



**TRANSICOLD**

# Compressor

**MODEL  
05G and  
05G BUS**

**OPERATION  
AND SERVICE**



**TRANSCOLD**

# **OPERATION AND SERVICE MANUAL**

## **MODEL 05G and 05G BUS COMPRESSOR**



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# TABLE OF CONTENTS

Section	Page
<b>1 DESCRIPTION</b>	<b>1-1</b>
1.1 Introduction	1-1
1.2 General Description	1-1
1.3 Compressor Reference Data	1-1
1.4 Detailed Description	1-3
1.4.1 Suction and Discharge Valves	1-3
1.4.2 Suction & Discharge Service Valves	1-3
1.4.3 Lubrication System	1-3
1.5 Compressor Unloader	1-4
1.5.1 Hot Gas Bypass Unloader	1-4
1.5.2 Suction Cutoff Unloader	1-5
1.5.3 Pressure-Operated Unloaders	1-6
<b>2 COMPRESSOR REPLACEMENT</b>	<b>2-1</b>
2.1 Compressor Removal	2-1
2.2 Compressor Replacement	2-1
2.2.1 Installing Compressor Unloaders	2-1
2.2.2 Installing Compressor	2-2
<b>3 COMPRESSOR MAINTENANCE</b>	<b>3-1</b>
3.1 Introduction	3-1
3.2 Inspection and Preparation for Reassembly	3-1
3.3 Cylinder Head and Valve Plate	3-1
3.4 Oil Pump and Bearing Head	3-2
3.4.1 Low Profile Gear Pump	3-2
3.4.2 Gear Pump	3-3
3.4.3 Vane Pump	3-4
3.5 Shaft Seal	3-5
3.6 Compressor Running Gear Removal	3-5
3.7 Compressor Running Gear Reassembly	3-7
3.8 Suction Strainer	3-8
3.9 Adding Oil	3-8
3.10 Installing Compressor	3-8

## LIST OF ILLUSTRATIONS

<b>Figure</b>	<b>Page</b>
1-1 Model 05G Compressor .....	1-2
1-2 Suction & Discharge Valve .....	1-3
1-3 Oil Pumps .....	1-3
1-4 Compressor Unloader – Hot Gas Bypass .....	1-4
1-5 Compressor Cylinder Head Unloaded – Hot Gas Bypass .....	1-4
1-6 Compressor Cylinder Head Loaded – Hot Gas Bypass .....	1-5
1-7 Compressor Cylinder Head (Unloaded) – Suction Cutoff .....	1-5
1-8 Compressor Cylinder Head (Loaded) – Suction Cutoff .....	1-6
1-9 Pressure-Operated Unloader Loaded Operation .....	1-6
1-10 Pressure-Operated Unloader Unloaded Operation .....	1-6
2-1 Removal of Piston Plug .....	2-1
2-2 Oil Level in Sight Glass .....	2-2
3-1 Cylinder Head & Valve Plate .....	3-1
3-2 Installing Suction Valves .....	3-2
3-3 Checking Suction Valve .....	3-2
3-4 Oil Pump and Bearing Head Assembly .....	3-2
3-5 Low Profile Gear Oil Pump .....	3-2
3-6 Gear Oil Pump .....	3-3
3-7 Vane Oil Pump .....	3-4
3-8 Shaft Seal .....	3-5
3-9 Shaft Seal Removal .....	3-5
3-10 Bottom Plate Removal .....	3-5
3-11 Bottom Plate and Oil Strainer Removed .....	3-6
3-12 Piston Rings Removed .....	3-6
3-13 Connecting Rod, Piston, and Pin .....	3-6
3-14 Seal End Main Bearings .....	3-7
3-15 Contoured Piston .....	3-7
3-16 Installing Piston Rod Assemblies and Seal End Thrust Washer .....	3-7
3-17 Piston Rings .....	3-7
3-18 Installing Pistons .....	3-8
3-19 Installing Suction Strainer .....	3-8
3-20 Piston Dimension (Wear Limits) .....	3-10
3-21 Compressor Exploded View .....	3-11

## LIST OF TABLES

<b>Table</b>	<b>Page</b>
3-1 Torque Values .....	3-9
3-2 Wear Limits .....	3-10

# SECTION 1

## DESCRIPTION

### 1.1 INTRODUCTION

This operation and service manual covers the Carrier Transicold Model 05G compressors. These compressors are designed for refrigeration (trailer) or air conditioning (bus & rail) applications. (See Figure 1-1) The following table list the special tools for the 05G compressors.

PART NO.	SPECIAL TOOLS
07-00219	Wrench, Compressor Sight Glass
07-00223	Pliers, Compressor Unloader Ring
07-00240-01	Wrench, Spanner (for Housing Mounted Clutch)
07-00241	Rotor Installation Tool (for Housing Mounted Clutch)
07-00242-01	Bearing Retaining Nut Socket (3.5" ) (Housing Mounted Clutch)
07-00242-02	Bearing Retaining Nut Socket (3" ) (for Housing Mounted Clutch)
07-00260-00	Acid Test Kit
07-00265-01	Totaltest Kit (Package of 1)
07-00266-00	Replacement Tubes for Totaltest Kit
58-00869-00	Filter, Felt (Suction Sock for System Clean Up)

### 1.2 GENERAL DESCRIPTION

The Model 05G compressors are of the open-drive reciprocating type. A crankshaft, connecting rods, pistons, and reed type valves accomplish vapor compression. Compressor wear is minimized by splash lubrication and by force feed lubrication. There are three types of oil pumps (Vane, Gear and Low Profile Gear) driven directly from the end of the compressor crankshaft. (See Figure 1-3)

#### CAUTION

**The gear oil pump must be set to rotate in the same direction as the crankshaft. (Refer to section 3.4)**

The tapered end of the crankshaft, which extends outside the crankcase, is adaptable to a variety of direct drive or belt-driven clutch mechanisms. 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. Sight glasses installed on both sides of the crankcase, provides a means for 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.

### WARNING

**Do not operate compressor unless suction and discharge service valves are open.**

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

### 1.3 COMPRESSOR REFERENCE DATA

Model	05G-37CFM	05G-41CFM
Displacement	37CFM	41CFM
No. Cylinders	6	
Bore	50.8 mm (2.00 in)	
Stroke	49.2 mm (1.937 in)	54.36 mm (2.14 in)
Weight	62 kg (137 lbs)	
<b>SPEED (RPM) FOR OIL PUMP</b>		
Vane	900 to 2200	
Gear	500 to 2200	
Low Profile Gear	500 to 2200	

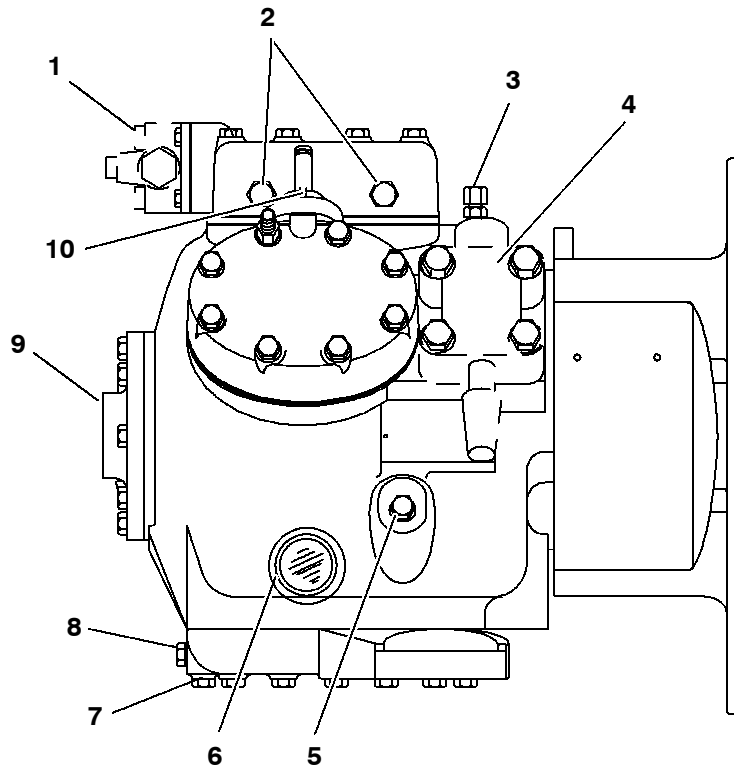
#### NOTE

The oils below are suitable for use with evaporator temperatures above -40°F (-40°C).

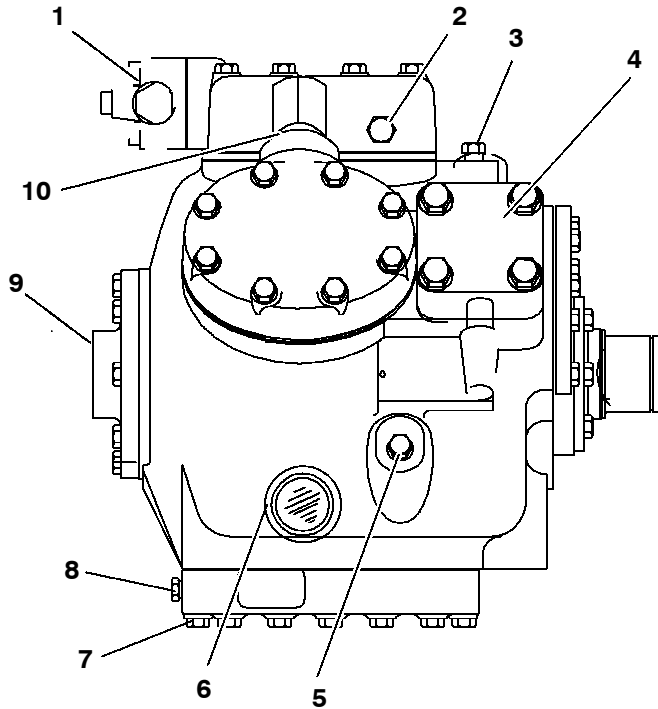
<b>Approved Oil for REFRIGERATION USE (TRAILER)</b>	
Refrigerant	Oil
R-12, R-22, R-500 or R-502	Zerol: 150 Synthetic P/N 07-00274
R-404A	Castrol Icematic: SW-68C
	Mobil Arctic: EAL 68
	ICI: Emkarate RL68H

<b>Approved Oil for AIR CONDITIONING USE (BUS AND RAIL)</b>	
Refrigerant	Oil
R-12 or R-22	Calumet Refining: R030
	Texaco: WF68
	Witco: 4GS Suniso
R-134a	Castrol Icematic: SW-68C
	Mobil Arctic: EAL 68
	ICI: Emkarate RL68H

Revised 10/96



**REFRIGERATION COMPRESSOR (TRAILER)**



**AIR CONDITIONING COMPRESSOR (BUS & RAIL)**

- |                             |                              |
|-----------------------------|------------------------------|
| 1. Discharge Service Valve  | 6. Oil Level Sight Glass     |
| 2. High Pressure Connection | 7. Bottom Plate              |
| 3. Low Pressure Connection  | 8. Oil Drain Plug            |
| 4. Suction Service Valve    | 9. Oil Pump (See Figure 1-3) |
| 5. Oil Fill Plug            | 10. Unloader                 |

**Figure 1-1. Model 05G Compressor**

## 1.4 DETAILED DESCRIPTION

### 1.4.1 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 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)

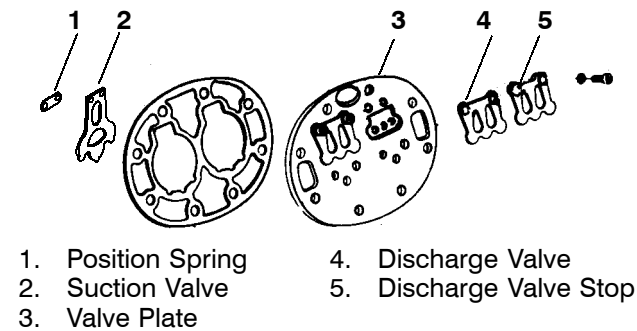


Figure 1-2. Suction & Discharge Valve

### 1.4.2 SUCTION & DISCHARGE SERVICE VALVES

The suction and discharge service valves used on the compressor are equipped with mating flanges for connection to flanges on the compressor. These valves are provided with a double seat and a gauge connection, which allows servicing of the compressor and refrigerant lines (See Figure 1-1).

Turning the valve stem counterclockwise (all the way out) will *backseat* the valve to open the suction or discharge line to the compressor and close off the gauge connection. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated when connecting the service manifold gauge lines to the gauge ports.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to close off the suction or discharge line to isolate the compressor and open the gauge connection.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise about 2 turns. With the valve stem midway between frontseated and backseated positions, the suction or discharge line is open to both the compressor and the gauge connection.

### 1.4.3 LUBRICATION SYSTEM

There are three types of oil pumps (Vane, Gear and Low Profile Gear) driven directly from the end of the compressor crankshaft (See Figure 1-3). 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.

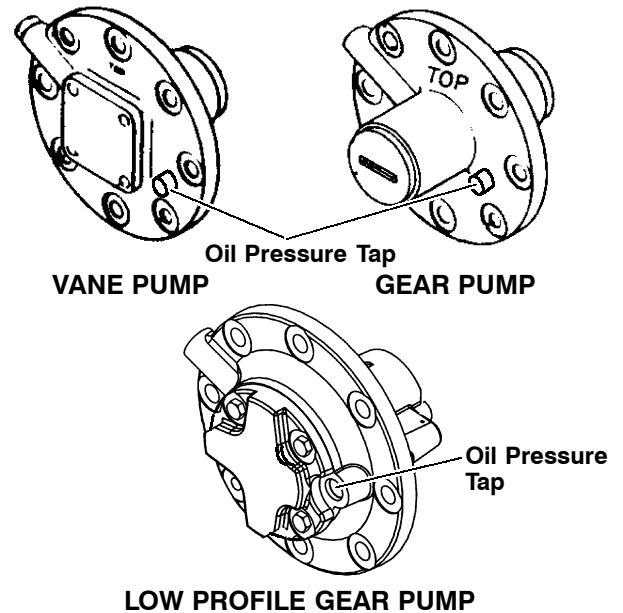


Figure 1-3. Oil Pumps

#### CAUTION

**The Gear oil pump must be set to rotate in the same direction as the crankshaft. (Refer to section 3.4)**

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 (2.09 to 2.30 kg/cm<sup>2</sup>) above suction pressure. When the oil pressure reaches 15 to 18 psi above suction pressure, the relief valve spring is moved forward allowing oil to return to the crankcase. The remaining oil flows through an orifice and into the shaft seal cavity to provide shaft seal lubrication and cooling. This oil is then returned to the crankcase through an overflow passage.

An additional oil pressure relief valve, built into the Gear and Low Profile Gear Oil Pump, is open at speeds above 400 rpm to relieve a portion of the oil pressure to the crankcase in order to maintain oil pressure below an acceptable maximum. At low speeds, the valve is closed to ensure adequate oil pressure at 400 rpm. At speeds above 1900 rpm, the oil pressure will be 25 to 30 psi (2.8 to 3.1 kg/cm<sup>2</sup>) above suction pressure.

The crankcase pressure equalization system consists of two oil return check valves and a 1/8-inch pressure equalization port between the suction manifold and crankcase. Under normal conditions, check valves are open and allow for oil return to the crankcase. Under flooded start conditions, pressure rises in the crankcase and closes the check valves, preventing excess oil loss. The equalization port allows for release of excessive pressure, that has built up in the crankcase, to the suction manifold; this ensures that the oil loss is kept to a minimum.

## 1.5 COMPRESSOR UNLOADER

The 6 cylinder 05G compressor can be applied with 2 bank of unloading.

There are two types of compressor unloader systems; the first one is the hot gas bypass and the second is the suction cutoff. They are easily distinguished from each other by observing the bottom side of the compressor cylinder head, it is either blank (Hot gas bypass) or has a cover plate (Suction cutoff).

The two types of compressor unloader systems can be controlled with either a pressure actuated valve or an electrically actuated (solenoid) valve.

### 1.5.1 HOT GAS BYPASS UNLOADER

The compressor is equipped with an unloader for capacity control. This consists of a self-contained, cylinder head bypass arrangement (See Figure 1-4) which is electronically controlled by the temperature controller.

The capacity controlled cylinder is easily identified by the solenoid which extends from the side of the cylinder head. When the solenoid energizes, the cylinder unloads allowing discharge gas to circulate as shown in Figure 1-5. The unloaded cylinder operates with little or no pressure differential, consuming very little power. A de-energized solenoid reloads the cylinder as shown in Figure 1-6.

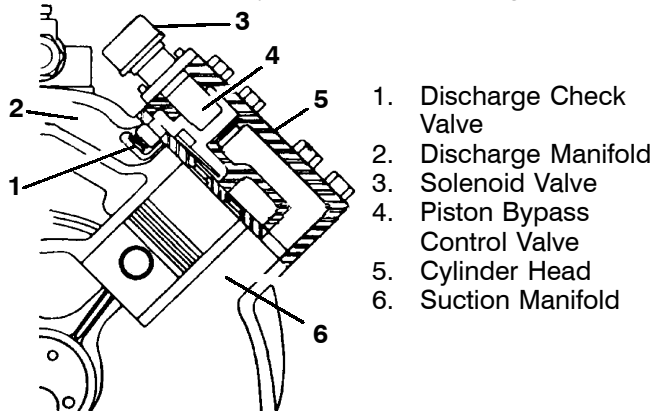


Figure 1-4. Compressor Unloader – Hot Gas Bypass

#### a. Major Working Parts

1. Solenoid and valve system
2. Spring loaded piston type bypass control valve
3. Spring loaded discharge check valve

#### b. Unloaded Operation

Pressure from the discharge manifold (Figure 1-5, item 15) passes through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7). Unless bled away, this pressure would tend to close the piston (6) against the piston spring (5) pressure.

With the solenoid valve (1) *energized* the solenoid valve stem (2) will *open* the gas bypass port (3).

Refrigerant pressure will be bled to the suction manifold (10) through the opened gas bypass port. A reduction in pressure on the piston bypass valve will take place because the rate of bleed through the gas bypass

port is greater than the rate of bleed through the *bleed orifice* (8).

When the pressure behind the piston has been reduced sufficiently, the valve spring will force the piston bypass valve *back*, *opening* the gas bypass from the discharge manifold to the suction manifold.

Discharge pressure in the discharge manifold will close the discharge piston check valve assembly (14) isolating the compressor discharge manifold from the individual cylinder bank manifold.

The *unloaded* cylinder bank will continue to operate *fully unloaded* until the solenoid valve control device is *de-energized* and the gas bypass port is closed.

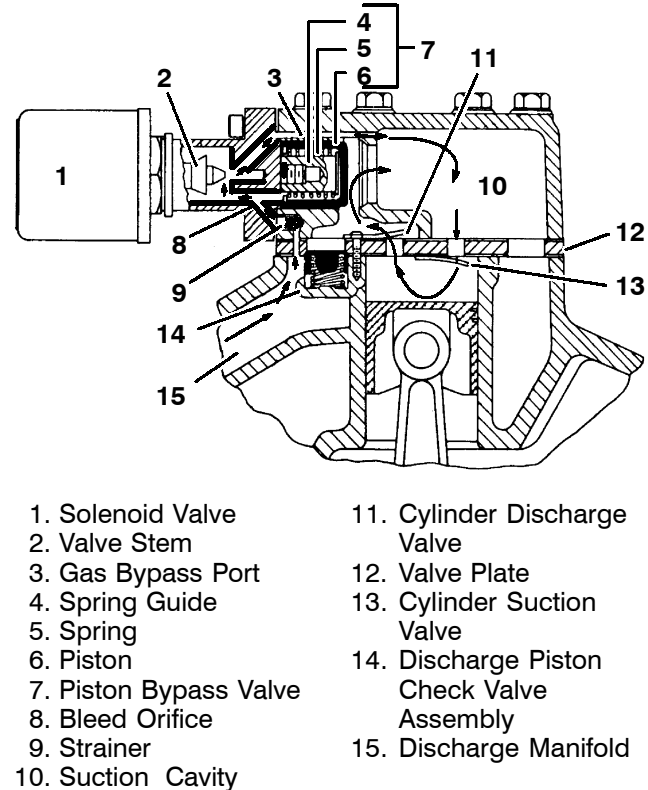


Figure 1-5. Compressor Cylinder Head Unloaded – Hot Gas Bypass

#### c. Loaded Operation

Discharge pressure bleeds from the discharge manifold (Figure 1-6, item 15) through the strainer (9) and (8) bleed orifice to the solenoid valve stem (2) chamber and the back of the piston bypass valve (7).

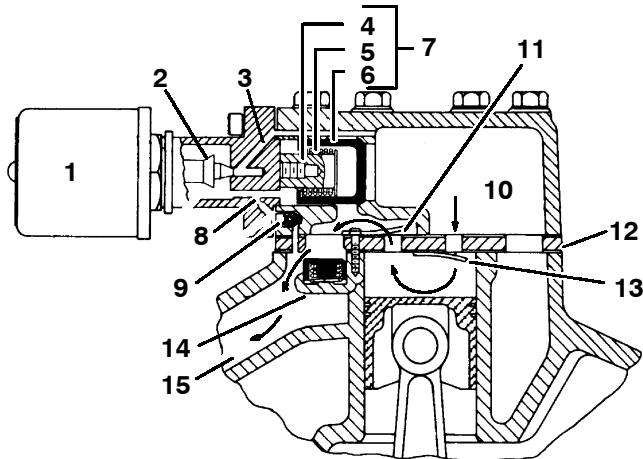
With the solenoid valve (1) *de-energized* the solenoid valve stem will *close* the gas bypass port (3).

Refrigerant pressure will overcome the bypass valve spring (5) tension and force the piston (6) *forward closing* the gas bypass from the discharge manifold to the suction manifold (10).

Cylinder discharge pressure will force open the discharge piston check valve assembly (14). Refrigerant gas will pass into the compressor discharge manifold.



The loaded cylinder bank will continue to operate fully loaded until the solenoid valve control device is energized and the gas bypass port is opened.



- |                        |   |
|------------------------|---|
| 1. Solenoid Valve      | 11. Cylinder Discharge Valve              |
| 2. Valve Stem          | 12. Valve Plate                           |
| 3. Gas Bypass Port     | 13. Cylinder Suction Valve                |
| 4. Spring Guide        | 14. Discharge Piston Check Valve Assembly |
| 5. Spring              | 15. Discharge Manifold                    |
| 6. Piston              |   |
| 7. Piston Bypass Valve |   |
| 8. Bleed Orifice       |   |
| 9. Strainer            |   |
| 10. Suction Cavity     |   |

**Figure 1-6. Compressor Cylinder Head Loaded – Hot Gas Bypass**

### 1.5.2 SUCTION CUTOFF UNLOADER

The compressor is equipped with unloaders for capacity control. This consists of a self-contained, suction cut-off arrangement which is electronically controlled by the temperature controller.

The capacity controlled cylinders are easily identified by the solenoid which extends from the side of the cylinder head. When the solenoid energizes, cylinders unload, preventing suction gas from being drawn into the cylinder (See Figure 1-7). The unloaded cylinders operate with little or no pressure differential, consuming very little power. A de-energized solenoid reloads the cylinders as shown in Figure 1-8.

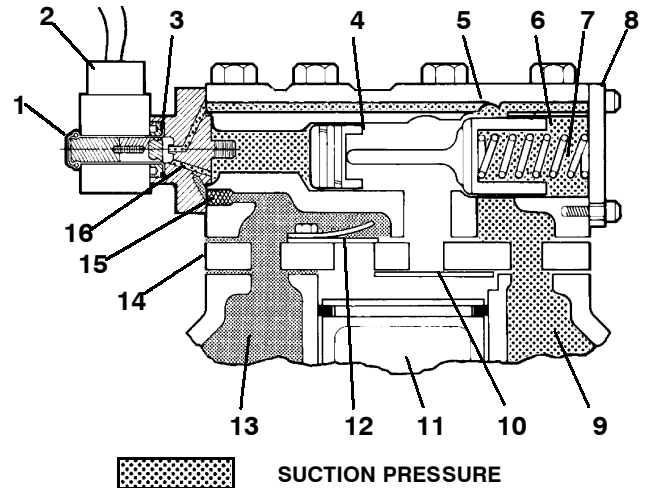
#### a. Major Working Parts



1. Solenoid and valve system
2. Unloader piston assembly
3. Spring and cover plate

#### b. Unloaded Operation

When the unloader valve solenoid energizes, the capacity control valve port opens (item 3, Figure 1-7). This allows the discharge gas behind the unloader piston assembly (item 4) to vent back to the suction side. The unloader valve spring (item 7) at this point, can move the unloader valve body to the left, blocking the unloader suction port. The cylinder bank is now isolated from the compressor suction manifold to unload these two

cylinders. No refrigerant is allowed into the cylinders and no compression takes place.



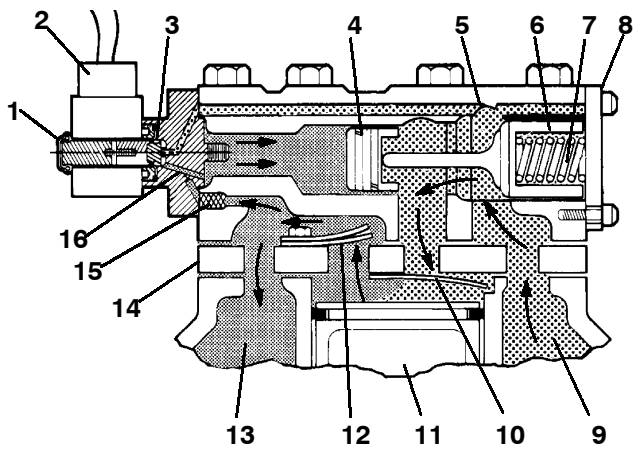
- |  |                    |
|--|--------------------|
|  | SUCTION PRESSURE   |
|  | DISCHARGE PRESSURE |



- |                                  |                        |
|----------------------------------|------------------------|
| 1. Solenoid Valve                | 9. Suction Manifold    |
| 2. Coil                          | 10. Suction Valve      |
| 3. Capacity Control Valve (Open) | 11. Piston             |
| 4. Unloader Piston               | 12. Discharge Valve    |
| 5. Cylinder Head                 | 13. Discharge Manifold |
| 6. Valve Body                    | 14. Valve Plate        |
| 7. Valve Spring                  | 15. Strainer           |
| 8. Cover Plate                   | 16. Bleed Orifice      |

**Figure 1-7. Compressor Cylinder Head (Unloaded) – Suction Cutoff**

#### c. Loaded Operation

When the unloader valve solenoid de-energizes, the capacity control valve port closes (item 3, Figure 1-8). This allows discharge pressure to build-up behind the unloader piston assembly. The high pressure will compress the unloader valve spring, opening the unloader suction port. Suction gas can now be drawn into the cylinders, running the bank fully loaded.



 SUCTION PRESSURE  
 DISCHARGE PRESSURE

- |                                    |                        |
|------------------------------------|------------------------|
| 1. Solenoid Valve                  | 9. Suction Manifold    |
| 2. Coil                            | 10. Suction Valve      |
| 3. Capacity Control Valve (Closed) | 11. Piston             |
| 4. Unloader Piston                 | 12. Discharge Valve    |
| 5. Unloader Head                   | 13. Discharge Manifold |
| 6. Valve Body                      | 14. Valve Plate        |
| 7. Valve Spring                    | 15. Strainer           |
| 8. Cover Plate                     | 16. Bleed Orifice      |

**Figure 1-8. Compressor Cylinder Head (Loaded) – Suction Cutoff**

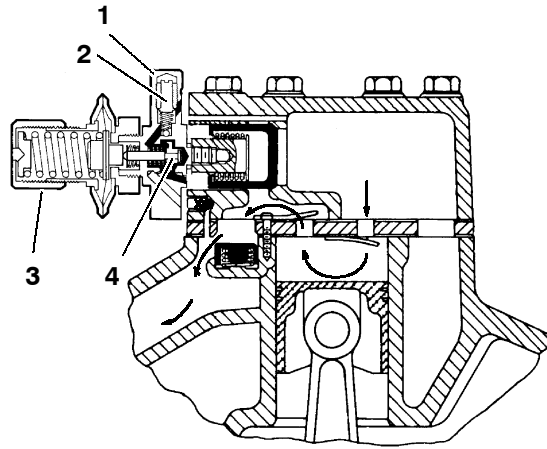
### 1.5.3 PRESSURE-OPERATED UNLOADERS

There are two types of compressor unloader systems; the first one is the hot gas bypass and the second is the suction cutoff. They are easily distinguished from each other by observing the bottom side of the compressor cylinder head, it is either blank (Hot gas bypass) or has a cover plate (Suction cutoff).

The two types of compressor unloader systems can be controlled with either a pressure actuated valve or an electrically actuated (solenoid) valve.

The pressure-operated unloaders are controlled by suction pressure and actuated by discharge pressure. The unloader valve controls two cylinders. On startup, controlled cylinders do not load up until differential between suction and discharge pressure is 10 psi (1.7 kg/cm<sup>2</sup>).

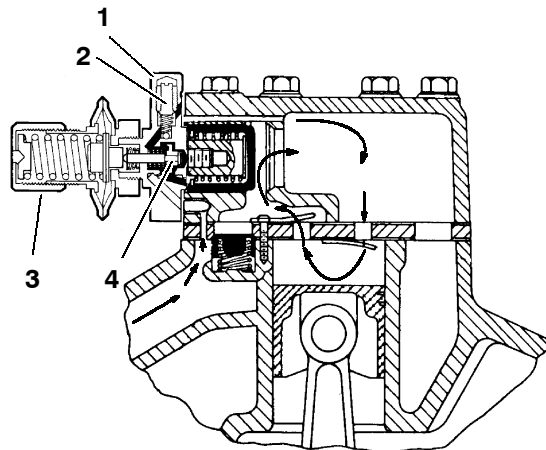
During *loaded operation*, when suction pressure is above the valve control point, the poppet valve will close. Discharge gas bleeds into the valve chamber; the pressure closes the bypass piston; and the cylinder bank loads up. Discharge gas pressure forces the check valve open, permitting gas to enter the discharge manifold. See Figure 1-9.



1. Sealing Cap
2. Pressure Differential Adjustment Screw
3. Control Set Point Adjustment Nut
4. Poppet Valve

**Figure 1-9. 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 1-10.



1. Sealing Cap
2. Pressure Differential Adjustment Screw
3. Control Set Point Adjustment Nut
4. Poppet Valve

**Figure 1-10. Pressure-Operated Unloader – Unloaded Operation**

## 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. Ensure power source is removed from any controls installed on the compressor.

c. Remove refrigerant using a refrigerant recovery system.

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

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 section 2.2 for replacement procedures.

#### 2.2 COMPRESSOR REPLACEMENT

Consult the unit service parts list for the correct replacement.

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

Service replacement compressors are furnished with cylinder head bypass piston plugs installed on the unloader flanges in lieu of the unloader valves. The unloaders (if used) must be removed from the defective compressor and transferred to the replacement compressor prior to installation. Refer to section 2.2.1.

If the defective compressor is to be returned for overhaul or repair, install the plugs on the compressor for sealing purposes during shipment.

#### 2.2.1 INSTALLING COMPRESSOR UNLOADERS

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

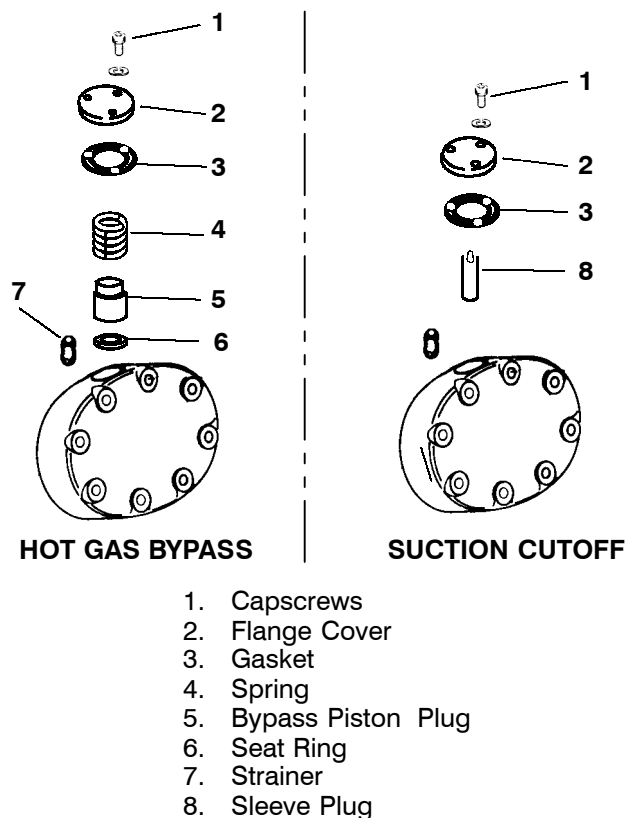


Figure 2-1. Removal of Piston Plug

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 defective 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 valve capscrews. When installing the unloaders, be sure to use the unloader capscrews.

d. Using a new gasket and unloader ring pliers (P/N 07-00223), install the unloaders in the cylinder heads of the replacement compressor. Refer to Table 3-1, 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

### WARNING

Midseat service valves or by other means relieve pressure in replacement compressor before removing plugs.

### CAUTION

The high capacity oil pump must be set to rotate in the same direction as the crankshaft. (Refer to Section 3.4)

a. Install the compressor by reversing the procedure of section 2.1. Install new locknuts on compressor mounting bolts and new gaskets on suction and discharge service valves.

b. Check oil level in sight glass (See Figure 2-2). If necessary, add or remove oil.

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

d. Fully backseat suction and discharge service valves.

e. Run the compressor and check for leaks and noncondensibles in the refrigerant system.

f. Check refrigerant level.

g. Recheck compressor oil level.

h. Check operation of compressor unloaders (if installed).

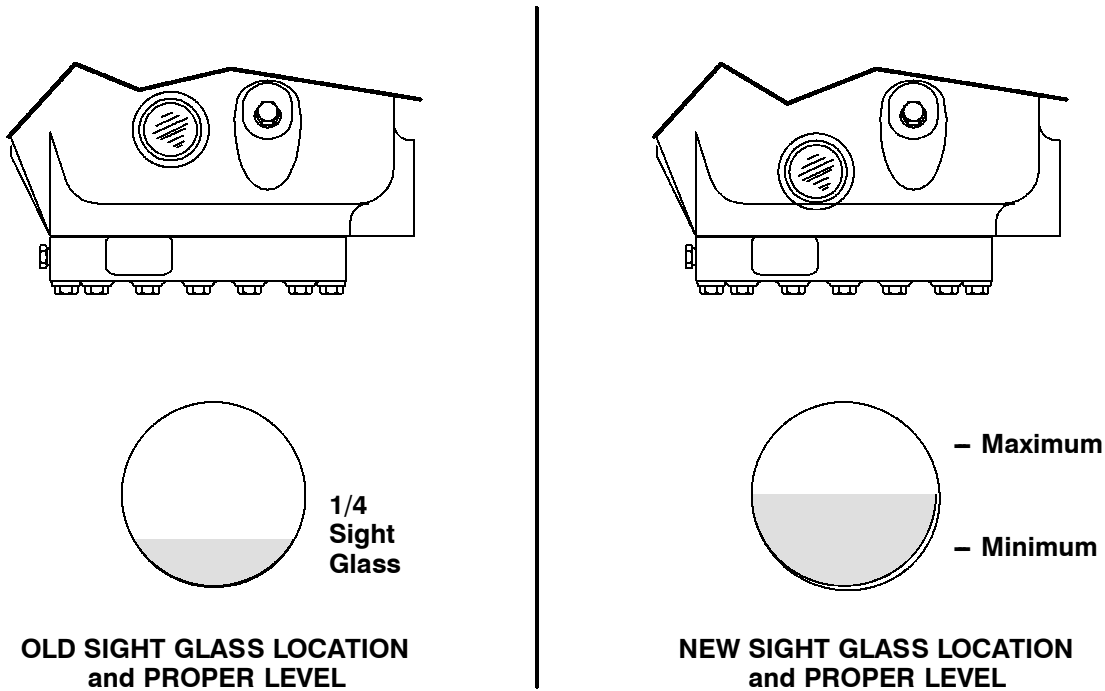


Figure 2-2. Oil Level in Sight Glass

## SECTION 3

### COMPRESSOR MAINTENANCE

#### 3.1 INTRODUCTION

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 and allow the oil to drain out slowly.

If dismantled parts are to be left overnight or longer, dip them in clean compressor oil (to prevent rusting) and store in protected area.

Refer to Table 3-1 for torque values for tightening bolts.

#### 3.2 INSPECTION AND PREPARATION FOR REASSEMBLY

- a. Clean all parts with an approved solvent. 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.
- c. Inspect suction and discharge valve seats (on valve plate).
- d. If unloaders are installed, inspect operation of unloader.
- e. After cleaning, ensure all moving parts are coated with compressor oil before reassembly.
- f. Use only new gaskets during reassembly. Ensure all gaskets (includes cylinder head, valve plate, and unloader or bypass plug gaskets) are installed dry.

#### 3.3 CYLINDER HEAD AND VALVE PLATE

##### a. Disassembly

##### WARNING

**Do not unscrew capscrews all the way before breaking seal. Entrapped pressure could result in injury.**

1. 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 3-1)
2. Remove the discharge valve capscrews, lock washers, stops, and valves.
3. Free the valve plates from the cylinder deck by using the discharge valve capscrews, without washers, as jackscrews through the outermost tapped holes in the valve plate after the valve stops and valves have been removed. Remove the valve plate gasket.
4. Discard valves and gaskets. Use only new valves and gaskets when assembling cylinder head and valve plate assemblies.

##### b. Reassembly

Some 05G compressors for refrigeration use only may have “canted” valve plates. The “canted valve” design allows a reduction in the distance between the discharge valve and the top of the piston. When piston is at TDC the volume of the compression chamber is smaller, contributing to increased compressor efficiency.

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

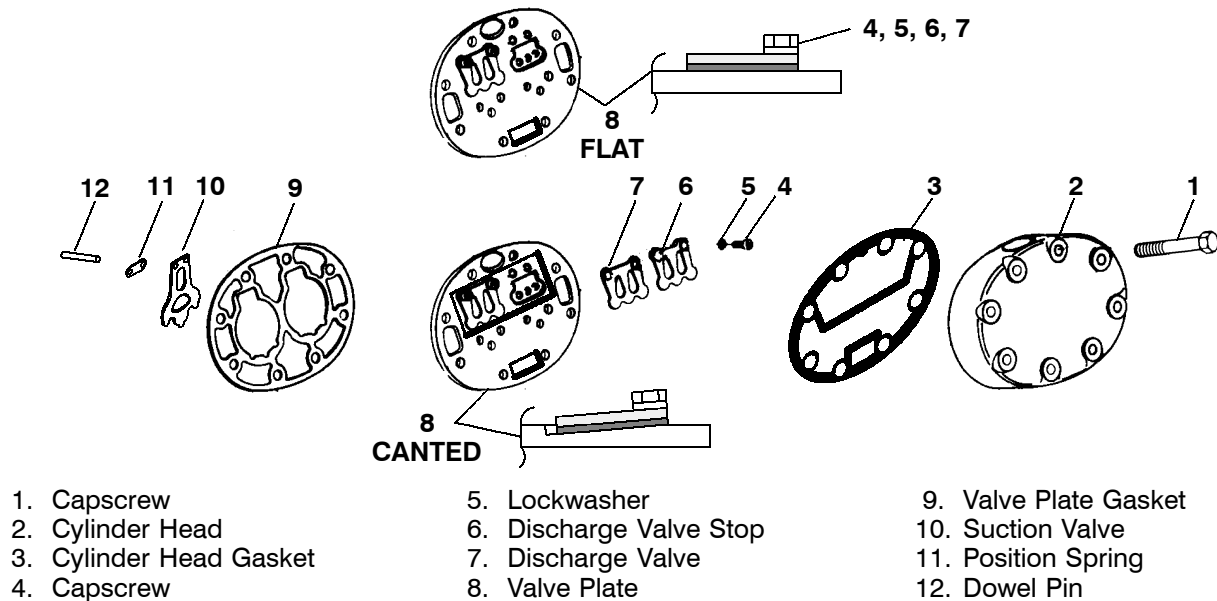


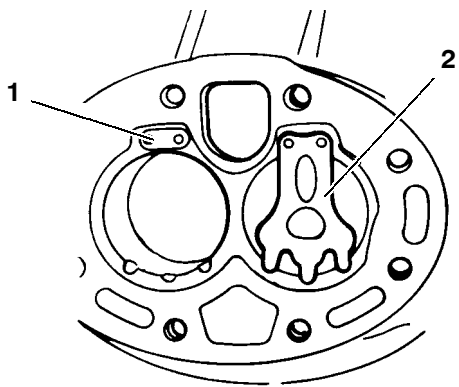
Figure 3-1. Cylinder Head & Valve Plate

2. Install suction valve positioning spring on dowel pins. Assemble positioning spring springs with spring ends bearing against cylinder deck. The spring will bow outward in the middle. (See Figure 3-2)

3. Place suction valve on dowel pins, over the positioning spring.

4. Place valve plate and new valve plate gasket on cylinder deck, ensuring that the valve plate is properly positioned on the four dowel pins.

5. Using a small screwdriver, operate the suction valves to ensure that the valve tips are not being held by the valve plate gasket. (See Figure 3-3)



- 1. Positioning Spring
- 2. Suction Valve

Figure 3-2. Installing Suction Valves

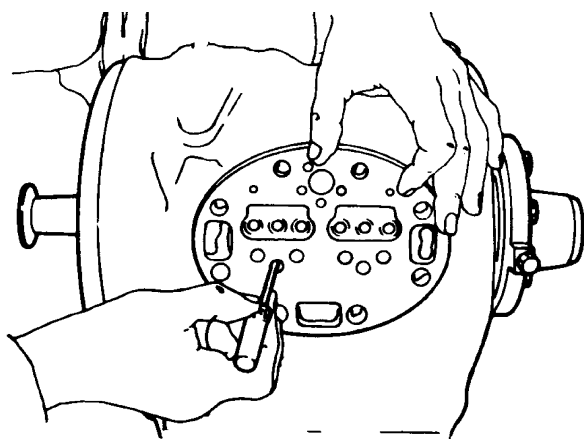


Figure 3-3. Checking Suction Valve

6. Install discharge valve and discharge valve stop with capscrews and lock washers.

7. Install capscrews, cylinder head and new cylinder head gasket with flat side to valve plate, ensuring that the gasket and cylinder head are properly positioned on the valve plate. Torque the capscrews, in a diagonal pattern, to a value shown in Table 3-1.

### 3.4 OIL PUMP AND BEARING HEAD

There are three types of oil pumps (Vane, Gear and Low Profile Gear) driven directly from the end of the compressor crankshaft.

#### 3.4.1 LOW PROFILE GEAR PUMP

##### a. Removal

Remove eight capscrews and remove oil pump bearing head assembly, gasket and thrust washer. (See Figure 3-4.)

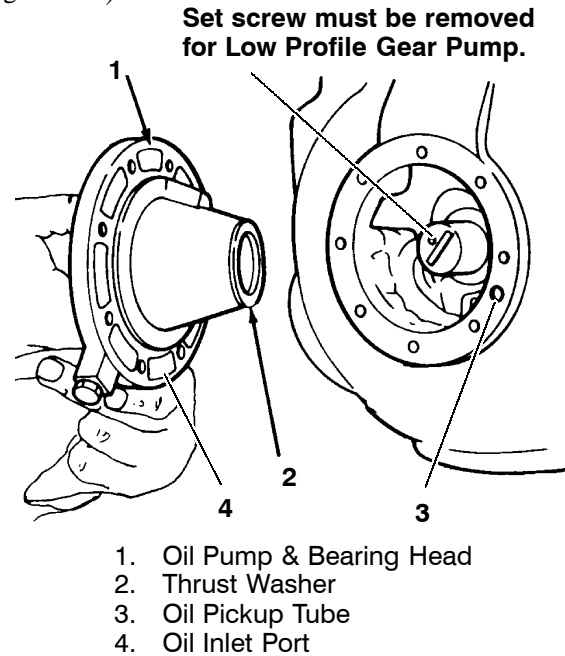


Figure 3-4. Oil Pump and Bearing Head Assembly

##### b. Disassembly, & Inspection

If it was determined that the oil pump was not operating properly, the entire oil pump and bearing head assembly must be replaced. Replacement parts for the pump are not available. However, in the event the pump requires inspection or cleaning, disassembly and reassembly by referring to Figure 3-5. Clean all parts; coat all moving parts with compressor oil before proceeding with reassembly.

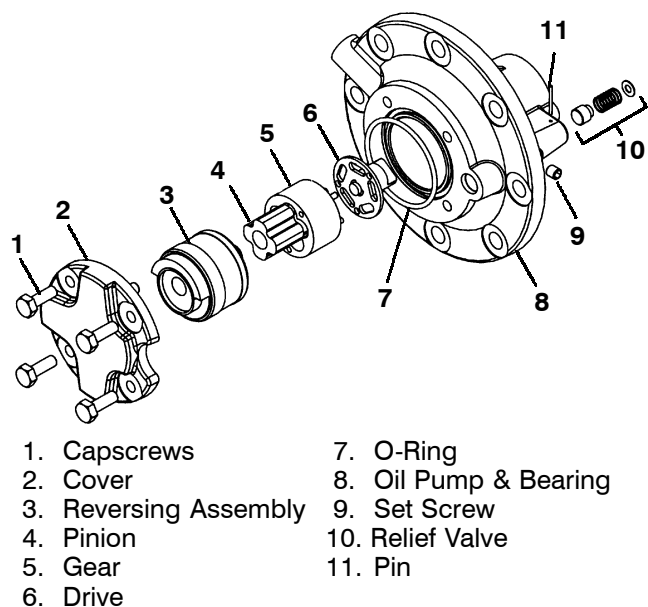


Figure 3-5. Low Profile Gear Oil Pump

### c. Reassembly

#### CAUTION

**Set screw on crankshaft must be removed for Low Profile Gear Pump (See Figure 3-4).**

1. Set screw on crankshaft must be removed for Low Profile Gear Pump.
2. Install the pump end thrust washer on the two dowel pins located on the bearing head. (See Figure 3-4.)

#### CAUTION

**Ensure that thrust washer does not fall off dowel pins while installing oil pump.**

3. Install the bearing head assembly with a new gasket on the compressor crankshaft. Carefully push oil pump on by hand ensuring that the thrust washer remains on the dowel pins, the tang on the end of the drive engages the slot in the crankshaft, and the oil inlet port on the pump is aligned with the oil pickup tube in the crankcase. The pump should mount flush with the crankcase and should be oriented as shown in Figure 1-1.
4. Align the gasket and install the eight capscrews in the mounting flange. Refer to Table 3-1, for applicable torque values.

### 3.4.2 GEAR PUMP

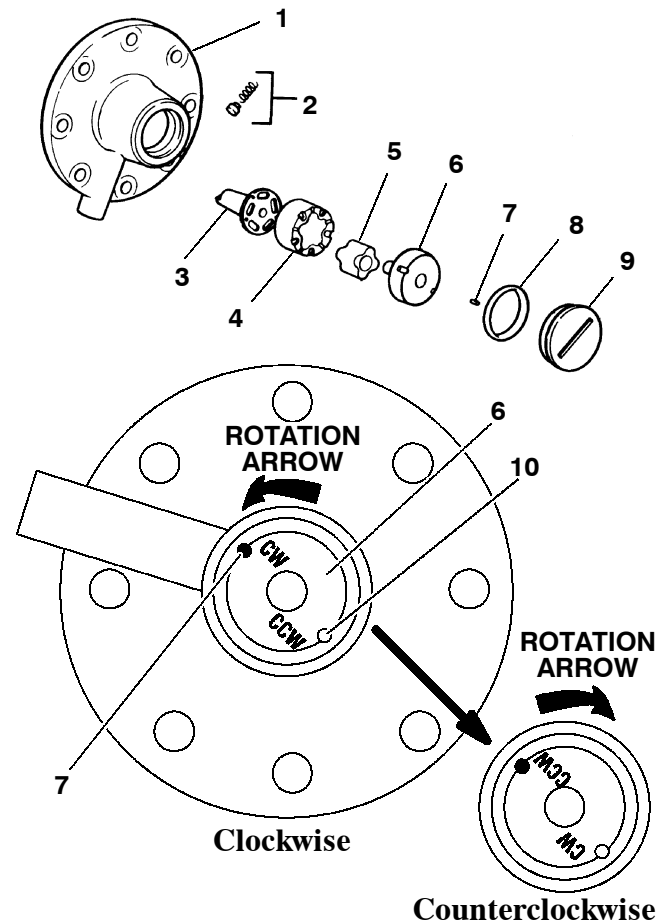
#### a. Removal

Remove eight capscrews and remove oil pump bearing head assembly, gasket and thrust washer. (See Figure 3-4.)

#### b. Disassembly, & Inspection

If it was determined that the oil pump was not operating properly, the entire oil pump and bearing head assembly must be replaced. Replacement parts for the pump are not available. However, in the event the pump requires inspection or cleaning, disassembly and reassembly instructions are provided below.

1. Remove pump cover and O-ring. (See Figure 3-6.)
2. Note direction of pump by location of pin in eccentric. The stamping in the eccentric next to the pin shows the direction the pump will rotate, *as viewed from the crankshaft end of the compressor.*
3. If direction of oil pump is not the same rotation as the crankshaft, remove pin. Pin can be removed by holding eccentric in, tipping top of pin slightly outward, and turning pump bottom side up; pin should fall out or use magnet to remove pin.
4. The remainder of the pump components can now be removed, if so desired, by pushing out the drive segment from the crankshaft end of the bearing head.
5. Remove the relief valve assembly by removing the retainer pin.
6. Clean all parts; coat all moving parts with compressor oil before proceeding with reassembly. Mark outside of pump at the short groove for ease of installing pin at a later time. Check wear between items 3 & 4 Figure 3-6.



- |                            |               |
|----------------------------|---------------|
| 1. Oil Pump & Bearing Head | 6. Eccentric  |
| 2. Relief Valve            | 7. Pin        |
| 3. Drive Segment           | 8. O-Ring     |
| 4. Five-Lobed Rotor        | 9. Cover      |
| 5. Four-Lobed Rotor        | 10. Vent Hole |

**Figure 3-6. Gear Oil Pump**

7. Insert drive segment and five-lobed rotor, ensuring that the pins on the rotor are inserted into the appropriate holes in the drive segment drive wheel.
8. Install the four-lobed rotor inside the five-lobed rotor, ensuring that the end with the counter bore is installed toward the drive segment.
9. Install the eccentric in direction indicated (CW or CCW) as so desired so oil pump rotates in the same direction as the crankshaft. The stamping in the eccentric next to the pin shows the direction the pump will rotate, *as viewed from the crankshaft end of the compressor.*
10. Install the pin in the shortest of the two grooves inside the bearing head.
11. Install the O-ring and pump cover.
12. Install the relief valve assembly.

### c. Reassembly

1. Install the pump end thrust washer on the two dowel pins located on the bearing head. (See Figure 3-4.)

#### CAUTION

**Ensure that thrust washer does not fall off dowel pins while installing oil pump.**

2. Install the bearing head assembly with a new gasket on the compressor crankshaft. Carefully push oil pump on by hand ensuring that the thrust washer remains on the dowel pins, the tang on the end of the drive segment engages the slot in the crankshaft, and the oil inlet port on the pump is aligned with the oil pickup tube in the crankcase. The pump should mount flush with the crankcase and should be oriented as shown in Figure 1-1.

3. Align the gasket and install the eight capscrews in the mounting flange. Refer to Table 3-1, for applicable torque values.

### 3.4.3 VANE PUMP

#### a. Removal

1. Remove four capscrews, gaskets and remove oil pump cover; this will free the oil feed guide retaining spring, cover gasket, and the oil feed guide. (See Figure 3-7.)

2. Remove the two drive segment capscrews and lock washer and remove the drive segment.

3. Remove eight capscrews and remove oil pump bearing head assembly and gasket. (See Figure 3-4.)

#### b. Disassembly, & Inspection

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.

1. Remove the plunger snap ring 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. Identify parts to ensure replacement in same cylinder.

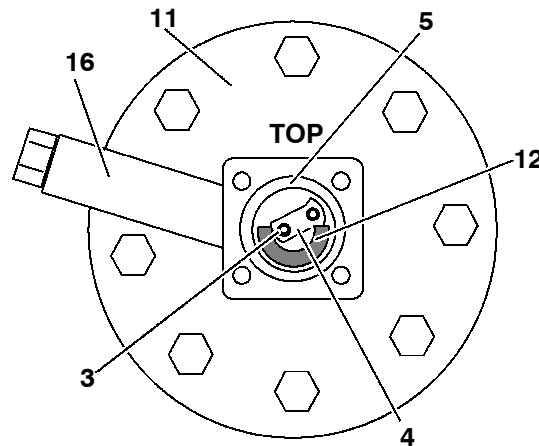
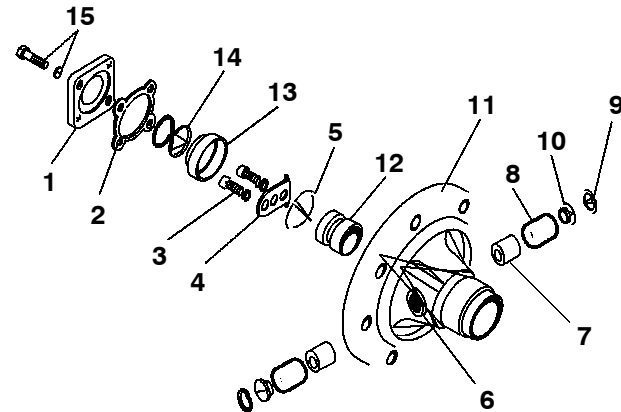
2. Push the pump rotor out of the bearing head by forcing against the rotor. Apply force from the bearing side and remove rotor from the opposite side. The pump rotor retaining ring will come out with the rotor.

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

4. 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.

5. 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.



- |                              |                           |
|------------------------------|---------------------------|
| 1. Oil Pump Cover            | 9. Retaining Ring         |
| 2. Cover Gasket              | 10. Spring Guide          |
| 3. Capscrews and Lockwashers | 11. Bearing Head          |
| 4. Oil Pump Drive            | 12. Pump Rotor            |
| 5. Rotor Retaining Ring      | 13. Oil Feed Guide        |
| 6. Pump Vane Cylinder        | 14. Retainer Spring       |
| 7. Pump Vane                 | 15. Capscrews and Washers |
| 8. Vane Spring               | 16. Oil Inlet Passage     |

Figure 3-7. Vane Oil Pump

### c. Reassembly

1. Install the bearing head assembly with a new gasket on the compressor crankshaft. Carefully push oil pump on by hand ensuring that the bearing head mounts flush to the crankcase body. The top of the bearing head is marked on the mounting flange.

2. Align the gasket and install the eight capscrews in the mounting flange. Refer to Table 3-1, for applicable torque values.

3. Install the drive segment with the two capscrews and lock washer.



4. 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 can now be installed.

5. Place the pump cover, with a new gasket, over the guide retaining spring and compress the spring to enable installation of the cover cap screws.

### 3.5 SHAFT SEAL

#### a. Disassembly

1. Remove 6 cap screws, remove shaft seal cover or clutch mounting hub and carbon washer. (See Figure 3-8)

2. Tap seal end of crankshaft to loosen seal grip on shaft. Using two long screwdrivers, pry out the shaft seal but do not damage gasket surface. (See Figure 3-9)

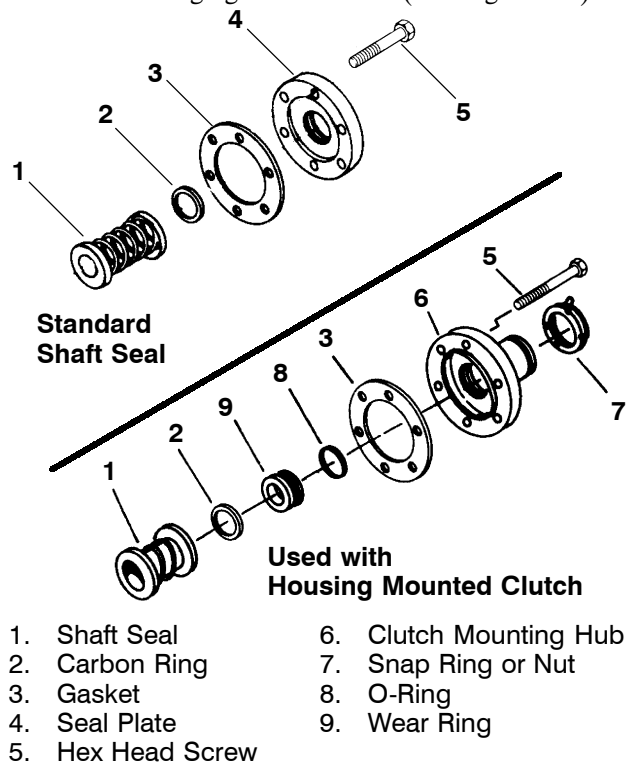


Figure 3-8. Shaft Seal

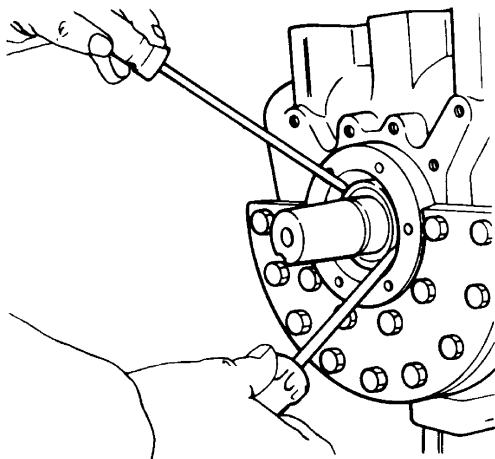


Figure 3-9. Shaft Seal Removal

#### b. Reassembly

1. Install new shaft seal assembly, cover gasket, and cover plate only. Never install a used seal assembly or gasket. A new carbon washer should never be installed in a used cover plate. When installing the seal assembly, use care not to damage carbon washer or seal seat.

2. Remove new carbon washer from new seal assembly. Lubricate shaft and neoprene seal bellows where it contacts the shaft. Slide seal assembly onto shaft until neoprene bellows start to grip the shaft.

3. Install the **OLD** carbon washer in the new seal seat. Install two cap screws in opposite sides of the old cover plate. Draw up cap screws evenly to properly position new seal assembly against shoulder on shaft. Remove cap screws and old carbon washer and cover plate.

4. Lubricate new carbon washer and carbon washer seal seat with refrigerant oil. Install new carbon washer in seal seat, taking care not to damage the carbon washer or the seat. Ensure that notches in carbon washer are aligned with two small knurls inside the seal seat. Install the new cover plate and gasket. Draw cap screws down evenly to prevent damage to carbon washer.

#### NOTE

Do not touch carbon washer sealing surface with your fingers.

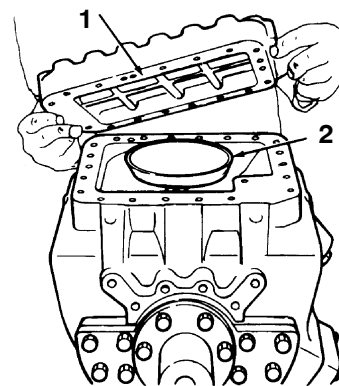
### 3.6 COMPRESSOR RUNNING GEAR REMOVAL

In order to disassemble Piston, Rod and Rings, first the cylinder head, oil pump and shaft seal must be disassembled (Refer to sections 3.3, 3.4 and 3.5).

#### a. Bottom Plate, Strainer, and Connecting Rod Caps

1. Turn the compressor over, bottom side up, and remove the bottom plate. (See Figure 3-10) Scrape off gasket.

2. Remove the oil strainer.



- 1. Bottom Plate
- 2. Oil Strainer

Figure 3-10. Bottom Plate Removal

3. Match mark each connecting rod cap and connecting rod for correct reassembly. Remove the cap screws, flat washers and connecting rod caps. It is recommended that the cap screws and flat washers be discarded and new cap screws (special) and flat washers be installed during compressor reassembly. (See Figure 3-11)

4. Push the piston rods down so that the piston rings extend below the cylinders. Remove and discard piston rings. Use only new rings when reassembling the compressor. (See Figure 3-12.)

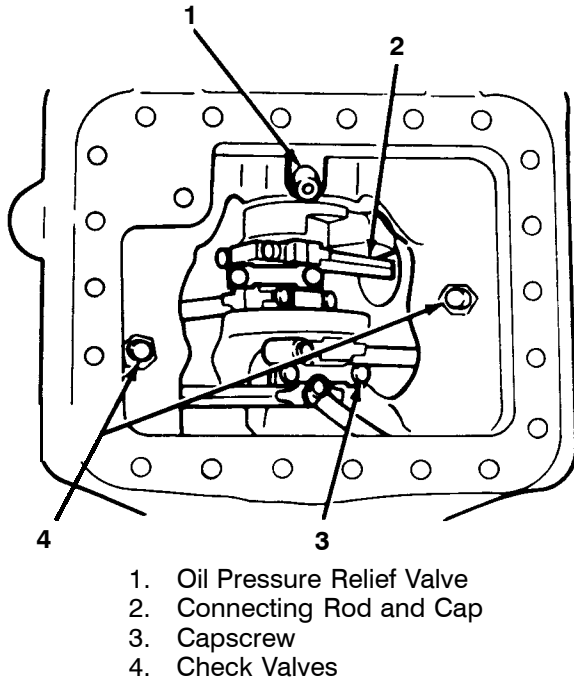


Figure 3-11. Bottom Plate and Oil Strainer Removed

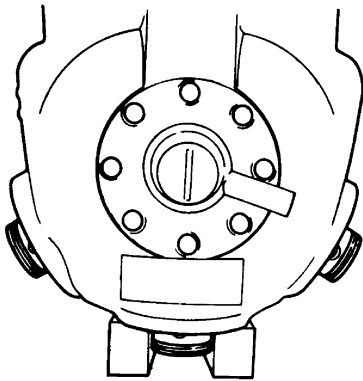


Figure 3-12. Piston Rings Removed

**b. Crankshaft and Seal End Thrust Washer**

**CAUTION**

**Do not allow crankshaft to drop on connecting rods inside the crankcase when removing the crankshaft.**

1. Push piston rod assemblies out of the way and remove crankshaft and seal end thrust washer.
2. Remove and check operation of oil return check valves (See Figure 3-11). The check valves are free floating devices and can easily be checked visually.
3. Remove and check oil pressure relief valve (See Figure 3-11). The oil pressure relief valve is a spring

loaded device which can be checked by using a small piece of stiff wire to ensure that the spring can be depressed.

4. Remove piston rod assemblies.

**c. Pistons, Rods, and Rings**

1. 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.
2. Match mark and disassembly pistons, pins, connecting rods, and caps. (See Figure 3-13)
3. Check wear dimensions of disassembled parts to determine if they are worn beyond limits given in Table 3-2.
4. If parts are worn beyond limits, replace them in matched sets as specified above.
5. Coat piston pins with compressor oil and reassembly pistons, pins, and connecting rods in matched sets.

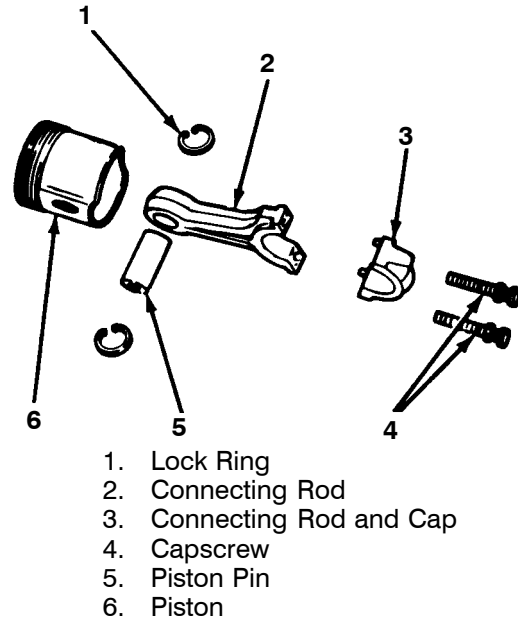


Figure 3-13. Connecting Rod, Piston, and Pin

**d. Seal End Main Bearings**

1. Inspect seal end main bearings. Check wear dimensions to determine if they are worn beyond limits given in Table 3-2.
2. If worn beyond limits remove seal end main bearings.

### 3.7 COMPRESSOR RUNNING GEAR REASSEMBLY

#### a. Seal End Main Bearings

1. When installing new seal end main bearings the oil groove is on top of the compressor with V grooves pointing to each other. When installed, there must be a 5/16 inch (7.93 mm) gap between the two bearings (See Figure 3-14).

2. Line boring seal end main bearings.

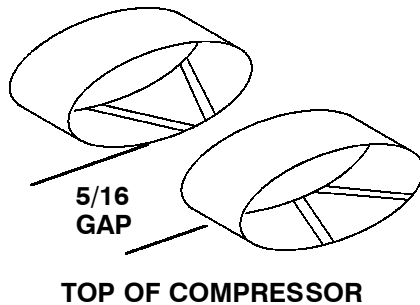


Figure 3-14. Seal End Main Bearings

#### b. Pistons, Rods, and Rings

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 honing lightly in an up and down rotating motion. Clean thoroughly after breaking glaze.

Some 05G compressors for refrigeration use only may have contoured pistons (See Figure 3-15). When installing contoured pistons into compressor, check suction valve and contoured piston are in the same orientation.



Figure 3-15. Contoured Piston

1. 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 shown in Table 3-2.

2. 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 must 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. (See Figure 3-16)

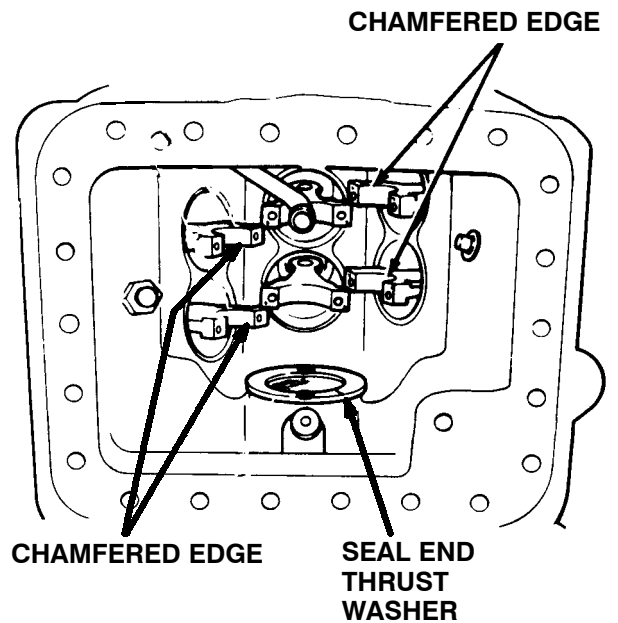


Figure 3-16. Installing Piston Rod Assemblies and Seal End Thrust Washer

3. Depending on date of manufacture, the compressor may be fitted with double or single ring pistons. Double ring and single ring pistons may be installed in the compressor, as long as matched pistons are used on each bank.

4. Old double ring pistons (with wider lower ring groove), the oil ring is installed in the groove nearest the bottom and the compression ring in the groove nearest the top. The oil ring is notched on the outside circumference. This notch must be installed towards the bottom. (See Figure 3-17)

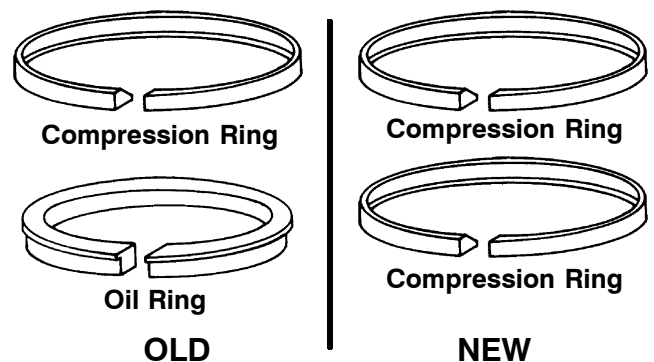


Figure 3-17. Piston Rings

5. The compression ring is chamfered on the inside circumference. This ring is installed with the chamfer towards the top. If using a double ring piston, stagger the ring end gaps so they are not aligned.

6. Measure side clearance between ring and ring groove in piston. Maximum dimensions are provided in Table 3-2.

### c. Crankshaft and Seal End Thrust Washer

1. 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 two dowel pins installed in the crankcase. Both thrust washers should be inspected for wear and scoring before reassembly (Refer to Table 3-2).

2. Install the seal end thrust washer on the two dowel pins. (See Figure 3-16) Ensure piston rods are pushed out of the way and install the crankshaft.

#### CAUTION

**Do not allow crankshaft to drop on connecting rods inside the crankcase when installing the crankshaft.**

### d. Bottom Plate, Strainer, and Connecting Rod Caps

1. 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 lightly tap piston down into the cylinder. (See Figure 3-18) The ring compressor can be easily fabricated from a piece of sheet metal.

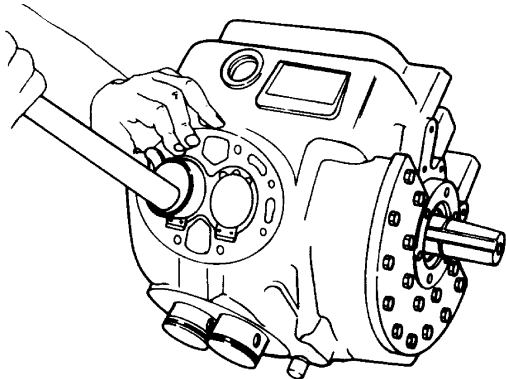


Figure 3-18. Installing Pistons

2. Install connecting rod caps on connecting rods using new capscrews (special) and flat washers. Reuse of the old capscrews is not recommended. Ensure that the caps are installed on the dowel pins. Torque capscrews to torque value shown in Table 3-1. Ensure freedom of movement of crankshaft after capscrews are torqued on each rod cap.

3. Check operation and reinstall check valves and relief valve. (See Figure 3-11). The check valves are free-floating devices and can easily be checked visually. The relief valve is a spring-loaded device which can be checked by using a small piece of stiff wire to ensure that the spring mechanism can be depressed.

4. Clean and reinstall the oil strainer.

5. 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 the torque value shown in Table 3-1.

6. Reassembly the cylinder head, oil pump and shaft seal (Refer to sections 3.3, 3.4 and 3.5).

### 3.8 SUCTION STRAINER

#### NOTE

Suction strainer has been preformed to fit into suction cavity.

Remove and clean the suction strainer. (See Figure 3-19) Check it for damage. If it is damaged, replace suction strainer. Install suction strainer and suction service valve using a new gasket.

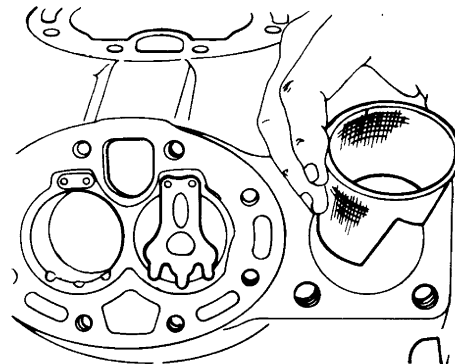


Figure 3-19. Installing Suction Strainer

### 3.9 ADDING OIL

Add the proper oil charge to the compressor through the oil fill plug. Refer to section 2.2.2 for the required oil charge. Refer to unit operation manual for other methods of adding oil to compressor.

### 3.10 INSTALLING COMPRESSOR

Refer to section 2.2.2 and the unit service manual to install the compressor. Allow compressor to run for 4 to 5 hours before checking new shaft seal assembly for leaks.

**Table 3-1. Torque Values**

SIZE DIAMETER (INCHES)	THREADS PER INCH	TORQUE RANGE		USAGE
		FT-LB	MKG	
1/16	27 (pipe)	8 to 12	1.11 to 1.66	Pipe Plug – Crankshaft
1/8	27 (pipe)	15 to 20	2.07 to 2.77	Oil Return Check Valve – Crankcase
1/4	20 (pipe)	20 to 25	2.77 to 3.46	Pipe Plug – Gauge Connection
1/4	20	10 to 12	1.38 to 1.66	Connecting Rod Capscrew
1/4	28	6 to 10	0.83 to 1.38	Oil Pump Drive Segment (Vane Pump)
		12 to 16	1.66 to 2.21	Unloader Valve
5/16	18	16 to 20	2.21 to 2.77	Cover Plate – Plate End
				Bearing Head (Vane Pump)
		20 to 30	2.77 to 4.15	Discharge Service Valve
3/8	16	40 to 50	5.53 to 6.92	Pump End Bearing Head
				Bottom Plate – Crankcase
				Cylinder Head
				End Flange
				Shaft Seal Cover
1/2	13	55 to 80	7.61 to 11.06	Suction Service Valve
#10	32	4 to 6	0.55 to 0.83	Oil Pump Drive Segment (Vane Pump)
1-1/2	18 NEF	35 to 45	4.84 to 6.22	Oil Level Sight Glass

NEF – National Extra Fine

Table 3-2. Wear Limits

PART NAME	FACTORY MAXIMUM		FACTORY MINIMUM		MAXIMUM WEAR BEFORE REPAIR	
	INCHES	MM	INCHES	MM	INCHES	MM
<b>SEAL END</b>						
End Play (Seal Removed)	0.035	0.8890	.030	0.7620	–	–
Main Bearing Diameter	1.8760	47.6504	–	–	.002	0.051
Main Bearing Journal Diameter	–	–	1.8725	47.5615	.002	0.051
<b>PUMP END</b>						
Main Bearing Diameter	1.3760	34.9504	–	–	.002	0.051
Main Bearing Journal Diameter	–	–	1.3735	34.8869	.002	0.051
<b>CONNECTING ROD</b>						
Connecting Rod Diameter	1.3768	34.9707	–	–	.0020	0.051
Piston Pin Bearing	0.6883	17.4752	0.6878	17.4701	.001	0.0254
<b>CRANKSHAFT</b>						
Crankpin Diameter	–	–	1.3735	34.8869	.0025	0.0635
Throw – Height <b>(37 CFM)</b>	0.9698	24.6329	0.9678	24.5821	–	–
Throw – Height <b>(41 CFM)</b>	1.072	27.2288	1.070	27.1780	–	–
<b>THRUST WASHER (Thickness)</b>						
Pump End	0.145	3.6830	0.144	3.658	.0250	0.6350
Seal End	0.157	3.987	0.155	3.937	.0250	0.6350
<b>CYLINDERS and PISTONS</b>						
Bore	2.0010	50.8254	–	–	.002	0.051
Piston (Diameter)	–	–	See Figure 3-20		.002	0.051
Piston Pin (Diameter)	–	–	0.6873	17.4574	.001	0.025
Piston Ring Gap	0.013	0.3302	0.005	0.127	.025	0.635
Piston Ring Side Clearance	0.002	0.051	0.001	0.0254	.002	0.051

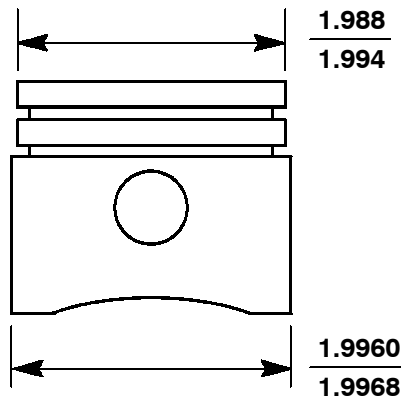


Figure 3-20. Piston Dimension (Wear Limits)

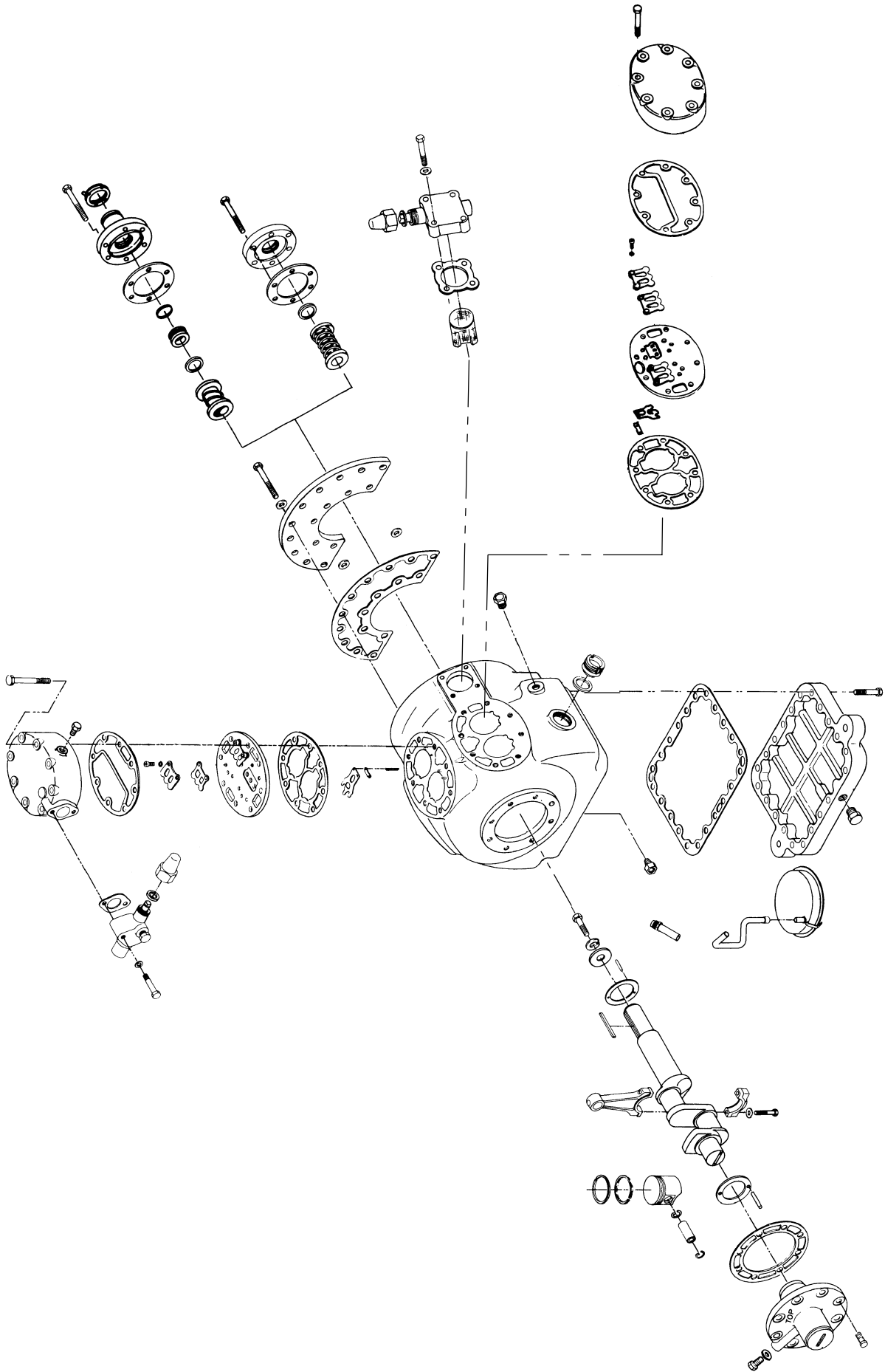


Figure 3-21. Compressor Exploded View