



PRODUCT SERVICE MANUAL

FOR

CIG Lip Seal & Weep Hole Design

Single Pump



WARNING

The Imo General Installation Operation, Maintenance, and Troubleshooting Manual, (No. SRM00046), as well as all other component manuals supplied with these type units should be read thoroughly prior to pump installation, start-up, operation, maintenance or troubleshooting.

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READ THIS ENTIRE PAGE BEFORE PROCEEDING

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

	DANGER
Failure to observe the precautions noted in this box can result in severe bodily injury or loss of life.	

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

CAUTION	ATTENTION
Failure to observe the precautions noted in this box can cause damage or failure of the equipment.	

Non-compliance 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 the pump and/or protection of the pump itself are marked by the sign: <div style="text-align: center;">ATTENTION</div>
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ATTENTION
<p>If operation of this 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.</p>

A. GENERAL INSTRUCTIONS

The instructions found herein cover the disassembly, assembly and parts identification of CIG lip seal and weep hole design single 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 the Imo General Installation Operation, Maintenance, and Troubleshooting Manual, (No. 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.

This manual cannot possibly cover every situation connected with the installation, operation, inspection, and maintenance of the equipment supplied. Every effort was made to prepare the text of the manual so that engineering and design data is transformed into the most understandable wording. Imo Pump must assume the personnel assigned to operate and maintain the supplied equipment and apply this 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 CIG lip seal and weep hole single pumps. This series of pumps has been designed for use in hydraulic, lubricating seal and fuel oil applications. 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 CIG lip seal and weep hole single pumps are positive displacement, internal gear pumps consisting of a single shaft that runs through the center of pump housings. This shaft drives the external gears (pinion gears) which in turn drives the internal gears (ring gears). Fluid is carried between the internal and external gear teeth of each pump and is discharged as the teeth mesh. The pinion and ring gears are separated in each pump by a crescent which is a sealing element in the pump between inlet and discharge ports.

D. PUMP MODEL IDENTIFICATION

This instruction manual covers the Imo CIG lip seal and weep hole single series pumps. The model of each pump is identified on the pump nameplate. Refer to Figure 1 for instructional keys when using this manual.

E. ORDERING INSTRUCTIONS

When corresponding with Imo Pump regarding CIG Single Series 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. Also record the manufactured lot number and date (these are stamped on the housing near the nameplate).
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 instruction manual (see Table 1, Pump Parts List) provides 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 General Instruction Manual, CA-1.

F. OPERATION

LIQUID LIMITATIONS

Never operate with fluids that are corrosive to iron, steel, aluminum or bronze. The pump is designed for fluids having the general characteristics of oil.

CAUTION	ATTENTION
<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 verification that operating requirements are within its capabilities.</p>	

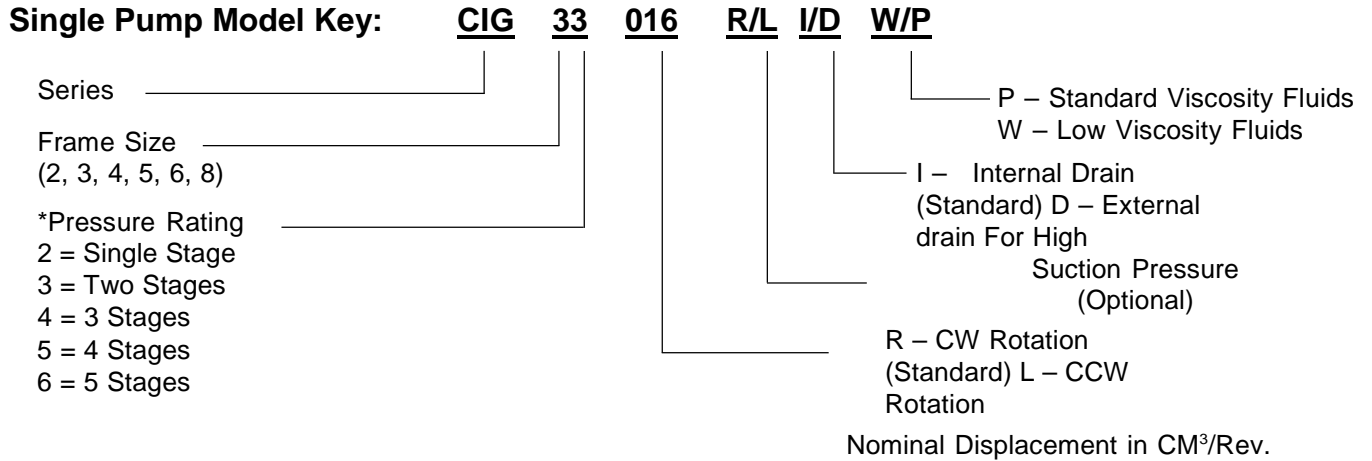


Figure 1 – Single Pump Configuration

G. PUMP DISASSEMBLY

Refer to Assembly 1 for one stage (X1, X2) pumps
Refer to Assembly 2 for multistage (X3, X4, X5, X6) pumps

1. Remove drive key (36)
2. Remove capscrews (38) and end cover (15) with O-ring (35).
3. Remove capscrews (39) and washers (34) (Washers not used on single stage units).

CAUTION	ATTENTION
In next step, ring gear (12), pinion (11) and key (13) will be removed. If ring (12) and pinion (11) are to be reused, identify them, with a marker or the like, so it can be determined to which housing they belong (if there is more than one housing in pump) and which direction face of each gear was positioned in housing. Do not mark with scribe or punch as this may leave a burr or high spot which could lead to pump damage or seizure. If key (13) is to be reused, mark it so that it can be assembled into its original stage and facing its original direction.	

4. Remove square housing (4), ring gear (12), pinion gear (11) and key (13) from shaft (6). Do not permit dowel pin (37) to drop as housing (4) is removed. Remove dowel pin (37) from square housing (4), front cover (1), or back of round housing (3) whichever is applicable.

NOTE: If square gear housing (4) will not slide easily off shaft (6) and pump is a one stage unit, clamp square housing (4) in a vise with front cover (1) free. With a soft headed hammer, tap alternately on mounting ears of front cover (1) until there is sufficient gap to insert a wedging device between the square housing (4) and front cover (1). If pump has more than one stage, clamp pump in a vise with square housing (4) free. With a soft headed hammer, tap on corners of square housing (4) until there is sufficient gap between square housing (4) and back of round housing (3) to insert a wedging device. Pry the gap until square housing (4) is free to slide off shaft.

CAUTION	ATTENTION
Take care not to damage either faces that are being pried against or O-ring (41) with prying device.	
CAUTION	ATTENTION
If gear housing (4) did not slide off easily because its bushing (53) was seized on shaft (6), ball bearing (31) was most likely damaged when housing (4) was pried off and it must be replaced. Alternately, if gear housing (4) will not slide off easily because its rabbet was jammed in either front cover (1) counter bore, if single pump, or housing tube (8) if multi-stage pump, ball bearing (31) may not have to be replaced.	

NOTE: If housing (4), ring gear (12) or pinion gear (11) cannot be removed without applying excessive force, pump should be returned to Imo for further disassembly and inspection.

5. If unit has only one stage, proceed to step #9. If pump has more than one stage, continue with step #6.
6. Remove housing tube (8). Remove O-rings (41) from rabbets on square housing (4) and round housing (3).

NOTE: Neither housing tube (8) nor O-ring (41) need be removed from round housing (3) unless O-rings (41) are to be replaced.

(Replacing O-rings is good practice when a pump is disassembled after extended service or if damaged during disassembly.)

CAUTION	ATTENTION
<p>In next step, ring gear (12), pinion (11) and key (13) will be removed. If ring (12) and pinion (11) are to be reused, identify them, with a marker or the like, so it can be determined to which housing they belong (if there is more than one housing in pump) and which direction face of each gear was positioned in housing. Do not mark with scribe or punch as this may leave a burr or high spot which could lead to pump damage or seizure. If key (13) is to be reused, mark it so that it can be assembled into its original stage and facing its original direction.</p>	
CAUTION	ATTENTION
<p>In next step, ring gear (12), pinion (11) and key (13) will be removed. If ring (12) and pinion (11) are to be reused, identify them, with a marker or the like, so it can be determined to which housing they belong (if there is more than one housing in pump) and which direction face of each gear was positioned in housing. Do not mark with scribe or punch as this may leave a burr or high spot which could lead to pump damage or seizure. If key (13) is to be reused, mark it so that it can be assembled into its original stage and facing its original direction.</p>	

- Remove round housing (3), ring gear (12), pinion gear (11) and key (13) from shaft (6). Do not permit dowel pin (37) to drop as round housing (3) is removed. Remove dowel pin (37) from either round housing (3) or front cover (1) whichever is applicable.

NOTE: If round gear housing (3) will not slide easily off shaft (6), and this is the last round housing (3) to be removed, clamp it in a vice with front cover free (1). With a soft headed hammer, tap alternately on mounting ears of front cover (1) to separate it from round housing (3). When there is sufficient gap between front cover (1) and round housing (3), insert wedging device. Pry gap until round housing (3) is free to slide off shaft. If there are several round housings (3) to remove, clamp pump with a vice with round housings (3) furthest from driver end free. Position a wedging device between the round (housings). Pry gap until rearmost round housing (1) is free to slide off shaft (6).

CAUTION	ATTENTION
<p>Take care not to damage either faces that are being pried against or O-ring (41) with prying device.</p>	
CAUTION	ATTENTION
<p>If gear housing (3) will not slide off easily because its bushing (53) was seized on shaft (6), ball bearing (31) was most likely damaged when housing (3) was pried off and must be replaced. If gear housing (3) will not slide off easily because its rabbet was jammed in either front cover (1) counterbore, in single pump, or housing tube (8) if multi-stage pump, ball bearing (31) may not have to be replaced.</p>	

NOTE: If housing (3), ring gear (12) or pinion gear (11) cannot be removed without applying excessive force, unit should be returned to Imo for further disassembly and inspection.

- Repeat steps 6 & 7 until all round housings (3) are removed.
- Remove O-ring (41) from front cover (1) if it did not come off with last housing removed.
- Remove capscrews (42) from seal housing (9), or (70) if "weep hole" design (see assembly drawing "inset").
- Remove shaft (6) from front cover (1). Removal of shaft also removes seal housing (9), or (70) if "weep hole" design, outside lip seals (32), where applicable, ball bearing (31), and bearing retaining ring (33).

CAUTION	ATTENTION
<p>Be sure that all gear keys (13) are removed before removing shaft (6). If not, the front cover (1) face will be damaged.</p>	

- Remove seal housing (9), or (70) if "weep hole" design, with lip seals (32), if applicable, from shaft (6).

13. If lip seals (32) are to be replaced, remove them from seal housing (9), or (7) if "weep hole" design, and discard.
14. If ball bearing (31) is to be replaced, remove snap ring (33) from shaft (1), press ball bearing (31) off shaft (1) and discard.
15. If inside lip seal (51) is to be replaced, remove spacer (50), or (69) if "weep hole" design, and then remove and discard lip seal (51).

H. INSPECTION OF PARTS

1. BALL BEARING – Ball bearings should be free turning and quiet. Their grease should have a soft consistency and not look or smell burned.
2. GEAR FACES – Some light scratching is acceptable, but if there is any scoring, the part should be replaced. These faces cannot be ground to remove a heavy score mark because their width is critical to performance of pump. Grinding more than several ten thousandths of an inch will cause low capacity. If the face is not flat, pump seizure could occur.

NOTE: Rings are provided with rework other than light stoning or cleaning of gears or gear housings is not recommended. New gear housing sleeve bearing factory installed.

3. RING GEAR OD – Light scratching and polishing is acceptable. If scoring is present, ring gear should be replaced.
4. HOUSING
 - a. Faces – Some light scratching is acceptable, but if there is any scoring, the part should be replaced.
 - b. Crescent – This piece should be checked for gouges or scoring. If the marking is severe, housing should be replaced.
ID – If any scoring is present, housing should be replaced.
5. SHAFT – Check shaft for wear, particularly areas where lip seals and bushings are located when pump is assembled. Any heavy wear is cause for shaft replacement. Check edges of keyways for cracks, chipping or rounding. If any of these exists, shaft should be replaced.
6. SLEEVE BEARING – If scoring or heavy polishing is present, bearing must be pressed out of housing, replaced and sized (see machining instruction on next page).
7. FRONT COVER – If faces are scored or heavily scratched, they must be machined per machining instructions. Check ball bearing seating area in front cover after severe ball bearing failure. If ball bearing seating OD is badly scored, deburr it before pump assembly.
8. LIP SEAL – If seal edge is flat or damaged or elastomer is deteriorated, replace lip seals.

I. MACHINING INSTRUCTIONS

The front cover (1) can usually be restored to as-new condition by machining damaged faces. Sleeve bushings (53), (54) and intermediate cover usually require replacement when cover is machined. To repair damage to face of front cover (Figure 2 on next page) and to replace sleeve bushings (C) proceed as follows:

1. Press out sleeve bushing (53) from front or intermediate covers.

NOTE: If pump is equipped with bronze bearing, consult factory.

2. Place front cover or intermediate cover in a lathe and indicate face (A) and counter bore (B) square and concentric with respect to bore C within .0008 inch TIR.
3. Machine face (A) deep enough to remove any scored material. Ensure that face is flat within .0008 inch TIR with a 32 micro inch finish.

CAUTION	ATTENTION
Being out of flat in excess of .0008" can cause pump failure.	

NOTE: If more than .015" is machined (removed) from face (A, Figure 2), the same amount should be machined removed) from G and F, Figure 2.

4. Press sleeve bushing (53) in from front cover or intermediate cover ensuring that split in bushing (53), is positioned as shown in Figure 2.
5. Fabricate a bushing sizing tool as shown in Figure 3. Press sizing tool through bushing from same direction bushing was originally installed to properly size bushing bore.

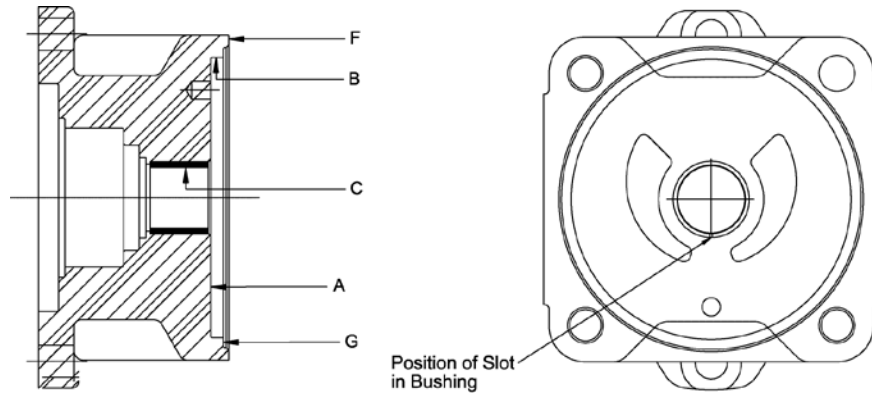
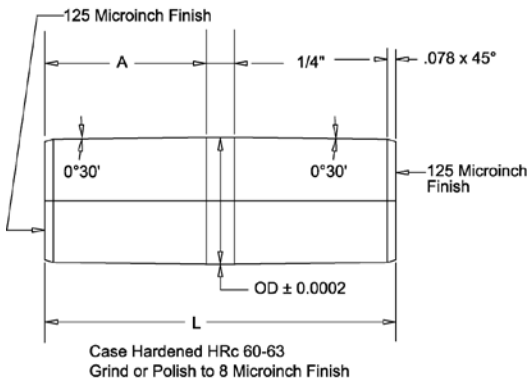


Figure 2 – Front Cover



Frame Size	"L"	"A"	"OD"
	in.	in.	in.
2	2.284	0.984	0.712
3	2.677	1.181	0.87
4	3.071	1.378	1.1062
5	3.465	1.575	1.382
6	4.252	1.969	1.776
8	5.039	2.362	2.17

Figure 3 – Sleeve Bearing (053), (054) Sizing Tool

J. SPARE PARTS AND KITS

IDP	Qty.	Description	Seal Kit	Shaft Kit	Round Hsg. & Gear Kit	*Square Hsg. & Gear Kit
1	1	Front Cover				
3	–	Round Housing			X	
4	1	Square Housing				X
6	1	Shaft		X		
8	1	Housing Tube				
9	1	Seal Housing				
11	–	Pinion Gear			X	X
12	–	Ring Gear			X	X
13	–	Key		X		
15	1	Rear Cover				
31	1	Ball Bearing		X		
32	2	Outside Seal	X			
33	1	Bearing Snap Ring		X		
34	4	Tie Rod Washers				
35	1	Rear Cover O-Ring	X			
36	1	Shaft Key		X		
37	–	Housing Pin				
38	4	Rear Cover Bolts				
39	4	Tie Rod Bolts				
41	–	Housing O-Ring	X			
42	4	Seal Housing Bolts				
50	1	Seal Spacer				
51	1	Inboard Seal	X			
53	–	Sleeve Bushing			X	X
69	1	Weep Hole Spacer				
70	1	Seal Housing (Weep Hole Design)				

* Housings and gears cannot be sold separately since they are matched sets.

Table 1 – Pump Parts List

K. REASSEMBLY OF PUMP

CAUTION	ATTENTION
READ THIS ENTIRE PROCEDURE <u>BEFORE</u> ASSEMBLING PUMP	

NOTE: Inspect all running surfaces for scratching, scoring and wear prior to assembly of pump. Minor scratching is acceptable. If parts are heavily scratched or scored, they should be replaced. Thoroughly clean all pump components.

	WARNING
Follow the suppliers recommendations when using cleaning fluids.	

NOTE: Imo Pump recommends replacement of all “O” rings, lip seals, and ball bearing every time these parts are disturbed from their original installed position. If “O” rings and lip seals are, in general, not to be replaced, they must be thoroughly inspected for nicks, cuts or other damage. If any individual “O” ring or lip seal is damaged, it must be replaced.

CAUTION	ATTENTION
If ball bearing (31) was removed from shaft (6), it <u>must</u> be replaced. Lip seal (32) <u>must</u> also be replaced (<u>do not</u> install lip seal until told to do so).	

NOTE: Refer to “Inspection of Parts” for additional information on part inspection and replacement. To assist in assembly, wipe all parts with light lubricating oil, if appropriate and available, to be pumped.

NOTE: Prior to assembly, remove all nicks and sharp edges on housings and gears with de-burring stone. Particular attention should be paid to kidney port chamfers in housings, to faces of ring and pinion gears and to areas of housings that were pried apart on disassembly. Avoid excessive breaking of edges at outside diameter of ring gear as this could negatively affect flow rate. When reinstalling gears in housings, be sure gears are installed in housings from which they were removed and face direction from which they were removed.

Refer To Assembly 1 For One Stage (X1, X2) Pumps
Refer To Assembly 2 For Multi-Stage (X3, X4, X5, X6) Pumps

1. Press ball bearing (31) onto shaft (6), pressing only on inner race, until it contacts its mating shoulder on shaft (6).

CAUTION	ATTENTION
Pressing bearing (31) on via its outer race will likely damage it, leading to reduced service life or failure.	

2. Install ball bearing snap ring (33) onto shaft (6).
3. Press lip seal(s), one at a time, into seal housing (9), or (70) for “weep hole” design, if applicable.

CAUTION	ATTENTION
Be sure to press only on outside diameter of lip seal(s) 32.	

NOTE: Lip seal(s) (32) must be installed facing direction shown on assembly drawing.

4. Wipe small amount of grease on edges of lip seal(s) (32) for lubrication.
5. Wipe small amount of grease on edge of inside lip seal (51) and install lip seal (51) in front cover (1). Be sure lip is facing direction shown on assembly drawing.
6. Install seal spacer (50), or (69) if “weep hole” design, into front cover. (Frame size 2 and 3 standard design pumps do not have this spacer.) If spacer (50) is on standard design pump, it will have a counter-bore which must be installed facing toward seal housing (9).
7. Install shaft (6) assembly with ball bearing (31) and snap ring (33) into front cover (1).
8. Install O-ring (40) onto seal housing (9) rabbet or in seal housing (70) groove, whichever is applicable.
9. Install seal housing (9), or (70) for “weep hole” design in front cover (1) and secure with capscrews (42). Torque capscrews, with torque wrench, to torque values on assembly drawing.
10. Install first stage key (13), chamfer side up, into keyway of shaft (6) and push it up as far as possible toward drive end of pump.

NOTE: If key (13) has a step, install key (13) with step facing up and away from front cover (1).

CAUTION	ATTENTION
When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and front cover (1) face. If not, it should be removed and a small step filed in the portion of the keyway that sticks above shaft keyway to prevent key (13) from touching front cover (1) face.	

11. Install first stage pinion gear (11) on shaft (6). Pinion gear (11) should slide freely on shaft (6) and key (13). If not, ensure key (13) is properly installed and shaft (6) and pinion (11) keyway are free of burrs. Ensure pinion (11) is installed in stage from which it was removed and is facing direction from which it was removed.

CAUTION**ATTENTION**

If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.

12. Install ring gear (12) in first stage square gear housing (4) if single stage unit, or round gear housing (3) if multi- stage unit. Ensure ring gear (12) is installed in stage from which it was removed and is facing direction from which it was removed if pump has more than one stage.

CAUTION**ATTENTION**

If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.

13. Install O-ring (41) on first stage square gear housing (4) if single stage unit, or round gear housing (3) if multi- stage unit. Ensure ring gear (12) is installed in stage from which it was removed and is facing direction from which it was removed if pump has more than one stage.

CAUTION**ATTENTION**

If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.

14. Install O-ring (41) on first stage square gear housing (4) if single stage unit, or round gear housing (3) if multi-stage unit.
15. Install dowel pin (37) in front cover (1).
16. Install first stage gear round gear housing (3), or square gear housing (4) if single stage pump, with installed ring gear (12), onto shaft (6). Ensure dowel pin (37) engages dowel pin hole in front cover (1) and pinion gear (11) installed on shaft (6) is properly positioned to enter gear housing (3).

NOTE: If single stage pump, proceed to Step 31 to complete assembly. If multiple stage pump, continue below with Step 16.

17. Install O-ring (41) on back of first stage gear housing (3).
18. Install housing tube (8) on back of first stage gear housing (3).
19. Install second stage key (13), chamfer side up, into keyway on shaft (6) and push it up as far as possible toward drive end of pump.

NOTE: If key (13) has a step, install key (13) with step facing up and away from front cover (1).

CAUTION**ATTENTION**

When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and front cover (1) face. If not, it should be removed and a small step filed in the portion of the keyway that sticks above shaft keyway to prevent key (13) from touching front cover (1) face.

20. Install second stage pinion gear (11) on shaft (6). Pinion gear (11) should slide freely on shaft (6) and key (13). If not, ensure key (13) is properly installed and shaft (6) and pinion (11) keyway are free of burrs. Ensure pinion (11) is installed in stage from which it was removed and is facing direction from which it was removed.
21. Install ring gear (12) in second stage round gear housing (3). Ensure ring gear (12) is installed in stage from which it was removed and is facing direction from which it was removed.

CAUTION	ATTENTION
<p>If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.</p>	

22. Install O-ring (41) on second stage gear housing (3).
23. Install dowel pin (37) back face of previous stage.
24. Install second stage round gear housing (3), with installed ring gear (12), onto shaft (6). Ensure dowel pin (37) engages dowel pin hole in back face of previous stage and pinion gear (11) installed on shaft (6) is properly positioned to enter gear housing (3).
25. Repeat steps 16 through 23 for third and fourth stage round gear housings (3) if applicable.
26. Install key (13) for last stage square housing (4), chamfer side up, into keyway of shaft (6).

NOTE: If key (13) has a step, install key (13) with step facing up and away from back face of previous stage.

CAUTION	ATTENTION
<p>When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and front cover (1) face. If not, it should be removed and a small step filed in the portion of the keyway that sticks above the shaft keyway to prevent key (13) from touching front cover (1) face.</p>	

27. Install pinion gear (11) for square housing (4) on shaft (6). Pinion gear (11) should slide freely on shaft (6) and key (13). If not, ensure key (13) is properly installed and shaft (6) and pinion (11) keyway are free of burrs. Ensure pinion (11) is installed in stage from which it was removed and is facing direction from which it was removed.

CAUTION	ATTENTION
<p>If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.</p>	

28. Install ring gear (12) in last stage square gear housing (94). Ensure ring gear (12) is installed in stage from which it was removed and is facing direction from which it was removed.

CAUTION	ATTENTION
<p>If gears are installed in wrong housing, pump may not perform properly or may seize during operation. This is because gears are matched to each housing individually and may not have correct clearances if installed in another housing. If gears are installed facing wrong direction, pump may not perform properly or may seize during operation. This is because some gears have chamfers on only one side. These chamfers must be positioned facing inside of housing so that there will be no interference with housing radii.</p>	

29. Install O-ring (41) on last stage gear housing (4).
30. Install dowel pin (37) in back of previous stage round housing (3).
31. Install last stage (square) gear housing (4), with installed ring gear (12), onto shaft (6). Ensure dowel pin (37) engages dowel pin hole in back face of previous stage round housing (3) and pinion gear (11) installed on shaft (6) is properly positioned to enter gear housing (4).
32. Install washers (34) on capscrews (39) with chamfer on washers (34) facing head of capscrews (39). Install capscrews (39), with washers (34) installed, and tighten with torque wrench to torque values on assembly drawing. Torque one-half value for all capscrews first, then torque to full specified torque value. Capscrew tightening pattern should be across opposite corners for both half torque and full torque tightening.

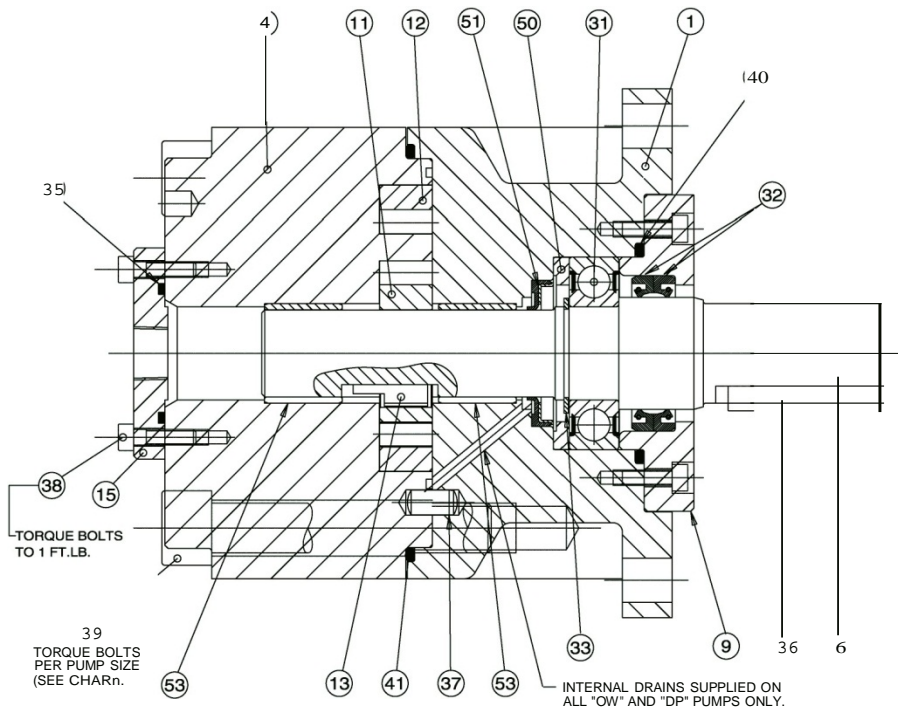
CAUTION	ATTENTION
<p>With capscrews (39) torqued to full value, pump shaft must turn freely by hand and without significant internal snagging. Otherwise, unit has not been properly assembled.</p>	

33. Install O-ring (35) into rear cover (15). If necessary, use a small dab of grease to hold O-ring (35) in place.
34. Install end cover (15) on square gear housing (4) using capscrews (38). Tighten capscrews (39) with torque wrench to torque values on assembly drawing.
35. Install coupling key (36) in keyway of shaft (6).

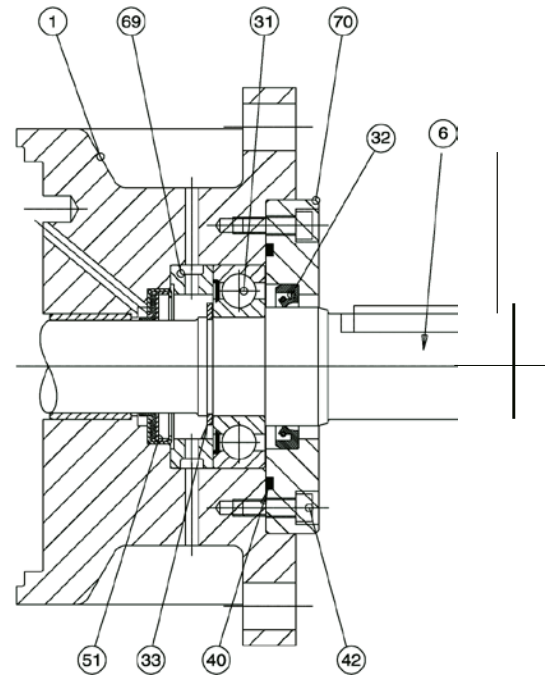
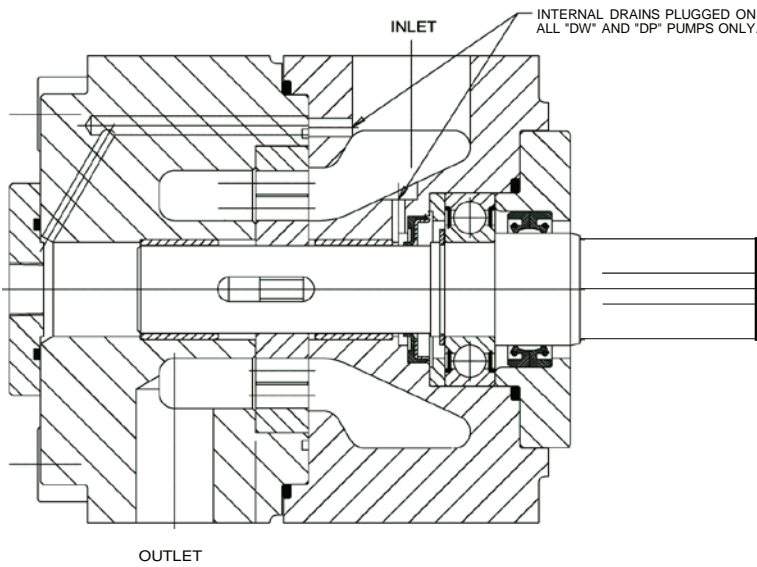
CAUTION	ATTENTION
<p>Take care not to bump shaft during storage, transportation, or installation of pump into operating system.</p>	

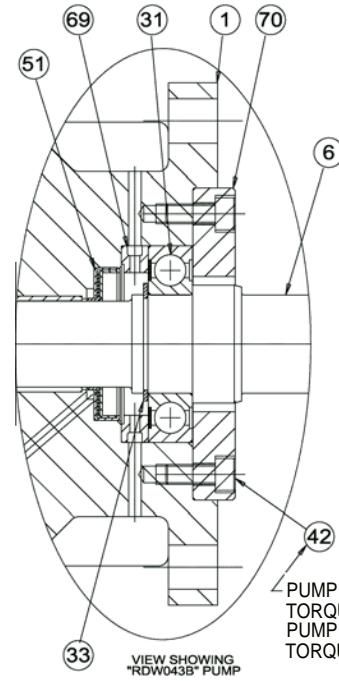
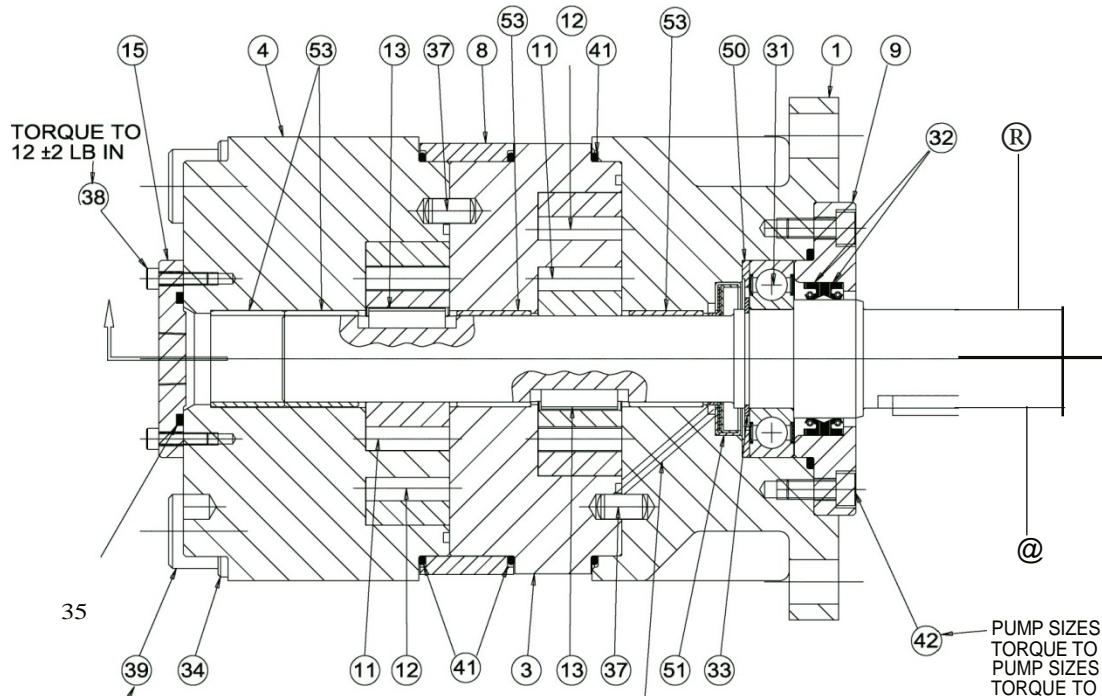
L. TROUBLESHOOTING

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



"X2" TORQUE TABLE				
FRAME SIZE	BOLT SIZE	PUMP MODIFICATION	TORQUE	
			LB FT	N.m
2	M10	W	30±2	41
		P		
3	M12	W	60±5	81
		P		
4	M16	W	115±10	156
		P		
5	M20	W	220±15	298
		P		
6	M24	W	435±15	590
		P		
8	M30	W	870±25	1180
		P		





TORQUE TO
12 ±2 LB IN

35

SEE TORQUE CHART

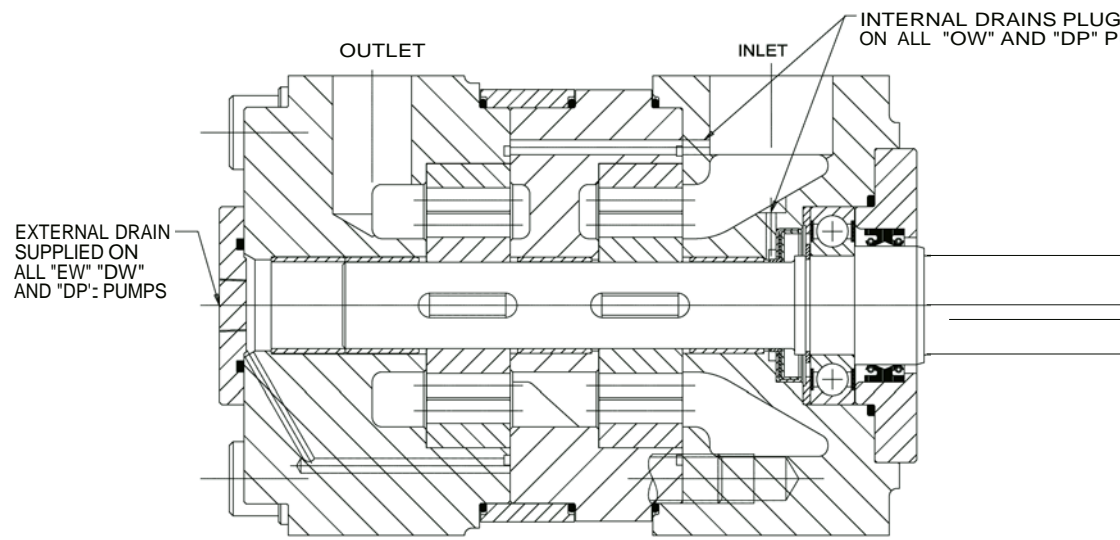
-INTERNAL DRAIN SUPPLIED
ON ALL "OW" AND "DP" PUMPS

PUMP SIZES 2,3 & 4
TORQUE TO 12±2 LB IN
PUMP SIZES 5,6 & 8
TORQUE TO 24±2 LB IN

PUMP SIZES 2,3 & 4
TORQUE TO 12±2 LB IN
PUMP SIZES 5,6 & 8
TORQUE TO 24±2 LB IN

VIEW SHOWING
"RDW0439" PUMP

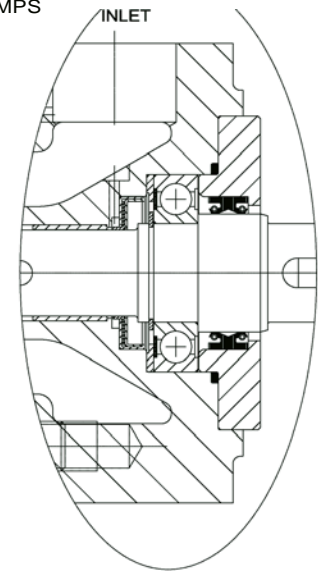
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EXTERNAL DRAIN
SUPPLIED ON
ALL "EW" "DW"
AND "DP" PUMPS

INTERNAL DRAINS PLUGGED
ON ALL "OW" AND "DP" PUMPS

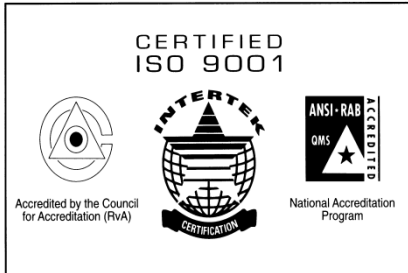
13



VIEW SHOWING
"042" PUMP

"X3" TORQUE TABLE

FRAME SIZE	BOLT SIZE	PUMP MODIFICATION	TORQUE	
			LB FT	N.m
2	M10	W	30±2	41
		P	45±2	61
3	M12	W	60±5	81
		P	90±5	122
4	M16	W	115±10	156
		P	175±10	237
5	M20	W	220±15	298
		P	325±15	441
6	M24	W	435±15	590
		P	650±20	881
8	M30	W	870±25	1180
		P	1300±25	1763



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