



IMO<sup>®</sup>

## INSTRUCTION MANUAL

### **SERIES C324A AND C424A (ROTOR SIZES 162-250)**

**WARNING**

**READ CA-1 AND THIS INSTRUCTION MANUAL BEFORE  
INSTALLATION, OPERATION, OR MAINTENANCE**

### **INSTRUCTIONS C324A-C424A-A (R-3)**

This manual now is  
identified as part no.  
SRM00043

## **FOREWORD**

The instructions given herein cover generally the operation and maintenance of subject equipment. Should any questions arise which may not be answered specifically by these instructions, they should be referred to Imo Pump for further detailed information and technical assistance. 704-289-6511, Ext. 343, 349 or 358.

This manual cannot possibly cover every situation connected with the operation, adjustment, inspection, test overhaul and maintenance of the equipment furnished. Every effort is made to prepare the text of the manual so that engineering and design data is transformed into the most easily understood wording. Imo Pump in furnishing the equipment and this manual, must presume that the operating and maintenance personnel assigned thereto have sufficient technical knowledge and experience to apply sound safety and operational practices which may not be otherwise covered herein.

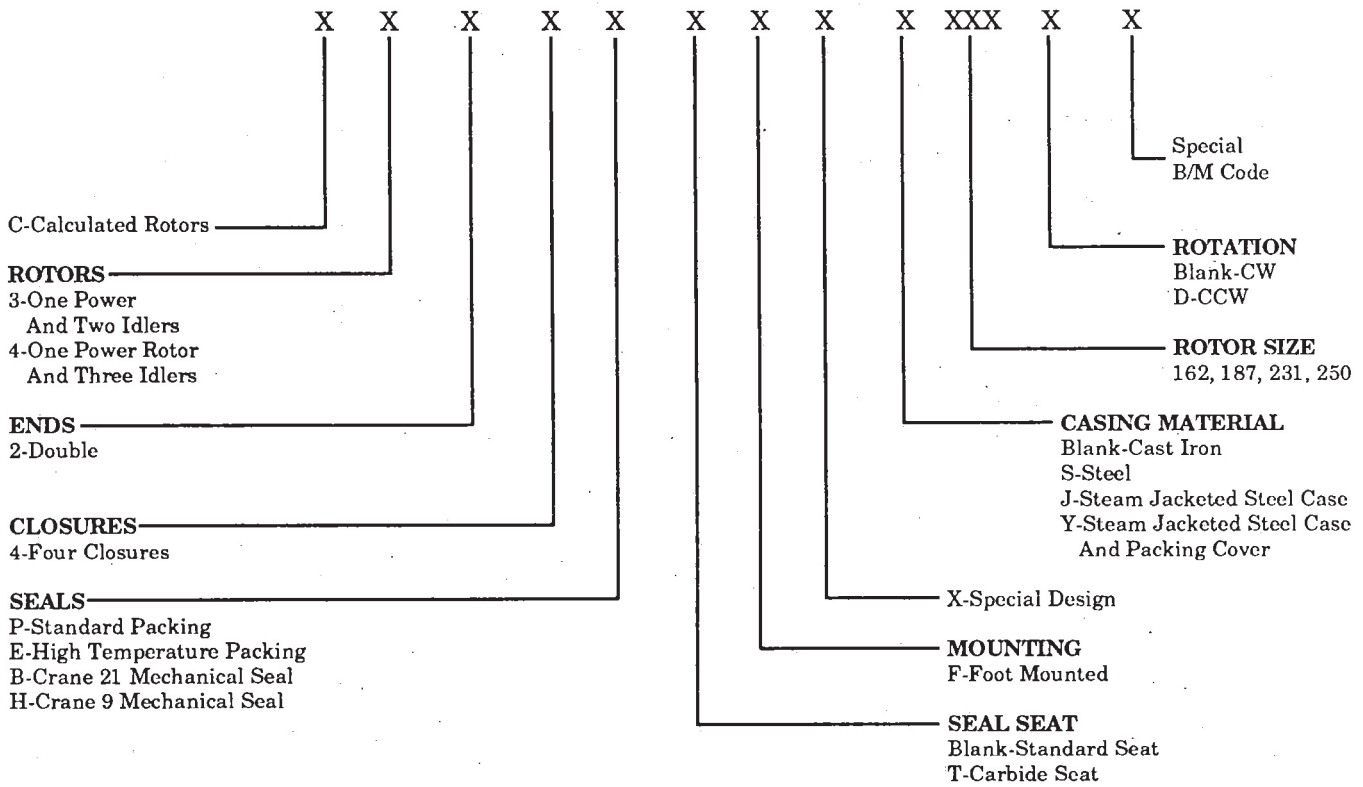
In application where Imo Pump furnished equipment is to be integrated with a process or other machinery, these instructions should be thoroughly reviewed to determine the proper integration of the equipment into the overall plant operational procedures. On critical or dangerous equipment, provide suitable safety and emergency systems to protect personnel and property from injury due to pump malfunction. If pump handles flammable, toxic, corrosive or explosive fluids, provide for safety in the event of pump leakage or malfunction.

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

**TABLE 1**  
**324A AND 424A PUMP TYPES**  
**ROTOR SIZES 162, 187, 231, 250**

INITIAL DESIGNATORS			PUMP FIG. NO.	SEALING DESIGN FIG. NO.	SEAL SEAT DESIGN FIG. NO.
A or B	CB, CC, CAB or CSB	C324A			
A324A	CB324A	C324APF	6	6	
A324A	CAB324A	C324APFJ	9	9	
A324AA	CB324AA	C324AHF	6	3	10 or 12 (2)
A324AA	CAB324AA	C324AHFJ	9	3	10 or 12 (2)
A324AAV	CB324AAV	C324AX (3)	7	3	10 or 12 (2)
A324AAV	CB324AAVS	C324AXS (3)	13	3	10 or 12 (2)
A324AAX	CB324AA	C324AHF	6	3	10 or 12 (2)
A324AAX	CB324AAS	C324AHFS	6	3	10 or 12 (2)
A324AAX	CAB324AAS	C324AHFJ	9	3	10 or 12 (2)
A324AAX	CAB324AAX	C324AHFJ	9	3	10 or 12 (2)
A324AAX	CAB324AAST	C324AHTFJ	9	3	10 or 12 (2)
A324AAXT	CB324AAST	C324AHTFS	6	3	10 or 12 (2)
A324AS	CB324AS	C324ABF	6	4	10 or 12 (2)
A324AS	CAB324AS	C324ABFJ	9	4	10 or 12 (2)
A324ASVS	CB324SVS	C324AXS (3)	13	4	10 or 12 (2)
A324ASX	CB324ASS	C324ABFS	6	4	10 or 12 (2)
A324ASXT	CB324ASST	C324ABTFS	6	4	10 or 12 (2)
	CB324ASSU	C324AXS (3)	6	14	12
A324ATX	CB324ASST	C324ABTFS	6	4	10 or 12 (2)
A324AV	CB324AV	C324AX (3)	13	13	
A324AVS	CB324ASV	C324AX (3)	13	4	10 or 12 (2)
A324AVS	CB324AVS	C324AXS (3)	13	4	10 or 12 (2)
A324AWX	CAB324AWS	C324AEFJ	9	9	
A324AX	CB324AX	C324AX (3)	6	7	
A324AX	CB324AX	C324AXS (3)	6	7	
A324AX	CB324AX	C324APFS	6	6	
A324AX	CAB324AX	C324APFJ	9	9	
A324AX	CAB324AX	C324AEFJ	9	9	
A324AX	CAB324AWX	C324AEFJ	9	9	
A424AAX	CC424AAS	C424AXS (3)	14	3	
A424ASX	CC424ASS	C424AXS (3)	14	4	
B324AAS	CB324AAS	C324AHFS	6	3	10 or 12 (2)
B324AAX	CB324AAS	C324AHFS	6	3	10 or 12 (2)
B324A	CB324A	C324APF	6	6	
B324AS	CB324AS	C324ABF	6	4	10 or 12 (2)
B324ASX	CB324ASS	C324ABFS	6	4	10 or 12 (2)
B324ASX	CAB324ASS	C324ABFJ	9	4	10 or 12 (2)
B324ASXT	CAB324ASST	C324ABTJ	9	4	10 or 12 (2)
	CSB324A	C324AX (3)	6	11	
	CSB324AAX	C324AHFY	9	8	
B324AW	CB324AW	C324AEF	6	6	
B324AWX	CB324WS	C324AEFS	6	6	

- (1) Pump model precedes rotor size. EXAMPLE: CB324A-162  
(2) Figures 6, 9 and 10 pumps can be equipped with either mechanical seal seat as illustrated in Figures 3, 4, 11 or 12.  
(3) Special pump Bill of Material Suffix (three or four digits) follows rotor size designator.



**FIGURE 1. Definition of Model Designators for C324A Pumps**

## ORDERING INSTRUCTIONS

All correspondence pertaining to renewal parts for Series 324A and 424A pumps must refer to this instruction book number and should be addressed to the nearest Imo Pump representative or Sales Office listed in CA-1 Manual.

The following directions should be followed for renewal part orders:

- 1 - Give the number of this instruction book.
- 2 - Give the pump type and serial number of the pump for which part(s) is ordered.
- 3 - Give the figure number(s) on which the pump type and sealing design part(s) are shown.

## STRUCTURAL LIMITS

Operating conditions such as speed, fluid viscosity, inlet pressure, temperature, filtration, duty cycle, mounting, drive type, etc. are interrelated. Due to variable conditions, specific application limitations may vary from structural limitations. **This equipment must not be operated without verification that operating requirements are within published capabilities as shown in the appropriate pump data manuals** (available from local Imo Pump offices and representatives listed in Manual CA-1).

Under no circumstances are the following structural limitations to be exceeded.

**MAXIMUM SPEED:** Contact the Imo Pump for Performance Tables. For residual and crude oil, pump speed should not exceed 1800 RPM.

**VISCOSITY:** 8.0 cst (50 SSU). Consult factory for lighter viscosities.

Maximum for type B—3000 SSU. For viscosities above 3000 SSU, use packed pump or type H. Contact the Imo Pump for minimum allowable operating viscosity at specific speed and pressures. Do not use pack pump for viscosities below 100 SSU.

**TEMPERATURE:** Type P      0-250°F.  
                  Type E      0-500°F.  
                  Type B      0-160°F.  
                  Type H      0-250°F.

**PRESSURE:** 500 PSIG

**SUCTION:** 25 PSIG MAXIMUM

**FILTRATION:** Light fluids—60 mesh  
                  Heavy fluids—1/8 to 3/16-inch

**DRIVE:** Direct Only

## DISASSEMBLY AND ASSEMBLY PROCEDURES

### SPECIAL NOTE

Disassembly and assembly procedures are given for pump types and sealing designs by Figure numbers. Ensure that the pump type is identified by the proper Figure for correct disassembly and assembly procedures. Refer to Table 1 for proper identification of pump types and applicable Figure Number.

### DISASSEMBLY PROCEDURES

**STEP 1. Figures 6, 9, 13 and 14.** Remove pump from driver after draining piping. Remove coupling hub and key (029). Remove tube (037) from pump. NOTE: Tube (037) is equipped with a needle valve (008) that must be replaced in its original installed position.

**STEP 2. Removal of Packing from Packing Housing.** (NOTE: For pumps equipped with mechanical seal proceed to Step 3.)

*Figures 6, 7, 8 and 9 only:* Remove nuts (006), bolts (005) and drip cup (003) from inboard packing box cover (017).

*Figures 6, 7, 8, 9 and 13 only:* Remove packing nuts (022) and washers (021) from gland bolts (020). Slide packing gland (028) off power rotor (013). Swing gland bolts (020) away from power rotor (013) and remove packing (027) using either a packing puller or sharp pointed brass or copper rod. Proceed to Step 4.

*Figure 11 only:* Remove bolts (022) and washers (021). Slide gland (028) off power rotor and remove packing using packing puller or sharp pointed brass or copper rod. Proceed to Step 4.

**STEP 3. Removal of Mechanical Seal.**

*Figures 10, 12, 14 and 15 only:* Remove bolts (046), seal cover (045) and gasket (044). NOTE: Mechanical seal seat will be removed when seal cover (045) is removed.

*Figure 10 and 15 only:* Remove mechanical seal seat (1, Figure 3 or 4) with O-ring (2, Figure 3 or 4) from seal cover (045). Remove O-ring (2) from seat (1).

*Figures 12 and 14 only:* Remove mechanical seal seat (1-A, Figure 3 or 4) with grommet (2-A, Figure 3 or 4) from seal cover (045). Remove grommet (2-A) from seat (1-A).

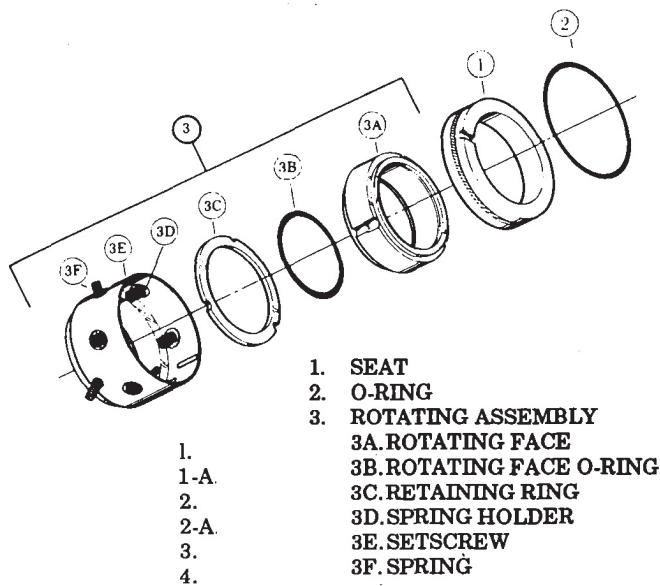
*Figures 10, 12, 14 or 15, Crane Type 9 Seal:* Loosen setscrews (8, Figure 3) and slide mechanical seal rotating parts (3 through 9, Figure 3), shim (043) and spacer (042) off power rotor (013).

*Figures 10, 12, 14 or 15, Crane Type 21 Seal:* Slide mechanical seal rotating parts (3 through 5, Figure 4), shim (043) and spacer (042) off power rotor (013).

**STEP 4. Removal of Inboard Packing or Mechanical Seal Cover.**

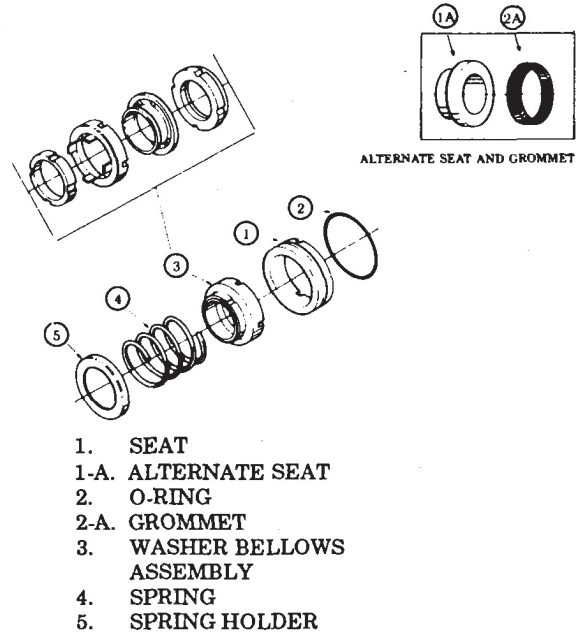
*All Pumps:* Remove bolts (002) and slide inboard cover (017) off power rotor (013). Remove gasket (004) from pump case (001).

*Figures 6, 9 and 13 only:* Removal of inboard cover (017) includes removal of packing bushing (018), stop pin (023), washer (024), check valve (039), bushing (040) and Plug (041). Slide washer (024) from inboard cover (017). Remove stop pin (023) and slide packing box bushing from inboard cover (017). No additional disassembly of inboard cover is required unless replacement of check valve (039) is required. Remove bushing (040) to remove check valve (039).



**Figure 3.** This figure is generally representative of the crane type 8-1 and Borg Warner Type Q mechanical seal.

- 1. SEAT
- 2. O-RING
- 3. ROTATING ASSEMBLY
  - 3A. ROTATING FACE
  - 3B. ROTATING FACE O-RING
  - 3C. RETAINING RING
  - 3D. SPRING HOLDER
  - 3E. SETSCREW
  - 3F. SPRING
- 1-A.
- 2.
- 2-A.
- 3.
- 4.



**Figure 4.** Crane Type 21 Mechanical Seal

- 1. SEAT
- 1-A. ALTERNATE SEAT
- 2. O-RING
- 2-A. GROMMET
- 3. WASHER BELLOWS ASSEMBLY
- 4. SPRING
- 5. SPRING HOLDER

*Figures 14 and 15 Only:* Removal of inboard cover (017) includes removal of bushing (018), stop pin (023) and plug (041). Remove stop pin (023) and slide bushing (018) from inboard cover (017).

*Figure 7 only:* Removal of inboard cover (017) includes removal of bushing subassembly (062), insert bushing (057), stop pin (023), check valve (039), plug (041), bushing (040) and washer (024). Slide washer (024) from inboard cover (017). Remove stop pin (023) and slide bushing subassembly (062) and insert bushing (057) from inboard cover (017). No additional disassembly of inboard cover (017) is required unless replacement of check valve is required. Remove bushing (040) to remove check valve (039).

*Figure 8 only:* Removal of inboard cover (017) includes removal of washer (024), stop pin (023), packing box bushing (018), gasket (060) and plugs (061). Slide washer (024) from inboard cover (017). Remove stop pin (023) and slide packing box bushing (018) from inboard cover (017).

*Figures 10 and 12 only:* Removal of inboard cover (017) includes removal of bushing (018) stop pin (023) and check valve (039). Remove stop pin (023) and slide bushing (018) from inboard cover (017). Slide check valve (039) from inboard cover if removal is required

*Figure 11 only:* Removal of inboard cover (017) includes removal of washer (024), stop pin (023), packing box bushing (018) and plug (090). Slide washer (024) from inboard cover (017). Remove stop pin (023) and slide packing box bushing (018) from inboard cover (017).

**NOTE:** The remaining disassembly procedures are for all pumps unless noted.

**STEP 5.** Remove outboard cover bolts (002) and remove outboard cover (015) and gasket (004). *Figure 13 only:* Remove thrust block (055) from outboard cover.

**STEP 6.** Grasp power rotor (013) and pull idlers (014) and power rotor (013) from inboard end. **NOTE:** As rotors slide from housing, wrap the rotors with a sling to prevent accidental dropping and to assist in holding the rotors in mesh for easy removal.

**STEP 7.** Remove plugs (007) from case (001). Stop pins (011) are match marked, using a centerpunch, on each pin and pump case to identify correct installation position and angle. If stop pin were replaced or if match marks are not visible, make new markings before removal of pins.

Each pin is fitted to its housing during assembly. If new housings are installed, new stop pins are required for correct fitting. Install a 3/16-16-inch bolt in each stop pin and remove stop pins (011). Tag each stop pin to identify installed location.

STEP 8. Slide housings (010) from the pump case (001). Slide spacer ring (012) from the pump case.

STEP 9. If outboard housing (010) is being replaced, loosen jam nuts (025) and remove adjusting screws (019). NOTE: Figure 14 pumps are equipped with adjusting screws on each end of pump housing that must be removed if housings are replaced.

## ASSEMBLY PROCEDURES

### SPECIAL NOTE

Prior to assembly of pump, all parts should be cleaned and inspected for burrs or nicks. Replace all worn or damaged parts. The IMO Pump Division recommends automatic replacement of gaskets, packing or mechanical seal when these parts are disturbed from their previously installed position. Wipe all parts with light lubricating oil prior to assembly. During assembly, perform only the steps applicable to pump being assembled. Refer to Table 1 to identify correct Figure Number(s) for each pump type.

STEP 1. *All Pumps:* Wipe spacer ring (012) with oil and slide spacer ring (012) into pump case (001). Align one open port of spacer ring (012) with outlet opening pump case.

NOTE: If new housings (010) are installed when performing Step 2, new stop pins (011) must be installed. Stop pins are to be field fitted to each new housing to ensure housing maintains alignment with case and second housing. If housing stop pins are not snugly fitted to housing, housing may rotate out of position during pump operation and damage rotors. To fit new stop pin, file or grind one or both stop pin flat surfaces until pin fits tightly into housing slot. Do not over grind flat surfaces.

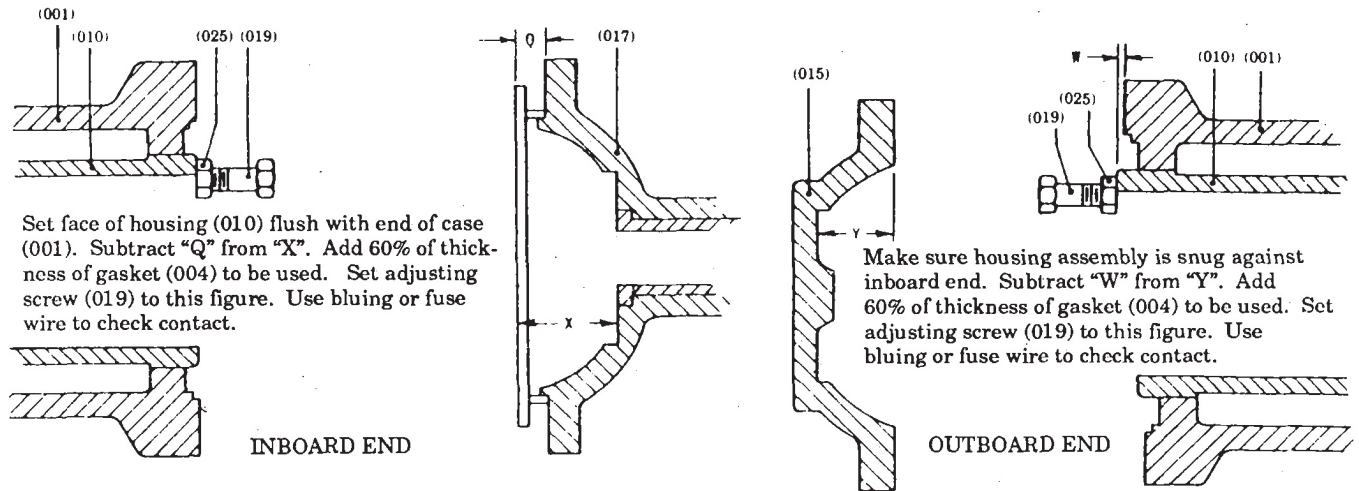
STEP 2. *All Pumps:* Wipe inboard housing (010) with oil. Align stop pin slot and slide housing (010) into case (001) inboard end until housing (010) contact spacer ring (012). With housing stop pin slot aligned with case (001), install stop pin (011) and plug (007) in inboard end. Wipe outboard housing with oil and install in outboard end of case. To assist in aligning housing bores, slide idlers (014) into idler bores and slide back and forth until idlers slide freely. When housing is aligned, install stop pin (011) and plug (007). Slide idlers back and forth to ensure no binding exists, indicating housing misalignment.

STEP 3. Setting of Housing Adjusting Screws:

*Figures 6, 9 and 13 only:* Install gasket (004) and unassembled inboard cover (017) on inboard end of case using bolts (002). Push outboard housing (010) toward inboard end until inboard housing (010) contacts lugs on inboard cover (017). Measure distance from outboard cover (015) flange face down to adjusting nut machined pad of the outboard cover (015) by placing a straight edge across the outboard cover flange face and measuring down to the machined pad. Measure gasket (004) thickness and add 60% of the measurement to the outboard cover machined pad depth measurement. Adjust adjusting screws (019) until the adjusting screw heads extend from housing a distance equal to the total measurement of outboard cover machined pad depth and 60% of gasket measurement. Lock jam nuts (025). Wipe blueing on heads of adjusting screws (019) and install gasket (004) and outboard cover (015) using bolts (002). Torque bolts to approximately 50 lbs. ft. Remove outboard cover to check for contact of adjusting screws. Adjust adjusting screws (019) until complete contact is formed between adjusting screws (019) and machined pads of outboard cover (015). *Caution:* Do not exceed 0.003" pressure on adjusting screws (019) to avoid distortion of rotor housing bores. When adjustment is correct, install gasket (004) and inboard cover (017) using bolts (002). Torque outboard cover bolts (002) to 170 lbs. ft. ( $\pm 10$  lbs. ft.) for rotor sizes 231 and 250. Note: Torque value for rotor sizes 162 through 187 is 85 lbs. ft. ( $\pm 5$  lbs. ft.).



**Figure 14 only:** Housing adjusting screws (019) at inboard and outboard ends of pump should be set following directions outlined in Figure 5. Set adjusting screws and verify correct adjustment on inboard end before adjusting outboard end. To verify setting of inboard end adjusting screws (019), place blueing or fuse wire on adjusting screw heads and install inboard cover (017) with gasket (004) and bolts (002). Tighten bolts (002) to approximately 50 ft. lbs. Remove inboard cover and verify adjusting screw contact on inboard cover. When correct adjustment is confirmed, install gasket (004) and inboard cover (017) using bolts (002). Torque bolts (002) to 170 lbs. ft. (+- 10 lbs. ft.) on rotor sizes 231 and 250 or 85 lbs. ft. (+- 5 lbs. ft.) on rotor size 162 and 187. Perform procedure for outboard end following directions in Figure 5 and check adjustment using outboard cover (015), gasket (004) and bolts (002). When adjustment is correct, install gasket (004) and outboard cover (015), using bolts (002). Torque bolts (002) to 170 lbs. ft. (+- 10 lbs. ft.) on rotor sizes 231 and 250 or 85 lbs. ft. (+- 5 lbs. ft.) on rotor sizes 162 and 187. **Caution:** Do not exceed 0.003" pressure on adjusting screws (019) to avoid distortion of rotor housing bores.



**FIGURE 5. Setting of Housing Adjusting Screws.**

**STEP 4. All Pumps:** Remove inboard cover bolts (002), inboard cover (017) and gasket (004).

**STEP 5. Installation of Rotors and Setting of Rotor End Clearance.**

**Figures 6 and 8 through 15 only:** Wipe bushing (018) with oil. Align bushing slot with tapped hole in inboard cover (017) where stop pin (023) will be installed. Using the inboard cover (017) as a fixture, carefully position the inboard cover (017) in a vice or other solid holding device on a drill press so that the tapped hole in the inboard cover is oriented in a vertical position. **NOTE:** Use caution to prevent damage to the threads of the tapped hole during this step. Run a 7/16" drill through the tapped hole and drill completely through one side of bushing (018). Carefully deburr the bushing bore where the drill comes through (do not remove molykote from bushing (018) bore when deburring). Install stop pin (023) in inboard cover (017). Check and verify that the stop pin (023) fully engages the bushing (018) in the hole just drilled, but does not extend into the bushing bore. If stop pin (023) extends into the bushing (018) bore, remove the pin and shorten as required. The stop pin (023) end face should be approximately 1/64" recessed from the bushing (018) bore.

**Figure 7 only:** Follow paragraph above when installing bushing (018) into inboard cover (017). With bushing (018) and stop pin (023) properly installed, continue on as follows; slide insert bushing (057) into bushing assembly (062). Ensure insert bushing (057) pin slot is aligned to receive pin (056) when installed.

**All Pumps:** Wipe power rotor (013), key (026) and collar (016) with oil. Slide shim (036) on power rotor (013) shaft. Install key (026) in power rotor key slot and install collar (016) on key

and power rotor. Slide assembled power rotor into housings (010) power rotor bore. Install gasket (004) and inboard cover (017) using bolts (002). Torque bolts (002) to approximately 50 lbs. ft. Mount a dial indicator on inboard cover to measure total axial free movement of power rotor (013). Remove inboard cover (017) and power rotor (013) from housing (010). Remove collar (016), key (026) and shim (036) from power rotor (013). Add or remove layers of shims (036) to limit total power rotor axial movement to 1/16-inch (+ 1/64, -0-inch) on packing type pumps or 0.030-inch (+ 0.005, -0-inch) on pumps equipped with mechanical seals. When shim adjustment is completed, slide adjusted thickness of shim (036) or power rotor (013). Install key (026) and collar (016) on power rotor (013).

*All Pumps:* Mesh threads of idlers (014) with threads of power rotor (013) and slide rotors into housing (010) rotor bore.

**STEP 6. Installation of Packing or Mechanical Seal.** NOTE: Figures 6 through 9, 11 and 13 are for packing type pumps. Figures 10, 12, 14 and 15 are for pumps with mechanical seals.

*Figures 6, 7, 9 and 13:* If check valve (039) was removed or requires replacement, install check valve (039) and bushing (040) in inboard cover (017).

*Figures 6 through 9, 11 and 13:* Install gasket (004) and assembled inboard cover (017) on pump case (001) using bolts (002). Torque bolts (002) to 170 lbs. ft. (+- 10 lbs. ft.) on rotor sizes 231 and 250 or 85 lbs. ft. (+- 5 lbs. ft.) on rotor sizes 162 and 187. Slide packing washer (024) on power rotor and in housing packing bore. Install packing (027) rings in packing bore starting with one ring of hard packing followed by two rings of soft ending with one ring of hard packing. Slide packing gland (028) on power rotor shaft and slide gland bolts (020) parallel with shaft so gland (028) will slide to packing bore. Slide washers (021) over gland bolts (020) and install nuts (022). Tighten gland nuts (020) evenly until gland (028) just starts to enter packing bore but is in contact with installed packing.

NOTE: When pump is first started for testing, adjust packing gland until seepage rate of packing is less than 8 drops per minute. Do not overtighten gland packing or packing will score power rotor due to lack of fluid seepage for lubrication.

*Figures 10, 12, 14 and 15.* Install gasket (044) and seal cover (045) on inboard cover (017) using bolts (046). Torque bolts (046) to 20 lbs. ft. (+- 2 lbs. ft.). Pull power rotor in the axial direction until collar (016) contacts bushing (018). With the power rotor "pulled out", lightly place a scribe mark on power rotor (013) shaft just where it starts to protrude from the seal housing (045). Remove bolts (046), seal cover (045) and gasket (044). Slide spacer (042) on power rotor (013) shaft until it contacts step cut shoulder of power rotor (013). Measure distance from power rotor scribe mark back to nearest surface of spacer (042). Identify measured distance as "X" to be used below. Determine required working length of mechanical seal from Special Note below, then proceed to next paragraph.

#### SPECIAL NOTE

Mechanical Seal working length for rotor sizes 231 and 250 is 1-1/8 inch (+ 0, - 1/64-inch). Mechanical Seal working length for rotor sizes 162 and 187 is 1-1/16 inch (+ 0, -1/64-inch). Select correct seal working length and identify length as distance "S".

*Figures 10, 12, 14 and 15:* Install O-ring (2, Figure 3 or 4) on seat (1, Figure 3 or 4) or grommet (2-A, Figure 3 or 4) on seat (1-A, Figure 3 or 4) and place assembled seat in seal cover (045). Measure thickness of power rotor bore of seal cover (045) including mechanical seal thickness and identify thickness as distance "Y". Determine required thickness of shim (043) by adding seal working length "S" to thickness of seal cover bore "Y" and subtracting the total from power rotor length "X".

$$\text{SHIM THICKNESS (043)} = X - (Y + S)$$

*Figures 10, 12, 14 and 15:* Add or subtract layers of shim (043) until correct shim thickness is obtained. Then slide shim (043) on power rotor (013). Install rotating parts of mechanical seal as follows.

**Crane 9 Mechanical Seal (Refer to Figure 3):** Slide mechanical seal rotating parts (3 through 10) on power rotor (013) until retainer (7) rests next to shim (043). Remove and discard retaining clips (10); then slide seal until full contact exists between seal retainer (7) and shim (043). Tighten set screws (8).

**Crane 21 Mechanical Seal:** Slide mechanical seal rotating parts (3 through 5, Figure 4) on power rotor (013) with spring holder (5, Figure 4) next to shim (043).

**Figures 10, 12, 14 and 15 only:** With mechanical seal seat and O-ring or grommet located in seal cover (045), install gasket (044) and seal cover (045) on inboard cover (017) using bolts (046). Torque bolts (046) to 20 lbs. ft. (+- 2 lbs. ft.).

**STEP 7. Figures 6 through 9 only:** Install drip cup (003) using bolt (005) and nut (006).

**STEP 8. All Pumps:** Install tubing (037), key (029) and pump coupling hub. Install pump on foundation or bracket and align pump-driver as described in CA-1 Manual. Connect coupling hubs.

**STEP 9.** Connect all piping to pump. Ensure all piping is supported independently from the pump.

**STEP 10. Figures 6 through 9, 11 and 13 only:** When starting pump, adjust packing seepage to allow no more than eight drops per minute. DO NOT over tighten packing. Seepage from packing gland provides cooling and lubrication of packing.

**STEP 11.** Adjust flow control needle valve (008) as required to ensure proper cooling in the packing/seal chamber.

TABLE 2

LIST OF MATERIAL FOR FIGURES 6 THROUGH 13

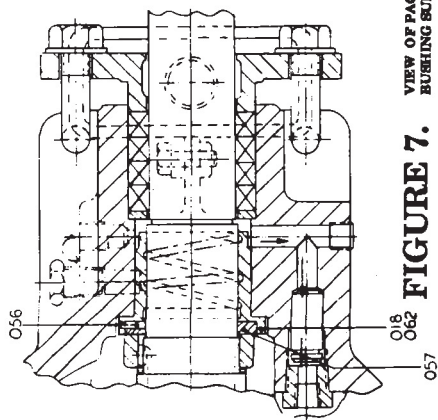
001	Case	034	Drive Screw (3)
002	Bolt (16)	035	No Flare Connector (2)
003	Drip Cup	036 (2)	Shim
004 (1)	Gasket (2)	037	Tubing
005	Bolt	038	Nipple
006	Nut	039 (2)	Check Valve
007	Plug (2)	040	Bushing
008	Needle Valve Sub-Assy.	041	Plug
009	Plug	042 (2)	Spacer
010 (2)	Housing (2)	043 (1)	Shim (2)
011 (2)	Stop Pin (2)	044 (1)	Gasket
012	Spacer Ring	045	Cover
013 (2)	Power Rotor	046	Bolt (4)
014 (2)	Idler (2) [3]	047 (1)	Seal
015	Outboard Cover	049	Close Nipple
016 (2)	Collar	050	Flush Bushing
017	Inboard Cover	051	Spring Pin
018 (2)	Bushing	052	Pipe Cap (40)
019 (2)	Adjusting Screw (2) [6]	053	No Flare Tee
020	Gland Bolt (2)	054	No Flare Elbow
021	Washer (2)	055 (2)	Block
022	Nut (2) (bolt, Figure 11)	056	Pin
023 (2)	Stop Pin	057 (2)	Insert Bushing
024	Washer	060 (1)	Gasket
025 (2)	Jam Nut (2) [6]	061	Plug (4)
026 (2)	Woodruff Key	062	Bushing
027 (1)	Packing	090	Plug (3)
028	Gland	096	Continuous Threaded Stud (2)
029	Key	097	Gland
030	Name Plate	098	Gland
031	Name Plate	099	Capscrew
032	Name Plate		
033	Drive Screw (4)		

(1) Minor Repair Kit items.

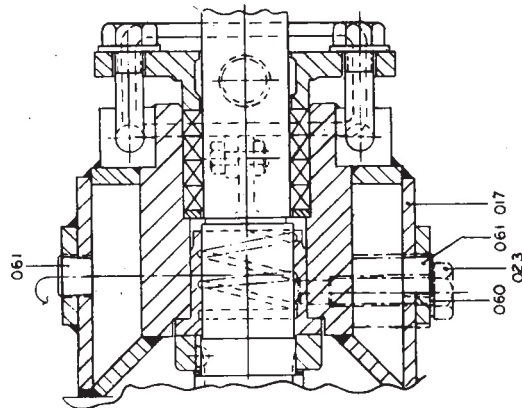
(2) Major Repair Kit items. (Items marked (1) are included in Major Repair Kit.)

Quantities are one except when noted in parentheses or brackets after part description.

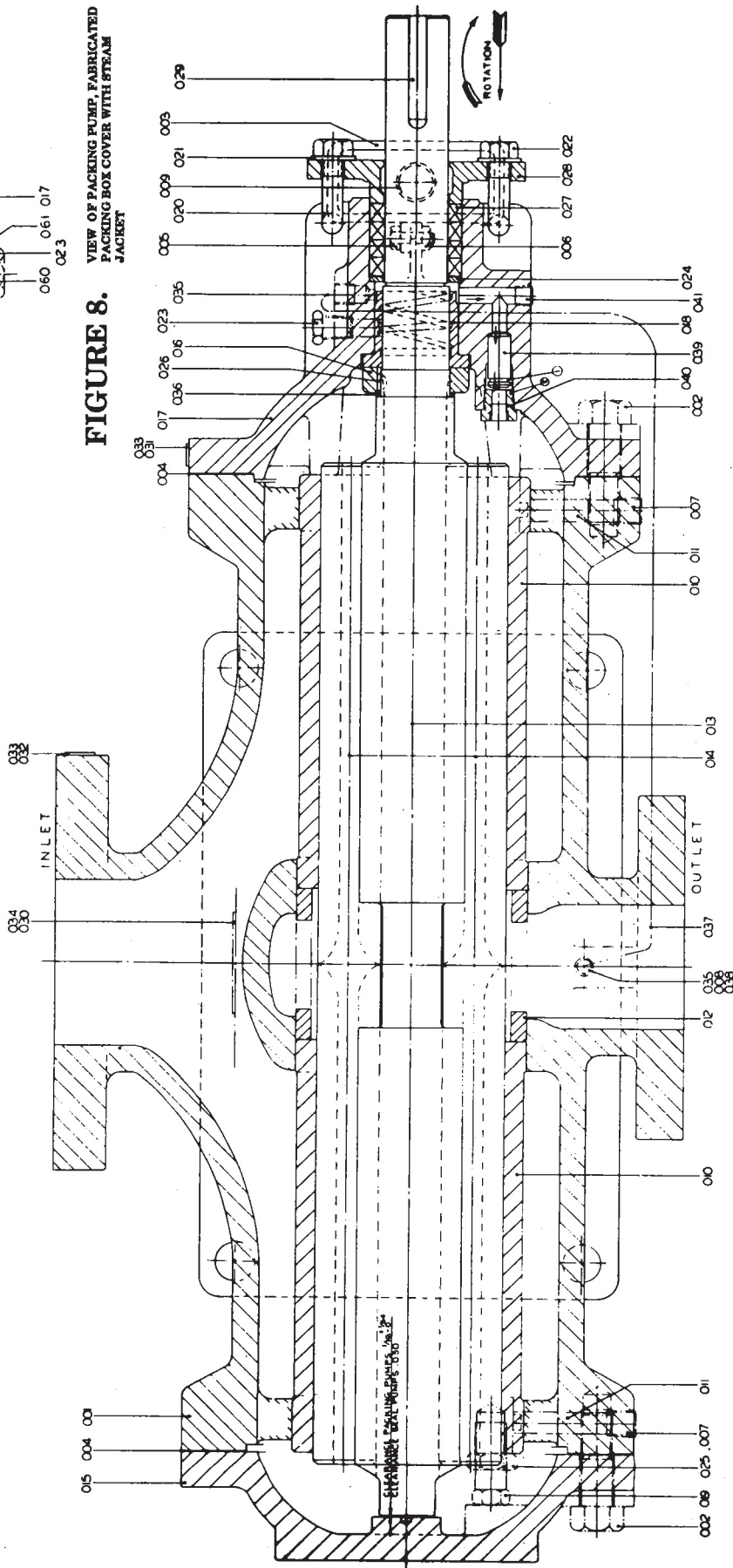
[. ] Denote quantities for 424A pumps.



**FIGURE 7.** VIEW OF PACKING PUMP WITH BUSHING SUB ASSEMBLY



**FIGURE 8.** VIEW OF PACKING PUMP, FABRICATED PACKING BOX COVER WITH STEAM JACKET



**FIGURE 6**





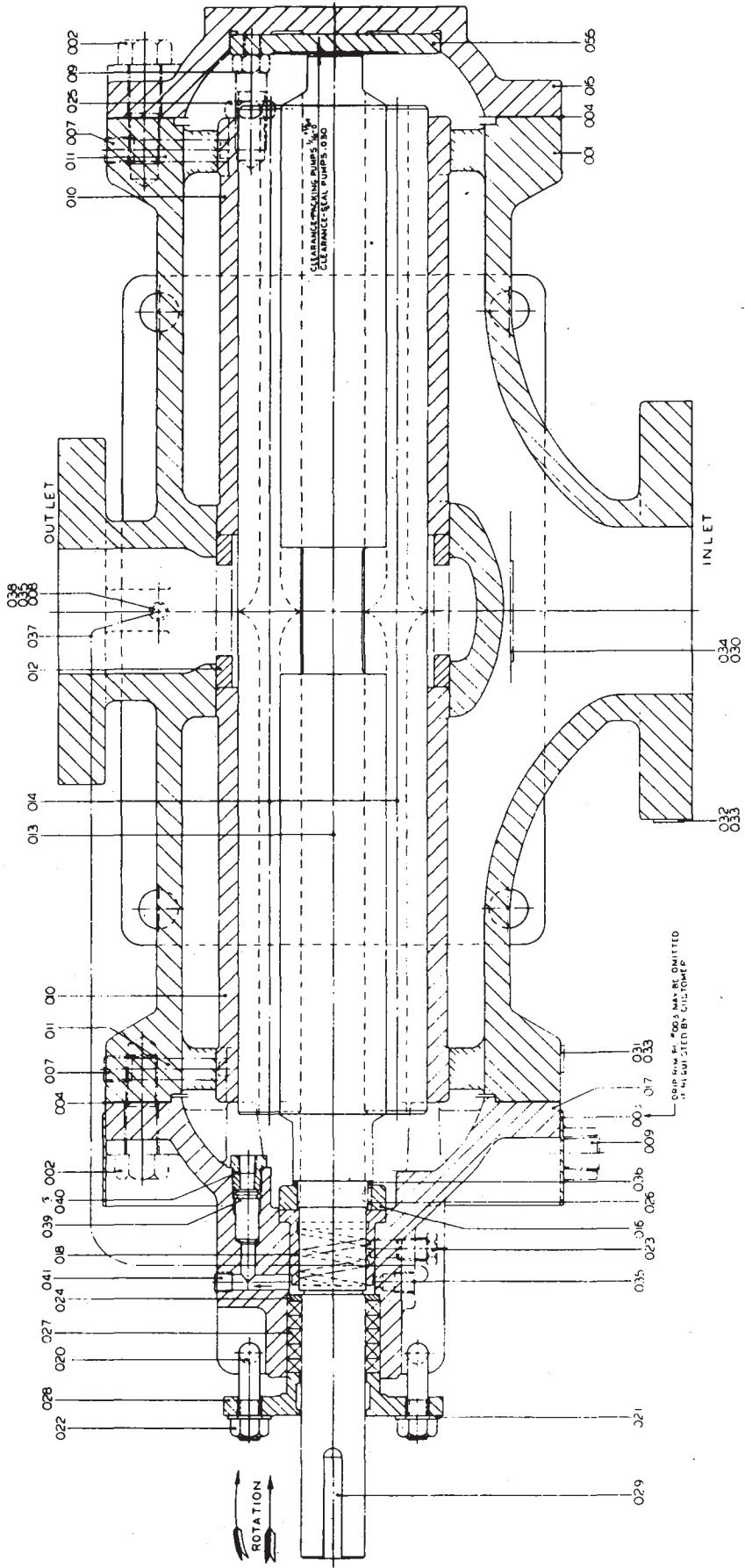
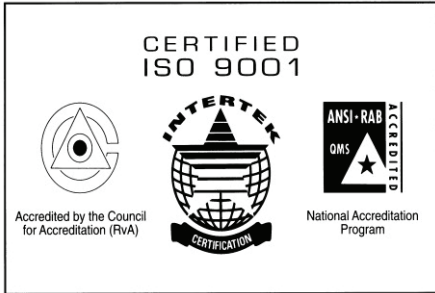


FIGURE 13. VERTICAL PUMPS





**CIRCOR**

1710 Airport Road  
PO Box 5020  
Monroe, NC USA  
28111.5020

Tel: +1. 877.853.7867

Email: [cc@circor.com](mailto:cc@circor.com)

Web: [www.circorpt.com](http://www.circorpt.com)

