SUMMIT

2196 2196-LF 2196-R 2796

Installation, Operation, and Maintenance Manual

Model: 2196 / 2196-LF / 2196-R / 2796



Standard Process
Chemical Pump Family



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#### INTRODUCTION

This installation, operation, and maintenance manual is designed to help you achieve the best performance and longest life from your Summit Pump models 2196, 2196-LF, 2196-R, and 2796.

This pump is an open impeller, centrifugal model with end suction / top discharge. The pump is designed for handling mild industrial corrosives.

If there are any questions regarding the pump or its application, which are not covered in this manual or in other literature accompanying this unit, please contact your Summit Pump distributor.

For information or technical assistance on the power source, contact the power source manufacturer's local dealer or representative.

#### 1.1 SAFETY

The following message types are used in this manual to alert maintenance personnel to procedures that require special attention for the protection and safety of both equipment and personnel:

### **DANGER**

Imminently hazardous situation which, if not avoided, will result in death or serious injury.

# WARNING

Potentially hazardous situation which, if not avoided, could result in death or serious injury.

# CAUTION

Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

# **NOTICE**

Includes Information on operation, maintenance, rules or directions. May indicate possible property damage.

# 1.2 2196 MODEL RELATIONSHIP CHART

The following chart shows the relationship and parts commonality within the 2196 family.

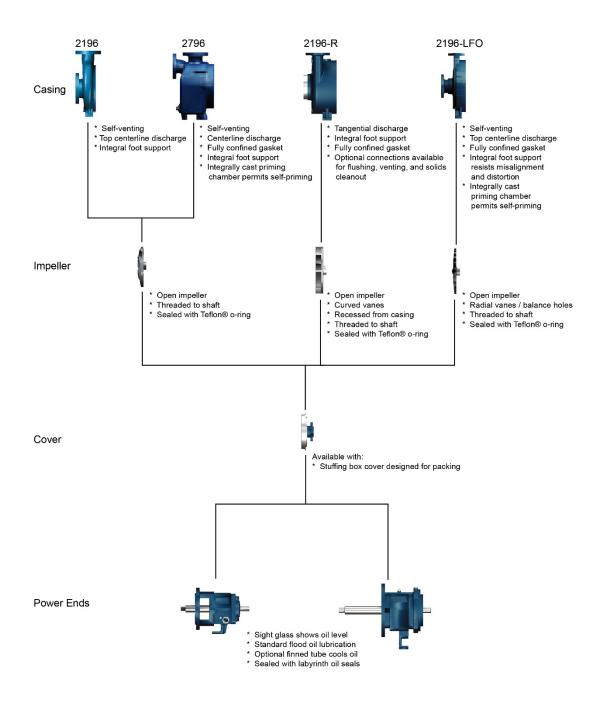


Figure 1-1: Model Interchangeability

# **RECEIPT AND STORAGE**

# 2.1 RECEIVING THE PUMP

# **▲** WARNING

Pump and assemblies are heavy, improper handling could result in serious injury.

Immediately upon arrival, carefully inspect the pump for evidence of damage during transit. Immediately report any damage to your Summit Pump Distributor.

# 2.2 STORING THE PUMP

Store the pump in a clean dry place. **Do not remove piping connection covers**. Rotate the pump shaft by hand at least once per week to maintain a protective film of oil or grease on the bearings. If you anticipate long-term storage, special treatment is available for purchase from Summit Pump, Inc.

# **INSTALLATION**

#### 3.1 LOCATION

When choosing a location for the pump, select an area that provides easy access for inspection and maintenance. Locate the pump as close as possible to the source which will provide NPSH (Net Positive Suction Head) equal to or greater than that required by the pump at any capacity over its expected operating range.

### 3.2 FOUNDATION

Use a foundation that is sufficient enough to support all points of the pump baseplate. Level and grout the base-plate per standard construction practices (see ANSI/HI 1.4.2-1997).

#### 3.3 PIPING CONNECTION – SUCTION / DISCHARGE

All piping must be independently supported and accurately aligned to the pump suction and discharge flanges. Ideally, you should place a short length of flexible or bellows type spool piece in the connections directly next to the pump flange.

# DANGER

Lock out driver power before beginning to work on pump

# CAUTION

Never use force to align piping to the pump flanges

# **A** CAUTION

Never operate pump with suction valve closed

At a minimum, use suction pipe that is one size larger than the flange. Use an eccentric reducer to meet the suction pipe with the pump. Mount the reducer flat side up. Elbows must be a minimum of ten diameters from the suction flange.

# **A** CAUTION

Never operate pump with discharge valve closed

The discharge piping should include isolation and check valves. The check valve prevents the pump from rotating backward. Place the check valve between the pump and isolation valve. The isolation valve is used for priming, starting, and shutting down the system. If you use pipe diameter increasers, place them between the pump and the check valve.

#### 3.4 ALIGNMENT

The alignment at the pump and drive shaft is one of the most important considerations in the pump installation.

# **▲** DANGER

Lock out driver power before beginning to work on pump

### 3.4.1 Aligning the Pump

- 1. Use flexible spacer couplings to achieve proper alignment.
- 2. Check and adjust the parallel and angular alignment to within .005 inches prior to connecting the coupling halves.
- 3. Jog the motor to check rotation. Its arrow should match up with the arrow on the pump.
- 4. Install a coupling guard when the pump is aligned.

Pumps in hot service will need an alignment check at operating temperatures.

#### 3.5 STUFFING BOX

#### 3.5.1 Packed Box

Braided packing is optional on all pumps. Install gland bolt nuts finger-tight only. Adjust the gland bolt nuts during start-up to achieve 40-65 drops of leakage per minute. Specific packing type is dependent on pH, temperature, etc. of the liquid being pumped.

Table 3-1: Packing Details

	Pump Model				
	STO	MTO	LTO	XLO	XLO-17
Lantern Ring Width	7/16"	5/8"	5/8"	5/8"	5/8"
Packing Size	5/16"	3/8"	3/8"	7/16"	7/16"
Number of Rings			5		

Clean and cool pumped liquid may be used to lubricate the packing. If the pumped liquid is not suitable, you must supply an external source of lubrication.

# **NOTICE**

Packing must be lubricated. See ANSI/ASME B73.1 M-2016

#### 3.5.2 Cartridge Mechanical Seal

# WARNING

Failure of the mechanical seal could result in serious injury and environmental damage.

# **DANGER**

Lock out driver power and make sure seal is depressurized before beginning work.

Refer to the manufacturer's installation, operating, and maintenance instructions. Failure to do so can result in environmental damage, personal injury, and seal malfunction and / or seal failure.

#### 3.5.2.1 Start Up

Read, understand and follow the manufacturer's installation, operation, and maintenance instructions.

## 3.5.2.2 Storage, Assembly and Disassembly

Read, understand and follow the manufacturer's installation, operation, and maintenance instructions.

#### 3.5.3 Type 1 Mechanical Seal

# 3.5.3.1 Installing type 1 mechanical seal

- 1. MTO, LTO, XLO Slide the stuffing box cover over the shaft/sleeve. Bolt the cover (184) to the frame adapter (108). STO Slide the 6" or 8" stuffing box cover (184) with adapter ring (108) over
  - shaft and bolt to bearing.
- 2. Mark / scribe the shaft at the face of the stuffing box.
- 3. Unbolt and remove the stuffing box cover.
- 4. Locate the installation reference dimension on the seal installation drawing. Normally this is the dimension from the face of the stuffing box to the rear of the seal.
- 5. Mark the shaft with a felt marker or marking tool at the dimension (i.e. 1/32").
- 6. Lubricate the shaft with silicon grease or soapy water. Slide the seal onto the shaft. Line up the face of the seal with your mark and secure with set screw.
- 7. Reassemble the pump.

#### 4 OPERATION

#### 4.1 LUBRICATION

# **A** CAUTION

Oil lubricated pumps are shipped with NO oil in the bearing frame.

# NOTICE

Grease lubricated pumps are packed with Mobil Grease XHP222 at the factory

# **NOTICE**

Grease lubricated pumps are intended to use grease only. Do not add oil to the bearing housing

Ball bearings are very sensitive to both over and under lubrication, both being detrimental to bearing performance. Use a thermometer to monitor bearing temperature. Overheating will reduce bearing life.

The relationship between bearing temperature and pumped liquid temperature is an indication of performance. Table 4-1 indicates the relationship between these temperatures.

Table 4-1: Liquid to Bearing Temperatures

	Degrees	Fahrenh	eit
Pumping liquid temperature	60°	200°	300°
Approximate normal line bearing temperature	115°	140°	160°

The information shown in Table 4-1 is based on a room temperature of 70°F. Maximum bearing operating temperature is 175°F. It is necessary to flush water through the stuffing box for liquid temperatures above 250°F. This can be done either through a flushing gland or the stuffing box seal cage.

### 4.1.1 Oil Lubrication

Use only high quality turbine oil with rust and oxidation inhibitors. Service temperatures determine oil viscosity. See Table 4-2.

Use a 300 SSU viscosity at 100° F for applications where pumping temperatures are below 200° F. At pumping temperatures above 350° F, use 470 SSU at 100° F with optional cooler.

Table 4-2: Oil Viscosities per Temperatures

Bearing Temperature	ISO Grade	Viscosity at 100 Degrees F
Up to 100° F	46	215 SSU
100° F to 350° F	68	300 SSU
Above 350° F	100	470 SSU

# 4.1.2 Adding Oil

To add oil to bearing frame, remove filler plug (113A). Fill to center of sight glass with the appropriate oil using Table 4-3 as a reference. Replace filler plug (113A).

### 4.1.3 Routine Inspection (daily)

Check oil level through sight glass. Add or remove oil if level is not at center of sight glass.

To add oil to the frame, remove oil fill plug (113A) and fill until oil level is at center of sight glass (319). Replace oil fill plug (113A). To remove oil from the frame, loosen frame drain plug (408A) and capture the excess oil in an appropriate container. Change oil immediately if oil appears cloudy or contaminated.

#### 4.1.4 Changing oil

Change oil every three months or 2000 hours. Change more frequently if pump is located in an extremely adverse atmosphere.

To change oil in frame, remove filler plug (113A). Have an appropriate container in place to catch the oil and remove frame drain plug (408A). Inspect drained oil for excess contaminates or moisture. Replace frame drain plug (408A). Fill to center of sight glass with the appropriate oil using Table 4-3 as a reference. Replace filler plug (113A).

# **NOTICE**

Under filling or over filling of the bearing frame can cause damage.

Table 4-3: Acceptable Bearing Oil

Tubic + 0. Acceptable Bearing On						
Acceptable I	Acceptable Lubricating Oils					
Chevron GT	46	68	100			
Exxon Terrestic		46	68	100		
Lubriplate		AC1	AC2	AC3		
Mobil:	DTE	-	Medium	Heavy		
Mobil:	Synthetic	525	626	627		
Shell:	Tellus Fluids HD	46	68	100		

#### 4.1.5 Grease Lubrication

Regrease grease lubricated bearings with NLG1 No. 2 consistency grease for pumped liquid temperatures -60° F to 350° F. Grease is not recommended for temperatures above 350° F. Regrease bearings every three months.

Table 4-4: Acceptable Bearing Greases

Acceptable Greases			
Citgo	Mystic EP2		
Keystone	81EP2		
Mobil	Mobil Grease XHP222		
Mobil Synthetic	SCH 100		

#### 4.1.5.1 Regrease bearings

- 1. Wipe dirt and foreign matter from the fittings.
- 2. Remove grease relief plugs from the bottom of the frame.
- 3. Fill grease through fittings until it comes out through the relief holes.
- 4. Reinstall grease relief plugs.

#### 4.2 ROTATION

# 4.2.1 Check Pump Rotation

- 1. Lock out power to the pump driver.
- 2. Remove the coupling guard and coupling.
- 3. Momentarily restore power and energize the motor to determine rotation.
- 4. Confirm that motor rotation coincides with proper pump rotation. The proper pump rotation is clockwise when viewed from the motor end. Lock out power to pump driver.

# NOTICE

Operating the pump in the opposite rotation may cause severe damage to the impeller and/or casing.

- 5. Reinstall the coupling and coupling guard.
- 6. Unlock power to pump driver.

#### 4.3 IMPELLER CLEARANCE

# **NOTICE**

Check impeller clearance prior to starting pump. Setting may have changed during transit.

# **▲** DANGER

Lock out driver power before beginning to work on pump

Impeller clearance is the measurement between the impeller vanes and the surface of the casing. This clearance is set at 0.005" for STO, 0.008" for MTO/LTO, 0.015" XLO/XLO-17/2196LF/2796. This clearance will need to be readjusted before initial startup. Note: 2196R impeller clearance of 0.060" is set between the back side of the impeller and the stuffing box cover. (See Section 5 APPENDIX A - IMPELLER CLEARANCE SETTING for detailed procedures on setting the impeller clearance.)

# 4.4 PRIMING

Prior to starting a centrifugal pump, it is imperative that you prime the pump by flooding the suction piping and casing with fluid. Priming will occur when you open the suction isolation valve and the packing sealing liquid valve.

# **NOTICE**

Do not operate pump dry.

#### 4.5 START UP

- 1. Rotate the pump by hand; making sure that the rotating element is spinning freely.
- 2. Be sure the suction valve is open.
- 3. Partially close the discharge valve.

# **▲** DANGER

Do not operate with discharge valve closed for an extended period of time.

- 4. Unlock power to the pump driver.
- 5. Slowly open the discharge valve as soon as the motor reaches operating speed.
- 6. Check stuffing box leakage and adjust, if necessary, to achieve leakage of 40-65 drops per minute.

- 7. Adjust the discharge valve as needed while checking piping for leaks.
- 8. Check mechanical operation of the pump and motor.

# **A** DANGER

Do not operate the pump without the proper guard. See ANSI/ASME B15.1

# 4.6 SHUT DOWN

- 1. Gradually close the discharge valve and turn off the power to the motor.
- 2. Lock out power to the pump driver.

#### APPENDIX A - IMPELLER CLEARANCE SETTING 5

A gradual loss in head and/or capacity can occur. You may restore performance by adjusting the impeller clearance, which is the measurement between the impeller vanes and the surface of the casing.

Table 5-1: Impeller Clearance Settings

Impeller Clearances					
Pumping Temperature	STO	MTO/LTO	XLO/XLO-17	2196LF and 2796	2196R*
-20 to 150° F (-29-66° C)	.005 (.13)	.008 (.20)	.015 (.38)	.015 (.38)	.060 (1.52)
Up to 175° F (80° C)	.005 (.13)	.008 (.20)	.015 (.38)	.015 (.38)	.060 (1.52)
Up to 200° F (93° C)	.005 (.13)	.008 (.20)	.015 (.38)	.015 (.38)	.060 (1.52)
Up to 225° F (107° C)	.006 (.16)	.009 (.23)	.016 (.40)	.016 (.40)	.060 (1.52)
Up to 250° F (121° C)	.007 (.18)	.010 (.26)	.017 (.43)	.017 (.43)	.060 (1.52)
Up to 275° F (135° C)	.008 (.21)	.011 (.28)	.018 (.46)	.018 (.46)	.060 (1.52)
Up to 300° F (149° C)	.009 (.23)	.012 (.30)	.019 (.48)	.019 (.48)	.060 (1.52)
Up to 350° F (177° C)	.011 (.28)	.014 (.36)	.021 (.53)	.021 (.53)	.060 (1.52)
Up to 400° F (204° C)	.013 (.33)	.016 (.41)	.023 (.58)	.023 (.58)	.060 (1.52)
Over 400° F (204° C)	.015 (.38)	.018 (.46)	.025 (.64)	.025 (.64)	.060 (1.52)
* Impeller clearance is set betw	een back side of	impeller and s	tuffing box cover (	2196R only).	

#### 5.1 FEELER GAUGE TECHNIQUE

#### 5.1.1 Models 2196, 2196-LF and 2796

Using the feeler gauge technique for impeller clearance setting for models 2196, 2196LF & 2796

- 1. Lock out power to the pump driver.
- 2. Remove the coupling guard.
- 3. Loosen jacking bolts (370D) and jam nuts (423).
- 4. Tighten bearing housing bolts (370C) evenly, while slowly rotating the shaft until the impeller starts to rub on the casing (100).
- 5. Using a feeler gauge, set the gap between the 3 housing bolts (370C) and the bearing housing (134). (Refer to Table 5-1 for settings.)
- 6. Tighten jack bolts (370D) evenly until bearing housing backs out and contacts the bearing housing bolts (370C).
- 7. Tighten jam nuts (423) evenly, rotating the shaft to make sure the assembly turns freely.
- 8. Reinstall the coupling guard.
- 9. Unlock power to the pump driver.

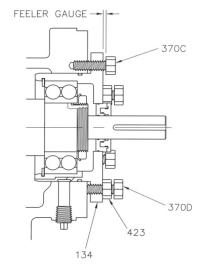


Figure 5-1: Feeler Gauge

# 5.1.2 Model 2196R Feeler Gauge Technique

Using the feeler gauge technique for impeller clearance setting for model 2196R

- 1. Lock out power to the pump driver.
- 2. Remove the coupling guard.
- 3. Remove coupling.
- 4. Loosen bearing housing bolts (370C) several turns.
- 5. Loosen jam nuts (423) and turn jack bolts (370D) evenly around several turns until impeller contacts stuffing box cover (184). Turn shaft to ensure contact is complete.
- 6. Use feeler gauge to measure the gap between the bearing frame (228) and the bearing housing (134). Reduce the measurement by .060" and place the resulting feeler gauge thickness between the bearing housing (134) and the bearing frame (228).
- 7. Loosen the jacking bolts (370D) several turns. Tighten the locking bolts (370C) to move the impeller away from the stuffing box cover (184) until the bearing housing (134) snugs up the feeler gauge between the bearing housing (184) and the bearing frame (228).
- 8. Turn jacking bolts (370D) in and tighten jam nuts (423) evenly, rotating the shaft to make sure the assembly turns freely.
- 9. Reinstall the drive coupling.
- 10. Reinstall the coupling guard.
- 11. Unlock power to the pump driver.

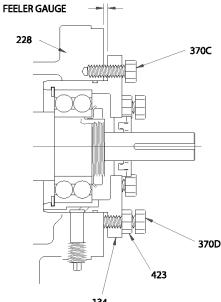


Figure 5-2: 2196R Feeler Gauge

#### 5.2 DIAL INDICATOR TECHNIQUE

#### 5.2.1 Models 2196, 2196-LF and 2796

Using the dial indicator technique for impeller clearance setting.

- 1. Lock out power to the pump driver.
- 2. Remove the coupling guard.
- 3. Place a dial indicator with a magnetic base on the pump base plate. Place the indicator against the end of the pump shaft or coupling face.
- 4. Loosen jack bolts (370D) and jam nuts (423).
- 5. Tighten bearing housing bolts (370C) evenly while slowly rotating the shaft until the impeller starts to rub on the casing (100).
- 6. Set the dial indicator to zero.
- 7. Tighten the jack bolts (370D) evenly until they contact the frame. Continue to tighten until the dial indicator reads the proper clearance as shown in Table 5-1.
- 8. Tighten bearing housing bolts (370C) evenly; then tighten jack bolts (370D) evenly. Be sure the dial indicator **does not move** from the proper setting.
- 9. Rotate the shaft to be sure it turns freely.
- 10. Reinstall the coupling guard.
- 11. Unlock power to the pump driver.

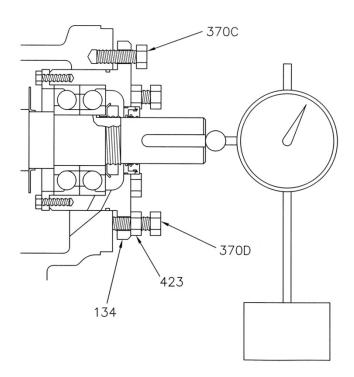


Figure 5-3: Dial Indicator Method

# 5.2.2 Model 2196-R Dial Indicator Technique

- 1. Lock out power to the pump driver.
- 2. Remove the coupling guard.
- 3. Remove coupling.
- 4. Place a dial indicator with a magnetic base on the pump base plate. Place the indicator tip in contact with either the shaft end or coupling face. (See diagram on page 14.)
- 5. Loosen bearing housing bolts (370C) several turns.
- 6. Loosen jam nuts (423) on jack bolts (370D) evenly around several turns until impeller contacts the stuffing box cover (184). Turn the shaft to ensure contact is made.
- 7. Set the dial indicator to zero.
- 8. Loosen the jacking bolts (370D) evenly several turns and tighten the bearing housing bolts (370C) to move the impeller away from the stuffing box cover until the dial indicator shows a 0.060" clearance.
- 9. Turn in the jacking bolts (370D) and tighten the jam nuts (423) evenly.
- 10. Rotate the shaft to be sure it turns freely.
- 11. Reinstall coupling.
- 12. Reinstall the coupling guard.
- 13. Unlock power to the pump driver.

# 6 APPENDIX B - CENTRIFUGAL PUMP TROUBLESHOOTING

The following table provides possible solutions for symptoms that you may encounter with your centrifugal pump.

# **▲** WARNING

Before attempting to service the pump:

- 1. Follow the shutdown procedures.
- 2. Lock out the power source.
- 3. Allow the pump to cool.
- 4. Close the suction and discharge valves.
- 5. Drain the pump.

Table 6-1: Troubleshooting

CENTRIFUGAL PUMP TROUBLESHOOTING							
Symptom	Cause	Solution					
Pump not delivering liquid	Pump not primed.	Re-prime pump.					
donvornig ilquid	Suction lift too high.	Install shorter suction pipe.					
	Wrong direction of rotation.	Change motor wiring.					
	Impeller clogged.	Back-flush pump.					
	Suction line plugged.	Remove debris.					
Low flow and low	Air leak in stuffing box.	Replace or adjust packing.					
head	Worn suction side plate.	Replace defective part.					
	Impeller worn or damaged.	Inspect and replace impeller, if needed.					
	Air leak in suction line.	Replace gasket.					
	Impeller clogged.	Back-flush pump.					
	Wrong direction of rotation.	Change motor wiring.					

CENTRIFUGAL PUMP TROUBLESHOOTING (Continued)						
Symptom	Cause	Solution				
Pump loses prime	Pump not primed correctly.	Re-prime pump.				
	Air leak in suction line.	Replace gasket or pipe plug.				
	Lantern ring in wrong location.	Repack moving lantern ring to correctly align with flush hole.				
Bearings are	Misalignment.	Realign drive coupling.				
running hot	Low or insufficient lubricant.	Check oil level and or grease.				
Motor requires excessive amperage	Stuffing box gland is too tight.	Readjust or replace packing.				
	Total dynamic head is too low.	Install throttle or reduce impeller diameter.				
	Rotary part rubbing stationary part.	Adjust part or replace parts.				
	Liquid is heavier than specified.	Check specific gravity of liquid.				
Stuffing box is leaking	Stuffing box is incorrectly packed.	Repack stuffing box.				
excessively	Shaft sleeve is scored or worn.	Replace shaft sleeve as required.				
	Wrong type of packing.	Install correct packing.				
	Shaft is bent.	Replace shaft.				
	Worn mechanical seal parts.	Rebuild seal; replace parts.				

# APPENDIX C - MAINTENANCE AND REPAIR

# WARNING

WEAR EYE PROTECTION. Failure to do so can result in serious personal injury.

# 7.1 DISASSEMBLY PROCEDURES

(See Section 8 APPENDIX D – PUMP CROSS SECTIONS AND PARTS LISTS for cross-section of corresponding model.)

Disassembling your model 2196, 2196-LF, or 2196-R pump

- 1. Lock out power supply at the motor starter.
- 2. Close off discharge, suction, sealing fluid, and cooling fluid.
- 3. Drain casing and flush, if needed.

# WARNING

Pump parts are heavy. Use proper lifting methods to avoid personal injury.

- 4. Place lifting sling through frame to ensure safe handling during disassembly/ assembly.
- 5. Remove bolts (370) holding the frame adapter (108) to casing (100).
- 6. Pull the frame adapter back from casing by tightening jack bolts (418).
- 7. Take the frame assembly to bench and secure for further work.
- 8. Scribe the location of coupling half on the shaft (122) and remove the coupling.

# WARNING

Never use heat to remove impeller. Heat combined with trapped fluid could cause an explosion, which can result in serious personal injury.

9. Remove the impeller (101) from the shaft (122) while holding the shaft with a strap wrench or suitable tool that will not mark the shaft.

# NOTICE

Threads are right-handed

# NOTICE

XLO - Remove impeller plug (428Y) from impeller (101). Do not save impeller gasket (428D)

#### 7.1.1 Packed Pump

- a. Remove the packing gland nuts (353A).
- b. Slide gland toward frame (228).
- c. Remove seal chamber nuts (423B).
- d. Slide off stuffing box cover (184).
- e. Remove packing (106) and lantern ring (105).

#### 7.1.2 Mechanical Seal

- a. Remove seal gland nuts (353A).
- b. Slide gland toward frame (228), exercising care to not drop stationary set from gland.
- c. Remove seal chamber nuts (423B).
- d. Slide off stuffing box cover (184).
- e. Remove mechanical seal rotating element (383) and sleeve (128) from pump shaft.
- f. Loosen set screws if present. Refer to cartridge seal manufacturer's instructions.
- g. Slide off seal gland with stationary seal and O-ring gasket.
- 10. Remove the frame adapter (108) by removing two dowel pins (469B) and four adapter bolts (370B) and then separate the adapter (108) from the bearing frame (228).

# NOTICE

This step does not apply to the 6" STO model.

- 11. Remove the bearing housing bolts (370C) and loosen the jam nuts (423).
- 12. Tighten the jack-bolts (370D) evenly to push the bearing housing out of frame.
- 13. Slide shaft assembly, with housing, out of bearing frame.
- 14. On the <u>STO</u> and <u>MTO</u>, remove the bearing housing snap ring (361A). On the <u>LTO</u> and <u>XLO</u>, remove bearing cover screws (370G) and remove bearing cover (109C). Then remove the bearing housing (134) by tapping with a rubber hammer.
- 15. Remove bearing lock nut (136) and bearing lock washer (382).
- 16. Remove inboard bearing (168A) and outboard bearing (112). Use an arbor press or bearing puller to facilitate. On <u>LTO</u> models only, do not remove oil ring (248A) unless it is damaged.

# **NOTICE**

**Do not** use a hammer, which may cause damage to the shaft

- 17. Complete disassembly of bearing frame (228). Remove oil plug (408A) (not shown), oil sight glass (145), oil cooler inlet (408L), outlet plugs (408M), and frame foot attachment bolt (529) and foot (241), where applicable.
- 18. Inspect all parts for cracks, erosion, pitting, rusting, damaged threads, corrosion, and groove worn shaft/sleeve. Replace casing if grooves and pits are greater than 1/8" deep. Replace impeller if grooves are greater than 1/16" or even wear exceeds 1/32". Inspect shaft sleeve if grooved or pitted. Shaft run out or bearing shoulder damage is cause for replacement.

# 7.2 ASSEMBLY PROCEDURES

(See APPENDIX D for cross-section of corresponding model.)

#### **Casing Bolt Torques**

Refer to Bolt Torque Values when assembling pump.

Table 7-1: Casing Bolt Torque Values

			2196, 2196LF, 21	96R, 2796 Casing Bo	olt Torques - Dry		
Flange Rating		ng	150 LB	CASING	300 LB CASING OR HIGH TEMPERATURE APPLICATIONS		
Casing Material		rial	Ductiile Iron, WCB 316SS, CD4MCu, A20		Ductile Iron, WCB	316SS, CD4MCu, A20	
ı	Bolt Specifica	ation	ASTM A307 Grade B (CARBON) HEAVY HEX HEAD BOLTS	(304SS) F593 Grade 1 OR (316SS) F593 Grade 2	ASTM A193 Grade B7 (CARBON)	ASTM A193 Grade B8/B8M (304SS/316SS) Class 2	
Head Markings		ngs	307B	7593C X C, G = Ø1/A* Ø5/B* X D, H=Ø3/A* Ø1-1/2* F593G X 316SS Grade 2 X	B7	B8 B8M	
Pump Size	Bolt Size	Length	Torque to lbft	Torque to lbft	Torque to lbft	Torque to lbft	
6" STO	5/8"-11	1-1/2"	59	107	173	120	
8" STO	1/2"-13	1-1/4"	87	54	87	60	
MTO LTO	5/8"-11	1-1/2"	59	107	173	120	
XLO	5/8"-11	1-3/4"	59	107	173	120	
XLO-17	7/8"-9	2"	170	212	495	275	

# 7.2.2 Hardware Torque values Table 7-2: Pump Bolt Torque Values

Item ID	Pump Size	Fastener/Thread Size	Length	Qty Per Pump	Grade/Material	ASTM A307 Max Torque (lbft)	ASTM F593 Max Torque (lbft)	Description
	STO		3-1/2" (0.50/2.00)					
	STO	3/8"-16	3"			N/A	22 lbft	
	Big & Taper Bore		(0.625/1.50)		ASTM F593 Grade 2 (316SS)			
	MTO, LTO		2-1/2" (0.625/1.125)					
353	MTO	1/2"-13	4"	4		N/A 54 lbft		Dynamic Seal capscrews and Nuts
	Big & Taper Bore		(0.875/2.25)					(Do not use torque value
	XLO, XLO-17		3-1/8" (0.875/1.50)					for Packing)
	LTO, XLO, XLO-17	5/8"-11	4"		ASTM A193 B8M Class 1 (316SS)	N/A 107 lbft		
	Big & Taper Bore	2/01/45	(0.875/1.75)					
353A	STO MTO, LTO	3/8"-16 1/2"-13	N/A	4	ASTM F594 Grade 1 (304SS)	12 lbft 30 lbft	22 lbft 54 lbft	1
555/1	XLO, XLO-17	5/8"-11	,	•	71511W1551 Glade 1 (50155)	58 lbft 107 lbft		•
	6" STO, MTO,	5/8"-11	1-1/2"	Varies				
370	LTO 8" STO	1/2"-13	1-1/4"	(Based on Model,	See Casing	See C		Casing Bolts
3,0	XLO	5/8"-11	1-3/4"	Diameter,	Torque Chart	Torque	Chart	casing ports
	XLO-17	7/8"-9	2"	and Size)				
370B	STO 8"	5/8"-11	1-1/4"	4		58 lbft	107 lbft	Bearing Frame to
3706	MTO, LTO XLO, XLO-17	1/2"-13	1-1/2"	4		30 lbft	54 lbft	Frame Adaptor
	STO	3/8"-16	1-1/4"	3		12 lbft	22 lbft	Bearing Frame
370C	MTO, LTO	1/2"-13	1-1/2"			30 lbft	54 lbft	to
	XLO, XLO-17	5/8"-11 3/8"-16	2" 1-1/4"	4	ASTM A307 Grade A (Carbon Steel)/	58 lbft	107 lbft	Bearing Housing
370D	STO MTO, LTO	1/2"-13	1-1/4"	3	ASTM F593 Grade 1 (304 SS)	N/A	N/A	Jack Bolt
3702	XLO, XLO-17	5/8"-11	2"	4		.,,,	,,,	Bearing Housing
	STO	None	e	None		N/A	N/A	
370F	MTO, LTO	1/2"-13	1-1/4"	2		30 lbft	54 lbft	Frame Foot Bolt
370G	XLO, XLO-17 LTO	5/16"-18	3/4"	10	<u> </u>	70 Ibin	N/A	Bearing Clamp Ring Bolt
3700	STO 6"	5/16"-18	1-3/4"	10				bearing cramp ring bore
	STO 8"	5/16"-18	2-1/2"		ASTM A307 Grade A (Carbon Steel)/	7 lbft	12 lbft	
370H	MTO 8"/LTO 8"	#10-24	2-1/2"	2	F593 Grade 1 (304 SS)	25 Ibin	37 Ibin	Box Cover to Adaptor Stud
	MTO, LTO XLO, XLO-17	5/16"-18 1/2"-13	2-1/2" 3"		, ,	7 lbft 30 lbft	12 lbft 54 lbft	
				_	ASTM A307 Grade A (Carbon Steel)/			
371C	XLO	3/8"-16	1"	6	ASTM F593 Grade 1 (304 SS)	12 lbft	22 lbft	Housing Cover Bolt
440	STO	3/8"-16	1-1/4"	2	ASTM A307 Grade A (Carbon Steel)/			6 : 7 // 115 //
418	MTO/LTO XLO	1/2"-13	2" 1-3/4"	3	ASTM F593 Grade 1 (304 SS)	N/A	N/A	Casing Tap (Jack) Bolt
	STO	3/8"-16	2 5/ 1	2	ASTM A563 Grade A Jam Hex	6 lbft	11 lbft	
423	MTO, LTO	1/2"-13	N/A	3	(Carbon Steel)/ ASTM F594 Grade 1	15 lbft	27 lbft	Bearing Housing Jack Bolt Jamnut
	XLO, XLO-17 STO	5/8"11 5/16"-18		4	(304SS)	26 lbft 7 lbft	54 lbft 12 lbft	
	MTO 8" /LTO 8"	#10-24			ASTM A563 Grade A Hex (Carbon	25 Ibin	37 lbin	Box Cover Adaptor
423B	MTO, LTO	5/16"-18	N/A	2	Steel)/ ASTM F594 Grade 1 (304SS)	7 lbft	12 lbft	Stud Nut
	XLO, XLO-17	1/2"-13				30 lbft	54 lbft	
469B	MTO, LTO, XLO	N/A	N/A	2	Steel	N/A	N/A	Alignment Pin
	STO	None		None	ASTM A563A (Carbon Steel)/			
529	MTO, LTO	1/2"	N/A	2	ASTM F594 Grade 1 (304SS)	N/A N/A Frai		Frame Foot Lock-Washer
	XLO, XLO-17							
113A	STO MTO, LTO	1/2"-14 NPT	9/16"	1	Carbon Steel / Stainless	2 *T.F		Oil-Fill Plug
1134	XLO, XLO-17	1/2 -14 NF1	3/10	1	Carbon Steel / Stanless	2 1.1		OII-I III Flug
	STO							
408M	MTO, LTO	1"-11 1/2" NPT	3/4"	1	Carbon Steel / Stainless	2 *T.F	F.F.T.	Oil-Cooler Inlet Plug
	XLO, XLO-17 STO							
408N	MTO, LTO	1/2"-14 NPT	9/16"	1	Carbon Steel / Stainless	2 *T.F	F.F.T.	Oil-Cooler Outlet Plug
	XLO, XLO-17							
240	STO	4" 44 4 /2 NDT	21/2		D/Cl	2 *** (		Minus Bank
319	MTO, LTO XLO, XLO-17	1"-11 1/2 NPT	N/A	1	Brass/Glass	2 *T.F	F.I.	View Port
	MTO, LTO, XLO	3/8"-18 NPT						
484A	STO	1/4"-18 NPT	N/A	1	Carbon Steel / Stainless	2 *T.F	F.F.T.	Stuffing Box Flush Plug
	XLO-17							OR Booring Oil Mist/Crosso
408H	STO MTO, LTO	1/4"-18 NPT	7/16"	1	Carbon Steel / Stainless	2 *T.F	F.F.T.	OB Bearing Oil Mist/Grease Upper Plug
408H	STO	1/4"-18 NPT	7/16"	1	Carbon Steel / Stainless	2 *T.F	FT	OB Bearing Oil Mist/Grease
400П	MTO, LTO	1/4-10 INT I	//10	1	Carbon Steet / Stailliess	2 1.1		Lower Plug
408H	STO MTO, LTO XLO, XLO-17	1/4"-18 NPT	7/16"	1	Carbon Steel / Stainless 2 *T.F.F		F.F.T.	IB Bearing Oil Mist/Grease Upper Plug
408H	STO MTO, LTO XLO, XLO-17	1/4"-18 NPT	7/16"	1	Carbon Steel / Stainless	2 *T.F.F.T.		IB Bearing Oil Mist/Grease Lower Plug
408A	STO MTO, LTO XLO, XLO-17	3/8"-18 NPT	N/A	1	Carbon Steel - Magnetic Plug	2 *T.F	F.F.T.	Magnetic Drain Plug
*T.F.F.T.	- Turns From Fing	er Tight						

#### 7.2.3 Pump Assembly

- 1. Clean the bearing frame and inspect all tapped holes. Chase as needed.
- 2. Install oil fill plug (113A), oil sight glass (144), and frame lubrication plugs (408H).
- 3. Attach bearing frame foot (241) with bolts (529), where applicable.
- 4. On the LTO model, install oil ring (248A) on shaft (122), if removed. Oil ring is a press fit onto shaft.

# **A** CAUTION

Use proper size drive tool to prevent damage and personal injury

- 5. On the LTO model, install bearing cover (109C) over shaft (122).
- 6. Install outboard bearing (112) on shaft (122).

If grease lubricated, install with shield away from impeller end.

If oil lubricated, there should be no seals or shields.

The recommended bearing installation method is heating the bearing using an induction heater.

# WARNING

WEAR INSULATED GLOVES when using heater. Failure to do so can result in serious personal injury while handling hot bearings.

# NOTICE

LTO frames use duplex angular contact bearings. Make sure bearings are mounted in the correct order, back to back.

- 7. Install a bearing lock washer (382) on the shaft.
- a. Place tang of lock washer in shaft keyway.
- b. Install lock-nut (136) on shaft.
- c. Using a spanner wrench, tighten the nut until snug; then bend any one of the tangs into a lock-nut slot.
- 8. Install inboard bearing (168A) on shaft (122).

If grease lubricated, install with shield toward impeller end.

If oil lubricated, there should be no seals or shields.

9. Install the outboard labyrinth oil seal (332) in the bearing housing (134). Follow

Maintenance instructions in Section 9 APPENDIX E – MAINTENANCE INSTRUCTIONS FOR LABYRINTH BEARING ISOLATORS.

# NOTICE

Make sure drain slots face down

- 10. Apply a thin coating of lubricant to the inside of the bearing housing (134).
- 11. Slide the bearing housing (134) over the outboard bearing assembly (112) and shaft (122). Place the coupling end of the shaft into the bearing housing through the labyrinth oil seal.

On the XLO model, install the bearing cover gasket (360G).

On the <u>STO</u> and <u>MTO</u> models, install the bearing housing snap ring (361A) into the groove on the bore of the bearing housing. Make sure the flat side is toward the bearing and the snap ring's opening is in the 6 o'clock position to allow oil drainage.

On the LTO and XLO models, install bearing cover (109C) and bolts (370G).

- 12. Install a new O-ring (496) over the O.D. of the bearing housing.
- 13. Apply a thin coating of lubricant to the outside of the bearing housing (134) and slide the assembly into the bearing frame (228).
- 14. Install bearing housing bolts (370C) into bearing frame (228) and install jack bolts (370D) and jam nuts (423). Hand-tighten evenly.
- 15. Attach frame (228) to adapter (108).
  - a. Align dowel pins (469B), adapter bolts (370B) and frame to adaptor gasket (360D).
  - b. Tighten using crisscross pattern.
  - c. Rotate shaft 360 degrees. It should be free.

# NOTICE

These steps do not apply to the 6" STO model

- 16. Set frame (228) and adapter (108) upright. Clamp to bench for safety as assembly continues.
- 17. Install inboard bearing labyrinth seal in adapter frame. Make sure that the seal's drain slots face down. Follow Maintenance instructions in Section 9 APPENDIX E MAINTENANCE INSTRUCTIONS FOR LABYRINTH BEARING ISOLATORS.
- 18. Put anti-seize compound on the shaft and, if equipped, install shaft sleeve (126) onto shaft (122).
- 19. Align anti-rotation pin with notch in sleeve (126).
  - For <u>mechanical seal</u> pumps, read manufacturer's instructions for assembly. (See Section 3.5 STUFFING BOX on page 5)
- 20. Install stuffing box cover (184) onto adapter with studs (353) and nuts (353A).

- 21. Install impeller (101) with new O-ring (412).
- 22. Using an impeller wrench or strap wrench on the coupling end of the shaft, tighten by rotating clockwise. Make sure coupling is tight to the shaft.
- 23. For packed pumps, install the appropriate packing (106) in the stuffing box cover (184) according to fluid being pumped (105).
  - a. First, insert two packing rings into bottom of box.
  - b. Next, insert the lantern ring (105). Make sure to stagger packing joints and lantern ring joint by 90 and be sure lantern ring lines up with flushing connection. Install gland halves (107).
  - c. Hand-tighten nuts (353A). You must make final adjustments after the pump has begun operation.

For mechanical seal pumps, continue by following manufacturer's instructions noted in Step 19.

- 24. Install casing gasket (351) onto stuffing box cover (184). At this point, the power end is ready for reinstallation into the casing or for storage for future use.
- 25. If returning to service, slide assembly into casing (100).
- 26. Install casing bolts (370) into frame to pull assembly into casing.
- 27. Rotate the shaft to ensure that no rubbing exists.
- 28. Adjust impeller clearance according to the instructions beginning on page 12.
- 29. Align drive coupling according to the instructions beginning on page 5, in addition to coupling manufacturer instructions.
- 30. If the motor was replaced, check rotation prior to reconnecting coupling halves. (See rotation instructions on page 9).

# CAUTION

Check that motor rotation agrees with pump rotation

31. Reinstall coupling guard.

Table 7-3: Spare Parts

RECOMMENDED SPARE PARTS						
SHAFT KIT						
MAINTENANCE KIT (902)						
IMPELLER (101)	IMPELLER O-RING (412)					
SHAFT (122)	BEARING HOUSING O-RING (496)					
SHAFT SLEEVE (126)	OUTBOARD LABYRINTH SEAL (332A)					
OUTBOARD BEARING (112)	INBOARD LABYRINTH SEAL (333A)					
INBOARD BEARING (168)	BEARING LOCKNUT (136)					
CASING GASKET (351)	BEARING HOUSING RETAINING RING (361A)					
FRAME-TO-ADAPTOR GASKET (360D)						

# 8 APPENDIX D – PUMP CROSS SECTIONS AND PARTS LISTS

# 8.1 MODEL 2196 STO CROSS SECTION

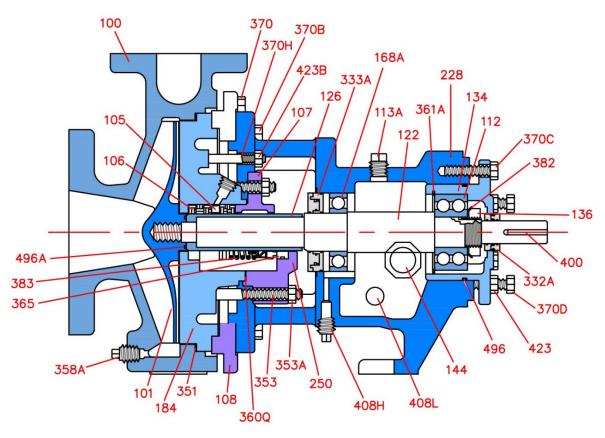


Figure 8-1: 2196 STO Cross Section

Table 8-1: 2196 STO Parts List

	MODEL 2196 STO PARTS LIST						
Item #	Qty	Description	Item #	Qty	Description		
100	1	Casing	360Q	1	Gasket; Gland, Mech. Seal		
101	1	Impeller	361A	1	Snap Ring, Bearing		
105	1	Ring, Lantern	365	1	Seal, Mechanical Stationary Element		
106	5	Packing	370	3	Bolt, Casing		
107	1	Gland, Packing	370B**	4	Bolt, Frame / Adapter		
108**	1	Adapter Ring	370C	3	Bolt, Bearing Housing		
112	1	Bearing, Outboard	370D	3	Jack Bolt, Bearing Housing		
113A	1	Plug, Oil Fill	370H	2	Stud, SBC / Adapter		
122	1	Shaft	382	1	Lock washer, Bearing		
126	1	Sleeve, Shaft	383	1	Seal, Mechanical Rotating Element		
134	1	Housing, Bearing	400	1	Key, Coupling		
136	1	Locknut, Bearing	408A	1	Plug, Frame Drain (Not Shown)		
168A	1	Bearing, Inboard	408H	1	Plug, Frame Lubrication Port		
184	1	Cover, Stuffing Box	408L	1	Plug, Oil Cooler Inlet (Not Shown)		
228	1	Frame	408M	1	Plug, Oil Cooler Outlet (Not Shown)		
250	1	Gland, Mechanical Seal	412	1	O-ring, Impeller		
319	1	Sight Glass	423	3	Jam nut, Bearing Housing / Frame		
332A	1	Labyrinth, OB	423B	2	Nut, Box Cover/Adapter Stud		
333A	1	Labyrinth, IB	496	1	O-ring, Bearing Housing / Frame		
351	1	Gasket, Case					
353	4	Stud, Gland					
353A	4*	Nut, Gland Stud	* Packing (	Gland h	has only 2 Studs & Nuts		
358A	1	Plug, Casing Drain	** Only Required on 8" Pump				

# 8.2 MODEL 2196 MTO CROSS SECTION

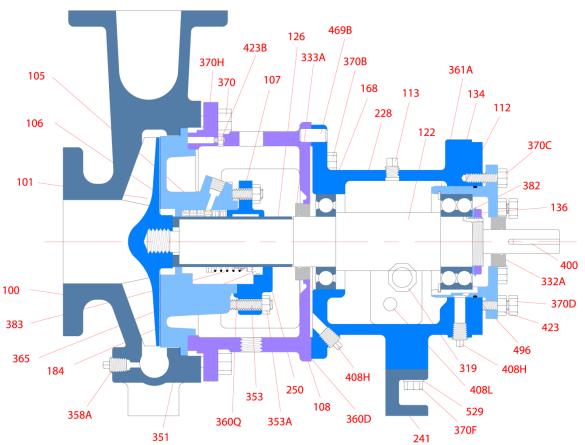


Figure 8-2: 2196 MTO Cross Section

Table 8-2: 2196 MTO Parts List

MODEL 2196 MTO PARTS LIST					
Item #	Qty	Description	Item #	Qty	Description
100	1	Casing	360D	1	Gasket, Frame/Adapter
101	1	Impeller	360Q	1	Gasket; Gland, Mech. Seal
105	1	Ring, Lantern	361A	1	Snap Ring, Bearing
106	5	Packing	365	1	Seal, Mechanical Stationary Element
107	1	Gland, Packing	370	8, 12, 16	Bolt, Casing
108	1	Adapter	370B	4	Bolt, Frame / Adapter
112	1	Bearing, Outboard	370C	3	Bolt, Frame / Bearing Housing
113	1	Plug, Oil Fill	370D	3	Jack Bolt, Bearing Housing
122	1	Shaft	370F	2	Bolt, Frame Foot
126	1	Sleeve, Shaft	370H	2	Box Cover/Adapter Stud
134	1	Housing, Bearing	382	1	Lockwasher, Bearing
136	1	Locknut, Bearing	383	1	Seal, Mechanical Rotating Element
168	1	Bearing, Inboard	400	1	Key, Coupling
184	1	Cover, Stuffing Box	408A	1	Plug, Frame Drain (Not Shown)
228	1	Frame	408H	5	Plug, Frame Lubrication Port
241	1	Foot Frame	408L	1	Plug, Oil Cooler Inlet
250	1	Gland, Mechanical Seal	408M	1	Plug, Oil Cooler Outlet
319	1	Gauge; Sight, Oil	412	1	O-ring, Impeller
332A	1	Labyrinth, Outboard Frame	423	3	Jamnut, Bearing Housing Jack Bolt
333A	1	Labyrinth, Inboard Frame	423B	2	Nut, Box Cover/Adapter Stud
351	1	Gasket, Case	469B	2	Dowel Pin, Frame / Adapter
353	4	Stud, Gland	496	1	O-ring, Bearing Housing / Frame
353A	4*	Nut, Gland Stud	529	2	Washer, Frame Foot to Frame
358A	1	Plug, Casing Drain	* Packing	Gland h	as only 2 Studs & Nuts

# 8.3 MODEL 2196 LTO CROSS SECTION

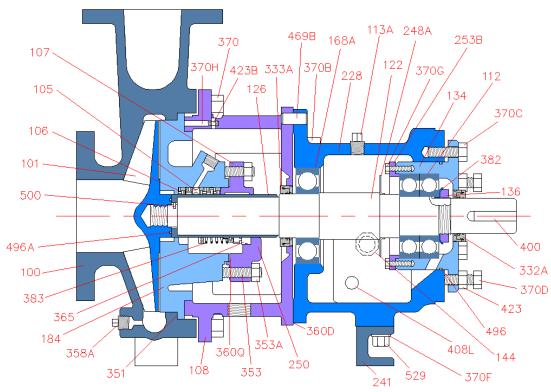


Figure 8-3: 2196 LTO Cross Section

Table 8-3: 2196 I TO Parts I ist

	MODEL 2196 LTO PARTS LIST					
Item #	Qty	Description	Item #	Qty	Description	
100	1	Casing	360D	1	Gasket, Frame/Adapter	
101	1	Impeller	360Q	1	Gasket, Gland, Mech. Seal	
105	1	Ring, Lantern	361A	1	Snap Ring, Bearing	
106	5	Packing	365	1	Seal, Mechanical Stationary Element	
107	1	Gland, Packing	370	8, 12, 16	Bolt, Casing	
108	1	Adapter	370B	4	Bolt, Frame / Adapter	
109C	1	Cover, Bearing, Outboard	370C	3	Bolt, Bearing Housing	
112	2	Bearing, Outboard	370D	3	Jack Bolt, Bearing Housing	
113	1	Plug, Oil Fill	370F	2	Bolt, Frame Foot	
122	1	Shaft	370G	6	Bolt, Bearing Cover	
126	1	Sleeve, Shaft	370H	2	Box Cover/Adapter Stud	
134	1	Housing, Bearing	382	1	Lockwasher, Bearing	
136	1	Locknut, Bearing	383	1	Seal, Mechanical Rotating Element	
168	1	Bearing, Inboard	400	1	Key, Coupling	
184	1	Cover, Stuffing Box	408A	1	Plug, Frame Drain (Not Shown)	
228	1	Frame	408H	4	Plug, Frame Lube Port (Not Shown)	
241	1	Foot Frame	408L	1	Plug, Oil Cooler Inlet	
248A	1	Ring, Oil	408M	1	Plug, Oil Cooler Outlet (Not Shown)	
250	1	Gland, Mechanical Seal	412	1	O-ring, Impeller	
253B	1	Ring, Clamp	423	3	Jamnut, Bearing Housing Jack Bolt	
319	1	Gauge; Sight, Oil	423B	2	Nut, Box Cover/Adapter Stud	
332A	1	Labyrinth, Outboard Frame	469B	2	Dowel Pin, Frame / Adapter	
333A	1	Labyrinth, Inboard Frame	496	1	O-ring, Bearing Housing / Frame	
351	1	Gasket, Case	500	1	Pin, Sleeve	
353	4*	Stud, Gland	529	2	Washer, Frame Foot to Frame	
353A	4*	Nut, Gland Stud				
358A	1	Plug, Casing Drain	* Packing	Gland h	as only 2 Studs & Nuts	

# 8.4 MODEL 2196 XLO CROSS SECTION

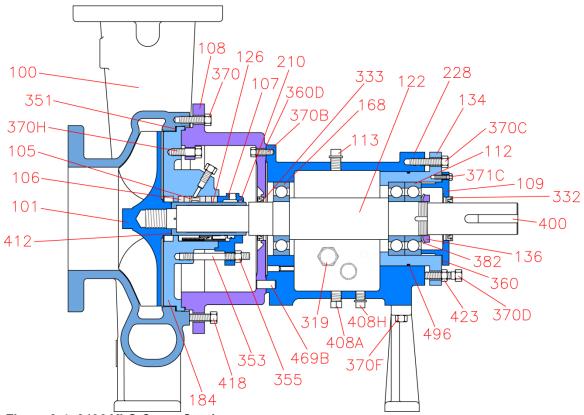


Figure 8-4: 2196 XLO Cross Section

Table 8-4: 2106 YI O Parts I ist

MODEL 2196 XLO PARTS LIST						
ltem #	Qty	Description	Item #	Qty	Description	
100	1	Casing	360	1	Gasket, End Cover	
101	1	Impeller	360D	1	Gasket, Frame/Adapter	
105	1	Ring, Lantern	370	16/24 <sup>1</sup>	Bolt, Adapter / Case	
106	5	Stuffing Box Packing	370B	4	Bolt, Frame / Adapter	
107	1	Gland	370C	4	Bolt, Housing / Frame	
108	1	Frame Adapter	370D	4	Jack Bolt, Housing Adjustment	
109	1	Bearing End Cover, Outboard	370F	2	Bolt, Frame Foot	
112	2	Bearing, Thrust, Outboard	370H	2	Stud, Cover / Adapter	
113	1	Oil Fill Plug	371C	6	Bolt, Cover/Housing	
122	1	Shaft, Sleeve Type	382	1	Lockwasher	
126	1	Sleeve	400	1	Coupling Key	
134	1	Housing, Bearing	408A	1	Drain Plug	
136	1	Locknut, Bearing	408H	1	Plug, Frame Lubrication Port	
168	1	Bearing, Radial, Inboard	408J <sup>2</sup>	1	Oiler Plug	
184	1	Cover, Stuffing Box	408L <sup>2</sup>	1	Cooler Plug	
210	1	Packing, Gland	408M <sup>2</sup>	1	Cooler Plug	
228	1	Frame	408N <sup>2</sup>	1	Sight Plug	
319	1	Sight Glass	412	1	O-Ring, Impeller	
332	1	Labyrinth Seal, Outboard	418	3	Bolt, Case Jackout	
333	1	Labyrinth Seal, Inboard	423	4	Housing Jam Nut	
351	1	Gasket, Casing	469B	2	Pin, Frame / Adapter	
353	2	Stud, Gland	496	1	O-Ring, Bearing Housing	
355	2	Nut, Gland				

<sup>&</sup>lt;sup>2</sup> 408J, 408L, 408M & 408N – NOT SHOWN ON THE DRAWING

# 8.5 MODEL 2196-LF CROSS SECTION

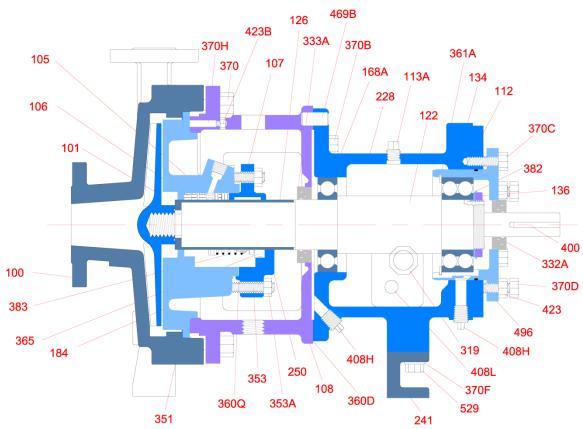


Figure 8-5: 2196LF Cross Section

Table 8-5: 2196LF Parts List

Table	Table 8-5: 2196LF Parts List						
		MODEL 2196	·LF PA	<u> RTS I</u>	LIST		
Item #	Qty	Description	Item #	Qty	Description		
100	1	Casing	360D	1	Gasket, Frame/Adapter		
101	1	Impeller	360Q	1	Gasket; Gland, Mech. Seal		
105	1	Ring, Lantern	361A	1	Snap Ring, Bearing		
106	5	Packing	365	1	Seal, Mechanical Stationary Element		
107	1	Gland, Packing	370	8, 12, 16	Bolt, Casing		
108	1	Adapter	370B	4	Bolt, Frame / Adapter		
112	1	Bearing, Outboard	370C	3	Bolt, Frame / Bearing Housing		
113	1	Plug, Oil Fill	370D	3	Jack Bolt, Bearing Housing		
122	1	Shaft	370F	2	Bolt, Frame Foot		
126	1	Sleeve, Shaft	370H	2	Box Cover/Adapter Stud		
134	1	Housing, Bearing	382	1	Lockwasher, Bearing		
136	1	Locknut, Bearing	383	1	Seal, Mechanical Rotating Element		
168	1	Bearing, Inboard	400	1	Key, Coupling		
184	1	Cover, Stuffing Box	408A	1	Plug, Frame Drain (Not Shown)		
228	1	Frame	408H	4	Plug, Frame Lubrication Port		
241	1	Foot Frame	408L	1	Plug, Oil Cooler Inlet		
250	1	Gland, Mechanical Seal	408M	1	Plug, Oil Cooler Outlet		
319	1	Gauge; Sight, Oil	412A	1	O-ring, Impeller		
332A	1	Labyrinth, Outboard Frame	423	3	Jamnut, Bearing Housing Jack Bolt		
333A	1	Labyrinth, Inboard Frame	423B	2	Nut, Box Cover/Adapter Stud		
351	1	Gasket, Case	469B	2	Dowel Pin, Frame / Adapter		
353	4	Stud, Gland	496	1	O-ring, Bearing Housing / Frame		
353A	4*	Nut, Gland Stud	529	2	Bolt , Frame Foot to Frame		
358A	1	Plug, Casing Drain	* Packing	Gland h	as only 2 Studs & Nuts		

#### 469B 126 423B 333A 370B 370H 361A 107 370 168A 113 134 105 112 228 106 122 370C 101 136 412A 400 332A 100 370D 423 383 496 365 319 408H 408H 250 408L 353 358A 108 529 360D 360Q 353A 184 370F

# 8.6 MODEL 2196-R CROSS SECTION

Figure 8-6: 2196R Cross Section

Table 8-6: 2196R Parts List

MODEL 2196-R PARTS LIST							
Item #	Qty	Description	Item #	Qty	Description		
100	1	Casing	360Q	1	Gasket; Gland, Mech. Seal		
101	1	Impeller	361A	1	Snap Ring, Bearing		
105	1	Ring, Lantern	365	1	Seal, Mechanical Stationary Element		
106	5	Packing	370	3	Bolt, Casing		
107	1	Gland, Packing	370B**	4	Bolt, Frame / Adapter		
108**	1	Adapter Ring	370C	3	Bolt, Bearing Housing		
112	1	Bearing, Outboard	370D	3	Jack Bolt, Bearing Housing		
113	1	Plug, Oil Fill	370F	1	Bolt, Foot to Frame		
122	1	Shaft	370H	2	Stud, SBC / Adapter		
126	1	Sleeve, Shaft	382	1	Lockwasher, Bearing		
134	1	Housing, Bearing	383	1	Seal, Mechanical Rotating Element		
136	1	Locknut, Bearing	400	1	Key, Coupling		
168A	1	Bearing, Inboard	408H	4	Plug, Frame Lubrication Port		
184	1	Cover, Stuffing Box	408L	1	Plug, Oil Cooler Inlet (Not Shown)		
228	1	Frame	408M	1	Plug, Oil Cooler Outlet (Not Shown)		
250	1	Gland, Mechanical Seal	412A	1	O-ring, Impeller		
319	1	Sight Glass	423	3	Jamnut, Bearing Housing / Frame		
332A	1	Labyrinth, OB	423B	2	Nut, Box Cover/Adapter Stud		
333A	1	Labyrinth, IB	496	1	O-ring,, Bearing Housing / Frame		
351	1	Gasket, Case	500	1	Pin, Sleeve		
353	1	Stud, Gland	529	2	Washer, Foot to Frame		
353A	4*	Nut, Gland Stud	* Packing (	* Packing Gland has only 2 Studs & Nuts			
358A	1	Plug, Casing Drain	** Only Re	quired	on 8" Pump		

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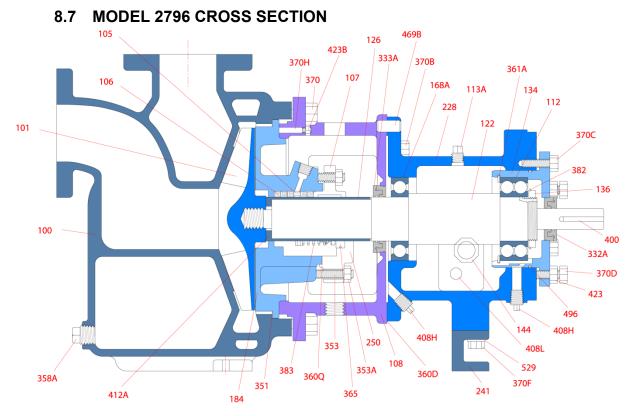


Figure 8-7: 2796 Cross Section

Table 8-7: 2796 Parts List

	MODEL 2796 PARTS LIST											
Item #	Qty	Description	Item #	Qty	Description							
100	1	Casing	360D	1	Gasket, Frame/Adapter							
101	1	Impeller	360Q	1	Gasket; Gland, Mech. Seal							
105	1	Ring, Lantern	361A	1	Snap Ring, Bearing							
106	5	Packing	365	1	Seal, Mechanical Stationary Element							
107	1	Gland, Packing	370	8, 12, 16	<sup>6</sup> Bolt, Casing							
108	1	Adapter	370B	4	Bolt, Frame / Adapter							
112	1	Bearing, Outboard	370C	3	Bolt, Bearing Housing							
113A	1	Plug, Oil Fill	370D	3	Jack Bolt, Bearing Housing							
122	1	Shaft	370F	2	Bolt, Frame Foot							
126	1	Sleeve, Shaft	370H	2	Box Cover/Adapter Stud							
134	1	Housing, Bearing	382	1	Lockwasher, Bearing							
136	1	Locknut, Bearing	383	1	Seal, Mechanical Rotating Element							
144	1	Gauge; Sight, Oil	400	1	Key, Coupling							
168A	1	Bearing, Inboard	408A	1	Plug, Frame Drain (Not Shown)							
184	1	Cover, Stuffing Box	408H	4	Plug, Frame Lubrication Port							
228	1	Frame	408L	1	Plug, Oil Cooler Inlet							
241	1	Foot Frame	408M	1	Plug, Oil Cooler Outlet							
250		Gland, Mechanical Seal	412A	1	O-ring, Impeller							
332A	1	Labyrinth, Outboard Frame	423	3	Jamnut, Bearing Housing Jack Bolt							
333A	1	Labyrinth, Inboard Frame	423B	2	Nut, Box Cover/Adapter Stud							
351	1	Gasket, Case	469B	2	Dowel Pin, Frame / Adapter							
353	4	Stud, Gland	496	1	O-ring, Bearing Housing / Frame							
353A	4*	Nut, Gland Stud	529	2	Washer, Frame Foot to Frame							
358A	1	Plug, Casing Drain	* Pack	ng Glar	nd has only 2 Studs & Nuts							

### APPENDIX E - MAINTENANCE INSTRUCTIONS FOR LABYRINTH **BEARING ISOLATORS**

#### 9.1 DETAILS OF OPERATIONS

The Labyrinth seal performs two functions:

- 1. Maintains the clean oil in the bearing housing.
- 2. Keeps contaminates from entering the bearing housing.

The unit is comprised of three major components: the **rotor**, the **stator**, and the O-

The **rotor** fits over the shaft and is held in place by an elastomeric drive ring. The drive ring causes the rotor to turn with the shaft and provides a positive static seal on the shaft. There is no metal-to-metal contact between the shaft and rotor, thus no wear and friction concerns.

The **stator** is held in the housing by a nominal .002" interference fit. An O-ring gasket on the outside diameter of the stator secures a positive seal between the stator and the housing bore. The designed Labyrinth grooves and lube return trough on the stator inside diameter retains the lubricant inside the bearing housing.

The rotor and stator act together to keep contamination out of the bearing housing. The O-ring, stator, and rotor are a unit and must not be pulled apart. If the unit is pulled apart or comes apart, it must be replaced with a new unit. The O-ring is

intended to be an inseparable design.

Repairs or replacement of seals are only necessary if excessive oil leakage is visible. If or when the bearing housing is disassembled, it is recommended that the rotor Orings be replaced.

#### 9.2 DISASSEMBLY PROCEDURES

### DANGER

Lock out power to avoid personal injury or death

- 1. Remove shaft assembly (122) per instructions for pump disassembly. (See page 18.)
- 2. STO removal. Insert a bar (wood or plastic) through the outboard bearing housing end of the bearing frame (228). Contact the inboard bearing isolator (333A). Remove by tapping the bar or pushing with an arbor press.
  - MTO and XLO removal. Disassemble the bearing frame adapter (108) per pump disassembly instructions. Remove the inboard bearing isolator (333A) with a bar (wood or plastic) by tapping or by pushing with an arbor press.
- 3. STO, MTO, and XLO outboard bearing isolator (332A) removal. Block up the outboard bearing housing (134) on the bench, coupling the end toward the bench top. Tap the isolator out of the housing or use an arbor press.
- 4. Inspect the bearing isolators. If the unit pulls apart, a new isolator is needed for reassembly.

5. Replace the rotor O-rings and stator O-rings each time the units are removed from the pump assembly.

### 9.3 INSTALLATION PROCEDURES

### **A** DANGER

Lock out power to avoid personal injury or death

1. STO, MTO, and XLO Inboard Isolator. Position the bearing frame (228) or adapter (108) inboard bearing side up. Place the isolator seal (333A) stator side in the bore. THE EXPULSION PORT MUST BE IN THE 6 O'CLOCK POSITION. While using a block large enough to cover the entire flange of the isolator, use an arbor press to press the stator into the bore. Press into place until the location ramp begins. (See Figure 9-1.)

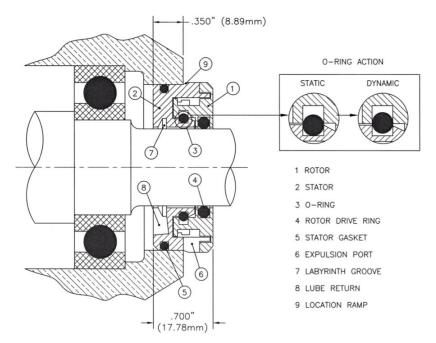


Figure 9-1: Bearing Isolator Installed

- 2. <u>Outboard Isolator (332A)</u>. Position the bearing housing (134) outside flange up. Place the isolator in the bore and press into place using the same technique as in Step 1 above.
- 3. Lightly lube the sleeve end of the shaft and rotor drive ring. Slide the bearing frame (228) or adapter (108) over the shaft per assembly instructions.
- 4. To assemble the outboard end, tape the shaft (122) keyway with black tape. Lube the tape and rotor drive ring. Slide the bearing housing (134) over the shaft (122) end and continue per assembly instructions.

MAKE SURE EXPULSION PORT AND LUBE RETURN ARE IN THE 6 O'CLOCK POSITION IN FINAL ASSEMBLY.

# 10 APPENDIX F - DIMENSIONAL DATA

# 10.1 MODEL 2196 DIMENSIONAL DATA

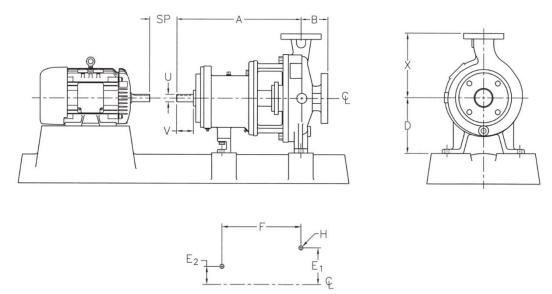


Figure 10-1: General 2196 Assembly

Table 10-1: General 2196 Assembly Dimensions

							1	2196 D	IMENS	SIONS	5						
PUMP			SIZE							F	оот г	PATTER	V		SHAFT		APPROX.
FRAME	ANSI	DIS	suc	IMP	х	D	В	А	SP	E1	E2	F	Н	U	KEYWAY	V	BARE PUMP WT. (LBS.)
	AA	1	1.5	6													85
	AB	1.5	3	6	]												90
STO	AC	2	3	6	6 1/2	5 1/4	4	13 1/2	3 3/4	3	0	7 1/4	5/8	.875	3/16 X 3/32	2	95
	AA	1	1.5	8	]												100
	AB	1.5	3	8													110
	A60	2	3	8	9 1/2												200
	A70	3	4	7	11												220
	A70	3	4	8	11												220
	A70	3	4	8G	11	8 1/4											220
	A05	1	2	10	8 1/2	0 1/4								MTO	MTO		200
мто	A50	1.5	3	10	8 1/2									1.125	1/4 X 1/8		220
	A60	2	3	10	9 1/2												230
or	A70	3	4	10	11		4	19 1/2	3 3/4	4 7/8	3 5/8	12 1/2	5/8	or	or	2 5/8	265
	A40	3	4	10H	12 1/2												275
LTO	A80	4	6	10	13 1/2									LTO	LTO		305
	A80	4	6	10H	13 1/2									1.875	1/2 X 1/4		305
	A20	1.5	3	13	10 1/2	10											245
	A30	2	3	13	11 1/2												275
	A40	3	4	13	12 1/2												330
	A80	4	6	13	13 1/2												405
	A90	6	8	13	16												560
	A100	8	10	13	18												670
	A110	6	8	15	18												610
XLO	A120	8	10	15	19	14 1/2	6	27 7/8	5 1/4	8	4 1/2	18 3/4	7/8	2.375	5/8 X 5/16	4	740
1 1	A120	8	10	15G	19	14 1/2	l °	21 110	5 1/4	l °	4 1/2	10 3/4	//0	2.375	3/0 \ 3/10	"	710
	A105	4	6	17	16												660
	A110	6	8	17	18												735
	A120	8	10	17	19												840

# 10.2 MODEL 2196 CAST IRON BASEPLATE RELATED DIMENSIONS

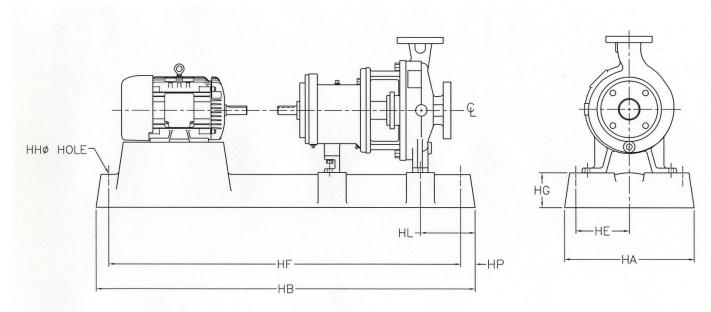


Figure 10-2: General Cast Iron Baseplate Assembly

Table 10-2: General Cast Iron Baseplate Dimensions

	Tuble 10-2. General Gust fron Buseplate Billiensions											
	CAST IRON RELATED BASEPLATE RELATED DIMENSIONS											
PUMP FRAME	BASEPLATE NUMBER	MAX MOTOR FRAME	НА	НВ	HE	HF	НР	HG	НН	HL		
	1	145	10	35	4	32 1/2	1 3/8	3 3/16	3/4	4 5/8		
STO	2	215	12	39	4 1/2	36 1/2	1 1/4	3 3/8	3/4	4 1/2		
	3	286	15	46	6	43 1/2	1 1/4	6	3/4	4 1/2		
	4	215	12	45	4 1/2	42 1/2	1 1/4	4	3/4	4 1/2		
MTO or	5	286	15	52	6	49 1/2	1 1/4	4 3/8	3/4	4 1/2		
LTO	6	365	18	58	7 1/2	55 1/2	1 1/4	5	1	4 1/2		
	7	444	18	60	7 1/2	57 1/2	1 1/4	5	1	4 1/2		
	8	286	26	62	11 1/4	47	13	4	1	5 1/4		
XLO	9	365	26	68	11 1/4	47	13	4	1	5 3/16		
	10	447	26	74	11 1/4	47	13	4 1/8	1	5 1/4		

# 10.3 MODEL 2196-LF DIMENSIONAL DATA

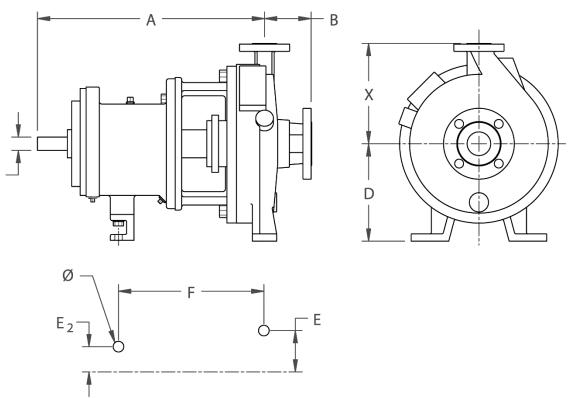


Figure 10-3: General 2196LF Dimensions

Table 10-3: General 2196LF Dimensions

	2196-LF DIMENSIONS											
PUMP			SIZE							APPROX.		
FRAME	ANSI		suc	IMP	Х	A	В	D	SP	BARE PUMP WT. (LBS.)		
STO	AA	1	1.5	4	6.5	13.5	4.0	5.25	3.75	84		
510	AA	1	1.5	8	6.5	13.5	4.0	5.25	3.75	100		
MTO/LTO	A05	1	2	10	8.5	19.5	4.0	8.25	3.75	200		
WITO/LIO	A03	Į.		10	6.5	19.5	4.0	0.25	3.75	245		
LTO	A20	1.5	3	13	10.5	19.5	4.0	10.0	3.75	285		

# 10.4 MODEL 2196-R DIMENSIONAL DATA

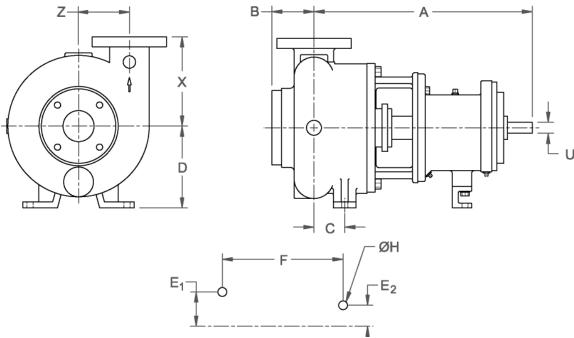


Figure 10-4: General 2196R Dimensions

Table 10-4: General 2196R Dimensions

	2196-R DIMENSIONS													
Pump										Foot F	Pattern			Shaft
Frame	Size	Z	X	Α	В	С	D	SP	E1	E2	F	Н	U	KEYWAY
STO	2x2-8	4.25	6.5	16	2.75	2.5	6		3	0	7.25		0.875	.19 x .09
	2x2-10	5.25	8.5	21.75	3.5	2.25	0.05							
MTO	3x3-10	5.13	9	22.50	4.25	.25 2.94	8.25	0.75				00	1.125	.25 x .125
or LTO	2x3-13		10.5	22.38	4.10	2.81		3.75	4.88	3.63	12.5	.63	1.125	.25 X .125
	3x4-13	6.63	10.5	22.81	4.12	3.31	10							
LTO	4x6-13		11.5	23.13	4.75	3.63							1.875	.5 x .25

# 10.5 MODEL 2796 DIMENSIONAL DATA

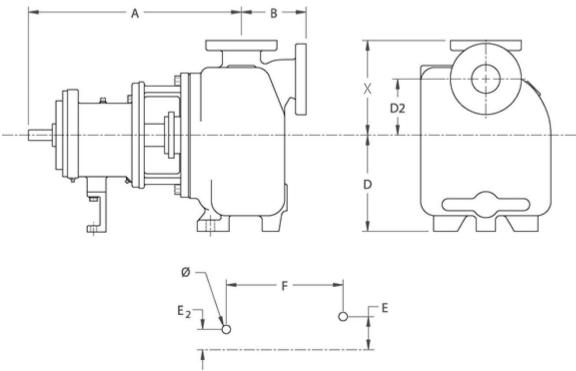


Figure 10-5: General 2796 Dimensions

Table 10-5: General 2796 Dimensions

	2796 DIMENSIONS												
PUMP		SIZE				FOOT PATTERN						APPROX.	
FRAME	DIS	suc	IMP	х	Α	В	D	D2	E	E2	F	н	BARE PUMP WT. (LBS.)
STO	1	1.5	6	7.25	15.5	5	7.5	4	3	0	7.25		170
310	1.5	1.5	8	7.88	15.5	J	7.0	4	3	U	7.25		170
	2	2			21.75	6.5							370
	3	3	10	10	22.63	6.75			4.00	3.63		.63	315
MTO/LTO	4	4			23.38	9.19	10	6			12.5	.03	370
WITO/LIO	3	3		11.5	22.63	6.75			4.88	3.03	12.5		400
	4	4	4 13	11.5	22.38 9.19	9.19							470
	6	6		15	27.75	7.50	12	7					690

# 10.7 MODEL 2196 STUFFING BOX RELATED DIMENSIONS

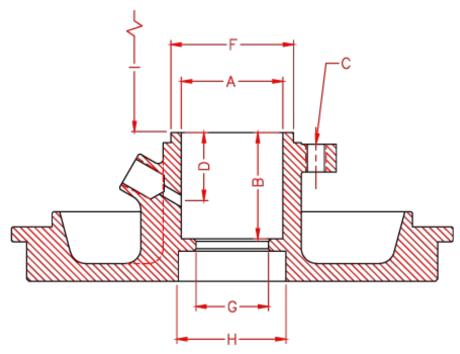


Figure 10-6: Standard Bore Stuffing Box

Table 10-6: Standard Bore Stuffing Box

	STANDARD BORE DIMENSIONS												
PUMP	^	_		С		F	-			I			
FRAME	А	В	B.C.	TAP	D	E	F	G	Н	OBSTRUCTION			
STO	2.00	2.13	3.25	3/8-16 UNC	0.97	1/4-18 NPT	2.39	1.40	-	2.18			
MTO	2.50	2.61	4.13	1/2-13 UNC	1.56	3/8-18 NPT	3.02	1.78	2.65	2.90			
LTO	2.88	2.63	4.50	1/2-13 UNC	1.56	3/8-18 NPT	3.52	2.15	2.63	2.90			
XLO   3.38   3.00   5.38   5/8-11 UNC   1.75   3/8-18 NPT   4.37   2.53   3.38   2.9										2.90			
XLO-17	3.63	3.00	5.38	5/8-11 UNC	1.63	1/4-18 NPT	4.38	2.78	3.50	2.90			

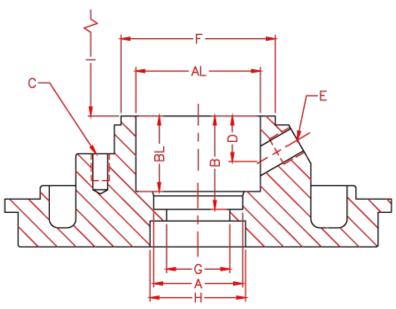


Figure 10-8: Large bore stuffing box

Table 10-7: Large Bore Stuffing Box

	LARGE BORE DIMENSIONS													
PUMP	_	Δ1	Ь	DI.		С	_	_		_	- 11	I		
FRAME	Α	AL	В	BL	B.C.	TAP	D	E	Г	G	Н	OBSTRUCTION		
STO	2.00	2.86	2.13	1.69	4.50	3/8-16 UNC	0.88	1/4-18 NPT	3.60	1.40	N/A	2.18		
MTO	2.50	3.50	2.61	2.12	5.50	1/2-13 UNC	1.28	1/2-14 NPT	4.34	1.78	2.69	2.90		
LTO	2.88	3.88	2.63	2.06	6.00	5/8-11 UNC	1.38	3/8-18 NPT	4.71	2.16	2.77	2.90		
XLO	3.38	4.75	3.00	2.50	6.75	5/8-11 UNC	1.38	3/8-18 NPT	5.45	2.53	3.38	2.90		
XLO-17	3.63	4.75	3.00	2.45	6.75	5/8-11 UNC	1.41	3/8-18 NPT	5.45	2.75	3.50	2.90		

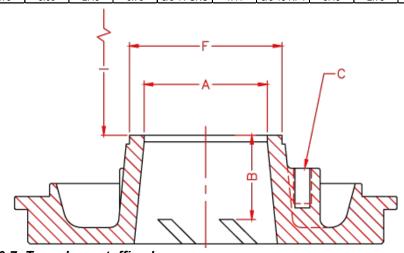


Figure 10-7: Taper bore stuffing box

Table 10-8: Taper Bore Stuffing Box

	TAPER BORE DIMENSIONS											
PUMP	Α	В		С	F	1						
FRAME	Α	Ь	B.C.	TAP	Г	OBSTRUCTION						
STO	2.88	1.75	4.50	3/8-16 UNC	3.60	2.18						
MTO	3.50	2.23	5.50	1/2-13 UNC	4.34	3.38						
LTO	3.88	2.21	6.00	5/8-11 UNC	4.71	3.38						
XLO 4.75 2.02 6.75 5/8-11 UNC 5.45 2.90												
XLO-17	4.75	2.02	6.75	5/8-11 UNC	5.45	2.90						

### 11 APPENDIX G - CONSTRUCTION DETAILS

### 11.1 MODEL 2196 CONSTRUCTION DETAILS

Table 11-1: General Construction Details

Construc	Construction Details All dimensions in inches and (mm).										
		Sī	О	МТ	О	LT	О	XL	.0		
	Diameter at Impeller	.75	(19)	1	(25)	1.25	(32)	1.5	(38)		
	Diameter in Stuffing Box (Solid shaft const.) (Sleeved Shaft - OD of shaft under sleeve)	1.375 1.125	(35) (29)	1.75 1.5	(45) (38)	2.125 1.875	(54) (48)	2.5 2	(64) (51)		
	Diameter Between Bearings	1.5	(38)	2.125	(54)	2.5	(64)	3.125	(79)		
Shaft	Diameter at Coupling	.875	(22)	1.125	(29)	1.875	(48)	2.375	(60)		
	Overhang	6.125	(156)	8.375	(213)	8.375	(213)	9.969	(253)		
	Maximum Shaft Deflection				0.002	(0.05)					
	Shaft Deflection Index (L <sup>3</sup> /D <sup>4</sup> ) (Sleeve Shaft) (Solid Shaft)	_	13 4	11 6:	-	4; 2:	-	6 2			
Sleeve	O.D. thru Stuffing Box/Seal Chamber	1.375	(35)	1.75	(45)	2.125	(54)	2.5*	(64)		
	Radial	SKF	6207	SKF	6309	SKF	6311	SKF	6313		
Bearings	Thrust	SKF A/	3306 C3	SKF :		SKF BEC		SKF A/0			
	Bearing Span	4.125	(105)	6.75	(171)	6.875	(164)	9.25	(235)		
Stuffing Box	Bore	2	(51)	2.5	(64)	2.875	(73)	3.375	(86)		
Power Limits	HP (kW) per 100 RPM	1.1	(.82)	3.4	(2.6)	5.6	(4.2)	14	(10.5)		

<sup>\*</sup>XLO-17 pumps with sleeved shafts have a 2.75" (70) sleeve O.D. for packing, and 2.50" (64) sleeve O.D. for mechanical seals.

### 11.2 MODEL 2196 SHAFT RUNOUT TOLERANCES

Table 11-2: Shaft TIR Tolerances

Shaft Runout Tolerances All	dimensions in inches and (mm)
At Stuffing Box	At Coupling
.002 (.051)	.001 (.026)

### 11.3 MODEL 2196 SHAFT END PLAY

Table 11-3: Shaft End-Play Tolerances

Shaft En	Shaft End Play All dimensions in inches and (mm)											
	STO	MTO	LTO	XLO								
Double Row	.0011/.0019 (.028/.047)	.0013/.0021 (.033/.054)	NA	.0014/.0023 (.036/.058)								
Duplex	.0007/.0010 (.018/.026)	.0009/.0012 (.022/.030)	.0010/.0015 (.026/.038)	.0010/.0015 (.026/.038)								

# 11.4 MODEL 2196 BEARING FITS & TOLERANCES

Table 11-4: Bearing and Bore Dimensions and Tolerances

Bearing Fits & Tolerances	All dimensions in inches and (n	nm)
---------------------------	---------------------------------	-----

According to ABEC I Standards							
	STO	MTO	LTO	XLO-X, XO-17			
Shaft O. D.	1.3785 (35.013)	1.7722 (45.013)	2.1660 (55.015)	2.5597 (65.015)			
Inboard	1.3781 (35.002)	1.7718 (45.002)	2.1655 (55.002)	2.5592 (65.002)			
Clearance	0.0010 (0.025) tight	0.0010 (0.025) tight	0.0012 (0.030) tight	0.0012 (0.030) tight			
	0.0001 (0.002) tight	0.0001 (0.002) tight	0.0001 (0.002) tight	0.0001 (0.002) tight			
Bearing I. D.	1.3780 (35.000)	1.7717 (45.000)	2.1654 (55.000)	2.5591 (65.000)			
Inboard	1.3775 (34.988)	1.7712 (44.988)	2.1648 (54.985)	2.5585 (64.985)			
Frame I. D.	2.8346 (72.000)	3.9370 ( 100.000)	4.7244 (120.000)	5.5118 (140.000)			
Inboard	2.8353 (72.019)	3.9379 (100.022)	4.7253 (120.022)	5.5128 (140.025)			
Clearance	0.0012 (0.032) loose	0.0015 (0.037) loose	0.0015 (0.037) loose	0.0017 (0.043) loose			
	0.0000 (0.000) loose	0.0000 (0.000) loose	0.0000 (0.000) loose	0.0000( 0.000) loose			
Bearing O.	2.8346 (72.000)	3.9370 ( 100.000)	4.7244 (120.000)	5.5118 (140.000)			
D. Inboard	2.8341 (71.987)	3.9364 (99.985)	4.7238 (119.985)	5.5111 (139-982)			
Shaft O. D.	1.1815 (30.011)	1.7722 (45.013)	1.9690 (50.013)	2.5597 (65.015)			
Outboard	1.1812 (30.002)	1.7718 (45.002)	1.9686 (50.002)	2.5592 (65.002)			
Clearance	0.0008 (0.021) tight	0.0010 (0.025) tight	0.0010 (0.025) tight	0.0012 (0.030) tight			
Olcarance	0.0001 (0.002) tight	0.0001 (0.002) tight	0.0001 (0.002) tight	0.0001 (0.002) tight			
Bearing I. D.	1.1811 (30.000)	1.7717 (45.000)	1.9685 (50.000)	2.5591 (65.000)			
Outboard	1.1807 (29.990)	1.7712 (44.988)	1.9680 (49.988)	2.5585 (64.985)			
Housing I. D.	2.8346 (72.000)	3.9370 ( 100.000)	4.3307 (110.000)	5.5118 (140.000)			
Outboard	2.8353 (72.019)	3.9379 (100.022)	4.3316 (110.022)	5.5128 (140.025)			
Clearance	0.0012 (0.032) loose	, ,	•	, ,			
	0.0000 (0.000) loose		·	•			
Bearing O.	2.8346 (72.000)	3.9370 ( 100.000)	4.3307 (110.000)	5.5118 (140.000)			
D. Outboard	2.8341 (71.987)	3.9364 (99.985)	4.3301 (109.985)	5.5111 (139-982)			

#### 12 APPENDIX H - ANSI B15.1 COUPLING GUARDS

### 12.1 INSTALLATION INSTRUCTIONS FOR SUMMIT PUMP ANSI B15.1 COUPLING GUARDS

### DANGER

Lock out/Tag out driver power before performing any work on pump

### DANGER

Replace all guards before re-energizing the driver

### WARNING

Before assembling or disassembling the coupling guard, de-energize the motor, lock out the motor controller/starter, and place a caution tag at the starter indicating that it is disconnected. Before resuming normal pump operation, replace the coupling guard.

# **NOTICE**

Summit Pump assumes no liability when these procedures are avoided

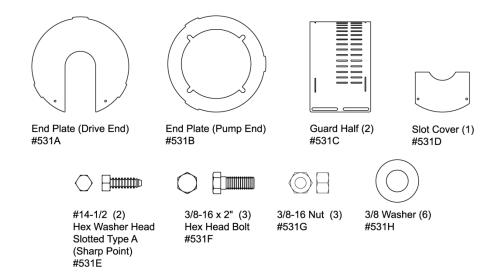


Figure 12-1: Guard Components

The design's simplicity allows complete coupling guard assembly, including the end plate (pump end), in about fifteen minutes.

#### 12.1.1 ASSEMBLY PROCEDURES

### **NOTICE**

If the end plate (pump end) was previously installed, make any necessary adjustments to the coupling and kip to step 2

1. On the STO, MTO, and LTO, align the end plate (pump end) to the bearing frame. (Impeller adjustment is not required.)

On the XLO-X, align the end plate (pump end) to the pump bearing housing with the small slots on the end plate aligned to the impeller adjusting bolts and the large slots clearing the bearing housing tap bolts. Then attach the end plate to the bearing housing using the jam nuts on the impeller adjusting bolts as shown in Figure H-3.

After attaching the end plate to the bearing housing, check and reset the impeller clearance as detailed in APPENDIX A - IMPELLER CLEARANCE SETTING.

### NOTICE

Complete the coupling adjustments before proceeding with the coupling guard assembly.

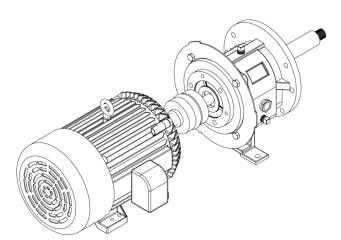


Figure 12-2: STO, MTO & LTO

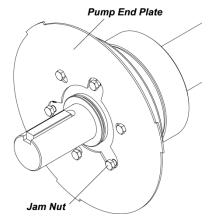


Figure 12-3: XLO

2. Slightly spread the bottom of the coupling guard half (pump end) and place it over the pump end plate as shown in Figure 12-4. The annular groove in the guard half is located around the end plate. (See Figure 12-5.)

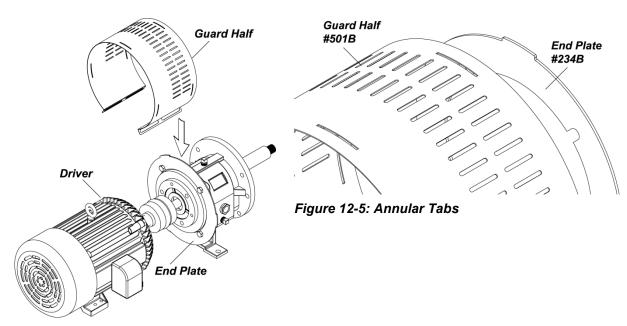


Figure 12-4: Shroud Install

3. After placing the coupling guard half (pump end) around the pump end plate, secure it with a bolt, nut and two (2) washers through the round hole in the front end of the guard half as shown in Figure 12-6. Tighten securely (See Figure 12-7).

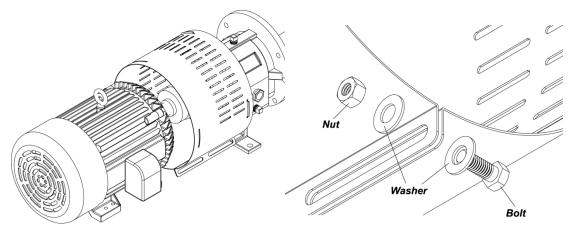


Figure 12-6: Secure around Pump End Plate

Figure 12-7: Bolt first shroud in place

4. Slightly spread the bottom of the coupling guard half (driver end) and place it over the coupling guard half (pump end) so that the annular groove in the coupling guard half (driver end) faces the motor as shown in Figure 12-8.

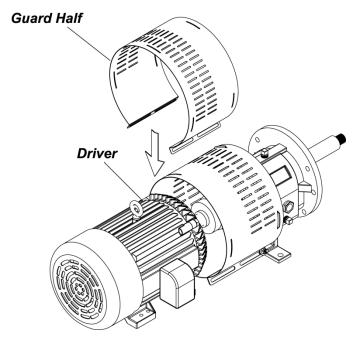


Figure 12-8: Driver end shroud install

Place the end plate (driver end) over the motor shaft as shown in Figure 12-9. Position the end plate in the annular groove at the rear of the coupling guard half (driver end) and secure it with a bolt, nut, and two (2) washers through the round hole at the rear of the guard half. Finger-tighten only.

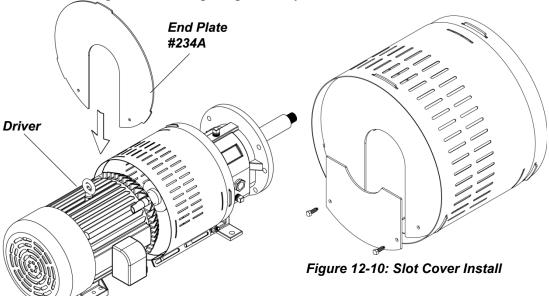


Figure 12-9: Driver End Plate install

5. Adjust the length of the coupling guard to completely cover the shafts and coupling as shown in Figure 12-11, by sliding the coupling guard half (driver end) toward the motor. After adjusting the length, secure the guard with a bolt, nut and two (2) washers through the slotted holes at the center of the guard and tighten. Check tightness on all nuts on the guard assembly.

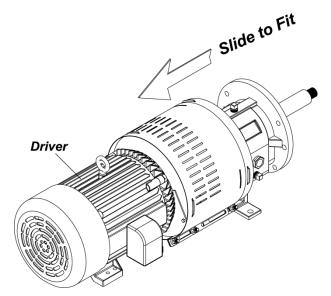


Figure 12-11: Fit Guard to Motor

#### 12.1.2 DISASSEMBLY PROCEDURES

It is necessary to remove the coupling guard for certain pump maintenance and adjustments, such as coupling adjustment, impeller clearance adjustment, and so forth. Replace the coupling guard after completing maintenance.

DO NOT resume normal pump operation while the coupling guard is removed.

### NOTICE

Refer to the assembly illustrations and instructions in reverse order for disassembly

- 1. Remove the nut, bolt and washers from the center-slotted hole on the coupling guard. Slide the motor end of the coupling guard half toward the pump.
- 2. Remove the nut, bolt and washers from the driver end of the coupling guard half and remove the end plate.
- 3. Slightly spread the bottom of the coupling guard half and lift it off.
- 4. Remove the remaining nut, bolt and washers from the pump end of the coupling guard half. Slightly spread the coupling guard half and lift it off.

### **NOTICE**

It is unnecessary to remove the end plate (pump end) from the bearing housing. If internal pump part maintenance is necessary, the bearing housing tap bolts are accessible without removing the end plate. Refer to APPENDIX C - MAINTENANCE AND REPAIR before removing the pump bearing housing

### 13 APPENDIX I - ANSI B15.1 ADAPTOR GUARDS

### DANGER

Lockout & Tag out driver power before performing any work on equipment.

### WARNING

Replace all guards before re-energizing the equipment

### **NOTICE**

Summit Pump, Inc. assumes no liability when these procedures are neglected.

### 13.1 COMPONENTS

While adaptor guards for all pump frames and sizes will vary in design and shape all guards will have the same general installation instructions. Pictured below is a guard half for an MTO 13-inch pump.



Adaptor **Guard Half** #531J QTY (2)

Figure 13-1: 2196 Adaptor **Guard Component** 

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#### 13.2 FASTENING GUARDS

2196 adaptor guards will either fasten to the stuffing box/adaptor studs and nuts or the casing jack bolts. Assembly instructions will show installation of an MTO 13-inch which uses the casing jack bolts. Instruction steps will be the same when using the studs and nuts to fasten the adaptor guard.

Table 13-1: Fastening Locations

2196 Adaptor Guard Fastening Location						
Frame	Size	Summit Number	Box Cover to Adaptor Stud/Nut	Casing Jack Bolt	Fastener Item #:	
STO	6/8"	GUARD-ADAPTOR STO	•		370H / 423B	
	8"	GUARD-ADAPTOR MTO 8IN		•	*418	
MTO/LTO	10"	GUARD-ADAPTOR MTO 10IN		•	*418	
	13"	GUARD-ADAPTOR MTO 13IN		•	*418	
	13"	GUARD-ADAPTOR XLO 13IN	•		370H / 423B	
XLO	15"	GUARD-ADAPTOR XLO 15IN	•		370H / 423B	
	17"	GUARD-ADAPTOR XLO 17IN		•	*418	

<sup>\*</sup>Note: If using Casing Jack Bolt, a jam nut is used to secure guard in place.

#### 13.3 GUARD ASSEMBLY

1. With pump assembled and all case bolts installed and torqued, remove the fastening hardware (418 or 370H & 423B). If using the casing jack bolt a <sup>3</sup>/<sub>4</sub>" bolt will be needed for guard fastening.

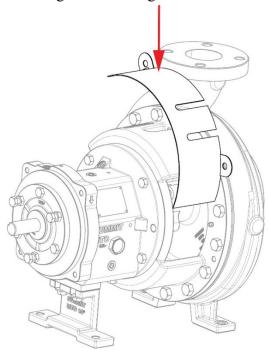


Figure 13-2: Install first guard half

2. Position the first guard half (531J) into position. Use the fastening hardware to hold the guard half in place but do not fully tighten yet.

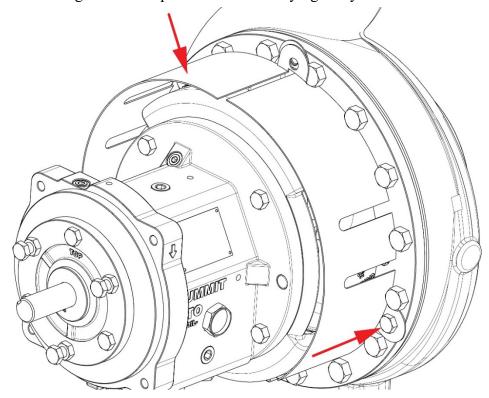


Figure 13-3: Install second guard half

3. Position the second guard half (531J) into position. The two halves will overlap each other if using casing jack bolts for fastening. If using box cover studs and nuts to fasten, the guard halves will not overlap.

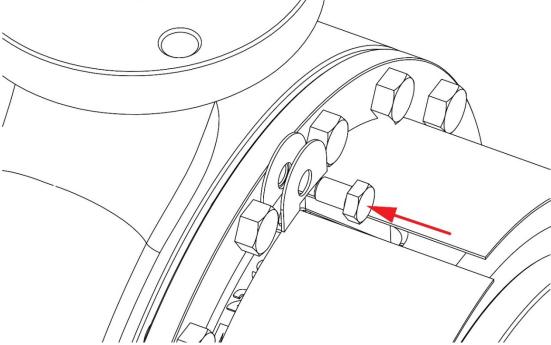


Figure 13-4: Install hardware

4. Make minor adjustments to the guard halves to fit precisely against the frame adaptor. Tighten and torque all fasteners to specified torques in Table 7-2 on page 21.

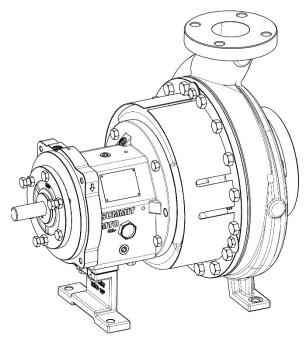


Figure 13-5: Guard installed using Casing Jack Bolt Fastening

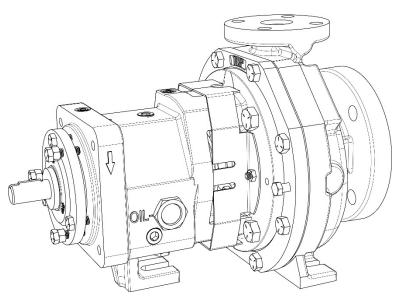
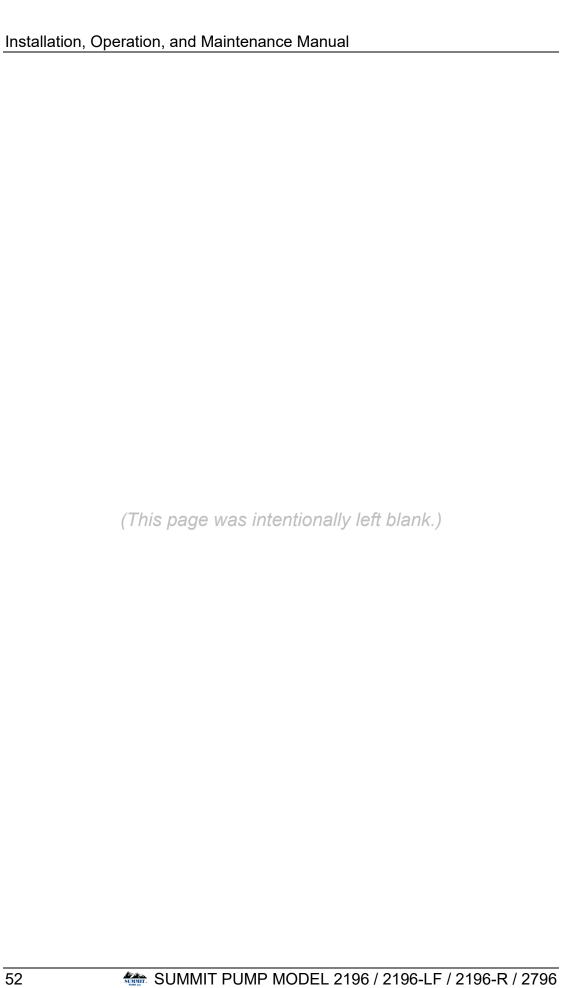
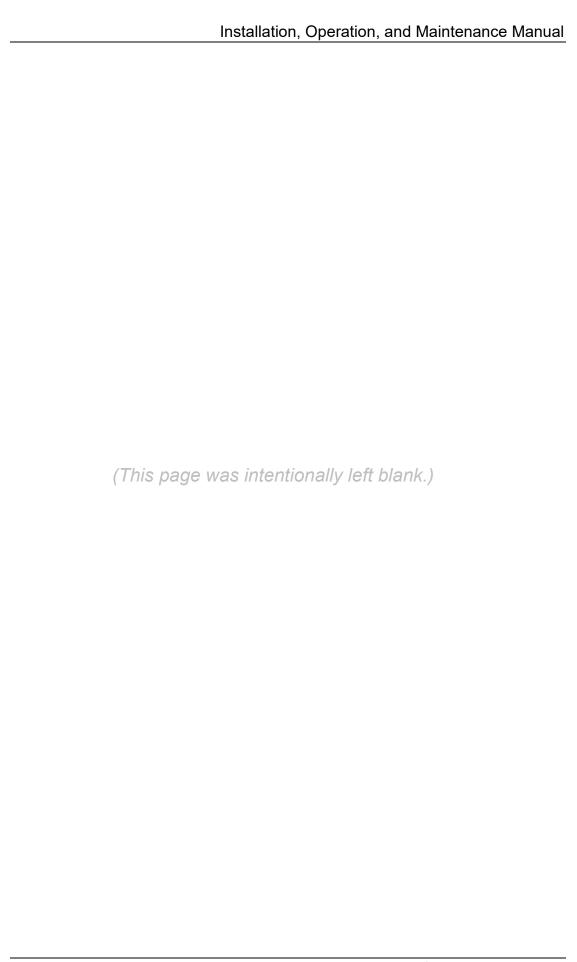


Figure 13-6: Guard installed using stuffing box to adaptor stud and nut





Purchase Date:	
Purchase Order#:	
Serial Number:	
Equipment Number: _	

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