. Install four (4) socket head cap screws (265), tighten securely.
6. Install new sealing element into gland.
7. Install gasket (360Q) and gland (107) on stuffing box cover (184). Install nuts (355).
8. Install dynamic seal assembly. Install nuts (370H) (Fig. 172).

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

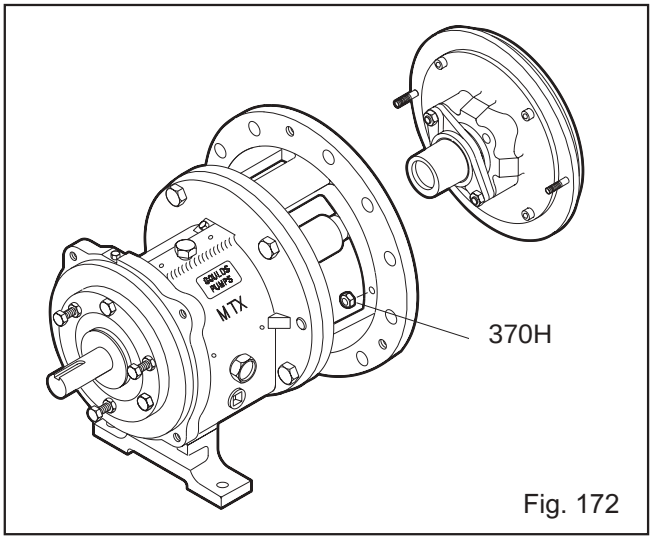


Fig. 172

9. Check stuffing box cover run-out. Rotate indicator through all 360 degrees. Total indicator reading greater than 0.005 in. indicates a problem (Fig. 173).

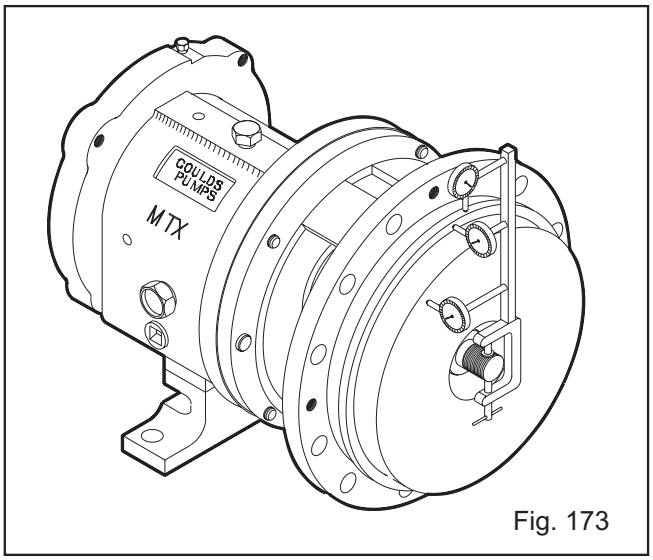


Fig. 173

Reinstall Back Pull-Out Assembly

WARNING

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

1. Clean casing fit and install casing gasket (351) in place on seal chamber/stuffing box cover.
2. Loosen clamping bolts (370C) and jacking bolts (370D) on bearing housing (Fig. 174).

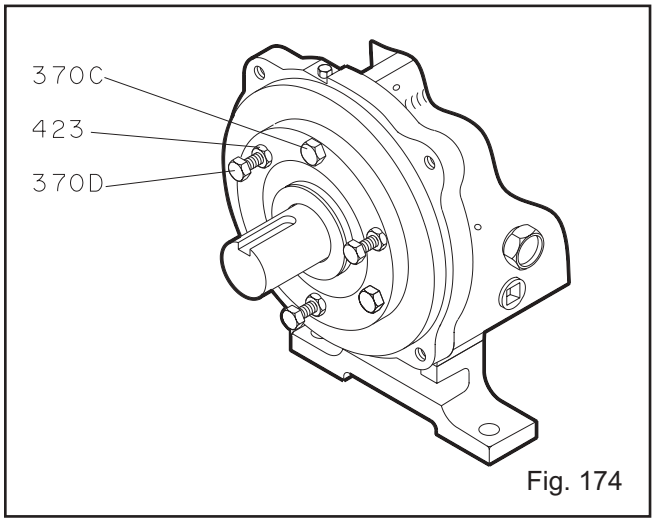


Fig. 174

3. Install back pull-out assembly in casing (Fig. 175, 176).

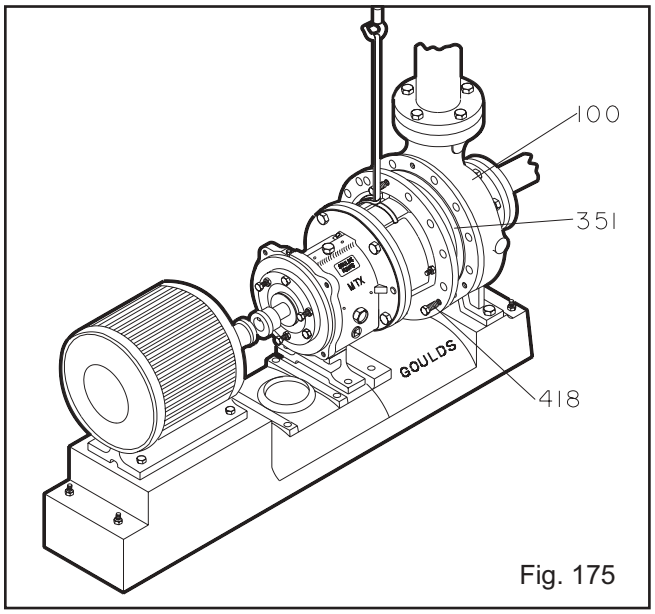


Fig. 175

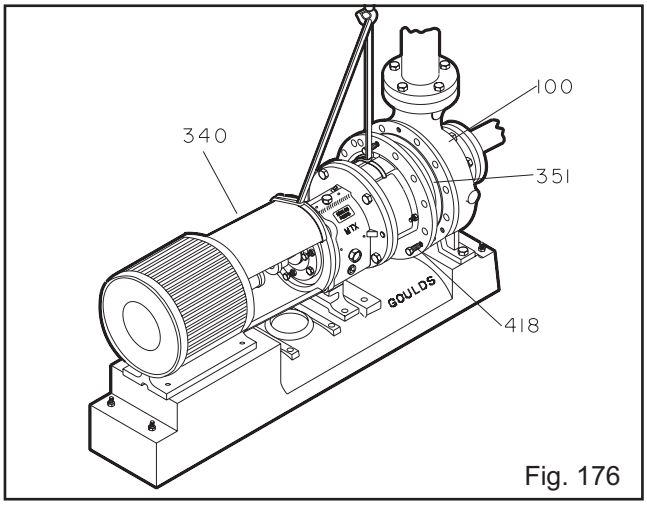


Fig. 176

4. Install casing bolts (370), finger tight. Casing bolts (370) may be coated with anti-galling compound to aid disassembly. Tighten the casing bolts per *Table 9* torque values. Install casing jack screws (418), snug tight (Fig. 177).

CAUTION

Do not overtighten casing jack screws (418).

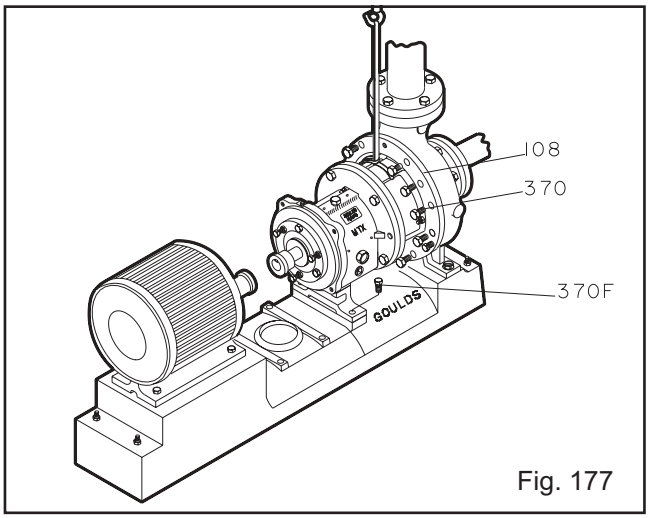


Fig. 177

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

6. Check total travel of impeller in casing. With new parts, acceptable range is 0.030 in. (.76 mm). to 0.065 in. (1.65 mm). If outside this range, improper parts or installation or too much pipe strain is present. Determine cause and correct.
7. Adjust impeller clearance according to procedure outlined in the Preventive Maintenance Section.
8. Replace auxiliary piping at this time.
9. Fill pump with proper lubricant. Refer to *Section 5, Preventive Maintenance* for requirements.

NOTE: For reassembly of the C-Face adapter, see Appendix V.

Model HT 3196 Only

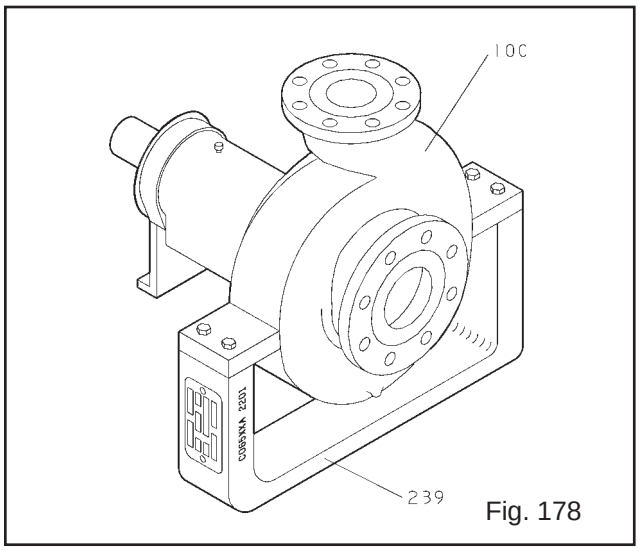


Fig. 178

1. Assemble casing support (239) to casing (100) as shown in Fig. 178. The stamped part number on the casing support (239) is located on the left hand side when facing the casing suction.

POST ASSEMBLY CHECKS

All checks and procedures listed under Safety, Installation, Operation and Preventive Maintenance sections must be followed.

After completion of these operations, check if it is possible to rotate shaft easily by hand. If all is proper, continue with pump start-up.

ASSEMBLY TROUBLESHOOTING

Symptom	Cause	Remedy
Excessive shaft end play.	Bearing internal clearance too great. Snap ring loose in bearing housing groove.	Replace bearings with correct type. Reseat.
Excessive shaft/sleeve runout.	Sleeve worn. Shaft bent.	Replace Replace.
Excessive bearing frame flange runout.	Shaft bent. Bearing frame flange distorted.	Replace Replace.
Excessive frame adapter runout.	Corrosion. Adapter to frame gasket not seated properly.	Replace. Reseat.
Excessive seal chamber/stuffing box cover runout.	Seal chamber/stuffing box cover not properly seated in frame adapter. Corrosion or wear.	Replace.
Excessive impeller vane tip runout.	Bent vane(s).	Replace impeller.

PARTS LIST WITH MATERIALS

Item	Qty per Pump	Part Name	3196, CV 3196, HT 3196, 3796				
			All D.I.	D.I. w/ 316SS Impeller	All 316SS	Al CD4MCu	All Alloy 20
100	1	Casing	1012				
101	1	Impeller	1013				
105	1	Lantern Ring	Teflon®				
106	1 Set	Stuffing Box Packing	Non-Asbestos Braid				
107	1	Gland—Packed Box	1203			1204	
108	1	Frame Adapter	1013				
109C	1 X	Outboard Bearing End Cover	1001				
112A	1	Outboard Bearing	Double row angular contact (duplex pair for LTX)				
113	2	Plug—Grease Relief	2210				
113B	1	Plug—Oil Fill	2210				
122	1	Shaft—Less Sleeve	▲		2229		2230
122	1	Shaft—With Sleeve	2238				
126	1	Shaft Sleeve	2229				2230
134	1	Bearing Housing	1001				
136	1	Bearing Locknut	Steel				
168A	1	Radial Bearing	Single Row Ball				
184	1	Seal Chamber/Stuffing Box Cover	1012	1012	1203	1216	1204
193	2	Grease Fitting	Steel				
228	1	Bearing Frame	STX All Others - 1001				
236A	10	Cap Screw—Bearing Clamp Ring	2210				
241	1	Frame Foot	1001				
248	1	Oil Thrower	2210				
250	1	Gland—Mechanical SEal	Material Varies				
253B	1	Bearing Clamp Ring	2210				
319	1	Sight Glass	Glass/Steel				
332A	1	Outboard Labyrinth Seal w/O-rings	Brass ASTM B505-96				
333A	1	Inboard Labyrinth Seal w/O-rings	Brass ASTM B505-96				
351	1	Casing Gasket	Aramid Fiber w/EPDM				
353	4	Gland Stud	2228				
355	4	Gland Stud Nut	2228				
358	1	Plug—Casing Drain	2210		2229		2230
358Y	1 X	Plug, Impeller	2229				2230
360C	1 X	Gasket—Thrust End Cover	Vellumoid				
360D	1	Gasket—Frame-to-Adapter	Vellumoid				
360Q	1	Gasket—Gland-to-Stuffing Box Cover	Material Varies				
361A	1	Retaining Ring	Steel				
370	★	Bolt—Adapter to Case	2210		2228		
370B	4	Bolt—Frame-to-Adapter	2210				
370C	✹	Clamp Bolt —Bearing Housing	2210				
370D	✹	Jack Bolt—Bearing Housing	2210				
370F	2	Bolt—Frame Foot to Frame	2210				
370H	2	Stud—Stuffing Box Cover-to-Adapter	2228				
371C	6 X	Cap Screw-End Cover to Bearing Housing	2210				
382	1	Bearing Lockwasher	Steel				
383	1	Mechanical Seal	Material Varies				
400	1	Coupling Key	2210				
408A	1	Plug—Oil Drane	2210				
408H	4	Plug—Oil Mist Connection	2210				
408J	1	Plug—Oiler	2210				
408L	1	Plug—Oil Cooler Inlet	2210				
408M	1	Plug—Oil Cooler Outlet	2210				
408N	1	Plug—Sight Glass	2210				
418	3	Jack Bolt—Adapter-to-Case	2228				
423	3	Jam Nut—Bearing Housing Jack Bolt	2210				
423B	2	Hex Nut—Stuffing Box Cover to Adapter	2228				
428	1	Gasket, Plug	Teflon®				
458Y	1 X	Plug, Impeller	2229				2230
469B	2	Dowel Pin—Frame-to-Adapter	Steel				
494	1	Tube Element, Finned Cooled	304SS / Copper				
496	1	O-Ring Bearing Housing	Buna N				
412A	1	O-Ring—Impeller	Teflon®				
497F	1	O-Ring—Outboard Labyrinth Rotor	Viton				
497G	1	O-Ring—Outboard Labyrinth Stator	Viton				
497H	1	O-Ring—Inboard Labyrinth Rotor	Viton				
497J	1	O-Ring—Inboard Laybrinth Stator	Viton				
497L	1	O-Ring Internal (inboard)	Viton				
497N	1	O-Ring Internal (outboard)	Viton				
503	1 #	Adapter Ring	1013				
529	1	Lockwasher—Frame Foot-to-Bearing Frame	Steel				
555	1	Tube, Finned Cooling Assembly	304AA / Copper				
555A	1	Tube, Ftg Male (Frame Cooling)	Brass				
555B	2	Connector, Thermocouple (Frame Cooling)	Brass				
555C	2	Elbow, Female (Frame Cooling)	Brass				
555D	1	Conn TC Sealed PWR	Cast Iron				

OF CONSTRUCTION

3196, CV 3196, HT 3196, 3796						NM 3196	3198
All 317SS	All Monel	All Nickel	All HastC	All Hast B	All Titanium	Vinylester	DI/ Teflon®
1209	1119	1601	1215	1217	1220	6929	9639
1209	1119	1601	1215	1217	1220	6929	6944
						—	—
						—	—
1209	1119	1601	1215	1217	1220	—	—
2232	2150	2155	2248	2247	2156	2229	—
				2229			6947
2232	2150	2155	2248	2247	2156	2229	—
1209	1119	1601	1215	1217	1220	6929	9639
2232	2150	2155	2248	2247	2156	2229	2229
2232	2150	2155	2248	2247	2156	2229	2229
2232	2150	2156	2248	2247	2156	—	—
2232	2150	2156	2248	2247	2156	—	—
2232	2150	2155	2248	2247	2156	—	—

✷	3 for STX, MTX, LTX 4 for XLT-X, X-17
★	4 for 6" STX 8 for 8" STX 8 for 8" MTX 16 for 13" MTX, LTX, XLT-X 24 FOR 15" XLTX-X 12 FOR 10" MTX, LTX & X-17
▲	2229 for Mech Seals 2237 all other
X	XLT - X & X-17 only
#	# STX only

6

MATERIAL CROSS REFERENCE CHART

Material	Goulds Pumps Material Code	ASTM	DIN	ISO	JIS
Cast Iron	1001	A48 CLASS 20			
Ductile Iron	1012	A395 Gr60-40-18			
Ductile Iron	1013	A536 Gr60-42-10			
CD4MCu	1041	A744 CD4MCU			
Monel	1119	A494 GrM-35-1			
316SS	1203	A744 CF-8M	1.4408		G5121 (SC514)
Alloy 20	1204	A744CN-7M	1.4500		
317SS	1209	A744CG-8M	1.4448		
Hastelloy C	1215	A494 CW-6M			
CD4MCu	1216	A744CD4MCU	9.4460		
Hastelloy B	1217	A494 N-7M			
Titanium	1220	B367 GrC-3			
Nickel	1601	A494 GrCZ100			
Monel	2150	B164 UNS N04400			
Nickel	2155	B160 UNS N02200			
Titanium	2156	B348 Gr2			
Carbon Steel	2201	A576 Gr. 1018 and 1020			
Carbon Steel	2210	A108Gr1211			
304SS	2228	A276 Type 304			
316SS	2229	A276 Type 316			
Alloy 20	2230	B473 (N08020)			
317SS	2232	A276			
4150 Steel	2237	A322Gr4150			
4140 Steel	2238	A434Gr4140			
4140 Steel	2239	A193 Gr. B7			
Alloy B-2	2247	B335 (N10665)			
Alloy C-276	2248	B574 (N10276)			
GMP-2000	6929	N/A			
PFA Lined Steel	6944	N/A			
PFA Lined 316SS	6947	N/A			
PFA Lined Ductile Iron	9639	N/A			

Fasteners/Plugs

Material	Goulds Pumps Material Code	ASTM
Carbon Steel	2210	A307Gr.B.
Stainless Steel	2228	F593Gr1
316 Stainless Steel	2229	F593Gr2

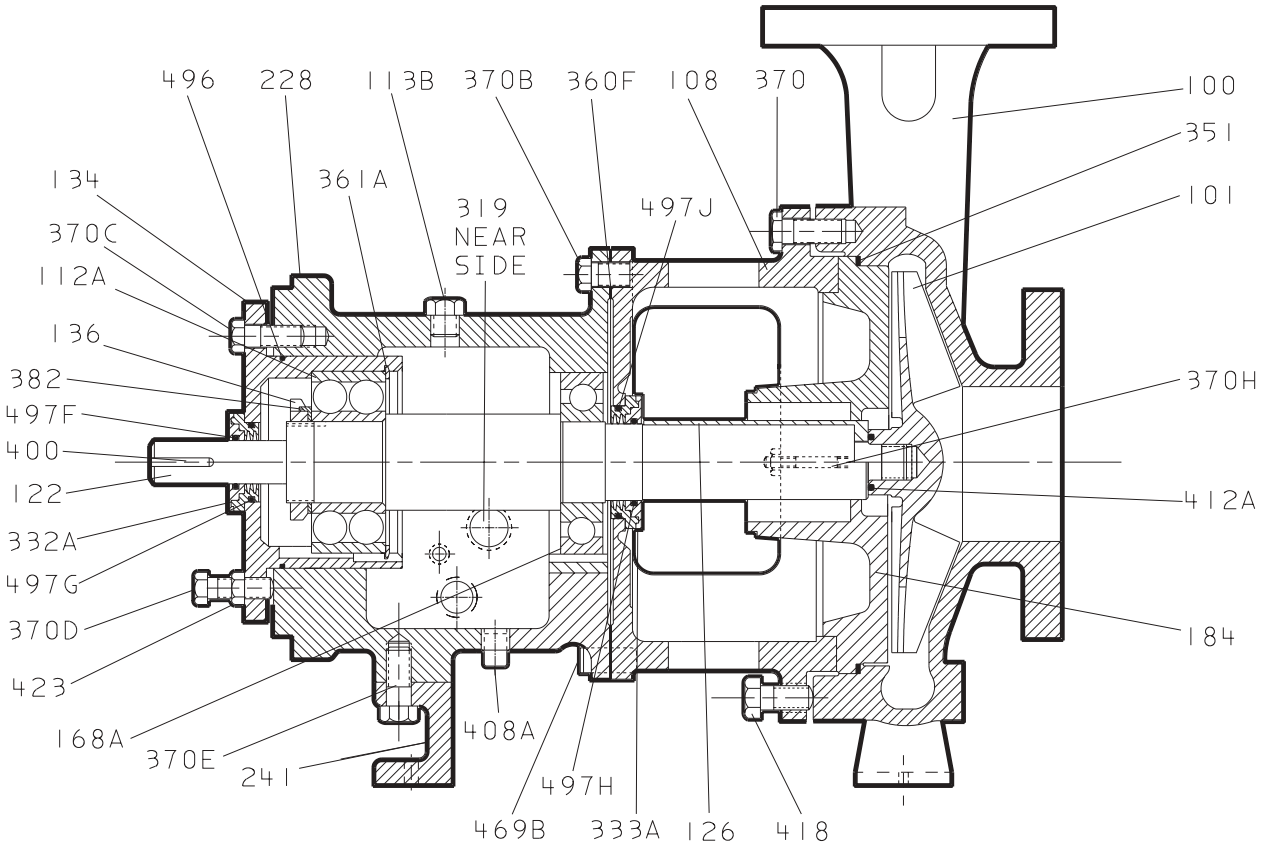
Model HT 3196 Parts List with Materials of Construction

(For all other Items refer to the 3196 Parts List with Materials of Construction)

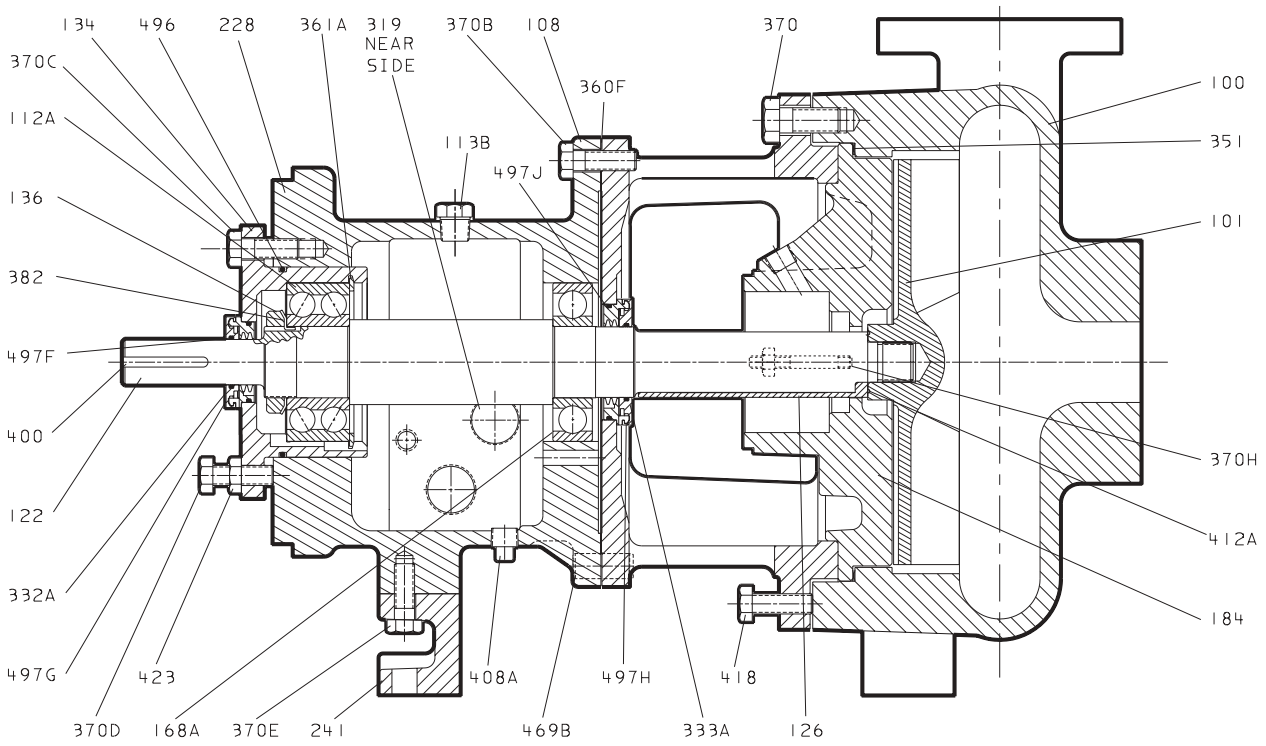
316SS			Alloy 20		
Item	**Part Description**	**Mat'l Code**	**Item**	**Part Descripton**	**Mat'l Code**
100	Casing	1203	100	Casing	1204
122	Shaft - With Sleeve	2229	122	Shaft - With Sleeve	2229
122	Shaft - Less Sleeve (Optional)	2229	122	Shaft - Less Sleeve (Optional)	2230
239	Support, Casing	2201	239	Support, Casing	2201
351	Gasket, Casing	5175	351	Gasket, Casing	5175
370	Screw, H. Cap Adapter to Casing	2239	370	Screw, H. Cap Adapter to Casing	2239
370Y	Screw, H. Cap Casing to Support	2210	370Y	Screw, H. Cap Casing to Support	2210
412A	O-Ring, Graphoil Impeller		412A	O-Ring, Graphoil Impeller	
437	Lockwasher, Casing to Support	2210	437	Lockwasher, Casing to Support	2210
494	Finned Cooler Tube		494	Finned Cooler Tube	

Hastelloy C			CD4MCu		
Item	**Part Description**	**Mat'l Code**	**Item**	**Part Descripton**	**Mat'l Code**
100	Casing	1215	100	Casing	1216
122	Shaft - With Sleeve	2229	122	Shaft - With Sleeve	2229
122	Shaft - Less Sleeve (Optional)	2248	122	Shaft - Less Sleeve (Optional)	2230
239	Support, Casing	2201	239	Support, Casing	2201
351	Gasket, Casing	5175	351	Gasket, Casing	5175
370	Screw, H. Cap Adapter to Casing	2239	370	Screw, H. Cap Adapter to Casing	2239
370Y	Screw, H. Cap Casing to Support	2210	370Y	Screw, H. Cap Casing to Support	2210
412A	O-Ring, Graphoil Impeller		412A	O-Ring, Graphoil Impeller	
437	Lockwasher, Casing to Support	2210	437	Lockwasher, Casing to Support	2210
494	Finned Cooler Tube		494	Finned Cooler Tube	

Model 3196 Cross Sectional

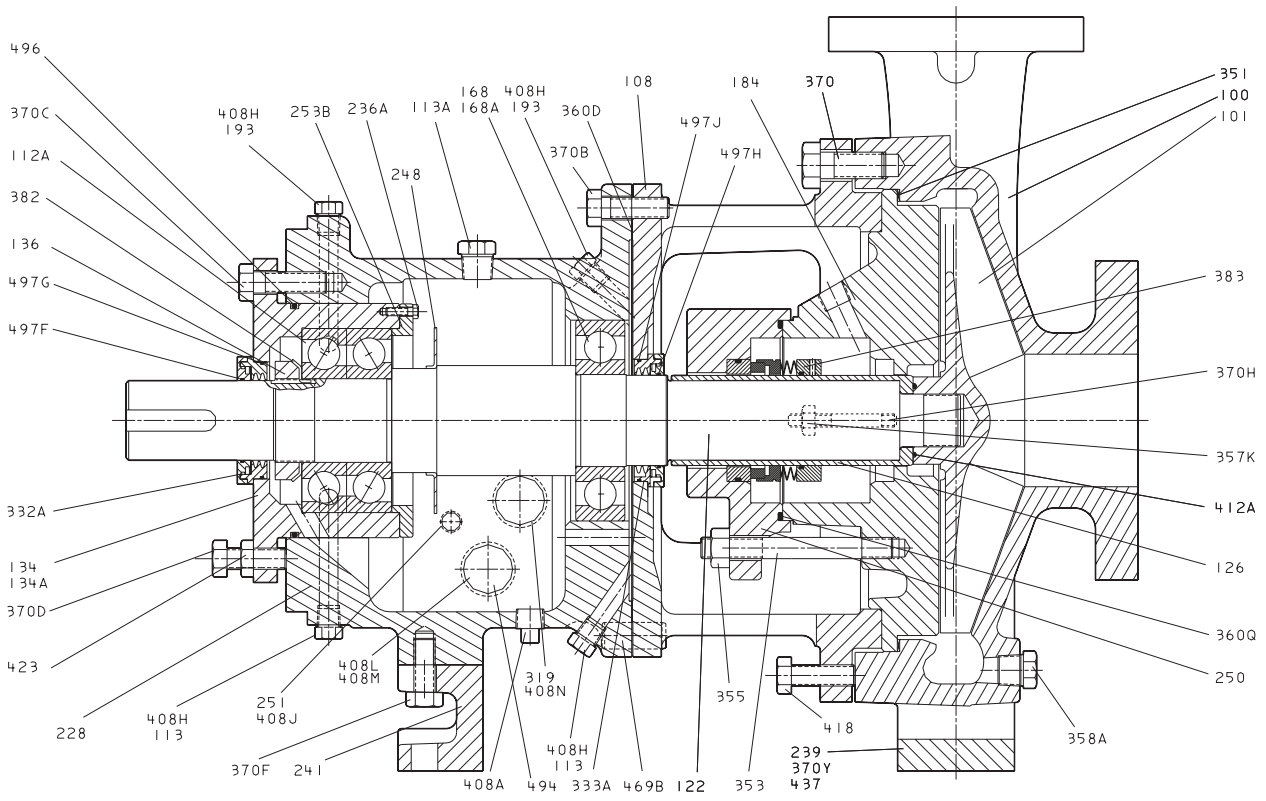


Model CV 3196 Cross Sectional



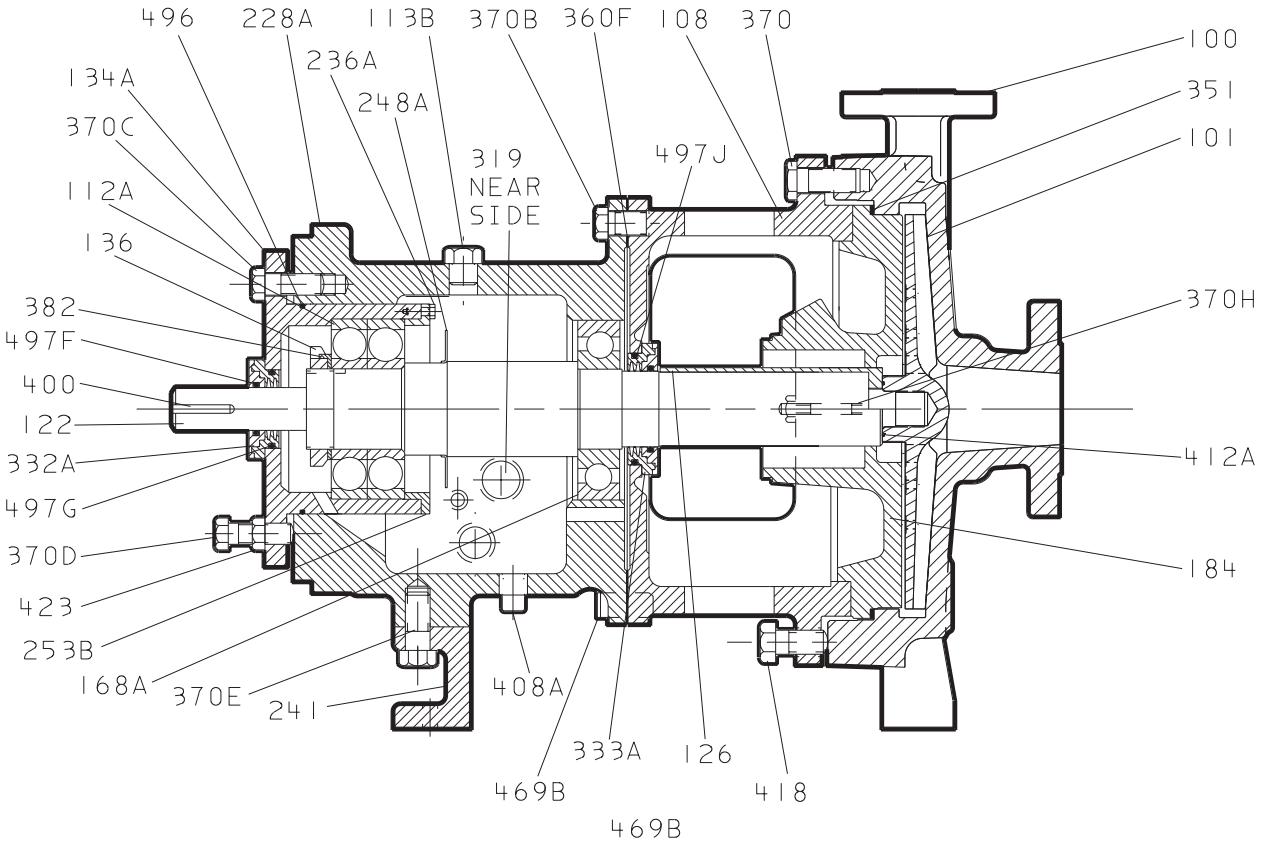
6

Model HT 3196 Cross Sectional (LTX)



Finned tube oil cooler is not shown but is standard with HT 3196.
See power frame exploded view drawing.

Model LF 3196 Cross Sectional



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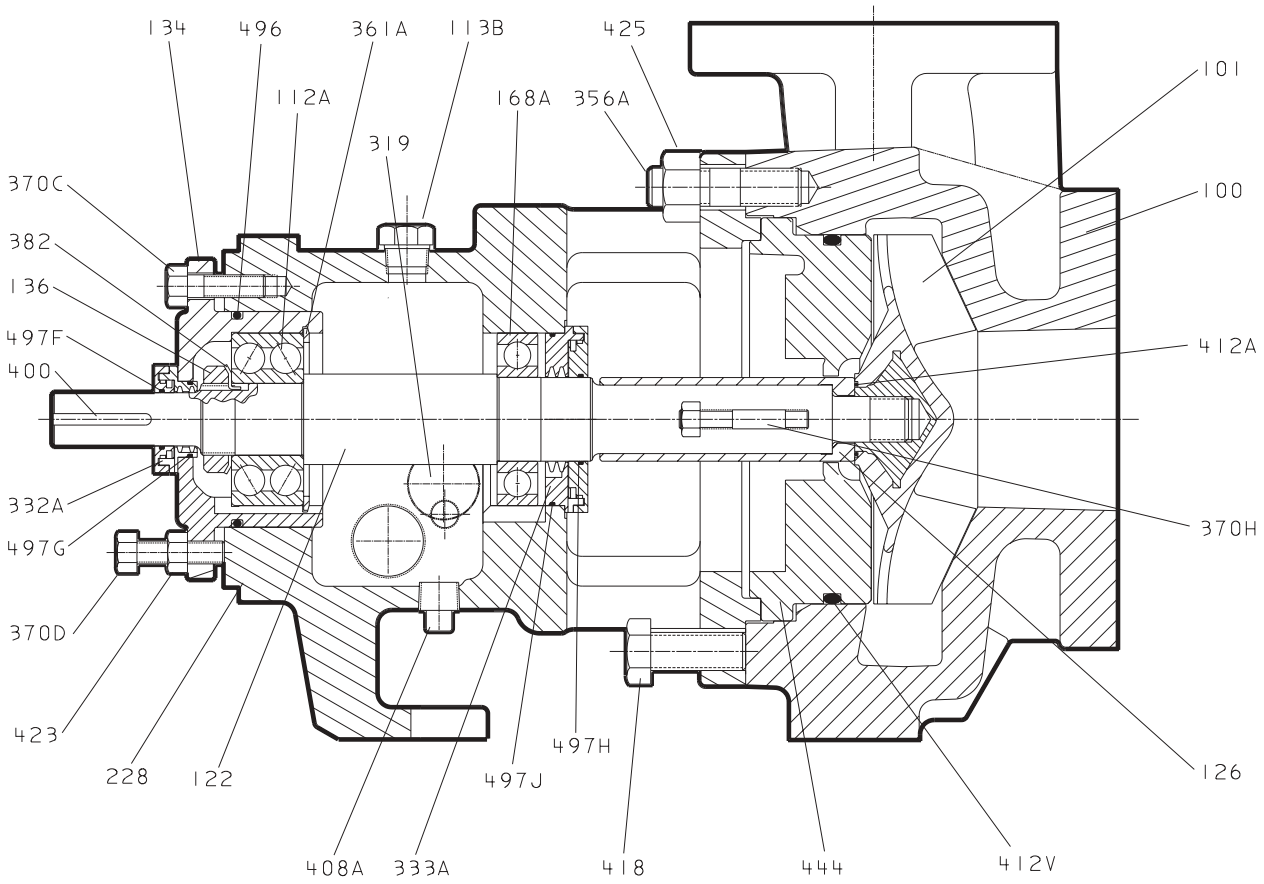
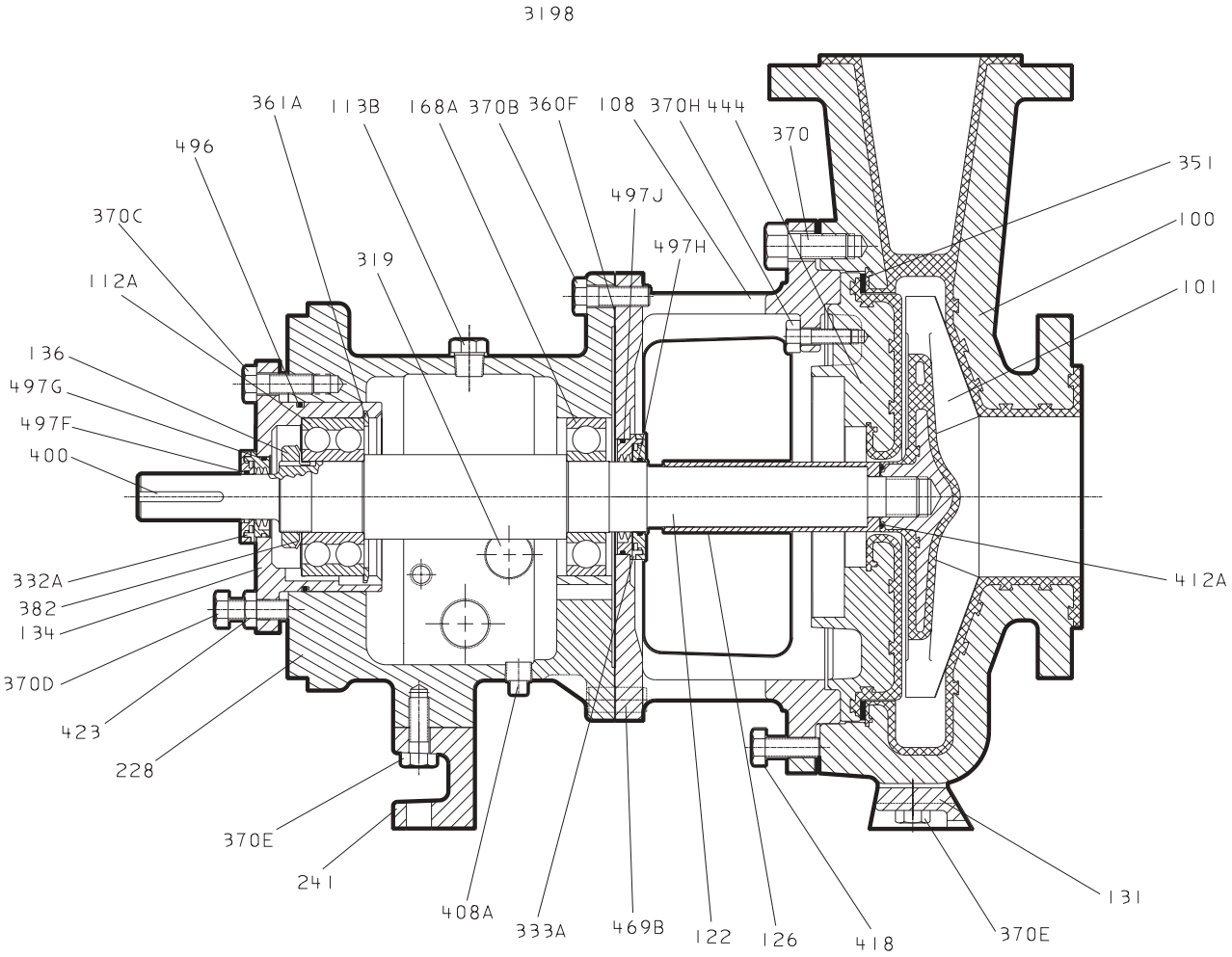
Model NM 3196 Cross Sectional



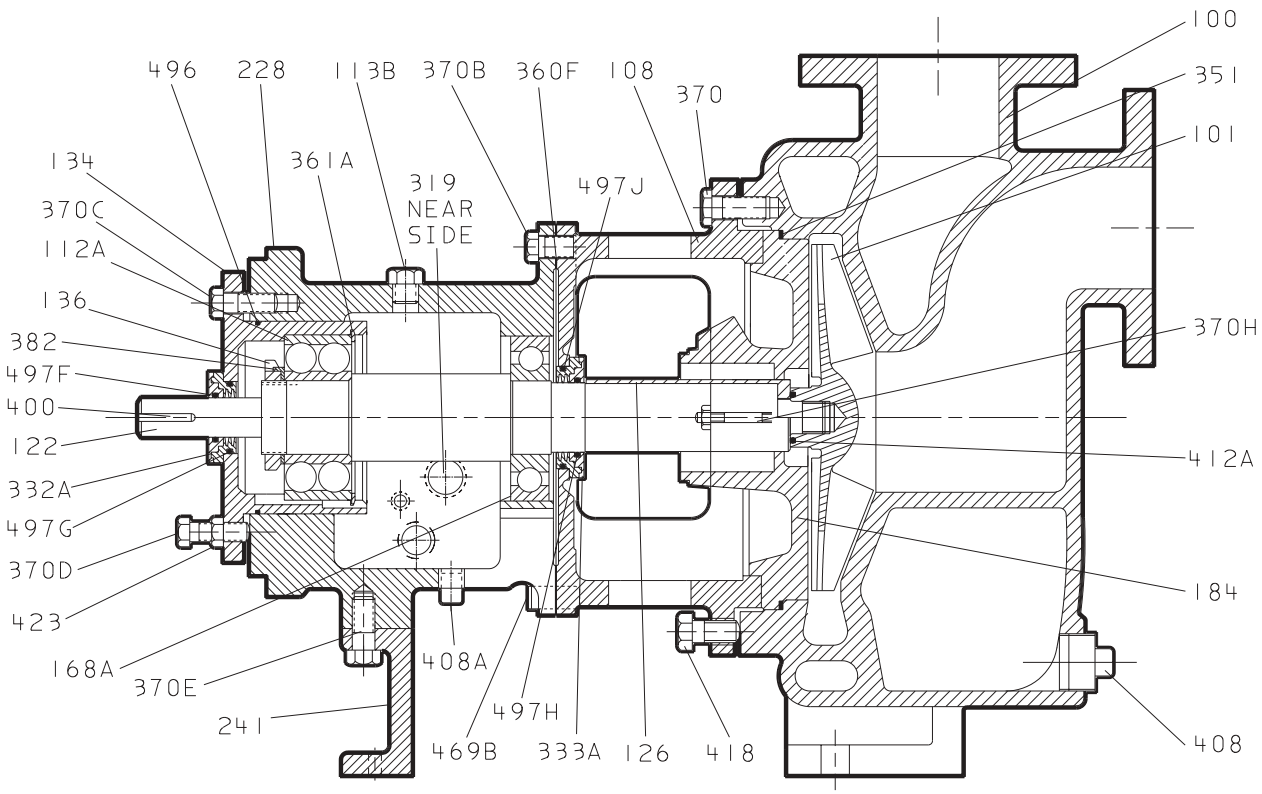
Model 3198 Cross Sectional



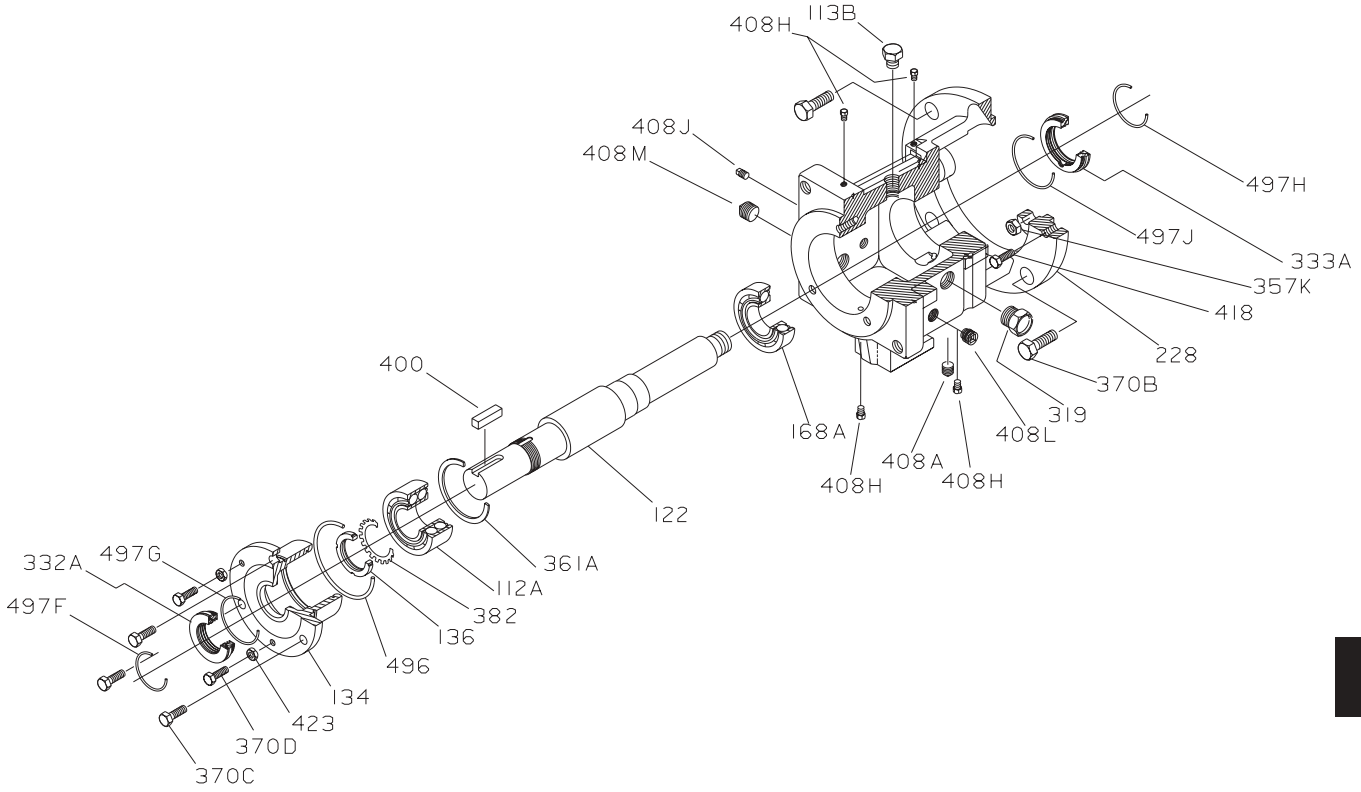
6

Model 3796 Cross Sectional

3796 MTX



STX Power End



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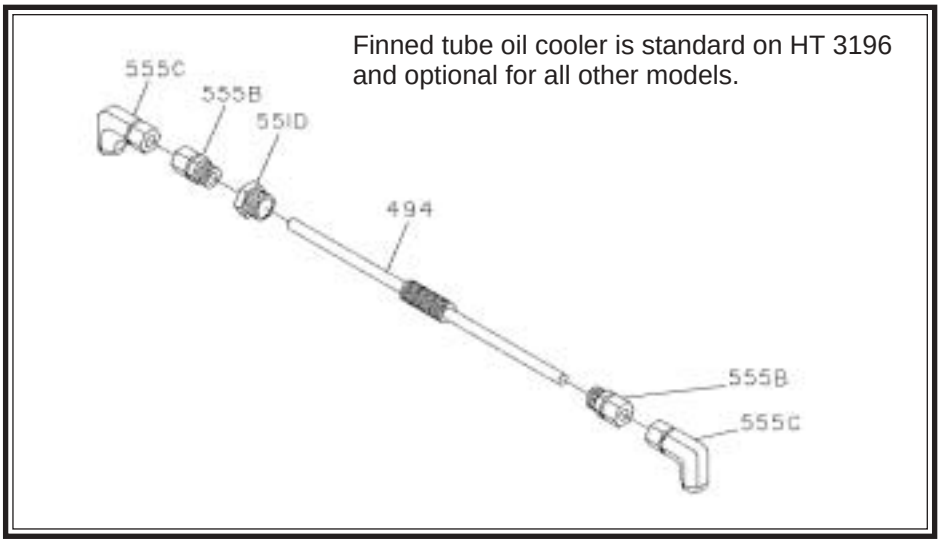
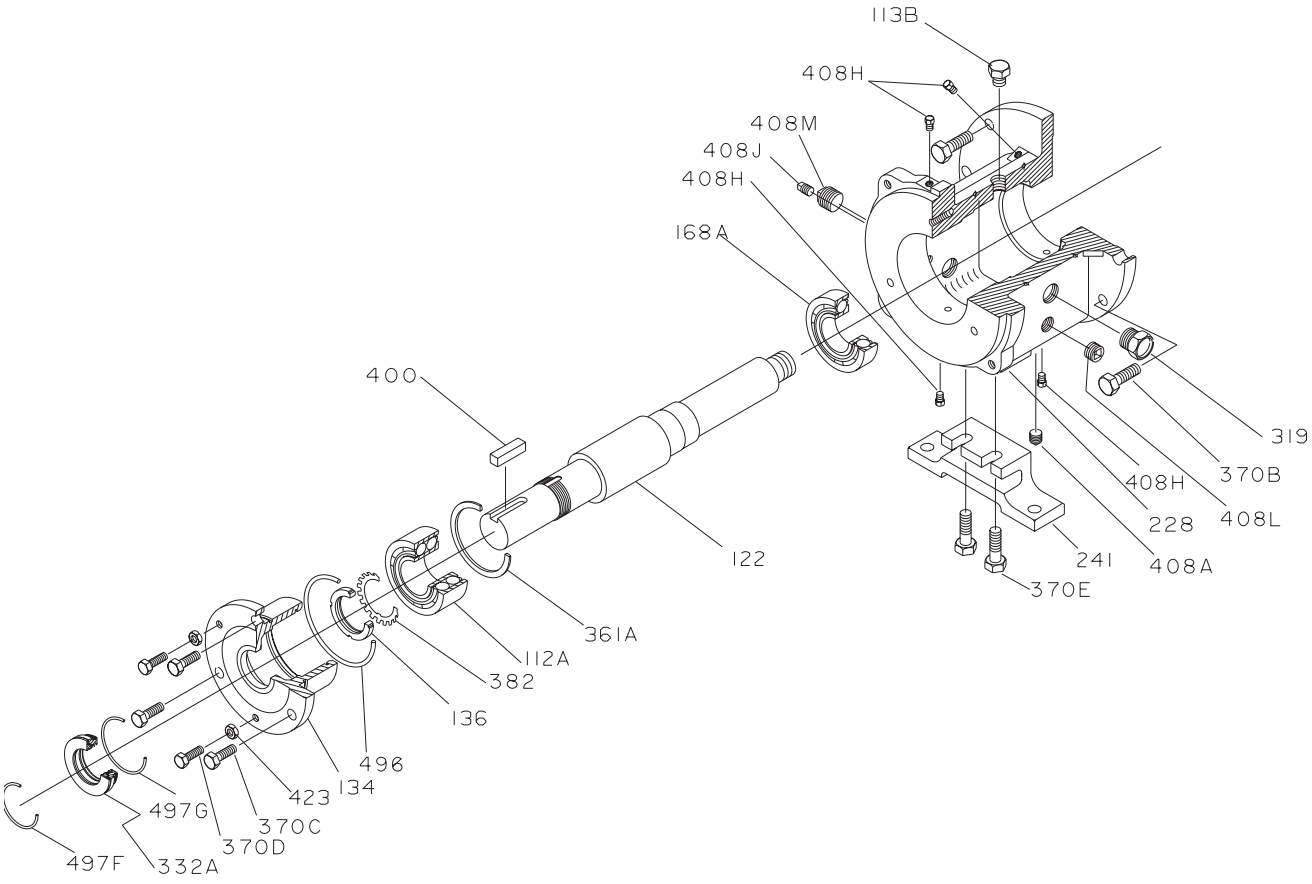
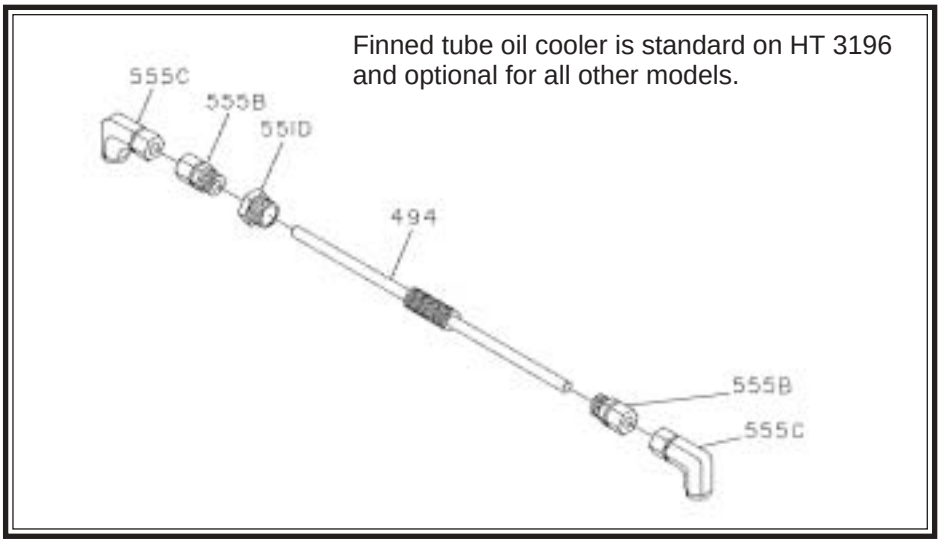


Finned tube oil cooler is standard on HT 3196 and optional for all other models.

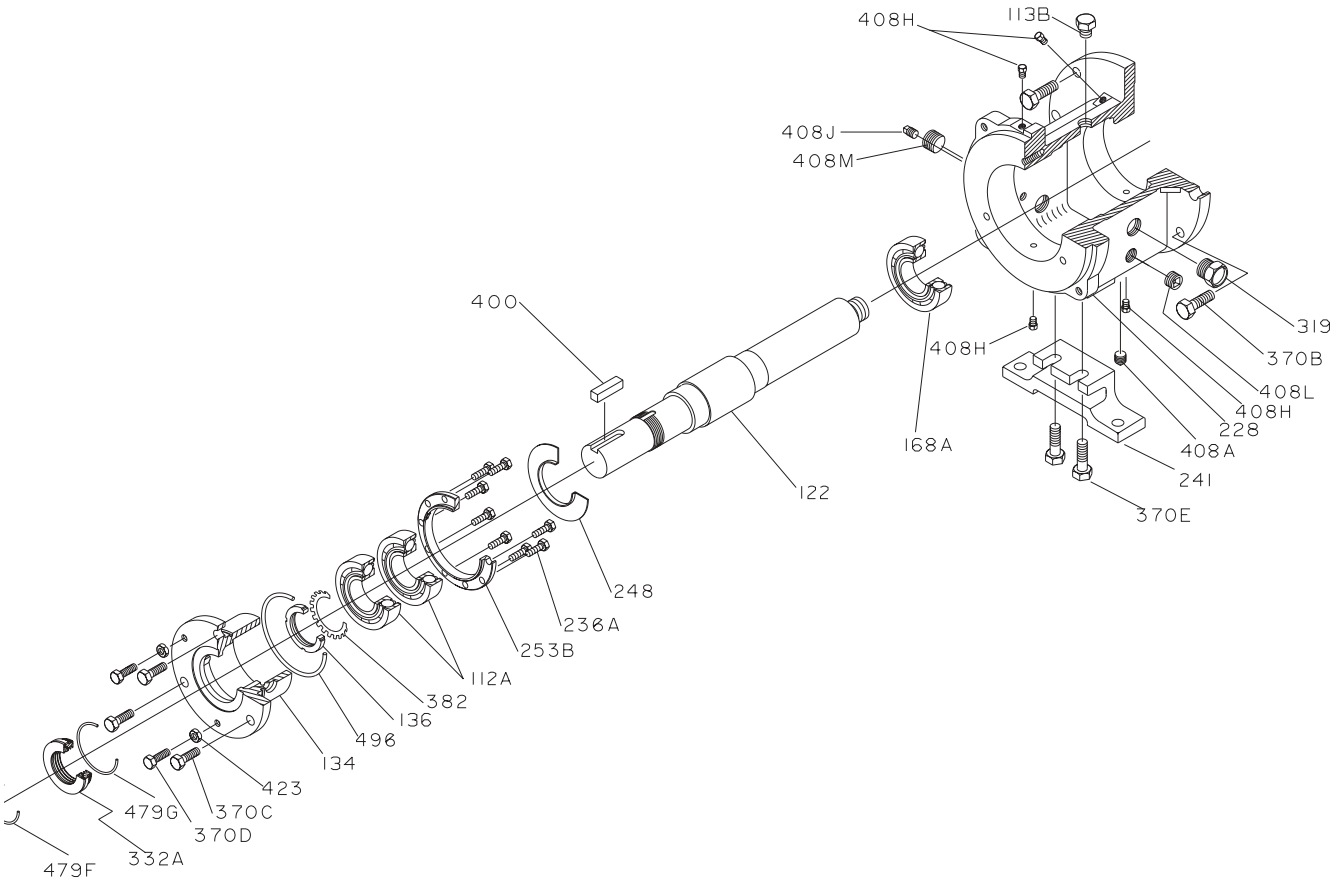
MTX Power End





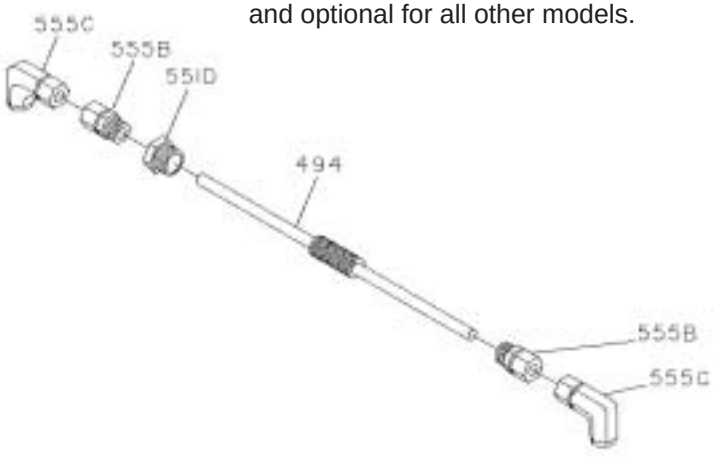
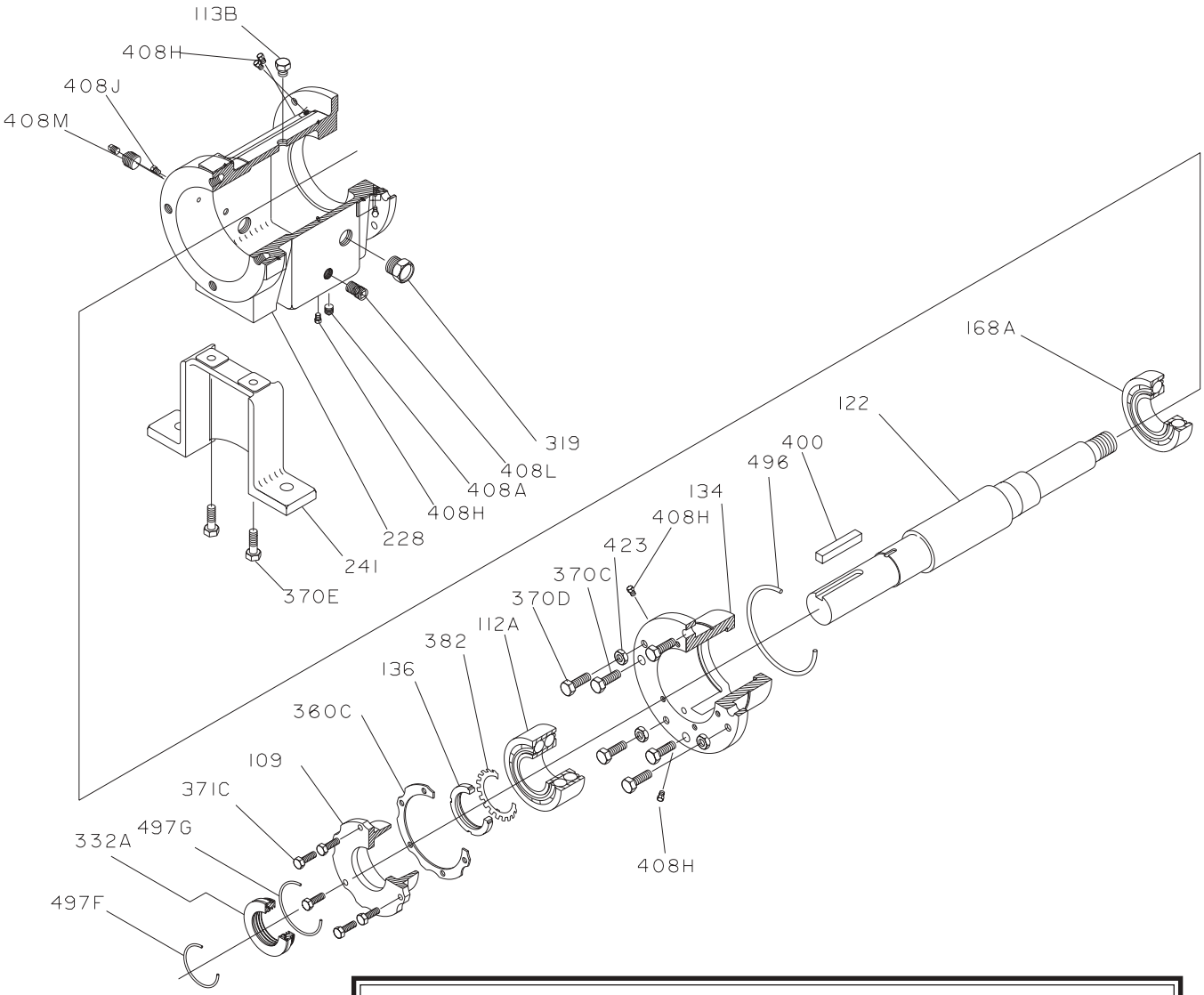
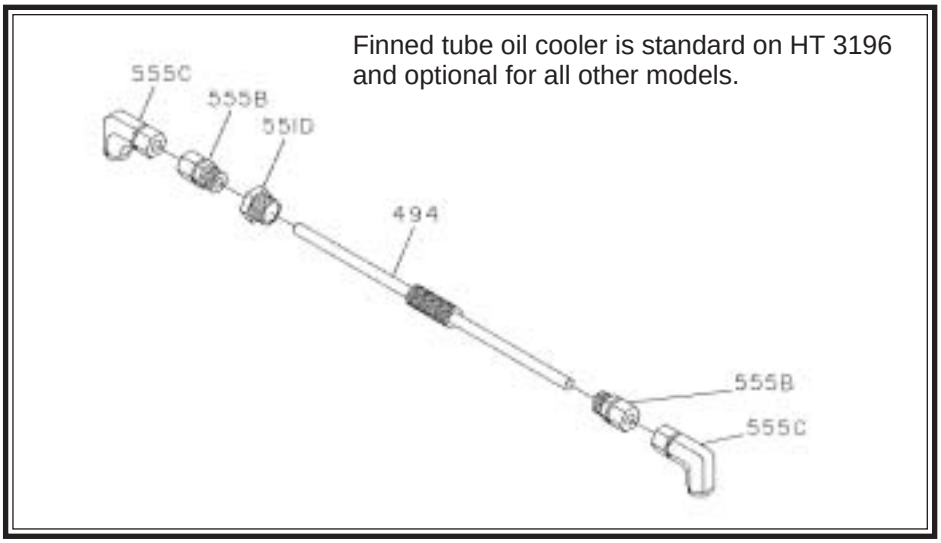
Finned tube oil cooler is standard on HT 3196 and optional for all other models.

LTX Power End



6

Finned tube oil cooler is standard on HT 3196 and optional for all other models.



XLT-X Power End