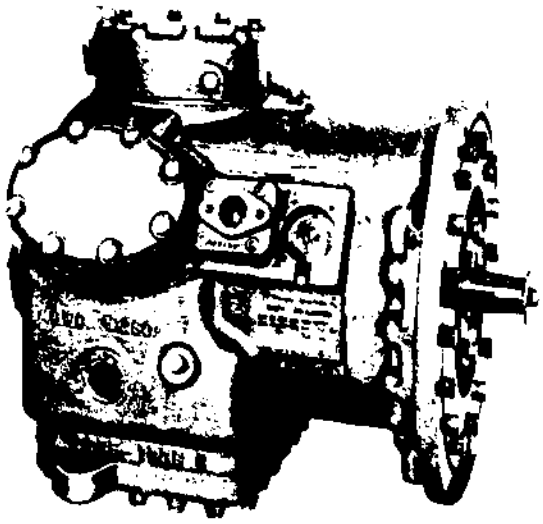
Division of
Carrier Corporation

Carrier
Transicold
Company

# MODEL
# O5D

# OPERATION AND SERVICE MANUAL
# O5D COMPRESSOR



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SECTION 1

DESCRIPTION

## 1.1 GENERAL DESCRIPTION

The Carrier Transicold Model 05D compressors are designed for refrigeration and air conditioning applications. These compressors are of the open, reciprocating type, that is, of positive displacement. A crankshaft, connecting rods, pistons, and reed type valves accomplish vapor compression. Compressor wear is minimized by splash lubrication and force feed lubrication, which is accomplished by an oil pump driven directly from the end of the compressor crankshaft.

The tapered end of the crankshaft, which extends outside the crankcase, is adaptable to a variety of direct drive mechanisms. See figure 1-1. A mechanical seal prevents refrigerant leakage where the rotating shaft passes through the crankcase.

The compressor is equipped with flanges for connecting suction and discharge service valves. Connections are also provided for pressure gauges and safety cutout switches. A sight glass provides a means of checking oil level in the compressor crankcase. A drain plug facilitates draining of oil from the crankcase and an oil fill plug enables addition of oil when necessary. A bottom plate provides access through the bottom of the crankcase for maintenance.

Capacity of the Model 05D compressor is determined by piston displacement and clearance, suction and discharge valve size, compressor speed, suction and discharge pressure, type of refrigerant, and unloader solenoid valves.

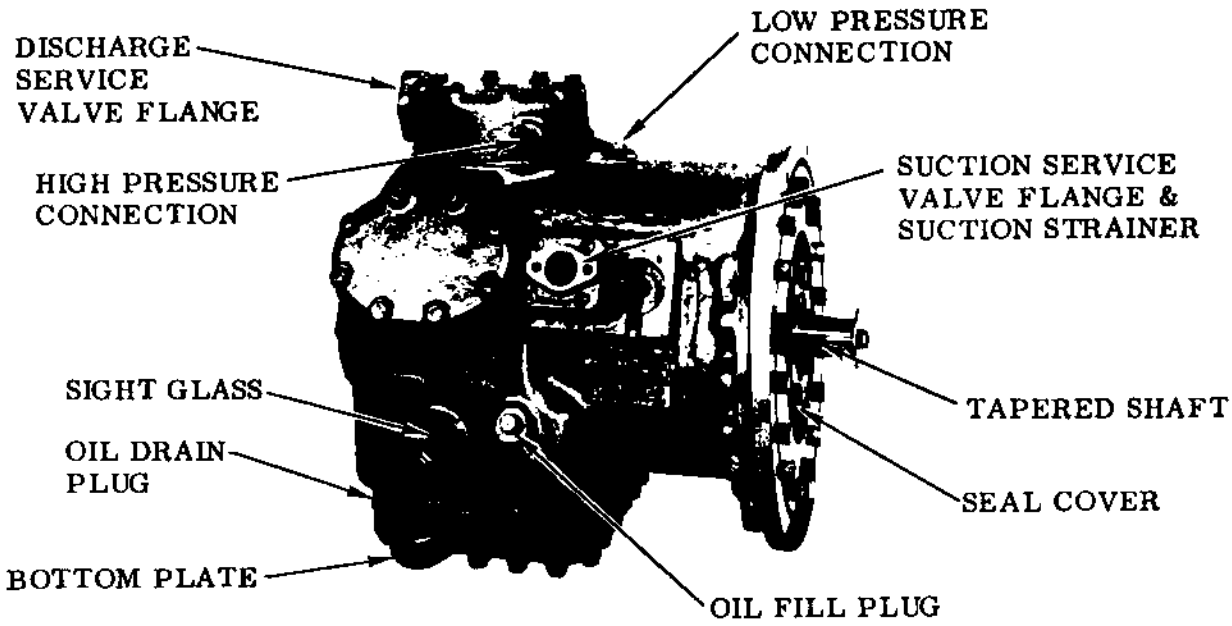



Figure 1-1. Model 05D Compressor

## 1.2 COMPRESSOR REFERENCE DATA

| | |
|---|---|
| Manufacturer | Carrier Transicold Company |
| Model No. | 05D |
| No. of Cylinders | 6 |
| Bore | 2" (50.8 mm) |
| Stroke | 1-15/16" (49.2 mm) |
| Operating Speed | 1350 to 1950 rpm (1750 rpm, nominal) |
| Minimum Speed (for lubrication) | 900 rpm |
| Horsepower | 15, nominal |
| Oil Pressure at 1750 rpm | 15 to 20 psi (1.05 to 1.4 kg/cm$^2$) above suction pressure |
| Oil Charge | 9 pints (4.3 litres) |
| Weight (less service valves) | 220 lb (100 kg) |
| Approved Oils* | |
| Sun Oil Co. | Suniso 3GS |
| Carrier | PP33-2 |

* NOTE: The above oils are suitable for use with reciprocating compressors using R-12 or R-22 and with evaporator temperatures above -40°F (-40°C).

## 1.3 DETAILED DESCRIPTION

### 1.3.1 SUCTION AND DISCHARGE VALVES

The compressor uses reed type suction and discharge valves made of highest quality steel for long life. The valves operate against hardened integral seats in the valve plate.

The pistons move in a straight line, but alternately in divergent directions. The downstroke of the piston admits refrigerant gas through the suction valve, and then compresses this gas on the upstroke, thereby raising its temperature and pressure. The compressed gas is prevented from re-entering the cylinder on its next downstroke by the compressor discharge valve. See figure 1-2 for a diagram of the gas flow through a compressor without capacity control unloaders. For compressors equipped with unloaders, refer to paragraph 1.3.2 and figures 1-3 through 1-6.

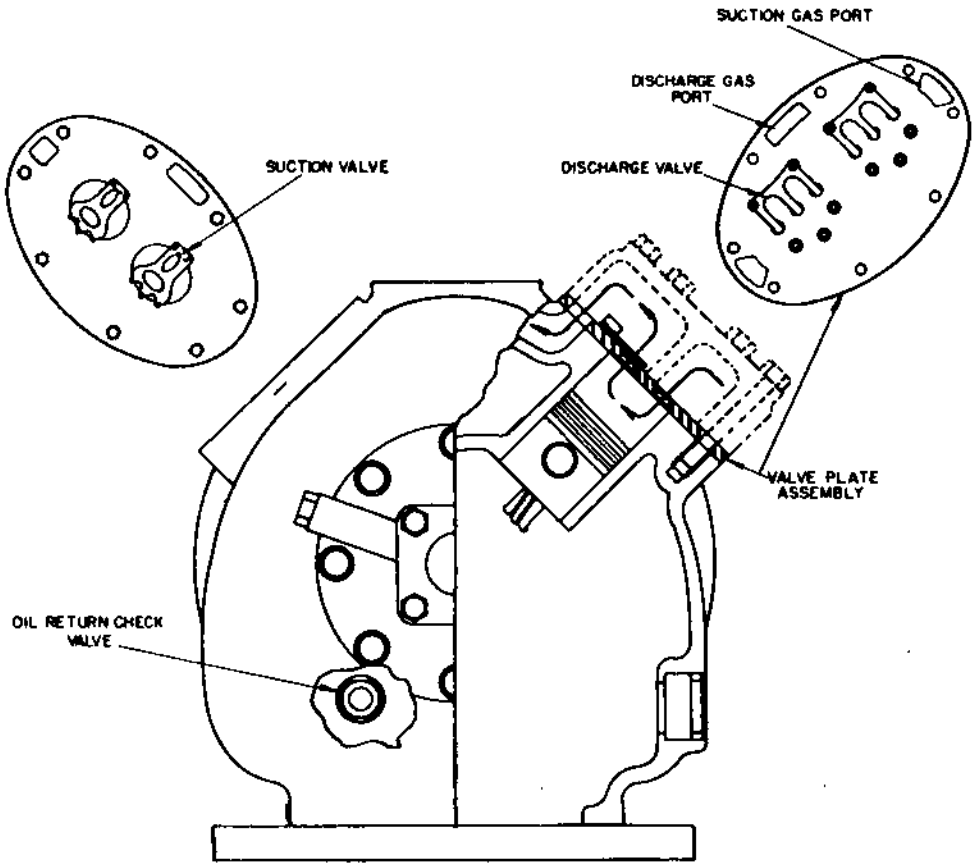



Figure 1-2. Gas Flow Through 05D Compressor Without Capacity Control

### 1.3.2 CAPACITY CONTROL UNLOADERS

There are two types of optional capacity control unloaders used with the 05D Compressors: electric solenoid-operated and pressure-operated unloaders. Both of these unloaders are of the snap-action, cylinder head bypass type, using a piston type control valve to control discharge gas flow. They differ primarily in the method of controlling the bypass control valve. The two types of unloaders can be easily identified by their shape. See figures 1-3 through 1-6.

#### 1.3.2.1 Electric Solenoid-Operated Unloaders

The unloader solenoid is controlled by either a pressure switch or temperature switch (thermostat). When demand for refrigeration decreases, the pressure or temperature switch energizes the solenoid which unloads the cylinder and allows discharge gas to circulate as shown in figure 1-3. The unloaded cylinders operate with little or no pressure differential, consuming very little power. When the solenoid is de-energized, cylinders reload allowing discharge gas to circulate as shown in figure 1-4.

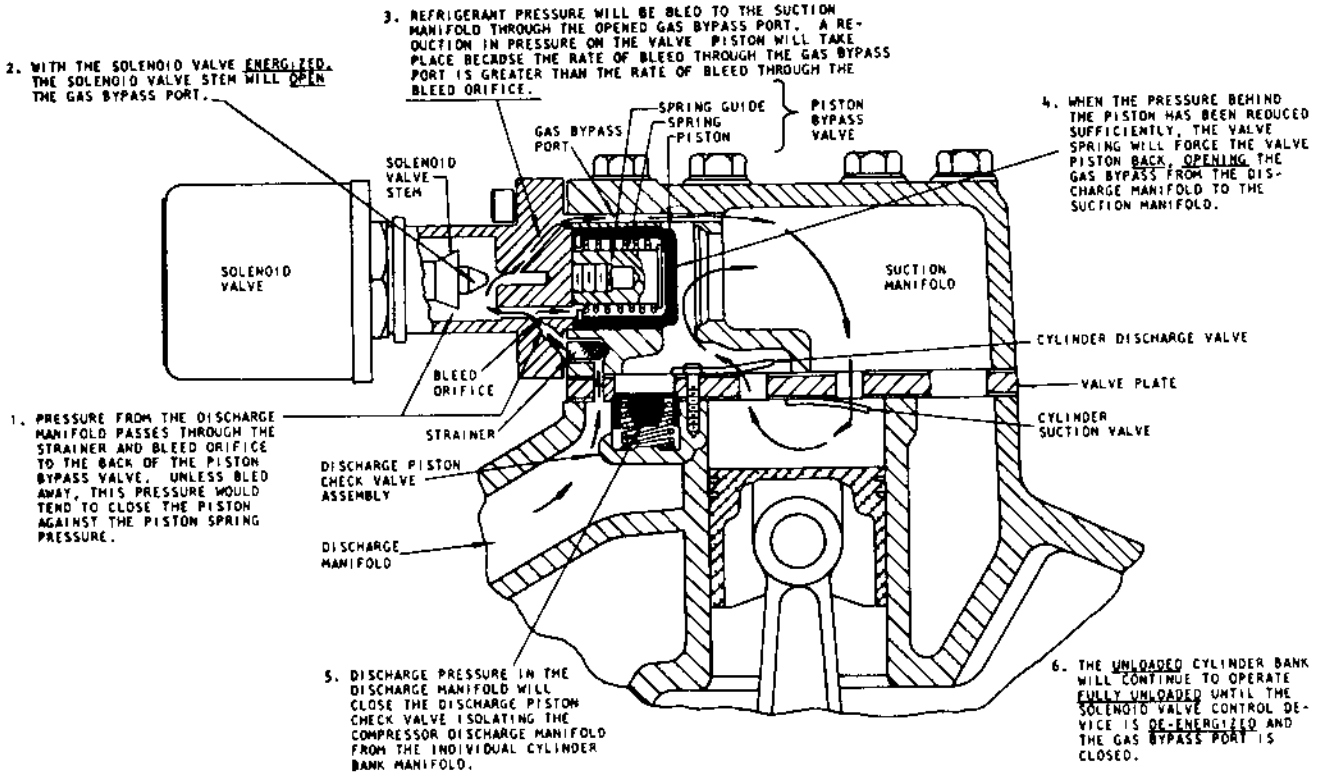



Figure 1-3. Solenoid-Operated Unloader, Unloaded Operation

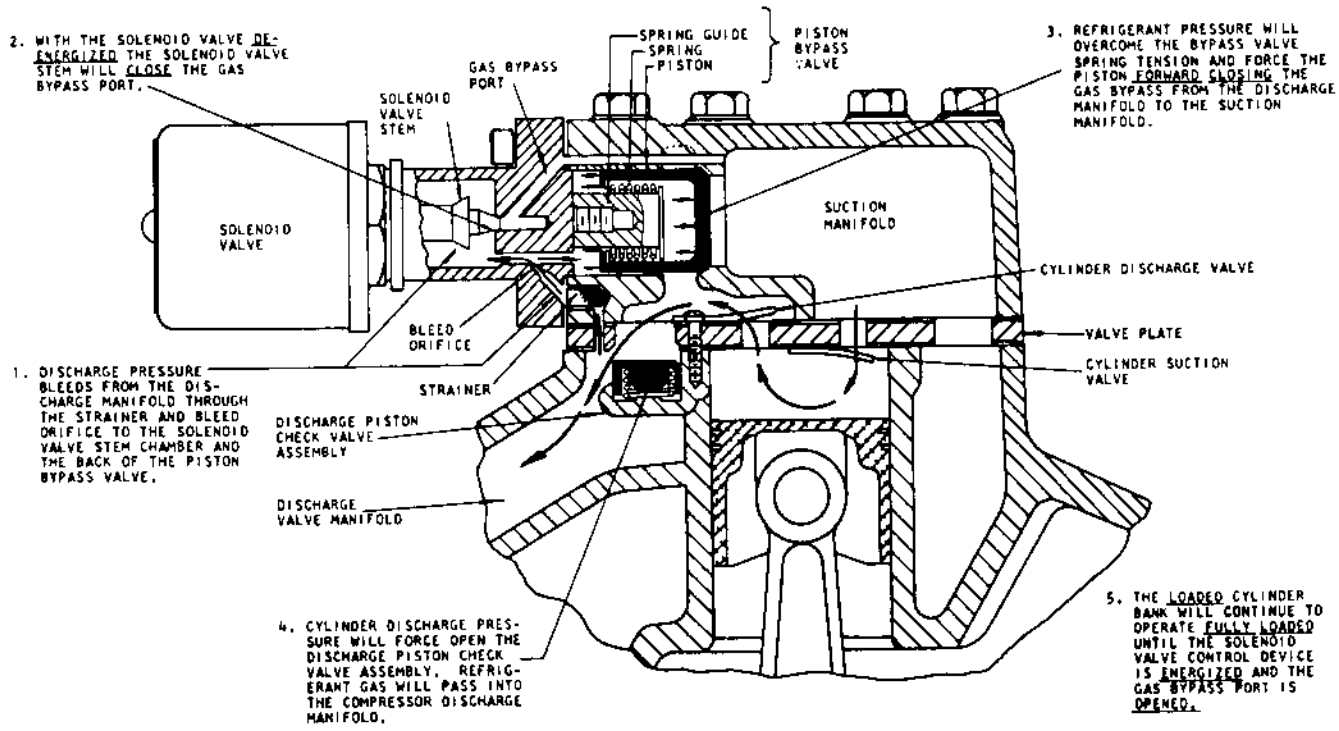



Figure 1-4. Solenoid-Operated Unloader, Loaded Operation

### 1.3.2.2 Pressure-Operated Unloaders

The pressure-operated unloaders are controlled by suction pressure and actuated by discharge pressure. Each unloader valve controls two cylinders. On startup, controlled cylinders do not load up until differential between suction and discharge pressure is 10 psi (0.7 kg/cm$^2$).

During loaded operation, when suction pressure is above the valve control point, the poppet valve will close. Discharge gas bleeds into the valve chamber; the pressure closes the bypass piston; and the cylinder bank loads up. Discharge gas pressure forces the check valve open, permitting gas to enter the discharge manifold. See figure 1-5.

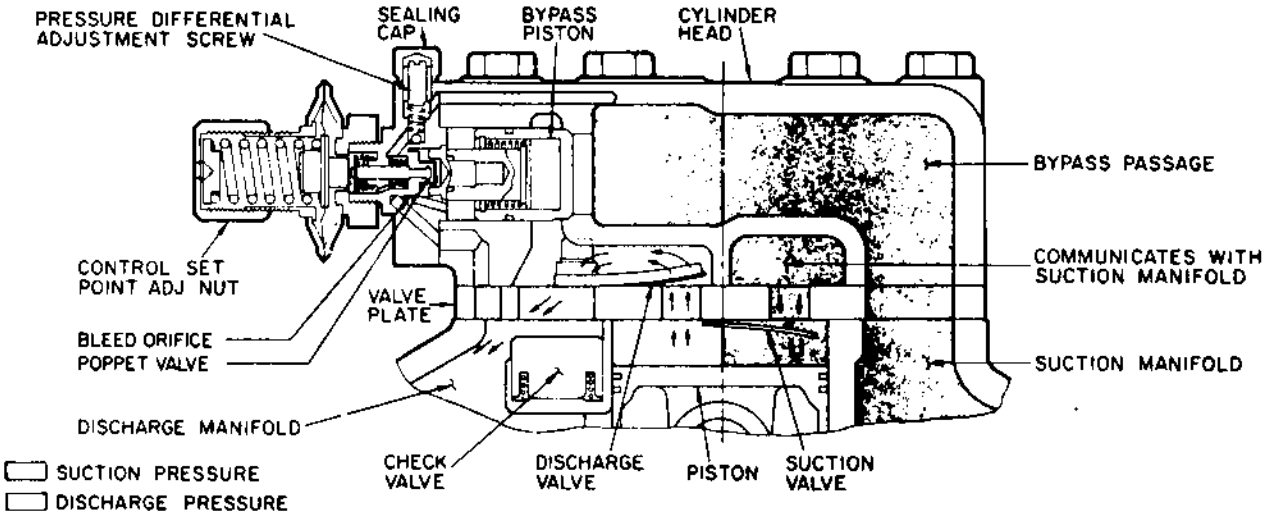



Figure 1-5. Pressure-Operated Unloader, Loaded Operation

During unloaded operation, when suction pressure drops below the valve control point, the poppet valve will open. Discharge gas bleeds from behind the bypass piston to the suction manifold. The bypass piston opens, discharge gas is recirculated back to the suction manifold and the cylinder bank is unloaded. Reduction in discharge pressure causes the check valve to close, isolating the cylinder bank from the discharge manifold. See figure 1-6.

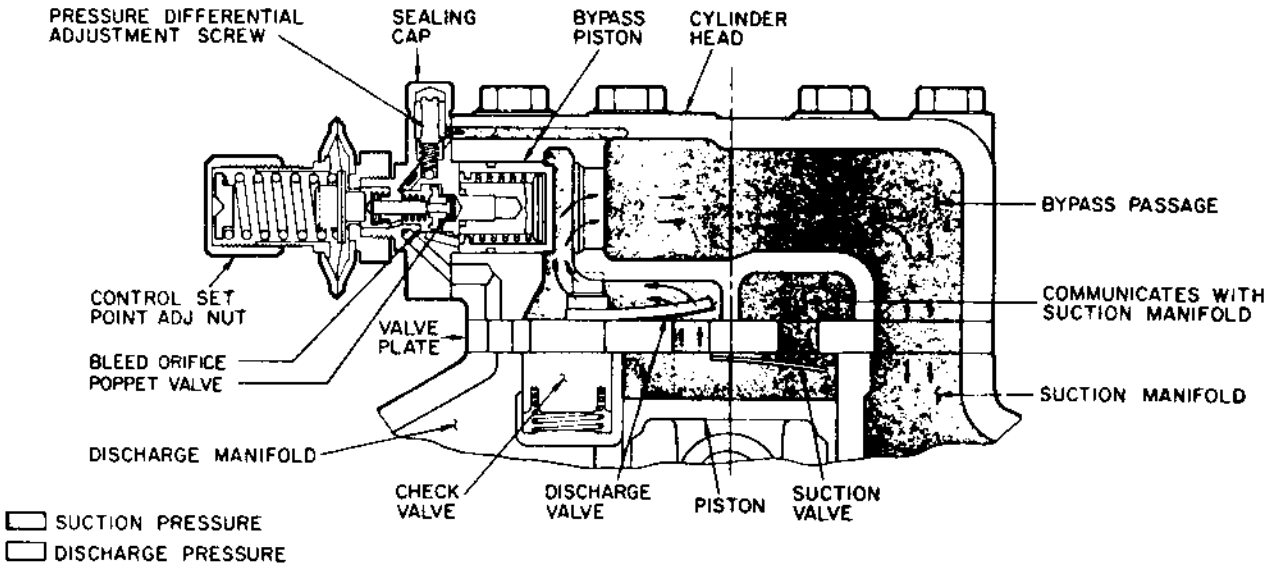



Figure 1-6. Pressure-Operated Unloader, Unloaded Operation

## 1.3.3. LUBRICATION SYSTEM

Force-feed lubrication of the compressor is accomplished by an oil pump driven directly from the compressor crankshaft. Refrigeration oil is drawn from the compressor crankcase through the oil filter screen and pick up tube to the oil pump located in the bearing head assembly. The crankshaft is drilled to enable the pump to supply oil to the main bearings, connecting rod bearings, and the shaft seal. See figure 1-7. The lubricating oil is pumped through the lube system by means of two spring loaded plungers operating on an eccentric rotor. See figure 3-5, page 3-7.

The oil flows to the pump end main bearings, connecting rod bearings and seal end main bearings, where the oil path is divided into two directions. The largest quantity flows to the oil relief valve, which regulates oil pressure at 15 to 18 psi (1.07 to 1.29 $kg/cm^2$) above suction pressure. The oil relief valve is contained in a copper tube located in the compressor crankcase. When the oil pressure reaches 15 to 18 psi (1.07 to 1.29 $kg/cm^2$) above suction pressure, the relief valve spring is moved forward allowing the oil to return to the crankcase. The remaining oil flows through a copper tube into the end cover plate and through an orifice to provide shaft seal lubrication and cooling.

Oil is returned from the suction side of the compressor to the crankcase side through an oil return check valve. A pressure differential is maintained between the crankcase side and suction (drive) side of the compressor to aid proper oil return. Vapor flows through a drilled passage in the crankshaft connecting the crankcase to the drive side passing through the hollow roll pin and hollow set screw in the mass end of the counterweight. As the shaft and counterweight revolve, a slight suction is created. This suction draws vapor from the crankcase side through the crankshaft, creating a lower pressure in the crankcase side than in the drive side. This lower pressure helps to draw the oil through the check valve and return it to the crankcase.

Four equalization holes drilled in the wall between the suction cavity and the crankcase allow equalization of suction pressure which prevents possible loss of oil pressure during flooded starts and provides for maximum lubrication during extreme operating conditions.

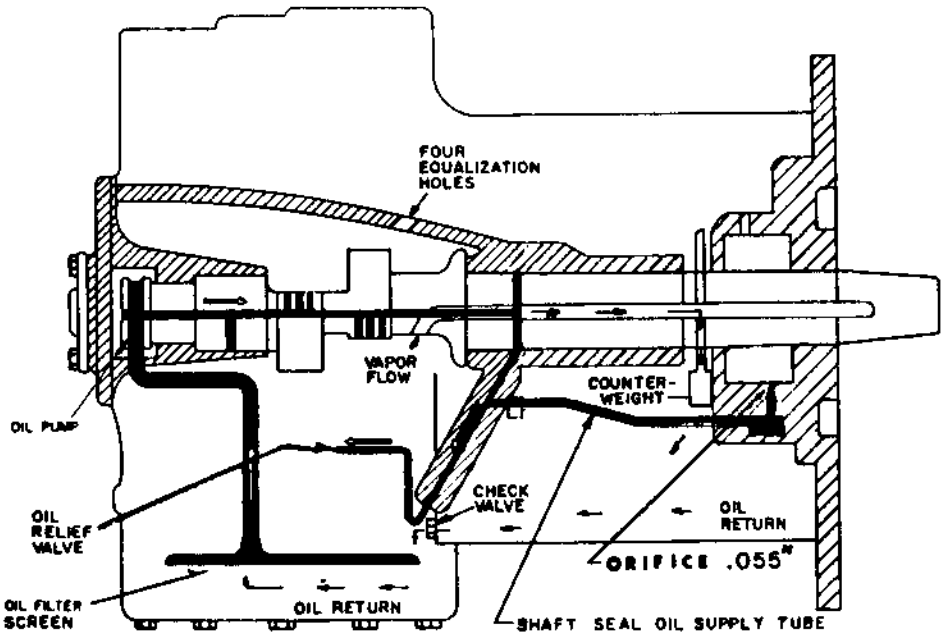



Figure 1-7. Lubrication System

## 1.3.4 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves furnished for use on the 05D compressors are equipped with mating flanges for connecting to flanges on the compressor. See figure 1-1. These valves are provided with a double seat and a gauge connection, which enable servicing of the compressor and refrigerant lines.

Turning the valve stem clockwise (all the way forward) frontseats the valve, closing off the suction and discharge lines and opening up the gauge connection to the compressor. See figure 1-8. Turning the valve stem counterclockwise (all the way out) backseats the valve, opening up the suction or discharge line to the compressor and closing off the gauge connection.

With the valve stem midway between frontseated and backseated positions, suction or discharge line is open to both the compressor and the gauge connection.

For example, when connecting manifold gauge to measure suction or discharge pressure, ensure valve stem is fully backseated. Then, to measure suction or discharge pressure, partially frontseat (about two turns) the valve stem.

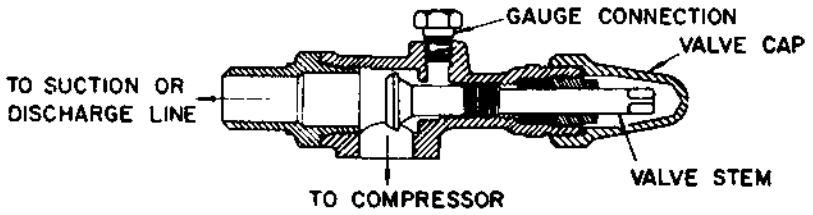



Figure 1-8. Suction or Discharge Service Valve

## SECTION 2

## COMPRESSOR REPLACEMENT

### 2.1 COMPRESSOR REMOVAL

Refer to the operation and service manual covering the equipment in which the compressor is installed for specific removal instructions. A general removal procedure is given below.

a. If compressor is completely inoperative, frontseat the suction and discharge service valves to trap the refrigerant in the unit. If the compressor will operate, pump down the unit; then, frontseat the suction and discharge service valves.

b. Slowly loosen plug in gauge connection on suction and discharge service valve and bleed refrigerant pressure to atmosphere.

c. Disconnect refrigerant lines at service valve flange connections on the compressor; retain hardware.

d. Ensure power source is removed from any controls installed on the compressor (e.g. capacity control solenoids, pressure switches, etc.).

e. Remove any components necessary to gain access to the compressor or to enable removal.

f. Disconnect the drive mechanism at the compressor.

g. Remove mounting hardware and remove compressor from unit.

h. If compressor is to be repaired, refer to Section 3 for repair procedures. If a replacement compressor is to be installed, refer to paragraph 2.2 for replacement procedures.

### 2.2 COMPRESSOR REPLACEMENT

Consult the unit service parts list for the correct replacement compressor and ensure one is available for installation.

Service replacement compressors are normally furnished without suction and discharge service valves and capacity control unloaders. The service valves are normally retained on the unit to isolate the refrigerant lines during compressor replacement. Blank-off pads are usually installed on the service valve flanges. These pads must be removed prior to installing the compressor. If the faulty compressor is to be returned for overhaul or repair, install the pads on the compressor for sealing purposes during shipment.

Service replacement compressors are normally furnished with cylinder head bypass piston plugs installed on the unloader flanges in lieu of the unloader valves. If capacity control unloaders are required, the unloaders must be removed from the faulty compressor and transferred to the replacement prior to installation. Refer to paragraph 2.2.1.

If the faulty compressor is to be returned for overhaul or repair, install the plugs on the compressor for sealing purposes during shipment. If the unloaders are inoperative, new ones may be purchased separately; consult the compressor or unit parts list for ordering information.

## 2.2.1 INSTALLING CAPACITY CONTROL UNLOADERS

a. Remove the three socket head capscrews holding piston plug to cylinder head of the replacement compressor. See figure 2-1.

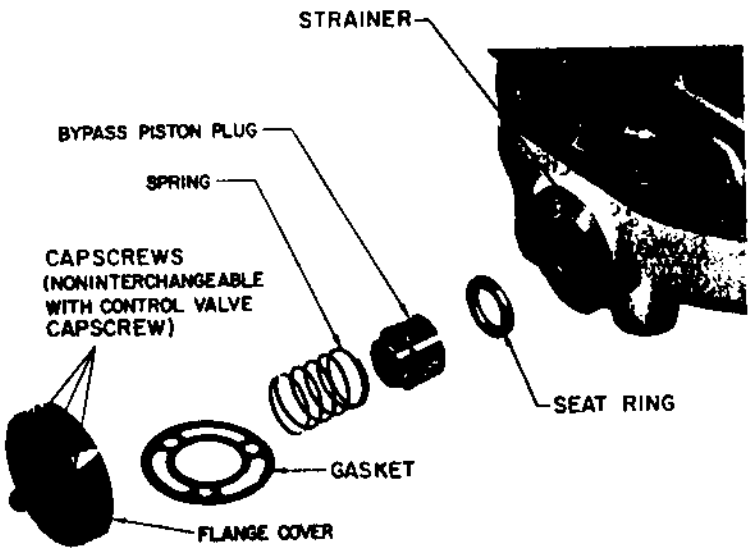



Figure 2-1. Removal of Bypass Piston Plug

b. Remove flange cover, gasket, spring, bypass piston plug, and seat ring. A tapped hole is provided in piston plug for use with a jackscrew to enable removal of the plug. One of the socket head capscrews may be used as a jackscrew.

c. Remove the three socket head capscrews holding unloader in the cylinder head of the faulty compressor; remove the unloader and retain the capscrews.

NOTE

Capscrews removed from the bypass piston plug flange cover are not interchangeable with capacity control unloader capscrews. When installing the unloaders, be sure to use the unloader capscrews.

d. Using a new gasket, install the unloaders in the cylinder heads of the replacement compressor. See figure 2-1. Refer to table 3-1, page 3-2, for required torque values.

e. If the defective compressor is to be returned for overhaul or repair, install the bypass piston plug, spring, seat ring and flange cover onto the cylinder heads.

## 2.2.2 INSTALLING COMPRESSOR

CAUTION

Do not backseat (open) suction and discharge service valves until the compressor has been leak tested and evacuated.

a. Install the compressor in the unit by reversing the procedure of paragraph 2.1, steps b. through g. Install new locknuts on compressor mounting bolts and new gaskets on suction and discharge service valves.

b. Check oil level in oil level sight glass. Oil level should be between bottom 1/8 and 1/2 of sight glass. If necessary, add or remove oil.

c. Leak test, evacuate, and dehydrate the compressor.

d. Fully backseat suction and discharge service valves.

e. Start the unit and check for leaks and noncondensibles in the refrigerant system.

f. Check refrigerant level.

g. Recheck compressor oil level.

h. Check operation of capacity control unloaders (if installed).

i. Check unit refrigeration cycles.

SECTION 3

COMPRESSOR MAINTENANCE

## 3.1 COMPRESSOR DISASSEMBLY

Prior to disassembly of the compressor, oil must first be drained from the crankcase. Place the compressor in a position where it will be convenient to drain the oil. Remove the oil fill plug to vent the crankcase. Loosen the drain plug in the bottom plate and allow the oil to drain out slowly.

If dismantled parts are to be left overnight or longer, dip them in clean compressor oil and wrap them in oil soaked rags to prevent rusting.

If a faulty part in the compressor is to be replaced, it may be necessary to remove other parts first. Therefore, the disassembly instructions that follow are arranged in the order for complete disassembly. See figure 3-4, page 3-5, for an exploded view of the compressor. Refer to table 3-2 for permissible wear limits and table 3-1 for torque values for tightening bolts.

### 3.1.1 CYLINDER HEAD AND VALVE PLATE ASSEMBLY

a. Loosen cylinder head capscrews. If the head is stuck, tap it lightly with a wooden or lead mallet to free it. Be careful not to drop the head or damage the gasket sealing surface. Remove cylinder head capscrews and gasket. See figure 3-4.

b. Remove the discharge valve capscrews and lock washers. Free the valve plate from the cylinder deck by using the discharge valve holddown capscrews as jackscrews through the tapped holes in the valve plate, after the valve stops and valves have been removed. Remove the valve plate gasket.

c. Discard valves and gaskets. Use only new valves and gaskets when reassembling cylinder head and valve plate.

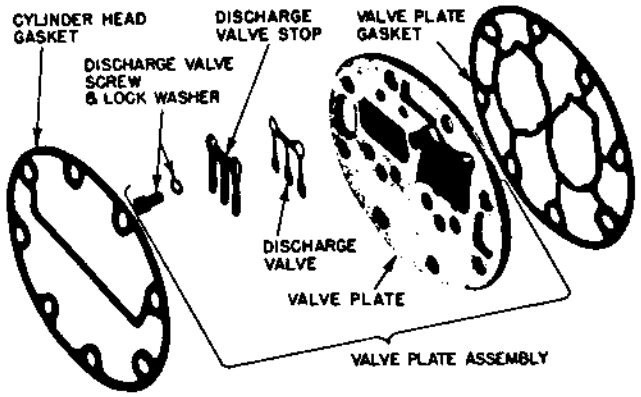



Figure 3-1. Exploded View of Valve Plate Assembly

Table 3-1. Torque Values

| SIZE DIAM(in.) | THREADS PER IN. | TORQUE RANGE FT-LB | TORQUE RANGE MKG | USAGE |
|---|---|---|---|---|
| 1/16 | 27 (pipe) | 8-12 | 1.11 - 1.66 | Pipe Plug - Crankshaft |
| 1/4 | 20 (pipe) | 20-25 | 2.77 - 3.45 | Oil Return Check Valve - Crankcase |
| | 20 (pipe) | 20-25 | 2.77 - 3.45 | Pipe Plug - Press. Gauge Connection |
| | 20 | 8-10 | 1.11 - 1.38 | Connecting Rod Capscrew |
| | 28 | 12-16 | 1.66 - 2.21 | Unloader Valve |
| | 28 | 6-10 | 0.83 - 1.38 | Oil Pump Drive Segment |
| No. 10 | 32 | 4-6 | 0.55 - 0.83 | Oil Pump Drive Segment |
| 5/16 | 18 | 16-20 | 2.21 - 2.77 | Cover Plate - Pump End Bearing Head<br>Suction Valve<br>Discharge Valve<br>Suction Valve Adapter - Crankcase |
| 3/8 | 16 | 25-30 | 3.46 - 4.15 | Pump End Bearing Head<br>Bottom Plate - Crankcase<br>Compressor Foot<br>Seal Cover |
| | 16 | 30-35 | 4.15 - 4.84 | Cylinder Head |
| 7/16 | 14 | 55-60 | 7.61 - 8.30 | End Cover - Crankcase |
| 1-1/2 | 18 NEF | 35-45 | 4.84 - 6.22 | Oil Level Sight Glass |

NEF - National Extra Fine

Table 3-2. Wear Limits

| PART NAME | FACTORY MAXIMUM INCHES | FACTORY MAXIMUM MM | FACTORY MINIMUM INCHES | FACTORY MINIMUM MM | MAXIMUM WEAR BEFORE REPAIR INCHES | MAXIMUM WEAR BEFORE REPAIR MM |
|---|---|---|---|---|---|---|
| SEAL END | | | | | | |
| Main Bearing Dia | 1.6260 | 41.3004 | | | .002 | 0.051 |
| Main Bearing Journal Dia | | | 1.6233 | | .002 | 0.051 |
| PUMP END | | | | | | |
| Main Bearing Dia | 1.3755 | 34.9377 | | | .002 | 0.051 |
| Main Bearing Journal Dia | | | 1.3735 | 34.8869 | .002 | 0.051 |
| CONNECTING ROD DIA | 1.3755 | 34.9377 | | | .002 | 0.051 |
| Piston Pin Bearing | | | .6878 | 17.4701 | .001 | 0.0254 |
| CRANKPIN DIAMETER | | | 1.9356 | 49.16 | .0025 | 0.0635 |
| Throw | 1.9396 | 49.27 | | | | |
| THRUST WASHER (Thickness) | | | | | | |
| Pump End | .145 | 3.683 | .144 | 3.658 | .040* | 1.016 |
| Seal End | .157 | 3.987 | .155 | 3.937 | .040* | 1.016 |
| CYLINDERS AND PISTONS | | | | | | |
| Bore | 2.0005 | 50.8127 | | | .002 | 0.051 |
| Piston (Dia) | | | 1.996 | 50.0698 | .002 | 0.051 |
| Piston Pin (Dia) | | | .6873 | 17.4574 | .001 | 0.025 |
| Piston Pin Bearing | | | Thumbfit | | | |
| Piston Ring Gap | .013 | 0.33 | .005 | 0.127 | .025 | 0.635 |
| Piston Ring Side Clearance | .002 | 0.051 | .001 | 0.0254 | .002 | 0.051 |
| SUCTION VALVE RECESS (Depth) | .082 | 2.08 | .078 | 1.98 | .090 | 2.286 |

* Maximum end clearance between thrust washer and shaft.

### 3.1.2 BOTTOM PLATE, STRAINER, AND CONNECTING ROD CAPS

a. Turn the compressor over on its side and remove the bottom plate and gaskets.

b. Remove the oil strainer.

c. Two types of connecting rod capscrews may be used on the connecting rod caps: a regular capscrew and locking tab or an epoxy encapsulated capscrew with a flat washer. In either case, it is recommended that the capscrew or capscrew and locking tab be discarded and a new epoxy encapsulated capscrew and flat washer installed during compressor reassembly.

d. Tap the connecting rod locking devices (if installed) flat and remove the capscrews and connecting rod caps. See figure 3-2. Match mark each connecting rod cap and connecting rod for correct reassembly.

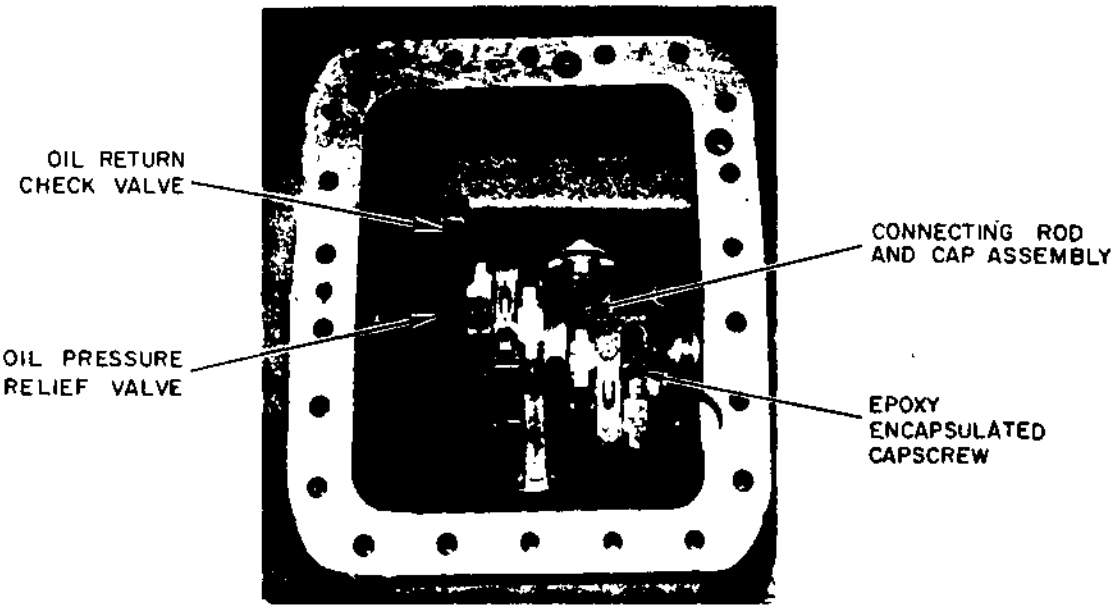



Figure 3-2. Bottom Plate Removed

e. Push the piston rods up so that the piston rings extend above the cylinders. Remove and discard the piston rings. Use only new rings when reassembling the compressor.

CAUTION

While turning crankcase, avoid bending or breaking the copper tube which connects to the oil suction strainer. The tube will extend out the bottom with the bottom plate removed.

### 3.1.3 OIL PUMP AND BEARING HEAD ASSEMBLY

a. Remove four capscrews and remove oil pump cover; this will free the oil feed guide retaining spring, cover gasket, and the oil feed guide.

b. Remove the two drive segment capscrews and lock washers. See figure 3-3.

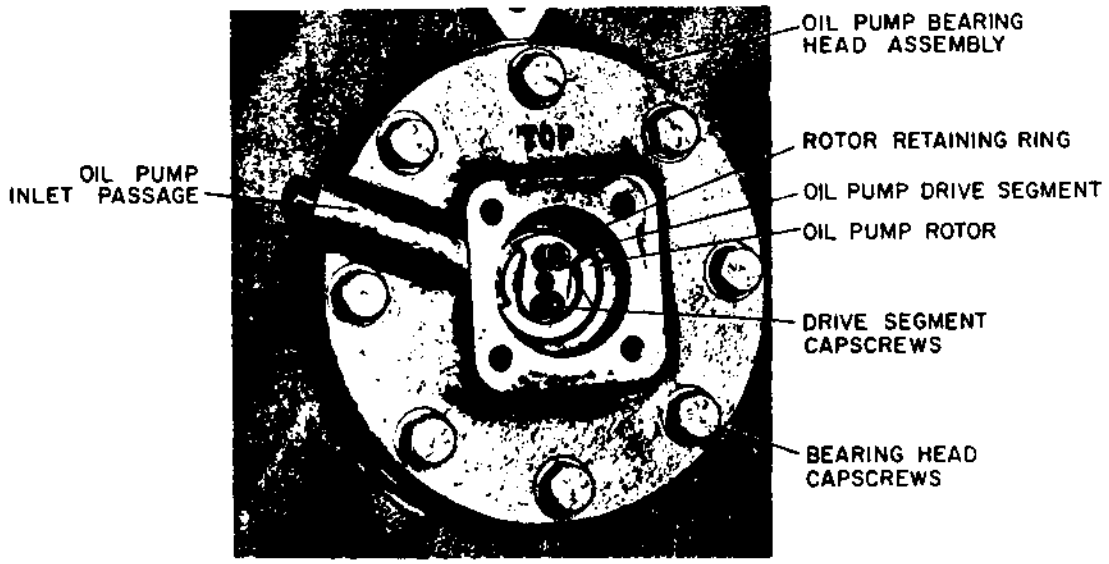



Figure 3-3. Bearing Head with Oil Pump Cover Removed

c. Remove eight capscrews and remove oil pump bearing head assembly, gasket, and thrust washer. Disassembly and repair of the pump and bearing head assembly will be accomplished during inspection and before reassembly.

### 3.1.4 END COVER, SEAL, AND CRANKSHAFT

a. Remove four capscrews and remove dust seal retainer and felt ring. Remove remaining four capscrews and remove shaft seal cover. See figure 3-10, page 3-12.

b. Remove shaft seal assembly, carbon ring washer, and gasket.

CAUTION

Do not drop the compressor end cover; pull cover straight off to avoid damage to shaft and shaft seal oil supply tube.

c. To remove the end cover, remove capscrews in the 3 o'clock and 9 o'clock positions and install two studs. The studs should be long enough to enable their use as guide supports when lifting off the cover. Remove the remainder of the capscrews. Carefully lift the end cover off horizontally and parallel to the shaft axis using the studs as guide supports. Do not allow the cover to drop from its own weight.

d. To remove the counterweight, remove the two setscrews which are installed radially into the counterweight. Tap out the roll pin so that it emerges from the mass end of the counterweight. Slide the counterweight off the shaft. See figure 3-9.

e. Push piston rod assemblies out of the way and remove the crankshaft and seal end thrust washer.

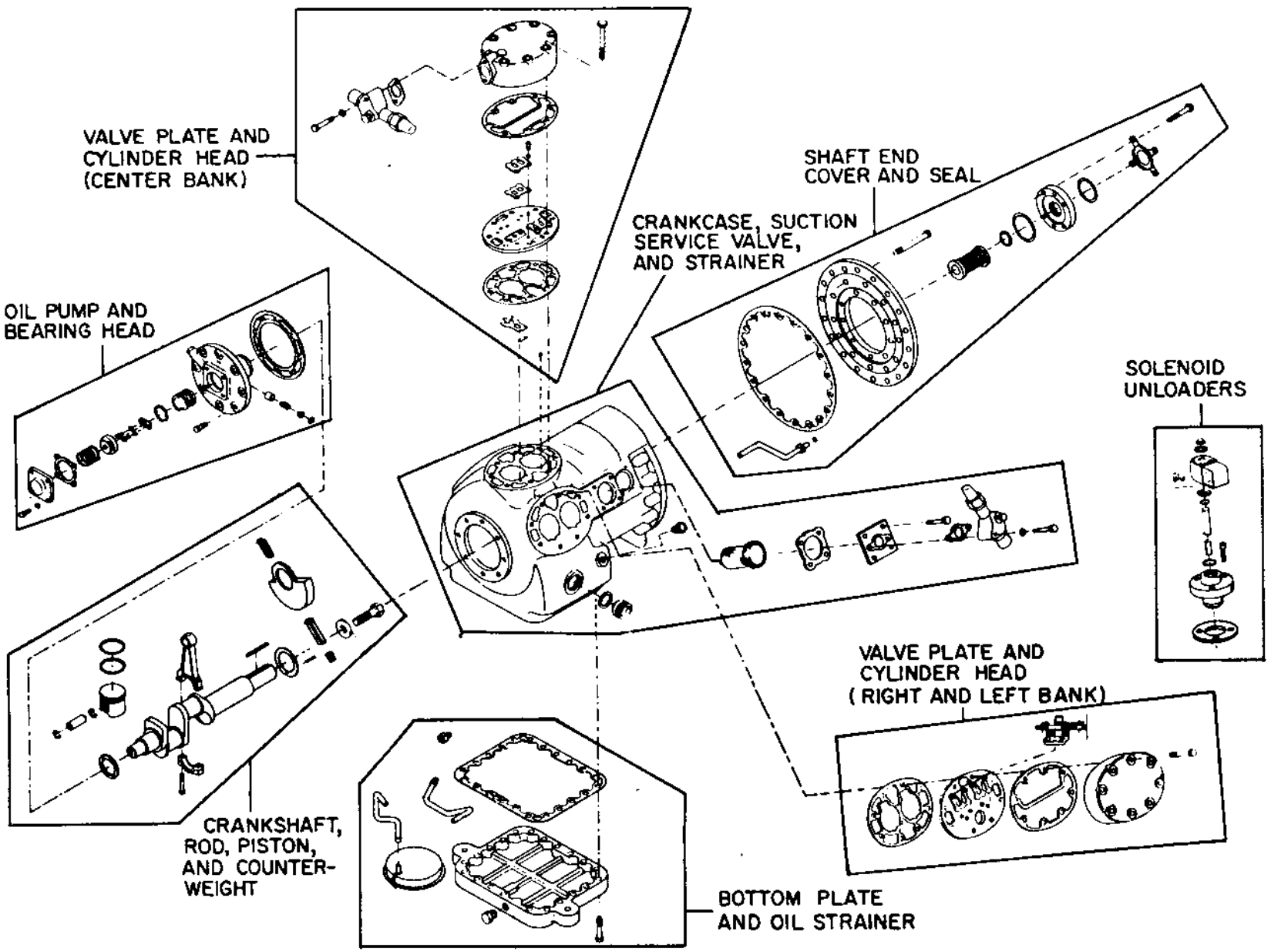



**Figure 3-4. Compressor Exploded View**

f. Remove and check operation of the oil return check valve. See figure 3-2, page 3-3.

g. Remove and check the oil relief valve.

h. Remove the piston rod assemblies.

i. Remove the refrigerant suction strainer (located under the valve adapter pad). Clean the strainer screen with a solvent. Inspect the strainer; if damaged, replace it.

## 3.2 INSPECTION AND PREPARATION FOR REASSEMBLY

### 3.2.1 GENERAL

a. Clean all parts with an approved solvent such as methyl ethyl ketone (MEK) or carbon tetrachloride. Use a stiff bristle brush to remove dirt from grooves and crevices.

b. Inspect all parts for wear and overall condition. Replace any defective or excessively worn parts. Refer to table 3-2, page 3-2, for a list of minimum and maximum wear limit dimensions.

c. Take inventory of all parts to ensure they are complete.

d. After cleaning, ensure all moving parts are coated with compressor oil before reassembly.

e. Use only new gaskets during reassembly. Ensure all metal gaskets (includes cylinder head, valve plate, and unloader or bypass plug gaskets) are installed dry. All fibre gaskets should be finger wiped with compressor oil before installing.

### 3.2.2 OIL PUMP AND BEARING HEAD DISASSEMBLY AND REPAIR

If it was determined that the oil pump was not operating properly, it is recommended that the entire oil pump and bearing head assembly be replaced to ensure trouble-free operation. However, if the cause of oil pump failure can be determined in the field and replacement parts for the pump are available, the pump can be repaired. The pump end bearing is integral with the bearing head and is not replaceable. If the oil pump was operating properly, disassemble the pump; clean all parts; and reassemble the pump as follows:

a. Remove the plunger snap rings with snap ring pliers. As each snap ring is removed, the spring guide, plunger spring, and plunger may be removed from the cylinder in the bearing head. See figure 3-5.

b. Push the pump rotor out of the bearing head by forcing against the rotor. Apply force from the bearing side and remove rotor from the opposite side. The pump rotor retaining ring will come out with the rotor.

c. Clean all parts; coat all moving parts with compressor oil before proceeding with reassembly.

d. Insert the pump rotor into the bearing head from the side opposite the bearing, with the rotor retaining ring in place on the rotor. Install the rotor retaining ring with the chamfered edge in. Compress the retaining ring (close gap) in order to fit the rotor and ring into their proper positions.

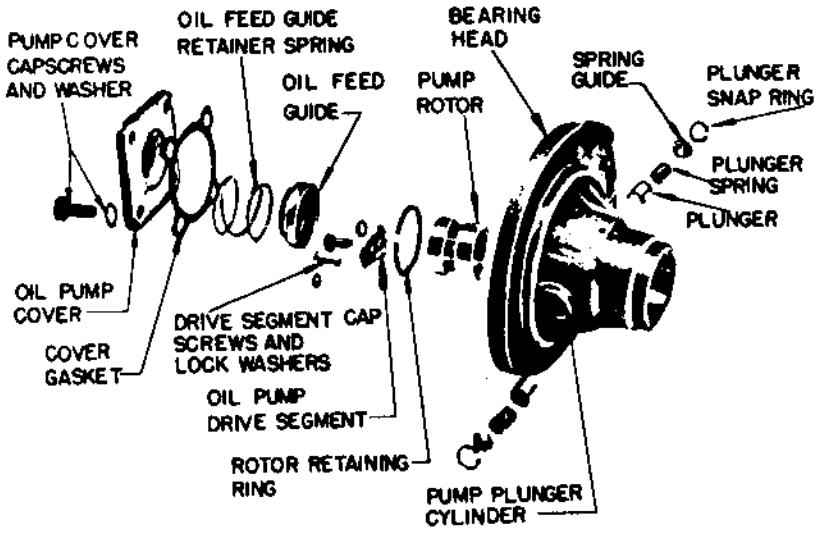



Figure 3-5. Oil Pump and Bearing Head Assembly

e. Insert one of the plungers into a cylinder in the bearing head (flat end in); then insert the plunger spring and spring guide. Insert retaining ring with ring pliers. Force the spring guide down to compress the plunger spring and to allow the retaining ring to fit into its locking groove. Follow the same procedure to reassemble the other plunger spring, guide, and snap ring in its plunger cylinder.

### 3.2.3. PISTONS, PINS, AND CONNECTING RODS

a. Piston and pin, and connecting rod and rod cap are matched sets and must not be interchanged. That is, if either the piston or piston pin is to be replaced, you must replace both of them. Likewise, if a connecting rod or rod cap must be replaced, both must be replaced.

b. Match mark and disassemble piston, pin, connecting rods, and caps. See figure 3-6.

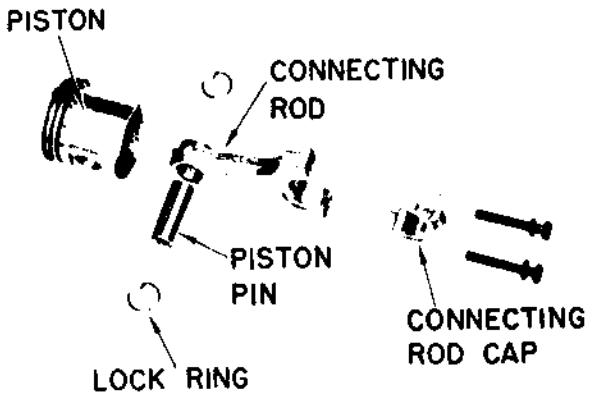



Figure 3-6. Connecting Rod, Piston, and Pin

c. Check wear dimensions of disassembled parts to determine if they are worn beyond limits given in table 3-2, page 3-2.

d. If parts are worn beyond limits, replace them in matched sets as specified above.

e. Coat piston pins with compressor oil and reassemble pistons, pins, and connecting rods in matched sets.

### 3.2.4 CRANKCASE PRESSURE EQUALIZATION HOLES

Check to ensure that the four pressure equalization holes have been drilled in the wall between the suction cavity and the crankcase. See figure 3-7 for location of the holes. If the holes have not been drilled in the crankcase wall, insert drill up through hole in bottom of compressor crankcase and drill four 3/16-inch holes at an angle of approximately 55 degrees, as shown by the 55 degree centerline in figure 3-7. Be sure to thoroughly clean out all drill filings after drilling the holes.

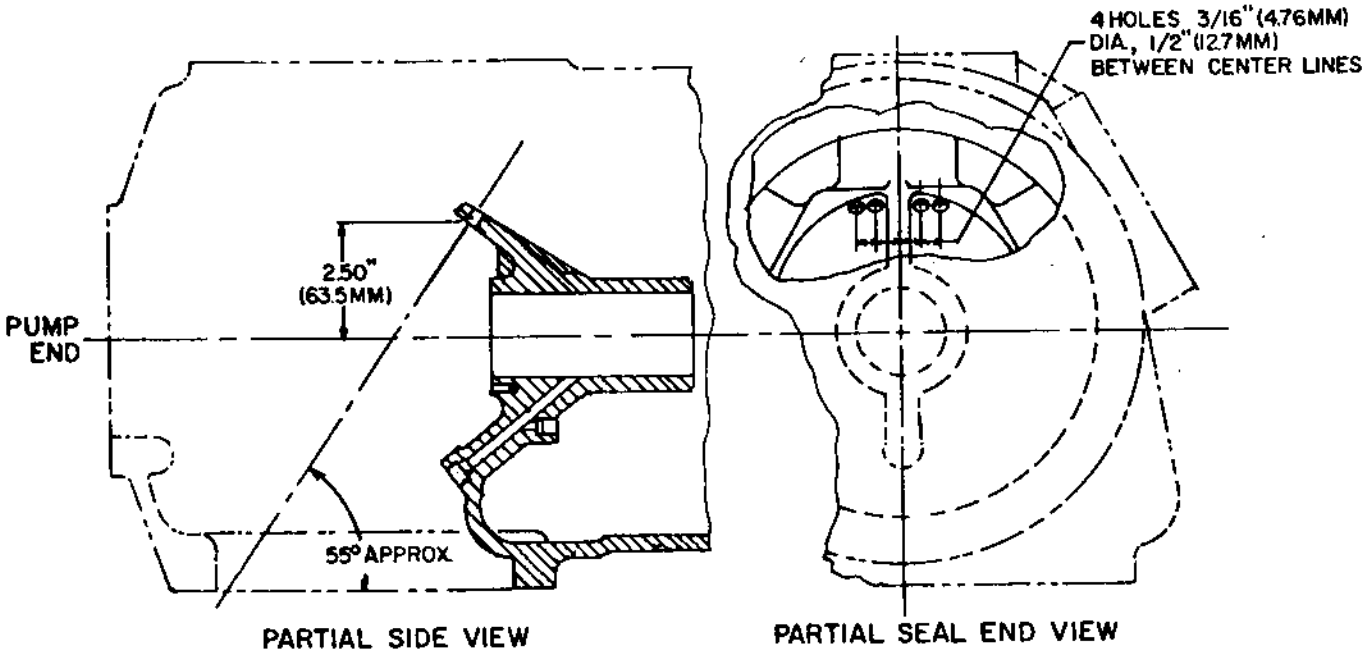



Figure 3-7. Location of Pressure Equalization Holes

## 3.3 COMPRESSOR REASSEMBLY

### 3.3.1 GENERAL

a. Ensure compressor and component parts are ready for reassembly. Refer to paragraph 3.2.

b. Prior to installing new piston rings, it is necessary to break the hard glazed surface of the cylinder in order to reduce the wearing-in period of the new rings. Break the glaze by rehoning lightly in an up and down rotating motion. Clean thoroughly after breaking glaze.

c. The instructions that follow are arranged in the normal order for reassembly of a completely disassembled compressor.

### 3.3.2 PISTONS, RODS, AND RING REASSEMBLY

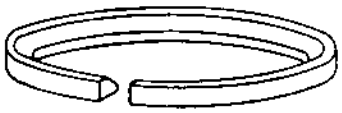
a. The gap between the ends of the piston rings can be checked with a feeler gauge by inserting the ring into the piston bore about one inch below the top of the bore. Align the ring in the bore by pushing it slightly with a piston. The maximum and minimum allowable ring gaps are .013 and .005 inches (0.33 and 0.127 mm).

b. Install the piston and rod assemblies up through the bottom of the crankcase and into the cylinders. Allow pistons to extend beyond the top of the cylinder to enable installation of piston rings. Pistons should be installed so that the chamfer, on the connecting rod, faces toward the crankshaft journals. Center rods on each crankshaft throw may be installed in either direction.

NOTE

Do not push pistons into cylinder until after crankshaft is installed.

c. The oil ring should be installed first, in the second groove, and the compression ring should be installed next, in the first groove nearest the piston top. The oil ring is notched and must be installed with the notch on the outside circumference and on the bottom. See figure 3-8. The compression ring is tapered on the inside circumference. Install this ring with the taper on the top of the ring facing toward the valve plate.



COMPRESSION RING

OIL RING

Figure 3-8. Piston Rings

d. When installing the rings on a piston, stagger the ring ends so that the gaps are not aligned. The ring grooves must be smooth so that the ring will not bind when compressed. Ensure that side clearance is .001 to .002 inch (0.0254 to 0.0508 mm) between the ring and the piston.

### 3.3.3 CRANKSHAFT, SEAL END THRUST WASHER, AND COUNTERWEIGHT

a. Two brass thrust washers are used. The pump end thrust washer is positioned on two dowel pins located on the bearing head and is installed with the oil pump and bearing head assembly. The seal end thrust washer is positioned just ahead of the seal end main bearing on a single dowel pin installed in the end of the crankshaft. Both thrust washers should be inspected for wear and scoring before reassembly.

b. Install the seal end thrust washer and crankshaft ensuring that the thrust washer is installed with the chamfered side toward the crankshaft journal.

NOTE

It is important that the counterweight with roll pin and hollow setscrew be properly installed on the shaft or proper oil return will be impaired.

c. Install the counterweight to hold the seal end thrust washer on the dowel pin. When installing the counterweight, it is important to slide it on the shaft with the chamfered edge toward the pump end of the shaft. The mass end of the counterweight is positioned 180° opposite the keyway in the shaft. See figure 3-9.

d. Tap the roll pin radially through the hole in the mass end until there is room to start threading the 3/16" (4.76 mm) long hollow setscrew; then, complete the setting by turning in the setscrew. The hollow setscrew will stop (bottom out) at the proper depth. The roll pin must penetrate through the counterweight until it meets the machined shoulder on the shaft.

e. The longer setscrew is screwed into the narrower portion of the counterweight in line with keyway on the shaft.

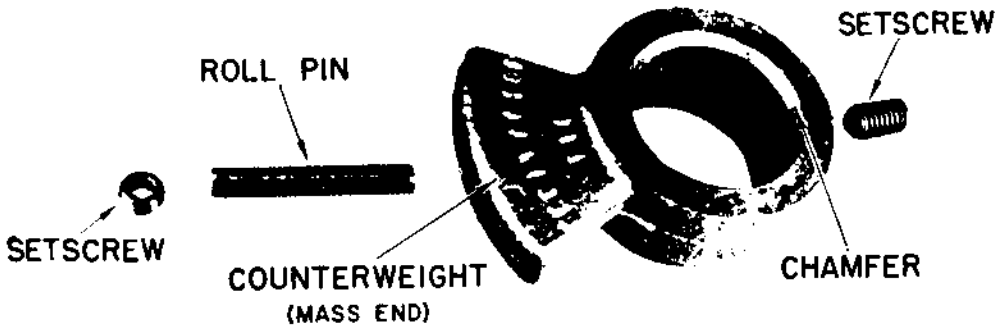



Figure 3-9. Counterweight, Roll Pin, and Setscrews

3.3.4 OIL PUMP AND BEARING HEAD ASSEMBLY AND THRUST WASHER

a. Install the thrust washer on the two dowel pins on the bearing head.

b. Install the bearing head assembly with a new gasket on the compressor crankshaft ensuring that the thrust washer remains on the dowel pins and the bearing head assembly mounts flush to the crankcase body. The top of the bearing head assembly is marked on the mounting flange.

c. Install the eight capscrews and gaskets in the mounting flange. Refer to table 3-1, page 3-2, for applicable torque values.

d. Install the drive segment with the two capscrews and lock washers. See figure 3-3, page 3-4.

e. Insert the oil feed guide with the large diameter in. Insert the guide retaining spring so that it fits over the smaller diameter of the feed guide. The pump cover now can be installed.

f. Place the pump cover, with a new gasket, over the guide retainer spring and compress the spring to enable installation of the cover capscrews. See figure 3-5, page 3-7. Tighten the cover capscrews to torque values given in table 3-1, page 3-2.

### 3.3.5 CONNECTING ROD CAPS

Do not tap piston with hammer if rings are caught at entrance to the cylinder. Using a ring compressor, squeeze rings sufficiently to allow piston to be pushed down into the cylinder. Ensure that ring ends are staggered so that the gaps are not aligned, and push piston down into the cylinder. Install connecting rod caps on connecting rods using new epoxy encapsulated capscrews and flat washers. Reuse of epoxy encapsulated capscrews or capscrews and locking tabs is not recommended. Ensure that caps are installed on the dowel pins. Torque capscrews to torque value shown in table 3-1. Ensure freedom of movement of shaft after capscrews on each rod cap are torqued.

### 3.3.6 CHECK VALVE, RELIEF VALVE, STRAINER, AND BOTTOM COVER PLATE

a. Check operation and reinstall check valve and relief valve. See figure 3-2, page 3-3, page 3-4.

b. Clean and reinstall the oil strainer.

c. Using a new gasket, install the bottom cover plate. See figure 1-1 for relative location of compressor mounting flanges. Torque cover capscrews, in a diagonal pattern, to torque value shown in table 3-1.

### 3.3.7 END COVER AND SHAFT SEAL

NOTE

Ensure that shaft seal oil supply tube is securely inserted in hole in end cover or shaft seal damage could occur.

a. Install two studs in the compressor end flange at the 3 o' clock and 9 o' clock positions. The studs should be long enough to enable their use as guide supports for installing the end cover. Ensure that the O-ring is installed on the end of the oil supply tube. Carefully install the end cover and a new gasket on the compressor end flange using the studs as guide supports. Ensure that the oil supply tube is inserted into the hole in the end cover. Install enough capscrews to hold the end cover in place. Remove the two studs and install the remainder of the capscrews. Torque capscrews to value shown in table 3-1.

b. Install new shaft seal assembly, cover gasket, and cover plate only. Never reinstall a used seal assembly and gasket. A new carbon ring should never be installed in a used cover plate. When installing the seal assembly, use care not to damage carbon ring or seal seat. If the new carbon ring is damaged during installation, replace it with a new one. See figure 3-11 for a pictorial procedure for installing the shaft seal assembly. See figure 3-10 for an exploded view of the seal assembly.

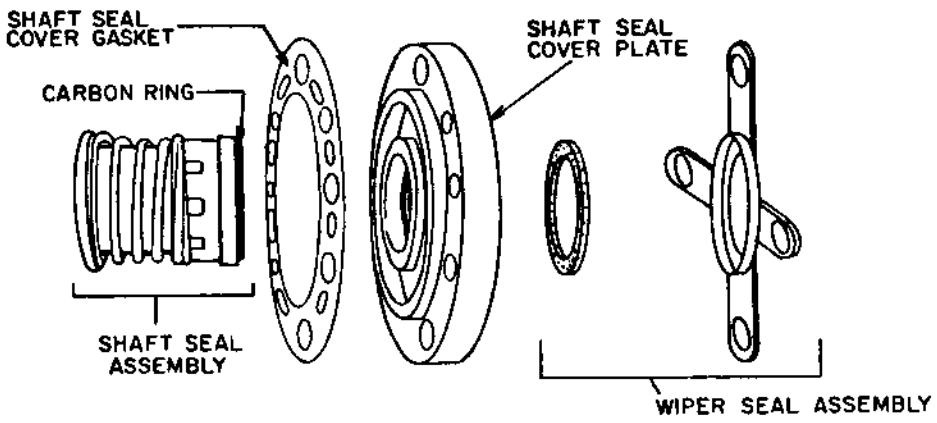
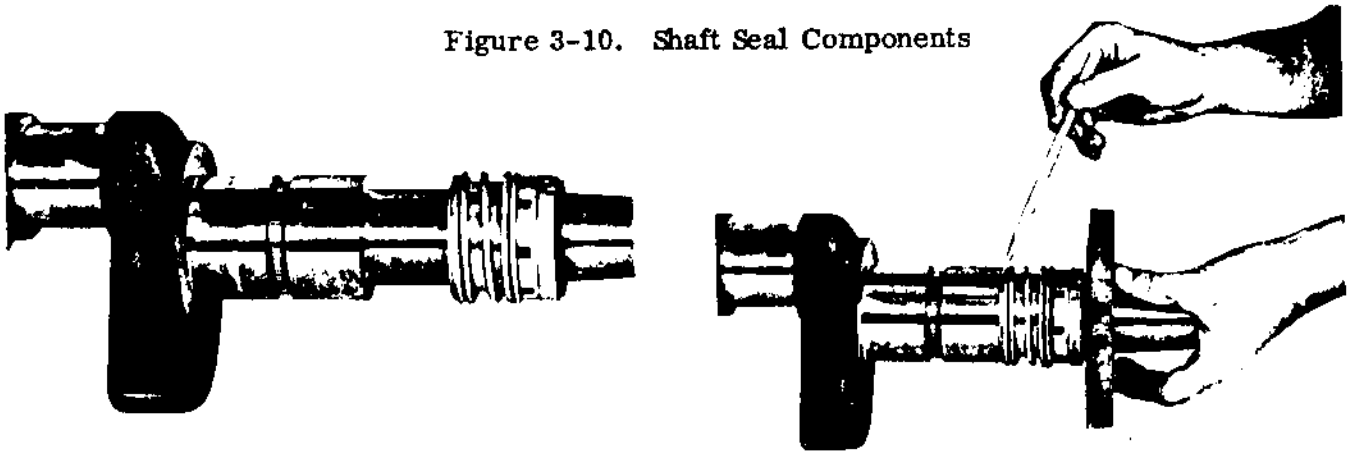



Figure 3-10. Shaft Seal Components



STEP 1 - Remove new carbon ring from new seal assembly. Lubricate shaft and neoprene seal bellows where it contacts the shaft. Slide seal assembly onto shaft until neoprene starts to grip the shaft.

STEP 2 - Install the old carbon ring in the new seal seat. Install two capscrews in opposite sides of the old cover plate. Draw up capscrews evenly to properly position new seal assembly against shoulder on shaft. Remove capscrews and old carbon ring and cover plate.

Figure 3-11. Installation of Sleeve Type Rotary Seal

c. Lubricate new carbon ring and carbon ring seal seat. Install new carbon ring in seal seat, taking care not to damage the carbon ring or the seat. Install the new cover plate and gasket. Reinstall the wiper seal assembly, drawing capscrews down evenly to prevent damage to carbon ring.

### 3.3.8 SUCTION AND DISCHARGE VALVE PLATE ASSEMBLY AND CYLINDER HEAD

a. Install only new valves and gaskets, and do not interchange valves.

b. Install suction valve positioning springs on dowel pins. Assemble positioning springs with spring ends bearing against cylinder deck. The spring will bow upward. See figure 3-12.

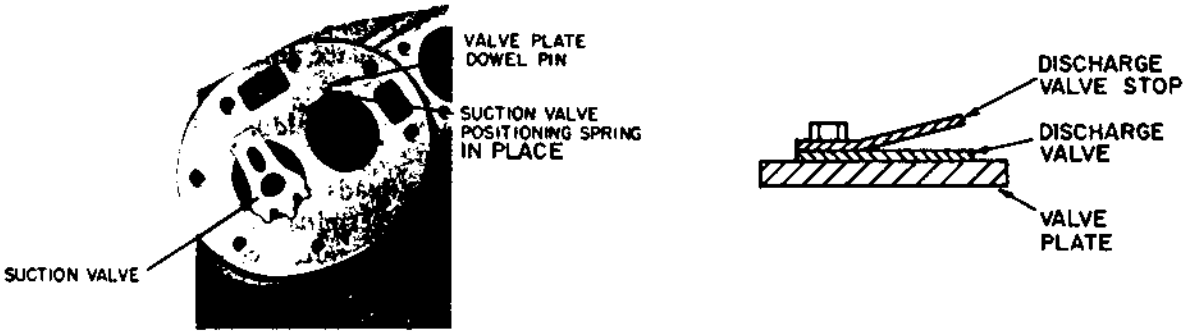



Figure 3-12. Suction Valve and Discharge Valve Installation

c. Place suction valves on dowel pins, over the positioning springs.

d. Place valve plate and new valve plate gasket on cylinder deck, ensuring that the valve plate is properly positioned on the four dowel pins (the top head has five dowel pins).

e. Using a small screwdriver operate the suction valves to ensure that the valve tips are not being held by the valve plate gasket.

f. Install discharge valve and discharge valve stop with capscrews and lock washers. See figure 3-12 and figure 3-1, page 3-1. Torque capscrews to value shown in table 3-1.

g. If capacity control unloaders are used, they are installed in the right and left cylinder heads. The center bank has a flange connection for the discharge service valve. Install cylinder head and new cylinder head gasket with capscrews, ensuring that the gasket and cylinder head are properly positioned on the valve plate. Torque the capscrews, in a diagonal pattern, to value shown in table 3-1.

h. Repeat the above procedure for the other two cylinder banks.

### 3.3.9 SUCTION STRAINER

Remove and clean the suction strainer (located under valve adapter pad). Check it for damage. If it is damaged, replace it. Reinstall the suction strainer and valve adapter pad using a new gasket.

### 3.3.10 ADDING OIL

Add the proper oil charge to the compressor through the oil fill plug or suction service valve cavity. See figure 1-1. Refer to paragraph 1.2 for the required oil charge.

## 3.4 REINSTALLING COMPRESSOR

Refer to paragraph 2.2.2 and the unit service manual to reinstall the compressor. Allow compressor to run for 4 to 5 hours before determining if new seal assembly leaks.