



IMO®

PRODUCT SERVICE MANUAL
FOR
CI G Lip Seal Double Pumps



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.

SRM00049

REV. 04 (20-0051)

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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 double pumps with lip seals.

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 General Instructions Manual, CA-1, 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 double pumps with lip seals. 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 double pumps with lip seals 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 double pumps with lip seals.

The model of each pump is identified on the pump nameplate.

Refer to Figure 1 for instructional keys when using this manual.

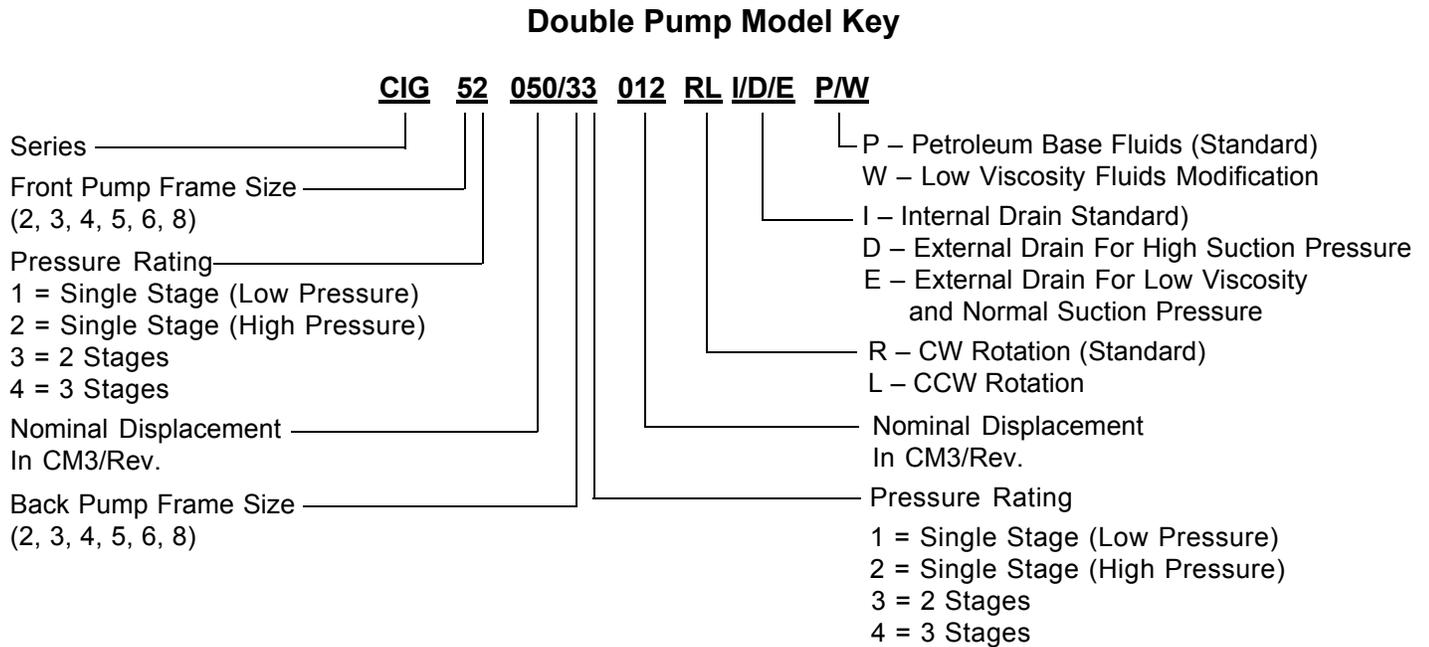


Figure 1 – Double Pump Configuration

E. ORDERING INSTRUCTIONS

When corresponding with Imo Pump regarding CIG Single Series pumps, refer to the pump nameplate, 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) provide the IDP Number(s) and names for the replacement parts(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, (No. SRM0046).

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

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.

G. PUMP DISASSEMBLY

Refer To Assembly Drawing In Back Of Manual

1. Remove drive key (36).
2. Remove capscrews (38) and end cover (15) with O-ring (35).
3. Remove capscrews (17) and washers (18). (Washers not used on single stage units.)

CAUTION

ATTENTION

In next step, ring gear (20), pinion (19) and key (21) will be removed. If ring (20) and pinion (19) 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 (21) is to be reused, mark it so that it can be assembled into its original stage and facing its original direction.

4. Remove square gear housing (7), ring gear (20), pinion gear (19) and key (21) from shaft (6). Do not permit dowel pin (22) to drop as housing (7) is removed. Remove dowel pin (22) from either square housing (7), intermediate flange (5) or back of round housing (14) whichever is applicable.

NOTE: If square gear housing (7) will not slide easily off shaft (6), and rear pump is a one stage unit, clamp pump in a vise with square housing (7) free. Position a wedging device between the square housing (7) and intermediate flange (5). Pry gap until the square housing (7) is free to slide off shaft (6). If pump has more than one stage, clamp round housing (14) in a vise with square housing (7) free. With a soft-headed hammer, tap alternately on corners of square housing (7) until there is sufficient gap between square housing (7) and back of round housing (14) to insert a wedging device. Pry the gap until square housing (7) is free to slide off shaft.

CAUTION	ATTENTION
Take care not to damage either faces that are being pried against or O-ring (10) with prying device.	

CAUTION	ATTENTION
If gear housing (007) will not slide off easily because its bushing (54) was seized on shaft (006), ball bearing (031) was most likely damaged when housing (7) was pried off and must be replaced. On the other hand, if gear housing (7) will not slide off easily because its rabbet was jammed in housing tube (23) or intermediate cover (5) counter bore, whichever is applicable, ball bearing (31) may not have to be replaced.	

NOTE: If housing (7), ring gear (12) or pinion gear (11) cannot be removed without applying excessive force, unit should be returned to lmo for further disassembly and inspection.

5. If rear pump has only one stage, proceed to step #9. If pump has more than one stage, continue with step #6.
6. Remove housing tube (23). Remove O-rings (10) from rabbets on square housing (7) and round housing (14).

NOTE: Neither housing tube (23) nor O-ring (10) need be removed from round housing (14) unless O-ring (10) is to be replaced. (Replacing O-rings is good practice when a pump is disassembled after extended service or if damaged during disassembly.)

CAUTION	ATTENTION
In next step, ring gear (20), pinion (19) and key (21) will be removed. If ring (20) and pinion (19) 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 (21) is to be reused, mark it so that it can be assembled into its original stage and facing its original	

7. Remove round gear housing (14), ring gear (20) pinion gear (19) and key (21) from shaft (6). Do not permit dowel pin (22) to drop as gear housing (14) is removed. Remove dowel pin (22) from either next round gear housing (14) or intermediate flange (5), whichever is applicable.

NOTE: If round gear housing (14) will not slide off easily shaft (6), and this is the last round housing (14) to be removed, clamp it in a vise with intermediate flange free (5). With a soft headed hammer, tap alternately on corners of intermediate flange (5) to separate it from round housing (14). When there is sufficient gap between intermediate flange (5) and round housing (14), insert wedging device. Pry gap until round housing (14) is free to slide off shaft (6). If there are several round housings (14) to remove, clamp pump in a vise with rearmost round housing (14) free. Position a wedging device between the round housings (14). Pry gap until rearmost round housing (14) is free to slide off shaft (6).

CAUTION	ATTENTION
Take care not to damage either faces that are being pried against or O-ring (010) with prying device.	

NOTE: If gear housing (14) will not slide off easily because its bushing (53) was seized on shaft (6), ball bearing (31) was most likely damaged when housing (14) was pried off and must be replaced. On the other hand, if gear housing (14) will not slide off easily because its rabbit was jammed in housing tube (23) or intermediate flange (5) counterbore, whichever is applicable, ball bearing (31) may not have to be replaced.

NOTE: If housing (14), ring gear (20) or pinion gear (19) can not be removed without applying excessive force, unit should be returned to lmo for further disassembly and inspection.

8. Repeat steps 6 & 7 until all round housings (14) are removed.
9. Remove O-ring (10) from intermediate flange (5) if it did not come off with last housing removed.
10. Remove capscrews (39) and washers (34). (Washers not used on single stage units.)

11. Remove intermediate flange (5) from shaft (6). Do not permit dowel pin (37) to drop as intermediate flange (5) is removed. Remove dowel pin (37) from either round housing (3), or square of housing (4) whichever is applicable.

NOTE: If intermediate flange (5) will not slide easily off shaft (6) and front pump has more than one stage, clamp rest of pump in a vise with intermediate flange (5) free. With a soft-headed hammer, tap alternately on corners of intermediate flange (5) until there is sufficient gap to insert a wedging device between it and front pump round (3) or square (4) housing, whichever is applicable. If front pump is a single stage pump, insert prying device between intermediate flange (5) and square housing (4) and pry apart.

CAUTION	ATTENTION
Take care not to damage either faces that are being pried against or O-ring (10) with prying device.	

CAUTION	ATTENTION
If intermediate flange (5) will not slide off easily because its sleeve bushing (54) was seized on shaft (6), ball bearing (31) was most likely damaged and must be replaced.	

12. If front pump has only one stage, proceed to step #17. If pump has more than one stage, continue with step #13.

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.	

13. Remove pinion gear (11) and key from shaft (6) and ring gear (12) from front pump round housing (3).

NOTE: If pinion gear (11) will not slide easily off shaft (6), its key (13) is most likely at least partially sheared. In this case, the disassembly cannot be completed in the field without the chance of damaging other good parts and the unit should be returned to Imo for further disassembly and inspection.

NOTE: If ring gear (12) will not come out of round housing (3), it is most likely seized on its OD and will not be possible to remove. The pump can still be disassembled with the ring gear (12) in the housing (3).

14. Remove round housing (3) 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 square housing (4) whichever is applicable.

NOTE: If round gear housing (3) will not slide easily off shaft (6), clamp it in a vise with the rest of the pump free. With a soft-headed hammer, tap on gear end of shaft (6) until there is sufficient gap to insert a wedging device between the round housing (3) and the next round (3) or square (4) housing, whichever is applicable. Pry the gap until round housing (3) is free to slide off shaft.

CAUTION	ATTENTION
Take care not to damage either faces that are being pried against or O-ring (10) with prying device.	

NOTE: If the shaft had to be hammered to remove the gear housing (3) from the shaft, the ball bearing (31) was damaged and must be replaced.

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

15. Remove housing tube (8). Remove O-rings (41) from rabbets on square housing (4) or round housing (3) whichever is applicable.

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

16. Repeat steps 13, 14 and 15 until all round housings (3) are removed.

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.

17. Remove pinion gear (11) and key (13) from shaft (6) and ring gear (12) from front pump square housing (4).

NOTE: If pinion gear (11) will not slide easily off shaft (6), its key (13) is most likely at least partially sheared. In this case the disassembly cannot be completed in the field without the change of damaging other good parts and the unit should be returned to Imo for further disassembly and inspection.

18. Remove square housing (4) from shaft (6). Do not permit dowel pin (37) to drop as square housing (4) is removed. Remove dowel pin (37) from either square housing (4) or front flange (2), whichever is applicable.

NOTE: If square gear housing (4) will not slide easily off shaft (6), clamp it in a vice with the front flange (2) free. With a soft-headed hammer, tap on gear end of shaft (6) until there is sufficient gap to insert a wedging device between the square housing (4) and the front flange (2). Pry the gap until square housing (4) is free to slide off shaft (6).

CAUTION

ATTENTION

Take care not to damage either faces that are being pried against or O-ring (10) with prying device.

CAUTION

ATTENTION

If the shaft had to be hammered to remove the square gear housing (4) from the shaft, the ball bearing (31) was damaged and must be replaced..

NOTE: If square housing (4) can not be removed without applying excessive force, unit should be returned to Imo for further disassembly and inspection.

19. Remove capscrews (42) from seal housing (9).

20. Remove shaft (6) from front flange (2). Removal of shaft also removes seal housing (9), outside lip seals (32), ball bearing (31), and bearing retaining ring (33).

21. Remove seal housing (9), with lip seals (32), from shaft (6).

22. If lip seals (32) are to be replaced, remove them from seal housing (9) and discard.

23. If ball bearing (31) is to be replaced, remove snap ring (33) from shaft (6), press ball bearing (31) off shaft (6) and discard.

24. If inside lip seal (51) is to be replaced 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: Rework other than light stoning or cleaning of gears or gear housings is not recommended. New gear housings are provided with 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.
 - c. 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 and replaced.
7. FRONT AND INTERMEDIATE COVERS – 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 (001) and intermediate flange (005) can usually be restored to as-new condition by machining damaged faces. Sleeve bushings (054) usually require replacement when cover is machined. To repair damage to face of front cover (Figure 2) and to replace sleeve bushings (C) proceed as follows:

1. Press out and replace bushings (C) in front cover, ensuring that slit is positioned as shown.

NOTE: If pump is equipped with bronze bearing, consult factory.
2. 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.
3. Place front cover in a lathe and indicate face (A) and counterbore (B) square and concentric with respect to bore (C) within .0008 inch TIR.
4. Machine face (A) deep enough to remove any scored material. Ensure that face is flat within .0008 inch TIR with a 32 microinch finish.

CAUTION	ATTENTION
Being out of flat in excess of .008" 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.

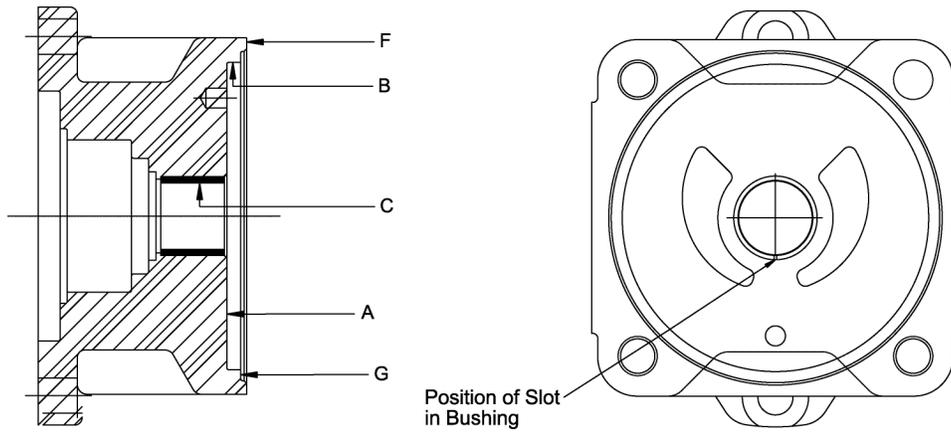
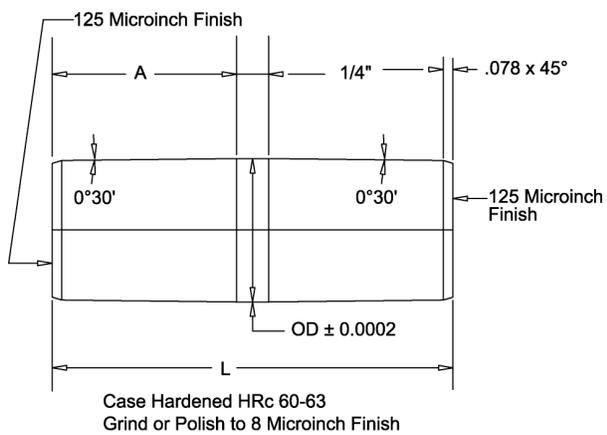


Figure 2 – Front Cover



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	Front Pump SQ Hsg. & Gear Set Kit	Front Pump RD Hsg. & Gear Set Kit	Back Pump SQ Hsg. & Gear Set Kit	Back Pump RD Hsg. & Gear Set Kit
1	1	Front Cover						
3	-	Front Pump Round Gear Housing				X		
4	1	Front Pump Square Gear Housing			X			
5	1	Intermediate Flange						
6	1	Shaft		X				
7	1	Back Pump Square Housing					X	
8	-	Front Pump Barrel						
9	1	Seal Housing						
10	-	Back Pump Housing O-Ring	X					
11	-	Front Pump Pinion			X	X		
12	-	Front Pump Ring			X	X		
13	-	Front Pump Key		X				
14	-	Back Pump Round Housing						X
15	1	Back Cover						
17	4	Back Pump Capscrew						
18	4	Back Pump Capscrew Washer						
19	-	Back Pump Pinion					X	X
20	-	Back Pump Ring					X	X
21	-	Back Pump Key		X				
22	-	Back Pump Pin						
23	-	Back Pump Barrel						
31	1	Ball Bearing		X				
32	-	Lip Seals	X					
33	1	Ball Bearing Snap Ring		X				
34	4	Front Pump Capscrew Washer						
35	1	Back Cover O-Ring	X					
36	1	Drive Key		X				
37	-	Front Pump Pin						
38	4	Rear Cover Capscrews						
39	4	Front Pump Screws						
40	1	Bearing Housing O-Ring	X					
41	-	Front Pump Housing O-Ring						
42	4	Seal Housing Capscrews						
51	1	Mechanical Seal	X					
53	-	Front Pump Sleeve Bushings			X	X		
54	-	Rear Pump Sleeve Bushings					X	X
70	1	Seal Cover						
74	1	Seal Spacer						
75	4	Bearing Housing Capscrews						
80	3	Weep Hole O-Rings	X					
81	1	Bearing Housing Aligning Pin						

*Housings, Pinions and Rings Cannot Be Sold Separately Since They Are Matched Sets

Table 1 – Pump Parts List

K. REASSEMBLY OF PUMP

CAUTION	ATTENTION
READ THIS ENTIRE PROCEDURE BEFORE 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 supplier's 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 must be replaced. Lip seal (32) must also be replaced if removed.	

NOTE: Refer to "Inspection of Parts" for additional information on part inspection and replacement. Wipe all parts with light lubricating oil to assist in assembly.

NOTE: Prior to assembly, remove all nicks and sharp edges on housings and gears with deburring 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 At End Of Manual

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 spacer (16) and snap ring (33) onto shaft (6).
3. Press lip seals (32) into seal housing (9) facing direction shown on assembly.

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

4. Wipe small amount of grease on edges of lip seals (32) for lubrication.
5. Wipe small amount of grease on edge of inside lip seal (51) and install lip seal (51) in front flange (2). Be sure lip is facing direction shown on assembly drawing.

CAUTION	ATTENTION
Be sure to press only on outside diameter of lip seals (51).	

6. Install shaft (6) assembly with ball bearing (31), spacer (16) and snap ring (33) into front flange (2).
7. Install O-ring (40) onto seal housing (9) rabbet.
8. Install seal housing (9) in front flange (2) and secure with cap screws (42). Torque capscrews, with torque wrench, to torque values on assembly drawing.

9. Install dowel pin (37) in front flange (2).
10. Install O-ring (40) in face of front flange (2).
11. Install square housing (4) on shaft (6) and slide it up until it engages dowel pin (37) and counterbore in front flange (2) and is tight up against front flange face (2).
12. Install key (13) chamfer side up in keyway of shaft (6) inside square housing (4).

Note: If key (13) has a step, install key (13) with step facing up and toward square housing (4).

CAUTION	ATTENTION
<p>When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and face of square housing (4). If not, it should be removed and a small step filed in portion of key (13) that sticks above shaft (6) keyway. This will prevent key (13) from touching face of square housing (4).</p>	

13. Install 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
<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>	

14. Install ring gear (12) in square gear housing (4). 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>	

15. Install O-ring (41) on square gear housing (4).
16. Install dowel pin (37) in square gear housing (4).

NOTE: If front pump of double pump is single stage pump, proceed to step 26 to complete assembly. If front pump is multiple stage pump, continue with step 17.

17. Install housing tube (8) on front counterbore of square housing (4).
18. Install O-ring (41) on back counterbore of round gear housing (3).
19. Install round housing (3) on shaft (6) and slide it on until it engages pin (37) in face of square housing (4) and is tight up against face of square housing (4).
20. Install key (13) chamfer side up in keyway of shaft (6) inside round housing (3).

NOTE: If key (13) has a step, install key (13) with step facing up and toward round housing (3).

CAUTION**ATTENTION**

When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and face of round housing (3). If not, it should be removed and a small step filed in portion of key (13) that sticks above shaft (6) keyway. This will prevent key (13) from touching face of round housing (3).

21. Install 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.

22. Install ring gear (12) in 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**

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.

23. Install dowel pin (37) in round gear housing (3).
24. Install O-ring (41) on round gear housing (3).
25. Repeat steps 17 through 24 until all round housings (3) are installed.
26. Install intermediate flange (5) onto shaft (6) and slide it on until it engages pin (37) in face of previously installed housing (3 or 4) and is tight up against face of previously installed housing (3 or 4).
27. 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.

NOTE: 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.

28. If back pump of double pump is single stage pump, proceed to step 37 to complete assembly. If back pump of double pump has more than one stage, continue below to step 29.

29. Install first stage key (21), chamfer side up, into keyway of shaft.

NOTE: If key (21) has a step, install key (21) with step facing up and away from intermediate flange (5).

CAUTION**ATTENTION**

When key (13) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and face of intermediate flange (5). If not, be sure opposite face of intermediate flange (5) is seated firmly up against face of last installed housing of front pump. If key (21) is still up against intermediate flange (5) face, it should be removed and a small step filed in portion of key (21) that sticks above shaft (6) keyway. This will prevent key (21) from touching face of intermediate flange (5).

30. Install first stage pinion gear (19) on shaft (6). Pinion gear (19) should slide freely on shaft (6) and key (21). If not, ensure key (21) is properly installed and shaft (6) and pinion (19) keyway are free of burrs. Ensure pinion (19) 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.

31. Install ring gear (20) in first stage gear housing (14). Ensure ring gear (20) 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.

32. Install dowel pin (22) in intermediate flange (5).
33. Install O-ring (10) on front counter bore of first stage gear housing (14).
34. Install first stage gear housing (14), with installed ring gear (20) and O-ring (10), onto shaft (6). Ensure dowel pin hole in housing engages dowel pin in intermediate flange (5) and pinion gear (19) installed on shaft (6) is properly positioned to enter gear housing (14).
35. Install O-ring (10) on back of first stage housing (14).
36. Install housing tube (23) on back counter bore of first stage gear housing (14).
37. Repeat steps 28 through 36 for second, third and fourth stage round gear housings (14), if applicable.
38. Install key (21), chamfer side up, into keyway of shaft (6).

CAUTION

ATTENTION

If key (21) has a step, install key (21) with step facing up and away from back face of previous stage.

CAUTION

ATTENTION

When key (21) is installed and pushed up toward drive end, there must be an approximately .020" gap between it and face of previous stage. If not, be sure previous stage is seated firmly up against face of last installed housing. If key (21) is still up against back of previous stage housing, it should be removed and a small step filed in portion of key (21) that sticks above shaft (6) keyway. This will prevent key (21) from touching face of previous stage.

39. Install square housing pinion gear (19) on shaft (6). Pinion gear (19) should slide freely on shaft (6) and key (21). If not, ensure key (21) is properly installed and shaft (6) and pinion (19) keyway are free of burrs. Ensure pinion (19) 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.

40. Install ring gear (20) in last stage square gear housing (7). Ensure ring gear (20) 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.	

41. Install O-ring (10) on last stage gear housing (7).
42. Install dowel pin (22) in last stage gear housing (7).
43. Install last stage square gear housing (7), with installed ring gear (20), onto shaft (6). Ensure dowel pin (22) engages dowel pin hole in back face of previous stage round housing (14) and pinion gear (19) installed on shaft (6) is properly positioned to enter gear housing (7).
44. Install washers (18) on capscrews (17) with chamfer on washers (18) facing head of capscrews (17). Install capscrews (17), with washers (18) 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.

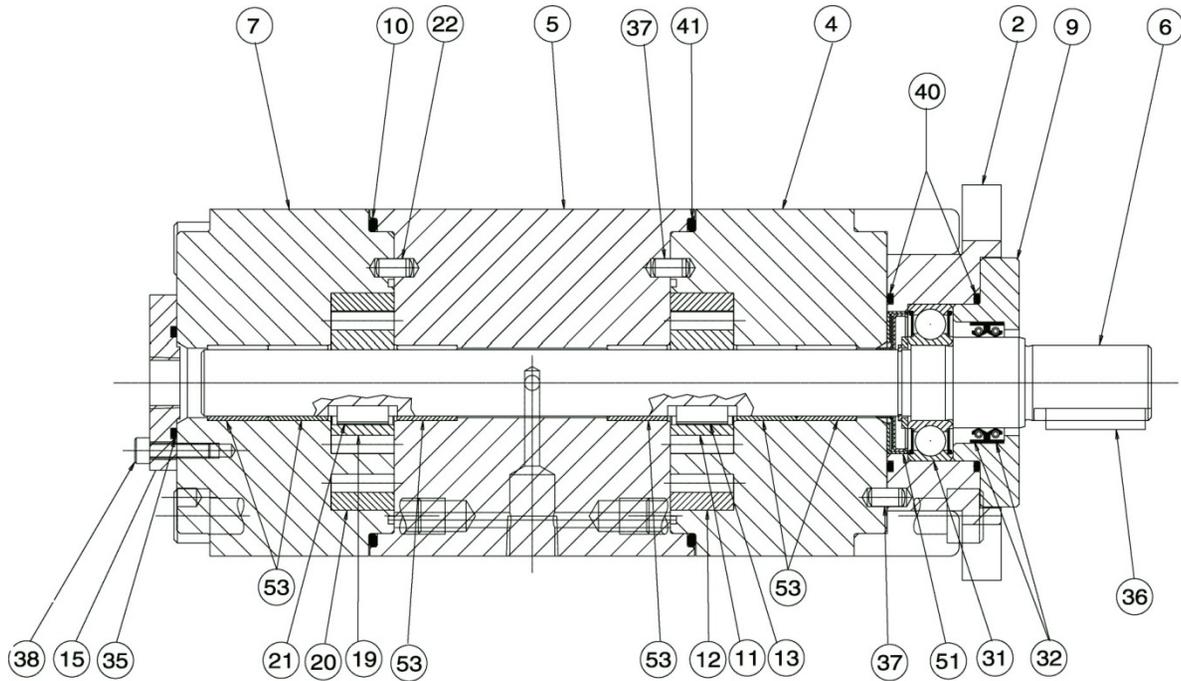
CAUTION	ATTENTION
With capscrews (17) torqued to full value, pump shaft must turn freely by hand and without significant internal snagging. Otherwise, unit has not been properly assembled.	

45. Install O-ring (35) into rear cover (15). If necessary, use grease to hold O-ring (35) in place.
46. Install end cover (15) on square gear housing (7) using capscrews (38). Tighten capscrews (38) with torque wrench to torque values on assembly drawing.
47. Install coupling key (36) in keyway of shaft (6).

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

L. TROUBLESHOOTING

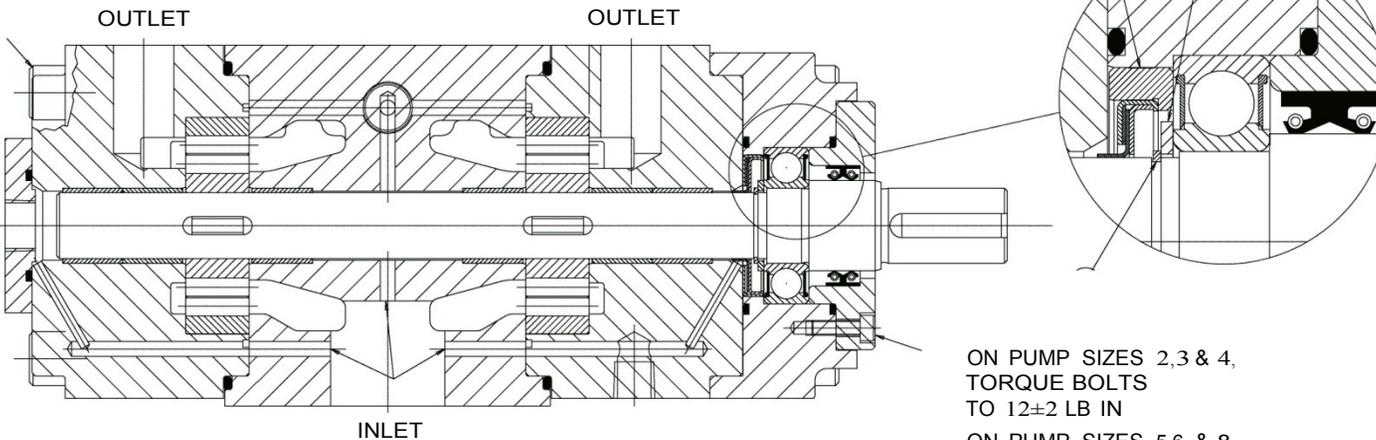
For assistance with troubleshooting, see General Instruction Manual CA-1.



"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		

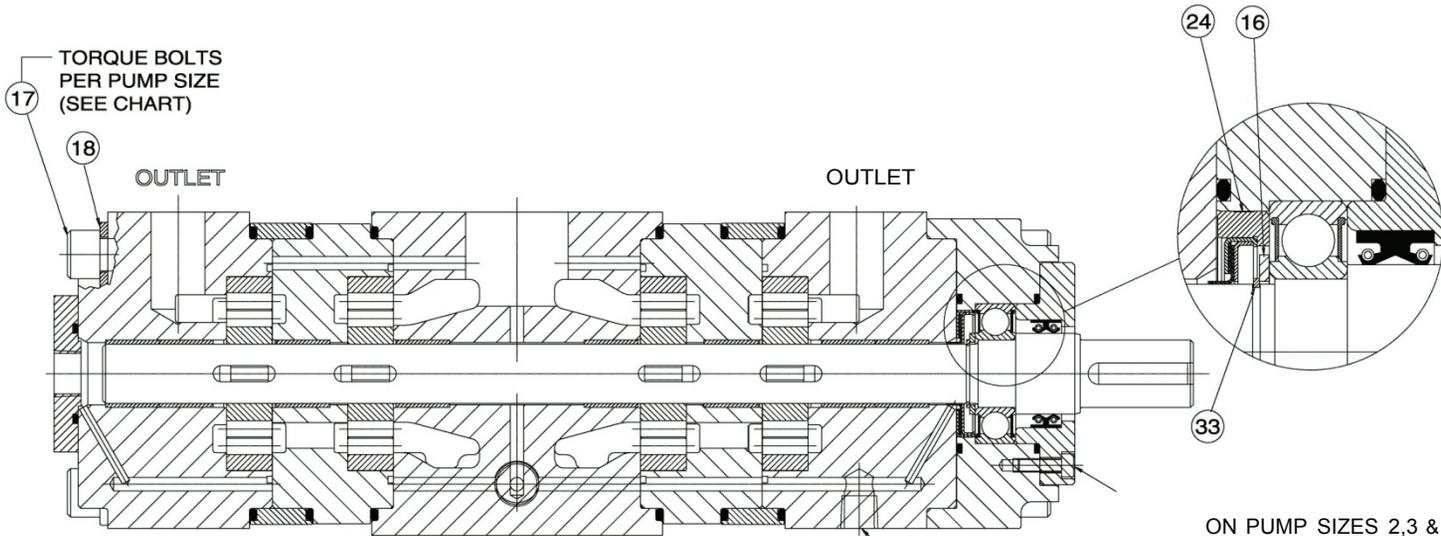
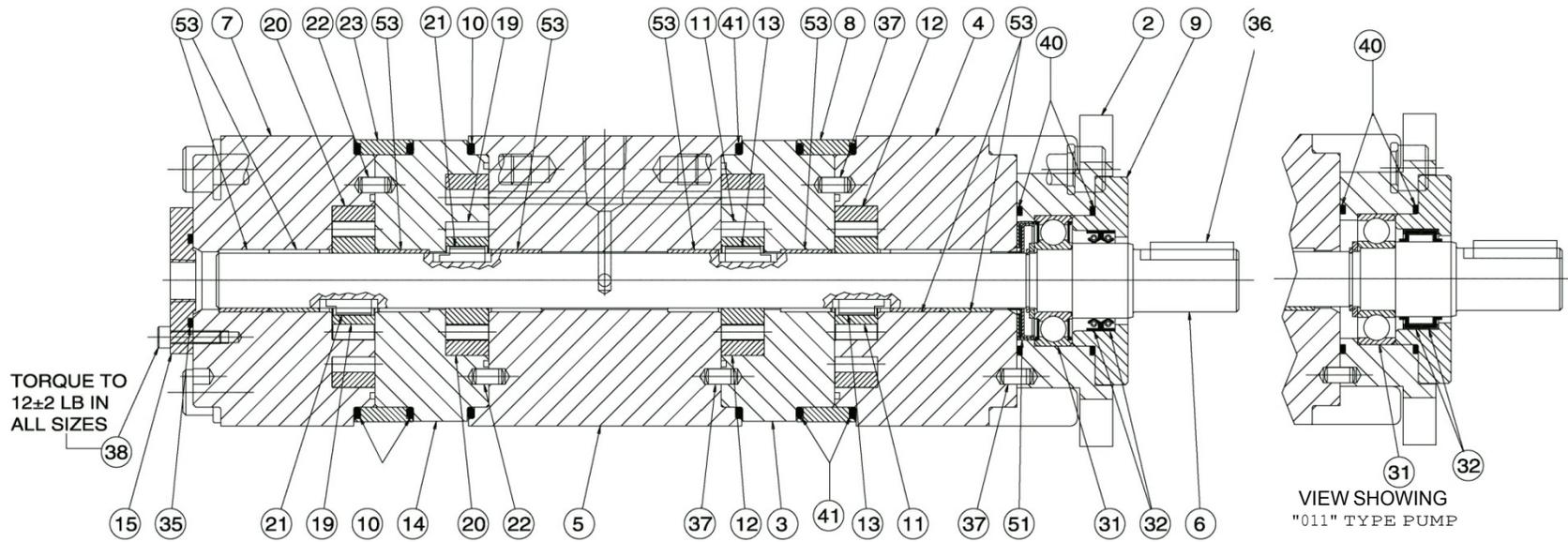
11

TORQUE BOLTS
PER PUMP SIZE
(SEE CHART)



ON PUMP SIZES 2,3 & 4,
TORQUE BOLTS
TO 12±2 LB IN

ON PUMP SIZES 5,6 & 8,
TORQUE BOLTS
TO 24±2 LB IN

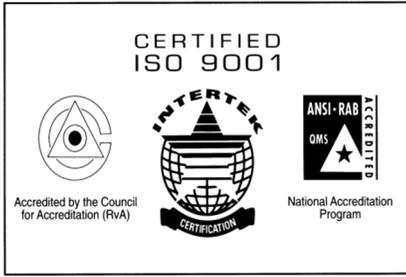


"X3" TORQUE TABLE

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

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

*-EXTERNAL DRAINS SUPPLIED
ON ALL "DW" PUMPS ONLY



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