



IMO®

# PRODUCT SERVICE MANUAL

## FOR

### E12L SERIES PUMPS

<b>WARNING</b>
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<p><b>The Imo General Installation, Operation, Maintenance, and Troubleshooting Manual, (No. SRM00046), along with this manual and all other component manuals supplied with these type units should be read thoroughly prior to pump installation, start-up, operation, maintenance, or troubleshooting.</b></p>
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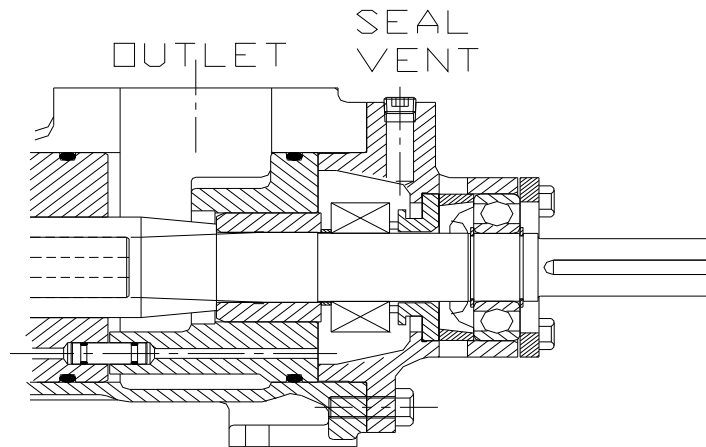
<b>Manual No. SRM00055</b>	<b>Rev. 06 (20-0051)</b>	<b>February 2020</b>
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## IMPORTANT NOTE

The importance of seal chamber priming cannot be overemphasized. Due to the prevalence of seal damage and leakage caused by not filling the seal chamber with liquid before putting a pump in service, this page is located at the beginning of this document.

## SEAL CHAMBER PRIMING

Fill mechanical seal chamber with liquid to insure seal does not start dry. This can be done by removing seal vent set-screw and pouring liquid into vent passageway before opening pump inlet. Alternately, seal chamber can be vented in situations where inlet pressure is above atmospheric by opening inlet and discharge valves and then loosening seal vent plug to allow positive inlet pressure to push air out of seal chamber until oil flows from it. **See figure below.**




**Filling or Venting Seal Cavity Using Seal Vent**


### CAUTION

Failure to fill or vent seal chamber as described above may cause damage to seal running faces which may result in seal leakage.



**READ THIS ENTIRE PAGE BEFORE PROCEEDING**

FOR SAFETY OF PERSONNEL AND TO PREVENT DAMAGE TO EQUIPMENT, THE FOLLOWING NOMENCLATURE HAS BEEN USED IN THIS MANUAL:

	<b>DANGER</b>	
Failure to observe precautions noted in this box can result in severe bodily injury or loss of life.		

	<b>WARNING</b>	
Failure to observe precautions noted in this box can cause injury to personnel by accidental contact with equipment or liquids. Protection should be provided by user to prevent accidental contact.		

	<b>CAUTION</b>		<b>ATTENTION</b>
Failure to observe precautions noted in this box can cause damage or failure of equipment.			

Noncompliance of safety instructions identified by the following symbol could affect safety for persons:  <div style="text-align: center;"></div>	Safety instructions where electrical safety is involved are identified by:  <div style="text-align: center;"></div>	Safety instructions which shall be considered for reasons of safe operation of pump and/or protection of pump itself are marked by the sign:  <div style="text-align: center;"><b>ATTENTION</b></div>
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	<b>ATTENTION</b>
If operation of pump is critical to your business, we strongly recommend you keep a spare pump or major repair kit in stock at all times. As a minimum, a minor repair kit (o-rings, gaskets, shaft seal and bearings) should be kept in stock so pump refurbishment after internal inspection can be accomplished.	

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## A. GENERAL INSTRUCTIONS

Instructions found herein cover disassembly, assembly and parts identification of E12L series pumps.

NOTE: Individual contracts may have specific provisions that vary from this manual. Should any questions arise which may not be answered by these instructions, refer to Imo General Installation Operation, Maintenance, and Troubleshooting Manual, SRM00046, provided with your order. For further detailed information and technical assistance please refer to Imo Pump, Technical/Customer Service Department, at (704) 289-6511.

Manual cannot possibly cover every situation connected with installation, operation, inspection, and maintenance of equipment supplied. Every effort was made to prepare text of manual so that engineering and design data is transformed into most easily understood wording. Imo Pump must assume personnel assigned to operate and maintain supplied equipment and apply instruction manual have sufficient technical knowledge and are experienced to apply sound safety and operational practices which may not be otherwise covered by this manual.

In applications where equipment furnished by Imo Pump is to become part of processing machinery, these instructions should be thoroughly reviewed to ensure proper fit of said equipment into overall plant operational procedures.



### WARNING

If installation, operation, and maintenance instructions are not correctly and strictly followed and observed, injury to personnel or serious damage to pump could result. Imo Pump cannot accept responsibility for unsatisfactory performance or damage resulting from failure to comply with instructions.

## B. INTRODUCTION

This instruction manual covers series E12L Series Imo pumps. This series of pumps has been designed for use in hydraulic, lubricating, and seal, applications requiring high inlet pressure capabilities. The model and design construction of each pump can be identified by the designator code on the pump nameplate. Definitions of model designators are identified in Figure 1.

## C. DESCRIPTION OF EQUIPMENT

The E12L Series pumps are positive displacement, rotary screw pumps consisting of a precision bored housing which encloses a driven screw (power rotor) and two intermeshing following screws (idler rotors). These screws when rotating form a succession of closures or cavities. As they rotate, fluid is moved axially from inlet port to outlet port in a continuous, uniform flow with minimum fluid pulsation and pump noise.

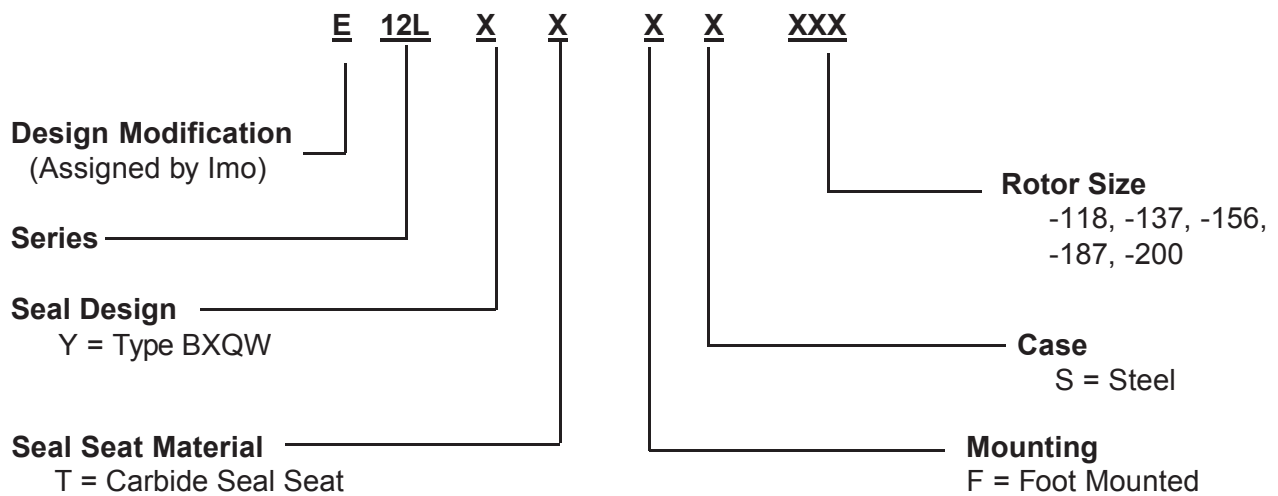
## D. PUMP MOEL IDENTIFICATION

This instruction manual covers the Imo Series E12L pumps with rotor sizes 118 through 200. The model of each pump is identified on the pump nameplate. Refer to Figure 1 and Table 1 for instructional keys when using this manual.

**Table 1 – E12L Series Pump Models**

Pump Model Number	Assembly Figure Number
E12LYTFS-118	3
E12LYTFS-137	4
E12LYTFS-156	5
E12LYTFS-187	5
E12LYTFS-200	5

**Figure 1 – Model Designator Definitions**



## E. ORDERING INSTRUCTIONS

When corresponding with Imo Pump regarding Series E12L pumps, refer to the pump nameplate, this instruction manual, and the assembly drawing as instructed below:

1. From pump nameplate, record the pump model number, serial number and manufactured date.
2. Record instruction manual number, revision and date.
3. From the instruction manual, record the figure numbers that apply to the replacement part(s).
4. From the assembly drawing or parts list (see Figures 3, 4, 5 and Table 3) provide the IDP number(s) and names for the replacement part(s).
5. Give the above information to your Imo service representative.\

Imo sales and service representatives are listed herein and in Imo General Installation Operation, Maintenance, and Troubleshooting Manual, SRM00046.

**F. OPERATION**

**F.1 LIQUID LIMITATIONS**

Never operate with thin liquids such as solvents or water. The pump is designed for liquids having the general characteristics of oil.

**F.2 OPERATING LIMITS**

<b>CAUTION</b>		<b>ATTENTION</b>
<p>Operating conditions, such as speed, fluid viscosity, temperature inlet pressure, discharge pressure, filtration, duty cycle, drive type, mounting, etc., are interrelated. Due to these variable conditions, the specific application limits may be different from that of the operational limitations. This equipment must not be operated without verifying system's operating requirements are within the pump's capabilities.</p>		

**Under no circumstances are the following operating limits (specified in Table 2) to be exceeded without specific approval from Imo Pump.**

**Table 2 – Normal Pump Operating and Structural Limits**

<b>MAXIMUM SPEED</b> .....	Rotor sizes 118 thru 156 4400 RPM Rotor size 187 thru 200 3600 RPM
<b>VISCOSITY</b> .....	45 SSU (5.8 cSt) Minimum – 3000 SSU (650 cSt) Maximum
<b>NOTE:</b> Consult factory for allowable operating viscosities at specific speeds and pressures. <b>DO NOT alter design viscosity without prior consultation with Imo Pump.</b>	
<b>MINIMUM – MAXIMUM LIQUID TEMPERATURE</b> .....	0 to 250F (-18 to 121C) <b>MAXIMUM</b>
<b>INLET PRESSURE</b> .....	200 psig
<b>NOTE:</b> Series 12L pumps are designed for positive inlet pressures. The unit should not be operated for extended periods of time with inlet pressure less than atmospheric.	
<b>MAXIMUM DISCHARGE PRESSURE</b> .....	Rotor Size 118, 4000 psig, Cont. Duty Rotor Sizes 137 thru 200 4500 psig, Cont. Duty
<b>NOTE:</b> Consult Imo Pump for 5000 psig operation	
<b>FILTRATION</b> .....	(See Imo General Installation Operation, Maintenance, and Troubleshooting Manual, SRM00046)
<b>DRIVE</b> .....	Direct only <b>ROTATION</b> .....Clockwise only facing pump shaft <b>MOUNTING</b> .....Foot or Flange mounted in any attitude

**G. PARTS LIST AND TORQUE TABLES**

**Table 3 – Pump Parts List**

IDP	QTY	DESCRIPTION	KIT	IDP	QTY	DESCRIPTION	KIT
1	1	Case		30	4	Bolt(s)	
2	2	Eyebolt(s)		31	1	Bearing Nut	XX
3	1	Housing	XX	32	1	Bearing Washer	XX
4	1	Housing	XX	33	2	Idler Rotor(s)	XX
5	1	Shim or Spacer	XX	36	1	Outboard Cover	
6	2	Back-up Rings(s)	X	37	1	Plug	
7	2	O-ring(s)	X	38	2	Plate, Sub-Assy(s)	
8	2	Vent Pin(s)		39	8	Cap Screw(s)	
9	1	Stop Pin		40	8	Cap Screw(s)	
10	1	O-ring	X	41	8	Dyna Seal(s)	
11	1	Plug		42	4	Lockwasher, Internal Teeth	
12	1	Inboard Cover		43	4	Cap Screw(s)	
13	1	O-ring	X	56	6	Drive Screw(s)	
14	1	O-ring	X	60	16	Lockwasher(s) ***	
15	1	Bal. Piston Bushing	XX	62	1	Spacer	
16	1	Spacer		63	1	Spring Pin	
17	1	Stop	XX	64	1	Spacer, Sub-Assy	
18	8	Cap Screw(s) (SEE NOTE)		65	1	Spacer	
19	5	O-ring(s)	X	66	1	Truarc Ring *	XX
20	5	Plug(s)		66	2	Cap Screw(s) **	XX
21	1	Inlet Head		67	2	Idler Rotor(s)	XX
22	1	Plug		70	1	O-ring	X
23	1	Power Rotor	XX	71	1	Set-Screw Cup	
24	1	Seal	X	72	3	Drive Screw(s)	
25	1	Truarc Ring(s)	X	74	1	LOCTITE	X
27	1	Key		75	4	Idler Rotor(s)	XX
28	1	Ball Bearing	X			Nameplate Module	
29	1	Retainer					

X = Minor Repair Kit Items.  
 XX = Major Repair Kit Items. (Items marked (X) are included in Major Repair Kit).  
 \* = For Rotor Sizes 118, 137 and 156  
 \*\* = For Rotor Sizes 187 and 200  
 \*\*\* = For Rotor Size 118 Only

**NOTE:** If Nylok cap screws (18) are assembled/disassembled more than 5 times, Imo suggests replacing with new Nylok cap screws.

**Table 4 – Fastener Tightening Torque Values**

IDP Number	ROTOR SIZE	ASSEMBLY Fig. Number	TORQUE VALUE (English)	TORQUE VALUE (Metric)
18 & 39	118	3	100 ±10 lb. ft.	135 ±14 Nm
18 & 39	137 & 156	4	160 ±10 lb. ft.	217 ±14 Nm
18 & 39	187 & 200	5	290 ±10 lb. ft.	393 ±14 Nm

## H. PUMP MAINTENANCE



### WARNING

Failure to observe precautions while installing, inspecting, and maintaining the pump can cause injury to personnel from accidental handling of liquids that may harm skin or clothing, or fire hazard risks from flammable liquids, or injury from high pressure fluid jets.



### DANGER

Before working on equipment, make sure all power to the equipment is disconnected and locked-out.

### H.1 GENERAL COMMENTS

**NOTE:** Part number identifiers (IDPs) contained within parenthesis such as (10) refer to the circled numbers shown on the assembly drawing. See Figure 3, 4 and 5, Tables 3 and 4.

### H.2 TOOLS REQUIRED

The procedures described in this manual require common mechanics hand tools, a torque wrench, dial indicator and suitable lifting device (such as) slings, straps, etc.

### H.3 PUMP DISASSEMBLY

**SPECIAL NOTE:** To service mechanical seal and ball bearings **ONLY**, perform H.3, Steps 1, 5 and H.4, Steps 3, 4, 7 and 8 **ONLY**.

### CAUTION

### ATTENTION

Fluid leakage from disassembly of pump may make the floor slippery and can cause personal injury.

### H. 4 Before starting pump disassembly perform the following:

- a. De-energize driver.
- b. Close all inlet and outlet valves.
- c. Vent pressure from pump and drain pumping liquid.
- d. Remove cap screws and lock washers from inlet and outlet flange fittings.
- e. Remove any O-rings from inlet and outlet flange grooves.
- f. Remove pump from driver by removing coupling hub and key (27) from power rotor (23) shaft.
- G. Remove pump from its mounting and locate on a suitable work bench.

**NOTE:** The Series E12L pumps incorporate highly finished precision parts that must be handled carefully to avoid damage to critical machined surfaces. The parts removed should be tagged for identification and their exact positions in the pump carefully noted so that new parts, or the same parts, are properly replaced without damage.



## H. 5 Remove Outboard Cover (Suction Side) – See Figures 3, 4 and 5

Remove cap screws (40) with Dyna seals (41) from outboard cover (36). Pull outboard cover slightly away from case (1) to release oil from inlet chamber of pump. Provisions must be made for oil spillage. Rotate power rotor (23) in opposite direction from normal to drain trapped fluid. Remove Dyna seals (41) from capped screws (40). Clean cap screws using LOCTITE Gasket Eliminator 504. Remove outboard cover (36) with sub-assembly from inlet head (21).

**NOTE:** The outboard cover (36) and sub-assembly consists of O-rings (14 & 19), plug (20), plate sub-assembly (38) and cap screws (43) with lockwashers (42).

Remove cap screws (43) and lock washers (42) and plate sub-assembly (38) from outboard cover (36). Remove O-rings (14 & 17) from grooves of outboard cover.

## H. 6 Remove Inlet Head (Suction Side)

Remove cap screws (39) and washers (60) and inlet head (21) from case (1). Remove O-rings (13 & 19) from grooves in case (1).

## H. 7 Remove Idler Rotors and Bearing Retainer

Remove idler rotors (67, 75 & 33) from bores of rotor housings (3 & 4) by rotating power rotor in the opposite direction of normal rotation. This will unscrew and release the idler rotors from the power rotor.

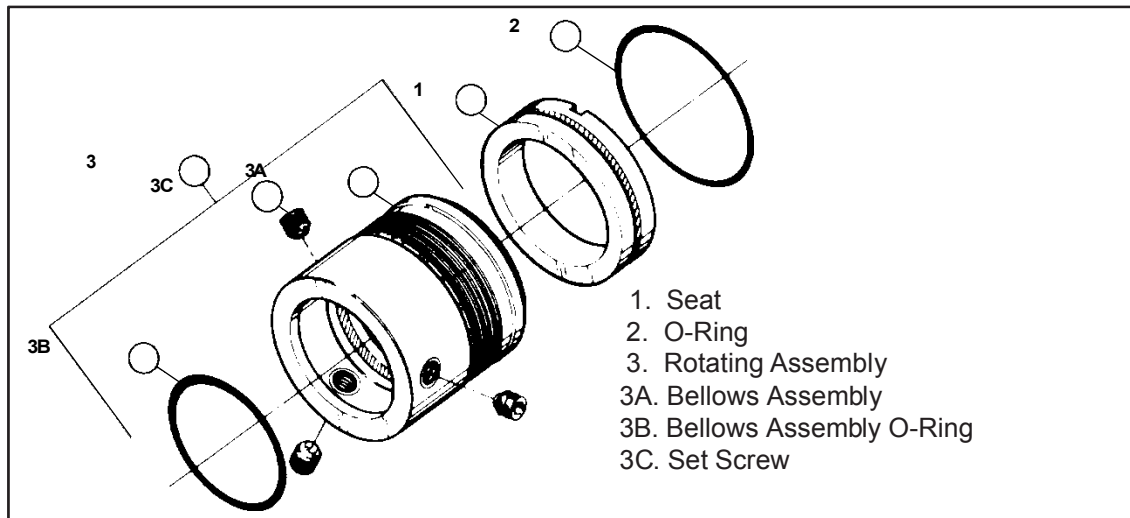
**NOTE:** Do not permit the idler rotors to drop as they emerge from housing (3). Remove hex bolts (30) and bearing retainer (29) from inboard cover (12).

## H. 8 Remove and Disassemble Power Rotor

Remove assembled power rotor (23) from pump. Disassemble power rotor assembly (23) as follows:

- a. Remove bearing nut (31) and washer (32).
- b. Using a bearing puller or arbor press remove ball bearing (28).
- c. Remove Truarc ring (25) from groove of power rotor (23).
- d. Remove spacer sub-assembly (64). Removal of spacer sub assembly (64) includes removal of spacer (62), spring pin (63) and mechanical seal stationary seat and O-ring (1 & 2) of Figure 2.
- e. Remove mechanical seal seat (1) and O-ring (2) of Figure 2 from spacer (62).
- f. Loosen set-screws (see Figure 2, (3C)) and slide mechanical seal rotating assembly (Figure 2, (3)) from power rotor (23).

**Figure 2 – Mechanical Seal (24)**



### H. 9 Remove and Disassemble Inboard Cover (Discharge side)

Remove cap screws (18) and (washers (60) 118 rotor size pump only) from inboard cover (12). Insert two 1/2"-13" x 2" jacking bolts in inboard cover (12). Tighten jacking bolts evenly to remove inboard cover from case (1). When cover removed from case remove jacking bolts.

**NOTE:** The inboard cover (12) removal includes removal of O-rings (70 & 7), back up ring (6), balance piston bushing (15), stop (17), Truarc ring (66) or cap screws (66) and plug (20).

Disassemble the inboard cover (12) as follows:


- a. Remove O-ring (70) from groove of inboard cover (12). Remove O-ring (7) and back-up ring (66) from groove of inboard cover (12).
- b. **For rotor sizes 118 to 156** – Remove Truarc ring (66) from groove of inboard cover (12).
- c. **For rotor sizes 187 and 200** – Remove cap screws (66) from stop (17).
- d. Remove stop (17) and balance piston bushing (15) from inboard cover (12).

Remove O-rings (19) from grooves of case (1).

**For rotor sizes 137 to 200** – Remove spacer (16) from case (1). Remove spacer (16) from case (1).

**For rotor sizes 137 and 187** – Remove spacer (65) from case (1).

Remove plug (11) with O-ring (10) from case (1). Remove stop pin (9) from case (1) by threading a 1/4"-20" x 2 1/2" bolt into bore of case and pulling stop pin from case.

	<b>CAUTION</b>	<b>ATTENTION.</b>
<b>DO NOT</b> drop housings as they emerge from case.		

- e. Remove housings (3 & 4) from case (1). Separate housings (3 & 4) and remove vent pins (8).
- f. Remove O-ring (7) and back-up ring (6) from groove of housing (4).

## I. 1 PUMP ASSEMBLY

**NOTE:** Prior to assembly, all parts should be cleaned and inspected for nicks and burrs. Replace all worn or damaged parts. Imo Pump recommends automatic replacement of mechanical seal (24), ball bearing (28) and O-rings (7, 10, 13, 14, 19 and 70) when these parts have been disturbed from their previously installed positions. Prior to assembly, wipe all parts including fasteners with a lubrication fluid that is compatible with the process liquid.

**NOTE:** When assembling the pump, refer to Figure 2 – Mechanical Seal, Figures 3, 4 and 5 – Assembly Drawings and Table 3 – Pump Parts List.

### I.2 Assemble and Install Housings into Case

Install back-up ring (6) and O-ring (7) in groove of housing (4). Install vent pins (8) in bores of housing (4). Install housing (4) in outboard end of case (1) with O-ring (7) and back-up ring (6) positioned toward inboard end of pump. Install housing (3) in case (1), ensuring that bores of housing (3) engage vent pins (8) installed in housing (4). Push housings into case (1) and align bore of housing (4) with stop pin (9) threaded bore in top of case. Use caution not to damage O-ring (7) during this assembly step. Install stop pin (9) in top of case (1), ensuring that stop pin is properly engaged in housing (4) slot. Install O-ring (10) on plug (11) and thread plug into bore in top of case (1).

### I.3 Assemble and Install Inboard Cover (Discharge Side)

**For Rotor sizes 137 to 200** – Install spacer (16) in case (1).

**For rotor sizes 137 and 187** – Install spacer (65) in case (1). Install back-up ring (6) and O-ring (7) in groove of inboard cover (12). Install balance piston bushing (15) and stop (17) on inboard cover (12).

**NOTE:** Back-up ring should be installed toward inboard end (discharge side) of pump when inboard cover (12) is installed.

**For rotor size 187 and 200** – Install cap screws (66) in stop (17).

**For rotor sizes 118, 137 and 156** – Install Truarc rings (66) in grooves of inboard cover (12). Install O-rings (19) in flange grooves of case (1). Using cap screws (18) and (washers (60) 118 rotor size only), assemble inboard cover (12) to case (1). Torque cap screws to values indicated in Table 4.

**NOTE:** Ensure the port of the inboard cover (21) is properly aligned with the case (1) port.

With the inboard cover (12), housings (3 & 4) and (spacer (16) if applicable) installed in case (1), push in all internal parts from outboard end (suction side) of pump until all parts are properly seated.

Using a depth gage, measure the distance from the exposed flat surface of housing (3) (**for rotor sizes 118, 156 or 200**) to flange of case (1) – OR – measure from spacer (65) (**for rotor sizes 137 or 187**) to case (1) to flange to determine required spacer (5) thickness. Subtract  $0.010 \pm .005$ " ( $0.25 \pm 0.13$  mm) from measurement.

**NOTE:** The working clearance between the inlet head (21) and spacer (5) is  $0.010 \pm 0.005$ " ( $0.25 \pm 0.13$ mm).

<b>CAUTION</b>	<b>ATTENTION</b>
Machining or grinding capabilities maybe required to ensure spacer (5) meets proper fit-up dimensions. If spacer (5) is not properly fitted, pump damage or failure may occur.	

Machine spacer to required thickness as determined above – OR – build-up layers of shim material to obtain the required thickness. Shim layers are 0.003 inches (0.08mm) thick. Install the shim/spacer (5) with proper thickness into case (1).

**I.4 Assemble Power Rotor**

Assemble power rotor (23) as follows:

- a. Install rotating assembly (3) (see Figure 2) of mechanical seal (24) onto power rotor (23). Push assembly next to cut shoulder on rotor shaft. Tighten set-screws (3C) (see Figure 2).
- b. Install O-ring (2) (see Figure 2) on stationary seat (1) of mechanical seal (24).

Install stationary seat and O-ring in spacer (62). Ensure that spring pin (63) engages slot in stationary seat.

- c. Install spacer (62) on power rotor (23) and lock-in using Truarc ring (25) in groove of rotor shaft.

<b>CAUTION</b>	<b>ATTENTION</b>
Bearing service life could be significantly reduced if the bearing is pushed on by its outer race ring.	

- d. Using a arbor press, install bearing (28) on power rotor (23). Press ONLY on inner race of bearing (28) when installing.
- e. Install washer (32) and nut (31) on rotor shaft (23).
- f. Install O-ring (70) in groove in the inboard cover (12).

**I.5 Install Power Rotor (Discharge Side)**

Install power rotor (23) into inboard cover (12) and pump case (1). Center each part as it enters the inboard cover (12). Install retainer (29) and bolts (30). Torque bolts to 25 ± 2 lb. ft. (33.9 ± 2.7 Nm)

**I.6 Install Idler Rotors (Suction Side)**

- a. Install idlers (33, 75 and 67) into idler bores of housings (3 & 4) from outboard end of pump. Mesh idlers with threads of power rotor and rotate power rotor (23) in normal pump rotation direction. Idlers will thread into pump housing. Install O-rings (13 & 19) in outboard flange grooves of case (1). Install inlet head (21) into case (1) ensuring that the inlet head idler balance drillings are properly aligned with the idler balance drillings of the case. Install cap screws (39) and (washers (60) 118 rotor size only) to secure inlet head to case. Torque cap screws to values indicated in Table 4.

**NOTE:** Inlet head (21) may be rotated in 90 increments from position shown in Figures 3, 4 and 5.

## **I.7 Install Outboard Cover**

Install O-rings (14 & 19) in grooves of outboard cover (36). Install plate sub-assembly (38) on outboard cover (36) using cap screws (43) and lockwashers (42). Install Dyna seals (41) on cap screws (40) using a thin coat of LOCTITE Gasket Eliminator 504. Using cap screws (40) and Dyna seals (41) secure outboard cover (36) to inlet head (21). Torque cap screws to  $50 \pm 5$  lb. ft. ( $68 \pm 7$  Nm).

**NOTE:** Use caution when installing plate sub-assembly (38) to avoid damage to O-rings (14 & 19). Also ensure that plate (38) oil ports are properly aligned with idler rotors (67).

### **CAUTION**

Ensure that "CAUTION" nameplate mounted on the outboard cover (36) is installed in the proper position with arrows aligned with case eyebolts (2). Also check that the oil ports in plate (38) are aligned with idler rotors (67).

## **I.8 Install Pump to Mount and Reconnect Couplings**

Assemble key (27) and pump coupling hub to power rotor shaft (23). Install pump on foundation or bracket. Reconnect all piping to pump.

## **I.9 Align Pump and Driver**

Perform alignment of pump and driver as specified in in Imo General Installation Operation, Maintenance, and Troubleshooting Manual, SRM00046.

## **J. TROUBLESHOOTING**

For assistance with troubleshooting see **Imo** General Installation, Operation, Maintenance, and Troubleshooting Manual, (No. SRM00046)

## **K. FIELD AND FACTORY SERVICE AND PARTS**

Imo Pump maintains a staff of trained service personnel that can provide pump installation, pump start-up, maintenance/overhaul and troubleshooting supervision as well as installation and maintenance training.

Our factories provide maintenance as well as overhaul and test facilities in the event the user prefers to return pumps for inspection or overhaul. Pumps that have been factory-overhauled are normally tested and warranted "as-new" for a period of one year from date of shipment. For either field service or factory overhaul assistance, contact your local Imo Sales Office or representative at the Technical/ Customer Service Department in Monroe, NC, USA.

Most pumps have repair kits available. Minor Repair Kits are used to repair leaking seals, bad bearings and/or for re-assembly after pump tear-down. They include (as applicable) pump shaft seals, packing, all gaskets/O-rings and bearings. Major Repair Kits are sufficient to rebuild completely worn-out pumps to "as-new" condition. They include all parts found in Minor Repair Kits plus all major internal parts subject to wear. Since kits have all the necessary parts, it is preferred that they be purchased rather than selecting individual parts. When parts are individually selected from the Parts List, some needed components are often overlooked. In addition, mixing worn or used parts with new parts risks rapid wear and shortened service life from the new parts.

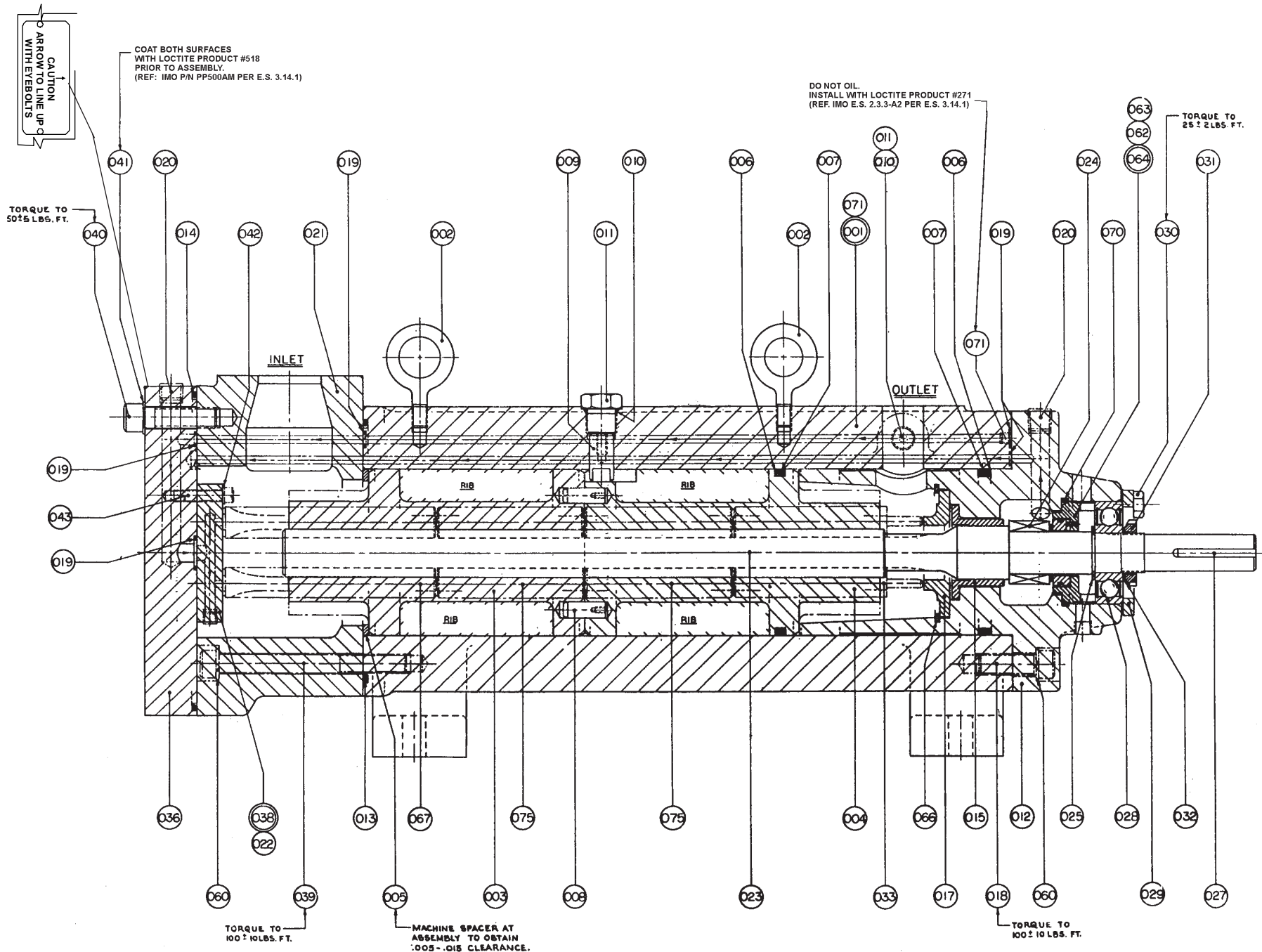


FIGURE 3 - PUMP ASSEMBLY - ROTOR SIZE 118

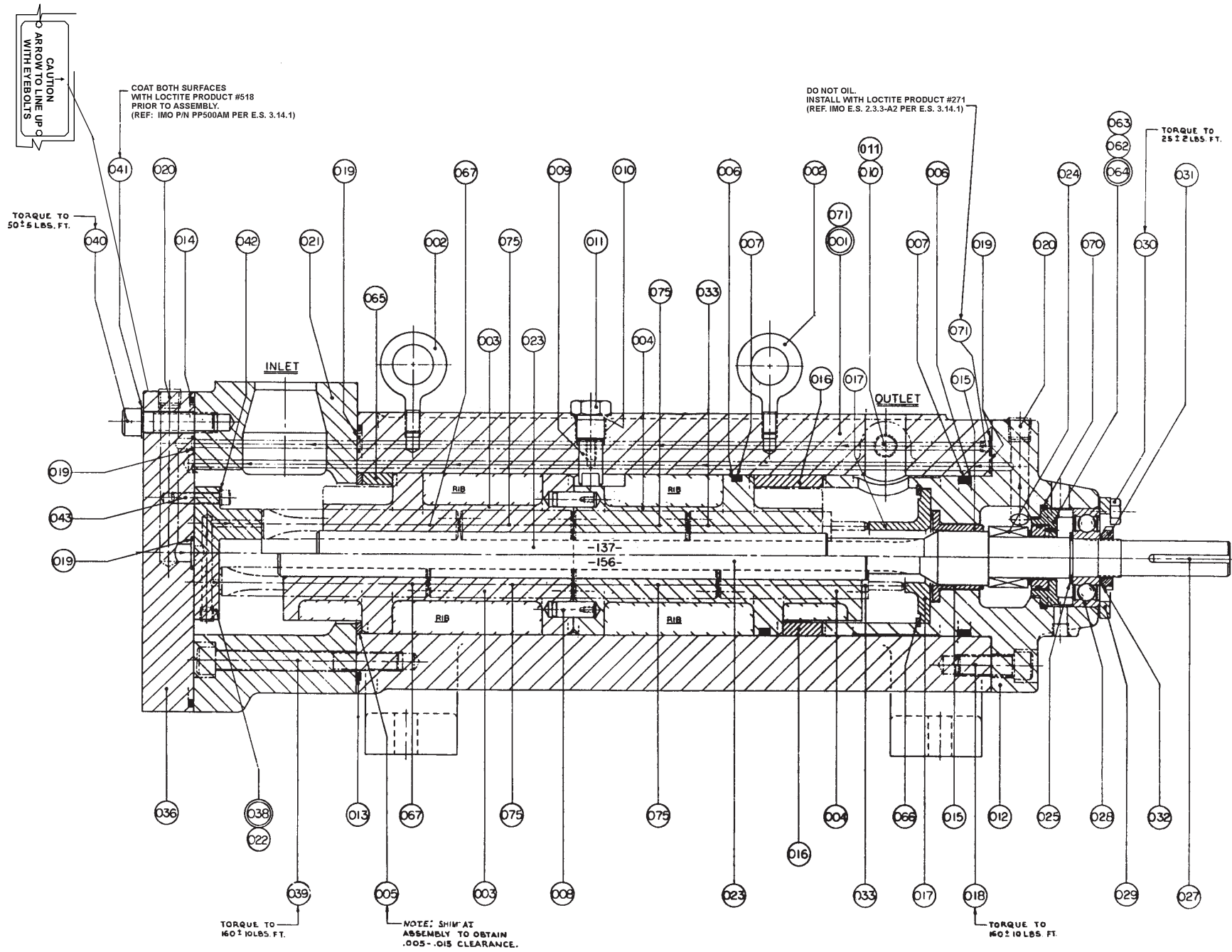


FIGURE 4 – PUMP ASSEMBLY – ROTOR SIZES 137 & 156

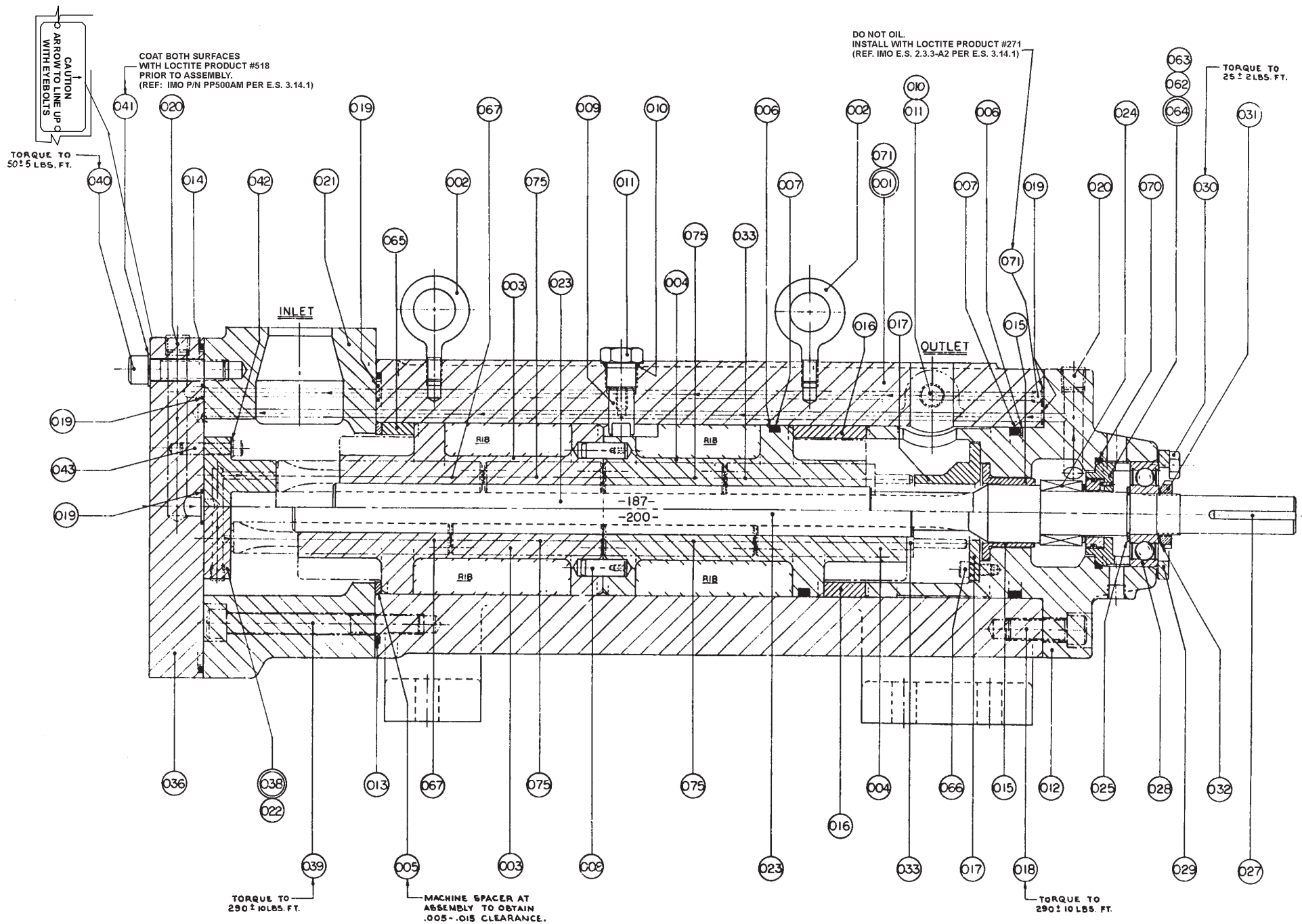
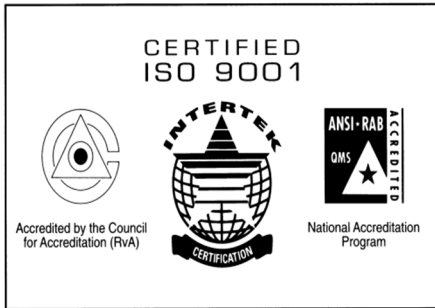


FIGURE 5 – PUMP ASSEMBLY – ROTOR SIZES 187 & 200





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