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THERMO KING COMPRESSORS

The most important part of the refrigeration system is the compressor. Its function is to pump the low pressure gas out of the evaporator so that a rapid and continuous boiling action is maintained in the coil. The low pressure gas is compressed and forced into the condenser coil where it is cooled by air passing through the coil. The high pressure and reduced temperature causes it to reliquefy.

When any repairs or replacements are to be made on the compressor, it is very important that the parts used are clean and not nicked or scratched. During disassembly, parts should be cleaned and inspected; and if they are to be used in reassembly, they should be wrapped in a clean cloth to prevent marring the surface. Oil all parts with compressor oil during assembly, and be sure they are installed in the same position as they were before.

COMPRESSOR OIL INDICATIONS

Discoloration of the oil is an indication of a contaminated system and future problems. Following is a color code and suggested steps to help you diagnose the condition and correct it.

COMPRESSOR OIL COLOR CODE

BLACK OIL. Indicates carbonization caused by air in the system.

BROWN OIL. Indicates copper plating caused by moisture in the system.

GRAY OR METALLIC OIL. Indicates bearing wear or piston scoring.

A contaminated system will cause a failure if left uncorrected. The contaminate in the system will break down the refrigerant oil, causing excessive bearing wear and scoring of parts within the compressor. Copper plating and moisture will affect the valve plate reeds and break down the refrigerant and affect the capacity of the unit. Particles and bearing scale traveling with the refrigerant will plug the driers and expansion valves, causing erratic operation until the condition is corrected. Flushing with Refrigerant II or the use of suction and liquid line driers is recommended whenever a contaminated system is found. In some cases, the contaminated condition can be corrected by changing oil, refrigerant and drier. Use a recommended evacuation process before the unit is placed in service.

GENERAL INFORMATION

Before overhauling the compressor, pump down the system, and close the compressor suction and discharge service valves.

Although some parts of the compressor can be removed for inspection or disassembly with the clutch coil, pulley and damper attached, major repairs or complete overhaul may best be made by removing the mounting bolts, pressure connections and the crankshaft drive and supporting the compressor on a workbench.

Refer to Figures 1 through 5 for exploded views of the compressor.

1. Remove the compressor as explained previously under "Compressor Removal".
2. Relieve pressure from the system.
3. Drain oil from the crankcase if the unit is to be completely disassembled, or if repairs require removal of the handhole cover.
4. Be certain the immediate area in which the compressor is to be overhauled is free of dust and that pieces of cloth used for cleaning parts are lint free.
5. When removing, assembling or installing parts, handle the parts carefully.
6. Coat each part with refrigerant oil as it is removed to prevent rusting.
7. Before installing parts, clean each part with a refrigerant parts cleaner, then oil the part with clean (new) compressor oil.
8. Inspect each part for nicks, burrs, wear, breakage or evidence of copper plating. Refer to "Recommended Compressor Wear Rate Table" at the end of this section for tolerances and wear limits.
9. Use new gaskets and O-rings when assembling the compressor.
10. Lubricate all parts, especially the bearing surfaces before installing. This will help the compressor to run without seizure when it is first started up and before oil pressure is built up.
11. Always use torque wrench when tightening bolts or screws. Improper tightening can cause premature wear, stripped threads, or failure of a part. Refer to "Compressor Torque Specifications."

The compressor has been designed to permit replacement of many parts and subassemblies without having to disassemble the entire unit. For example, a cylinder liner can be replaced without having to remove the piston and rod.

The overhaul procedures that follow cover disassembly and assembly of the compressor in a logical sequence and to the extent recommended by Thermo King Corporation.

COMPRESSOR DISASSEMBLY

NOTE: To prevent damage to parts of the compressor and to help assure proper performance of the unit after assembly, follow the procedures given previously in "General Information" when disassembling or assembling the compressor.

Clutch Pulley and Damper Removal

Key numbers in the following text refer to Figure 1.

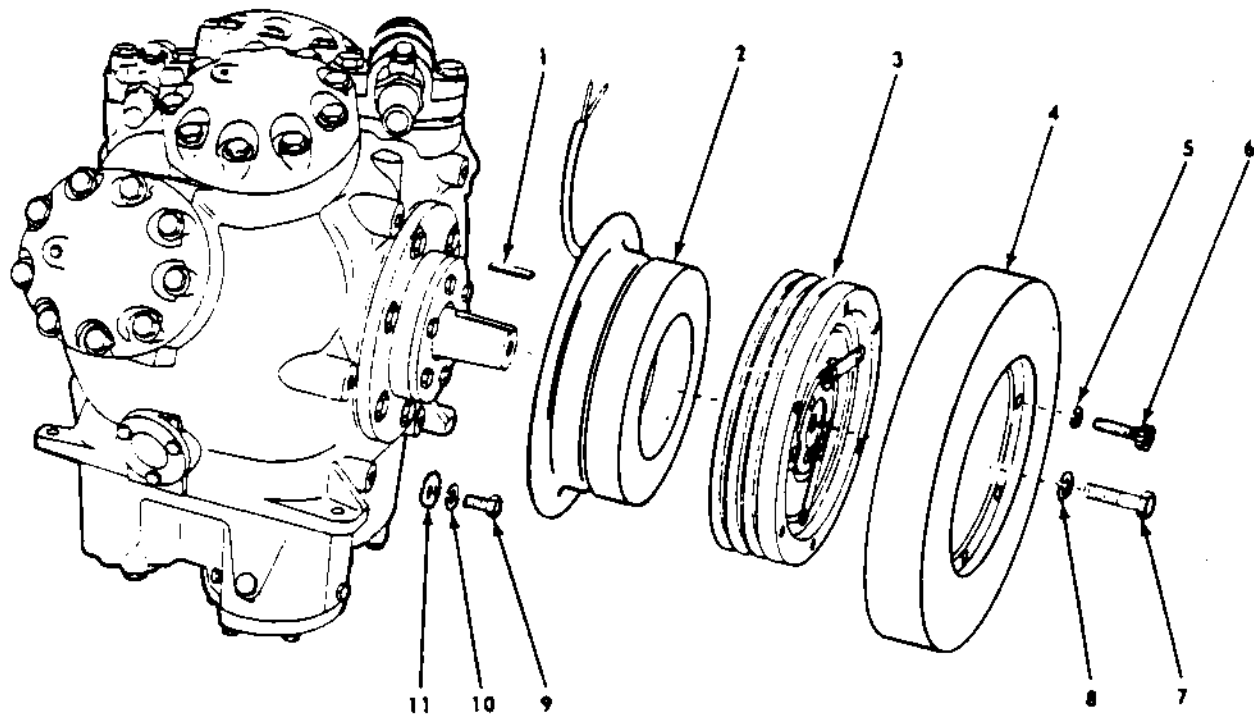
1. Separate the clutch coil wiring connector from the line connector.
2. Remove bolt (7) and washer (8) securing pulley (3) and crankshaft.
3. Using a puller bolt in pulley hub, separate pulley (3) and key (1) from the compressor shaft.
4. Remove bolts (9), washers (10), and retainers (11) which attach the clutch coil to the housing.
5. Remove bolts (6) and washers (5) which attach the damper to the pulley and remove the damper.

NOTE: Viscous damper is applicable only on GM/TMC RTS Buses with very few exceptions.

Clutch Bearing Replacement

Key numbers in the text refer to Figure 6.

1. Remove outer and inner snap rings (1 and 2) from the clutch pulley (5) and pressure plate (6).
2. Support the pressure plate hub on the Hub Support Tool (Figures 7 and 8). Insert the Hub Removal Tool (Figure 9) through the holes in the pressure plate hub and press on the bearing inner race to separate the pressure plate assembly from the pulley and bearing.
3. Support the pulley at the open end of the bearing bore (Figure 10). Press Bearing Tool (Figure 11) against the bearing outer race to remove the bearing from the clutch pulley.
4. Thoroughly clean the pulley and pressure plate. Inspect parts for cracks or damage and replace if necessary.



- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Key 2. Clutch Coil (24-volt) 3. Clutch Pulley 4. Viscous Damper (GM & TMC RTS Only) 5. Lockwasher (0.250) 6. Allen Head Screw | <ol style="list-style-type: none"> 7. Bolt (0.437-20x1.75") with Nylok Patch 8. Special Thick Washer (0.437) 9. Bolt (0.375-16x.75) 10. Lockwasher (0.375) 11. Retainer |
|---|--|

Figure 1 — Compressor Clutch, Coil and Damper

5. Position the new bearing in the bore. Support the pulley as shown in Figure 12. Place the 3½" end of the Bearing Tool (Figure 11) against the bearing outer race and press the bearing into the bore until it is seated.
6. Support the pulley and bearing at the bearing inner race (Figure 13) using the Bearing Support Tool (Figure 8). Apply pressure on the hub, pressing until the pressure plate stops.
7. Replace the bearing retaining rings (Snap Rings 1 and 2 on Figure 6) in the clutch pulley and pressure plate hub.

Suction and Discharge Valve Removal

Key numbers in the text refer to Figure 2.

1. Remove two bolts (1) which attach the discharge valve to the compressor. Remove valve (2) and gasket (3).
2. Remove two bolts (4) which attach the suction valve (5) to the compressor. Remove the valve, gasket (6) and strainer (7).

Cylinder Head and Discharge Valve Removal

Key numbers in the following text refer to Figure 3.

1. Loosen and remove all but two opposed cylinder head attaching bolts (1). Alternately loosen the remaining two bolts two or three full turns as shown in Figure 13.

CAUTION: The cylinder heads are under spring tension. To help prevent being injured by the cylinder head, check cylinder head (3) to be sure it is following the heads of attaching bolts (1). If the head is not following the bolts, tap around the edge of the head with a plastic or rawhide hammer until head gasket (4) breaks loose.

2. Slowly and alternately loosen the two remaining cylinder head bolts to relieve tension of the cylinder head spring. When the last two bolts are turned all the way out, the spring should be fully extended.
3. Remove the cylinder head, then lift off the cylinder head spring (5) and remove the head gasket (4).
4. Lift the discharge valve assembly from the compressor (Figure 14).

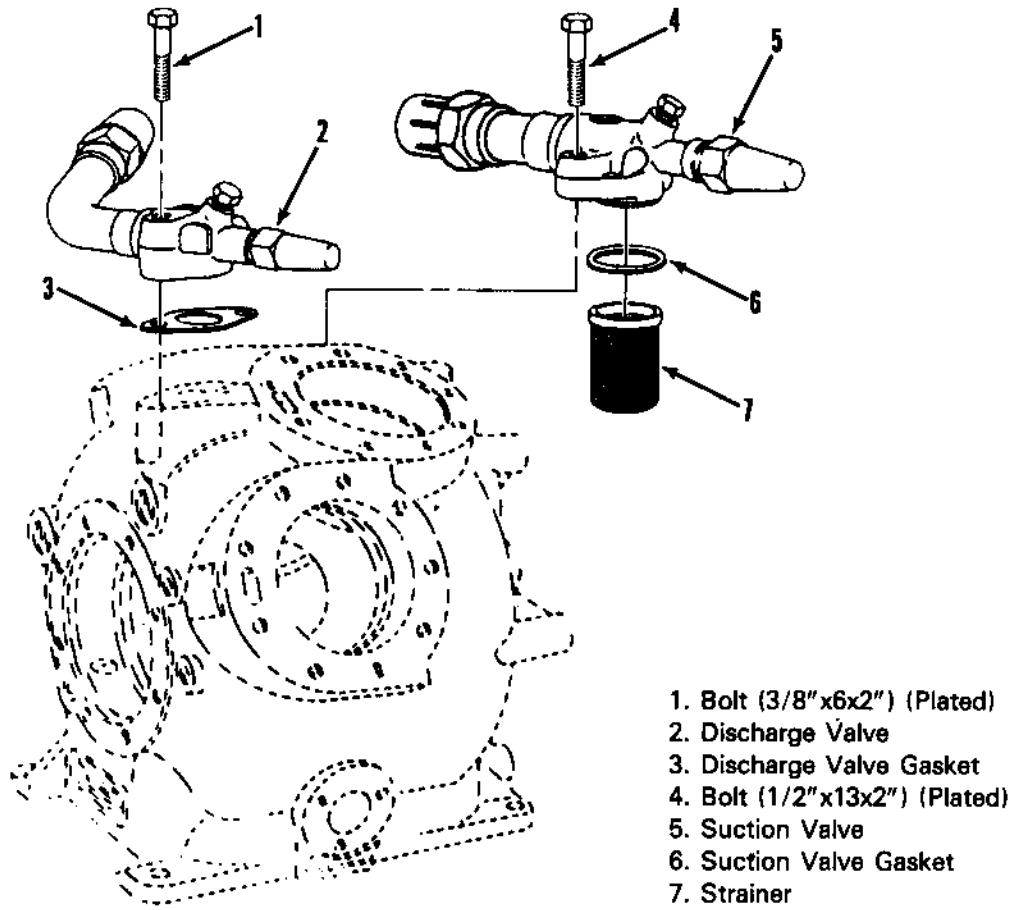
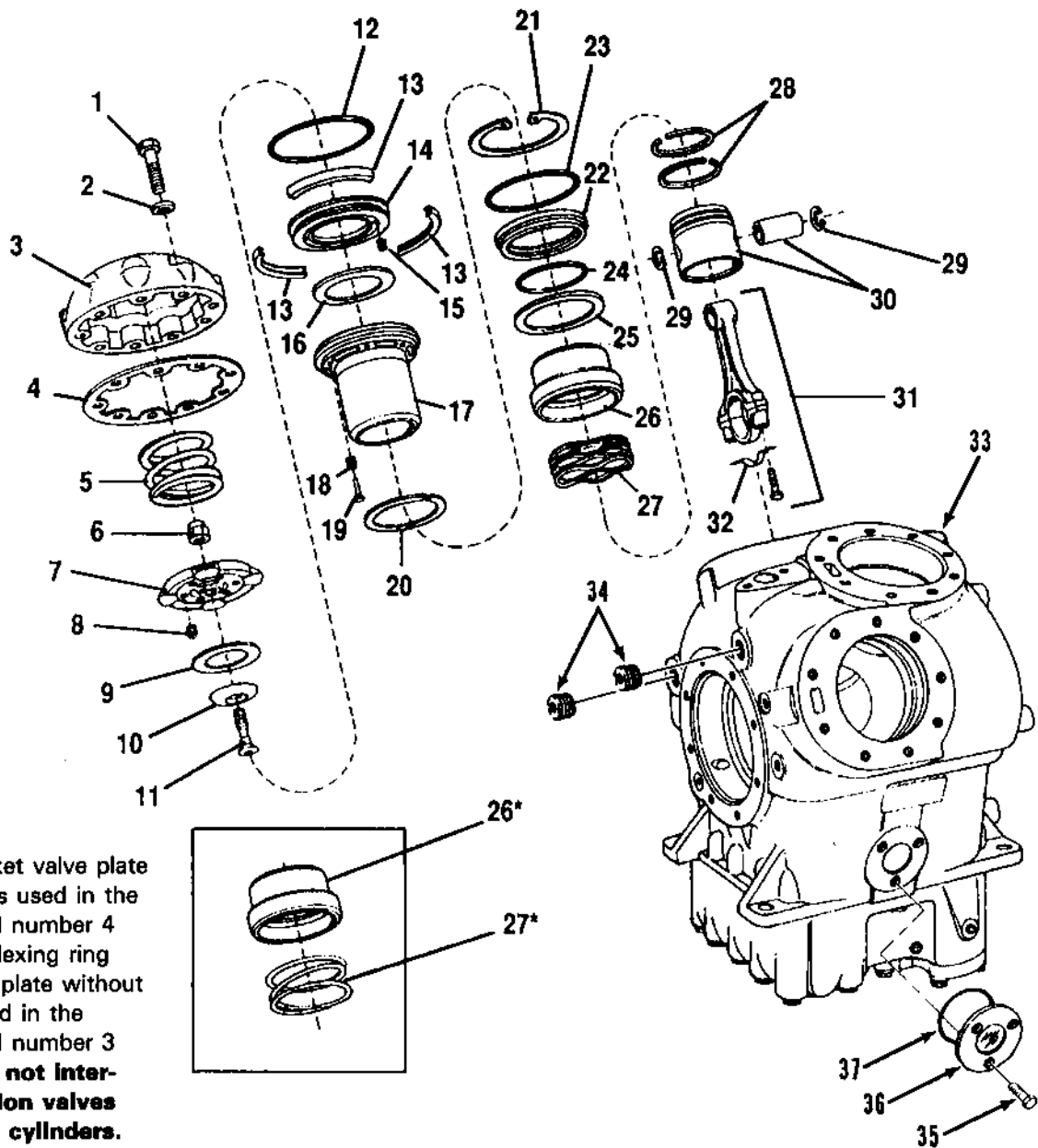


Figure 2 — Compressor Suction and Discharge Valves

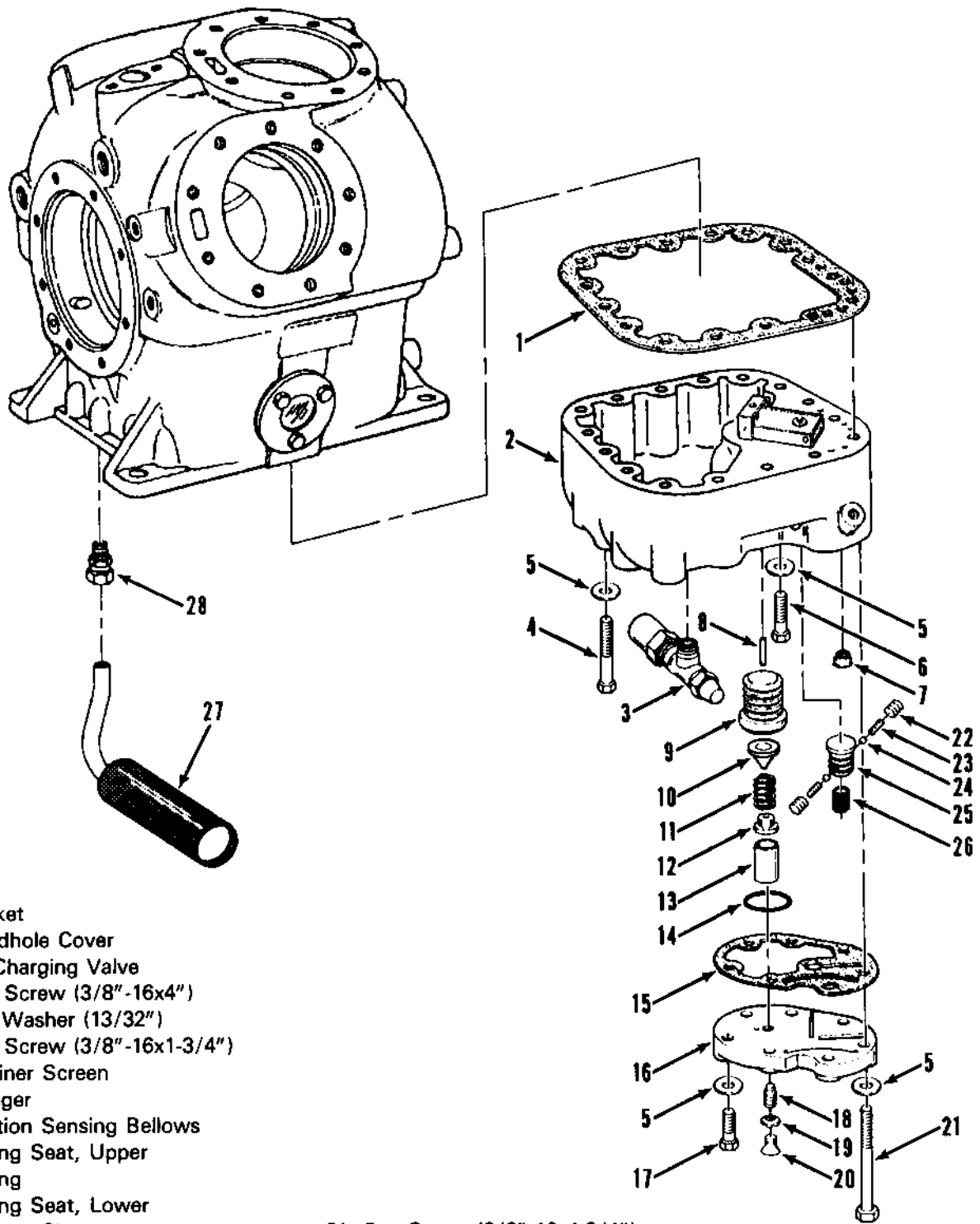


- 1. Bolt (3/8"-16x1-3/4")
- 2. Flat Washer (13/32")
- 3. Cylinder Head
- 4. Gasket
- 5. Cylinder Head Spring
- 6. Lock Nut
- 7. Valve Cage
- 8. Discharge Valve Spring
- 9. Discharge Valve
- 10. Discharge Valve Seat
- 11. Valve Cage Screw
- 12. O-ring
- 13. Retaining Rings

- * 14. Valve Plate
- * 15. Suction Valve Spring
- * 16. Suction Valve
- 17. Cylinder Liner
- 18. Lift Pin Spring
- 19. Lift Pin
- 20. Take Up Ring
- 21. Retaining Ring
- 22. O-ring Retainer
- 23. Retainer to Housing O-ring
- 24. Retainer to Piston O-ring
- 25. Lower Retaining Ring

- 26. Unloader Piston
- 27. Unloader Spring
- 28. Compression Ring
- 29. Retaining Ring
- 30. Piston Head and Pin Assy.
- 31. Connecting Rod Assembly
- 32. Lock Strap
- 33. Compressor Housing
- 34. Pipe Plug
- 35. Cap Screw (1/4"-20x5/8")
- 36. Sight Glass
- 37. O-ring

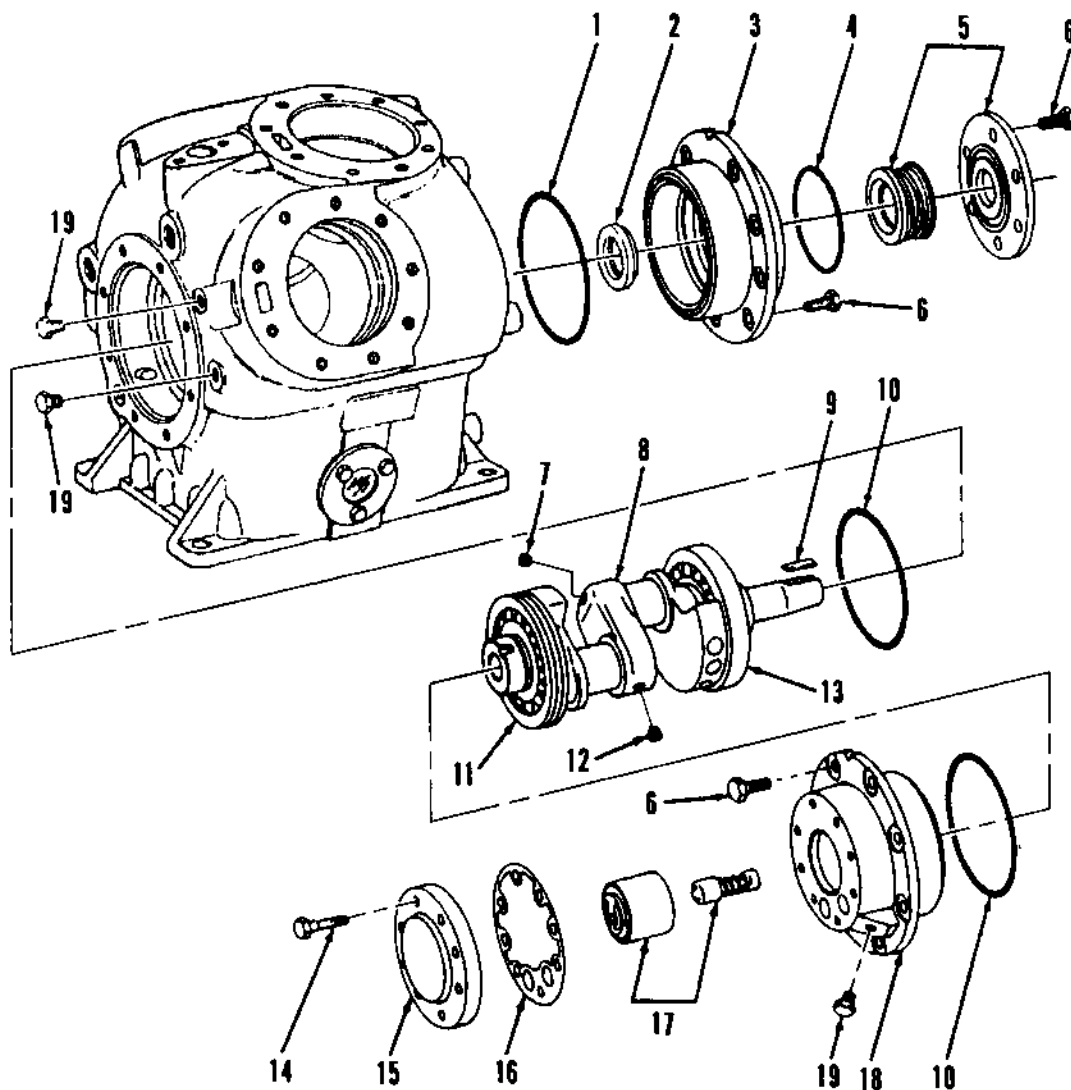
Figure 3 – Compressor Cylinder Head and Unloader Assembly



- 1. Gasket
- 2. Handhole Cover
- 3. Oil Charging Valve
- 4. Cap Screw (3/8"-16x4")
- 5. Flat Washer (13/32")
- 6. Cap Screw (3/8"-16x1-3/4")
- 7. Strainer Screen
- 8. Plunger
- 9. Suction Sensing Bellows
- 10. Spring Seat, Upper
- 11. Spring
- 12. Spring Seat, Lower
- 13. Bellows Sleeve
- 14. O-ring
- 15. Distributor Cover Gasket
- 16. Distributor Cover
- 17. Cap Screw (3/8"x1-1/4")
- 18. Adjusting Screw (5/16"-24x3/4")
- 19. Lock Washer
- 20. Flat Head Screw (5/16"-24x3/8")

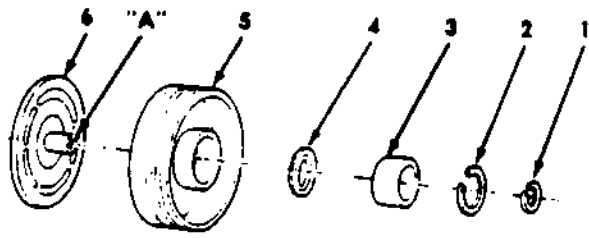
- 21. Cap Screw (3/8"-16x4-3/4")
- 22. Detent Screw
- 23. Detent Spring
- 24. Detent Ball
- 25. Piston Actuator
- 26. Piston Actuator Spring
- 27. Oil Strainer Assembly
- 28. Adapter Fitting (1/2" O.D. x 3/8" NPTF)

Figure 4 — Compressor Handhole Cover and Strainer Assembly



- | | | |
|---------------------------------|------------------------------------|---------------------------------|
| 1. O-ring, Bearing Head/Housing | 8. Crankshaft | 14. Screw (.312-18x1.25") |
| 2. Oil Seal | 9. Drive Key | 15. Oil Pump Cover and Pin |
| 3. Seal End Bearing Head | 10. Bearing Head to Housing O-ring | 16. Oil Pump Cover Gasket |
| 4. Shaft Seal O-ring | 11. Pump End Roller Bearing | 17. Oil Pump and Valve Assembly |
| 5. Shaft Seal and Gland Plate | 12. Magnetic Plug | 18. Pump End Bearing Head |
| 6. Screw (.375-16x1.00") | 13. Seal End Roller Bearing | 19. Hex Head Plug (1/8 NPT) |
| 7. Plug (1/8 NPTF) | | |

Figure 5 — Compressor Crankshaft, Seal End and Pump End Assembly



1. Press Plate Snap Ring
2. Bearing Snap Ring
3. Clutch Bearing
4. Dust Shield
5. Clutch Pulley
6. Clutch Pressure Plate

Figure 6 — Clutch Pulley Assembly

Discharge Valve Cage Disassembly

Key numbers in text refer to Figure 3.

1. Remove the discharge valve as explained under "Cylinder Head and Discharge Valve Removal" previously.
2. Remove the locknut (6) from the valve cage bolt (11).
3. Remove the bolt (11) and valve seat (10) from valve cage (7).
4. Separate the discharge valve six springs from the valve cage (Fig. 16).
5. Disassemble, inspect and assemble the discharge valve before proceeding to other parts of the compressor.

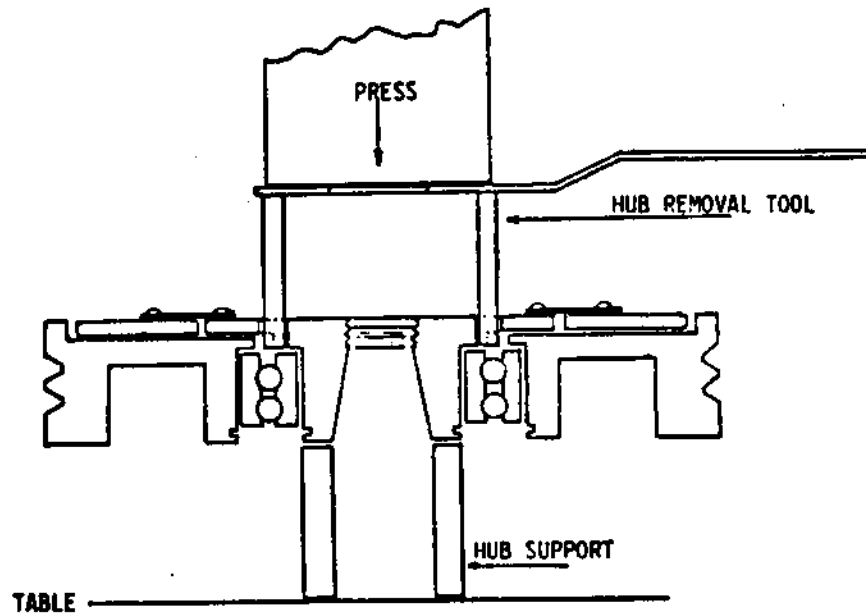


Figure 7 — Pressure Plate Assembly/Pulley Separation

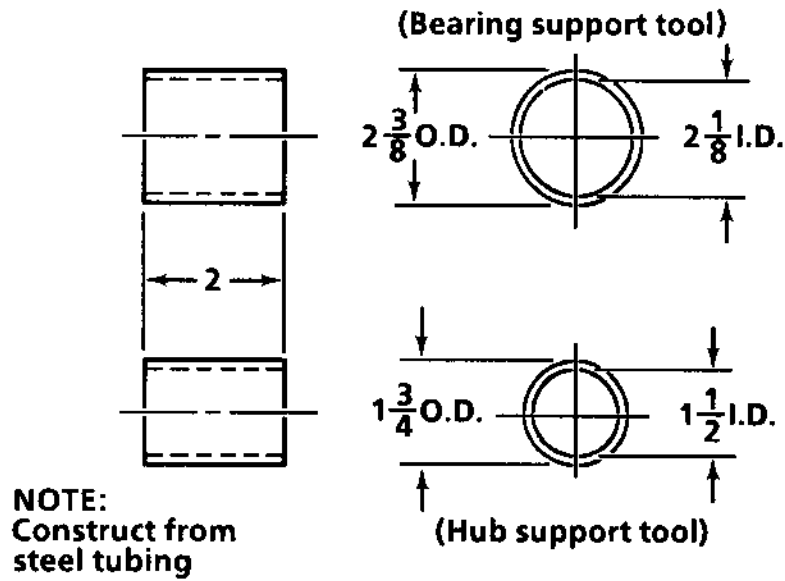


Figure 8 – Hub and Bearing Support Tools

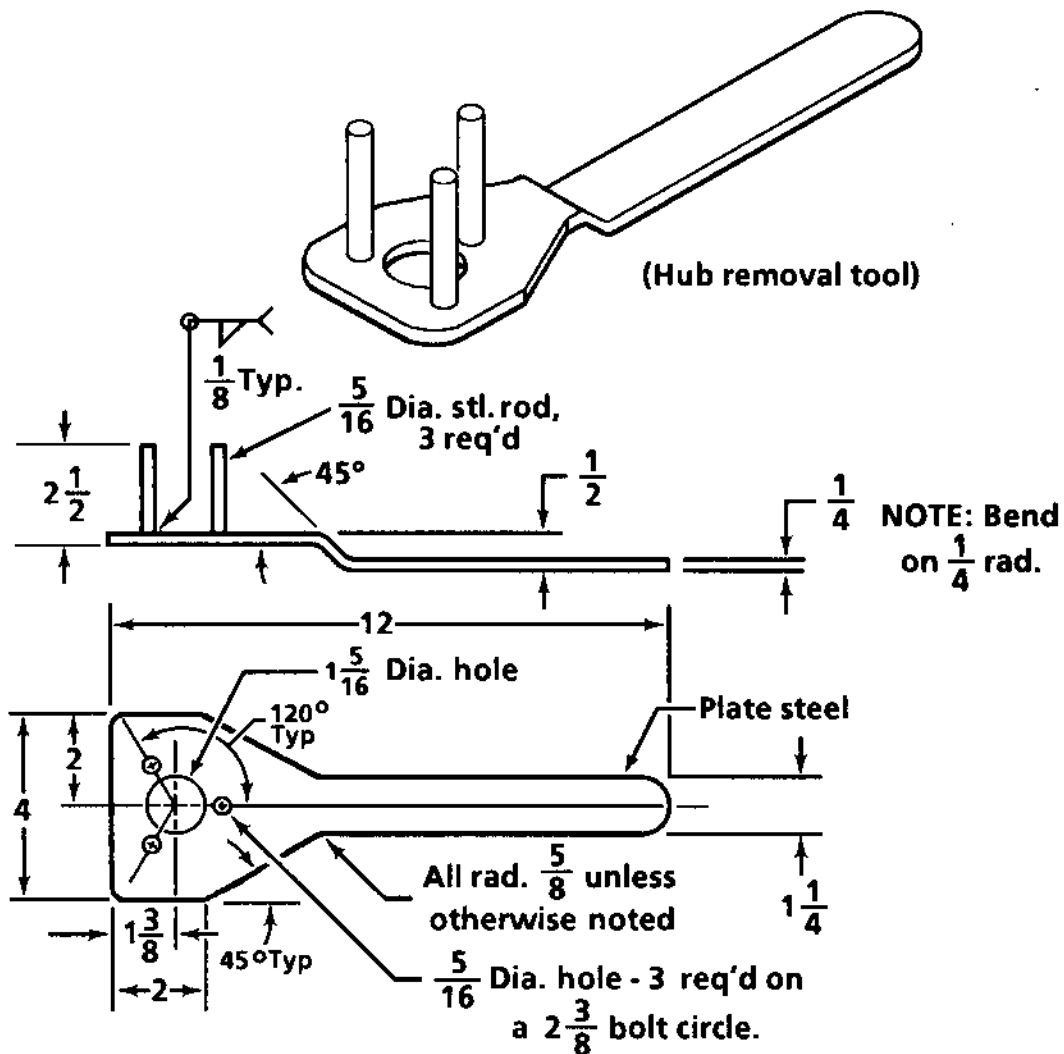


Figure 9 – Hub Removal Tool

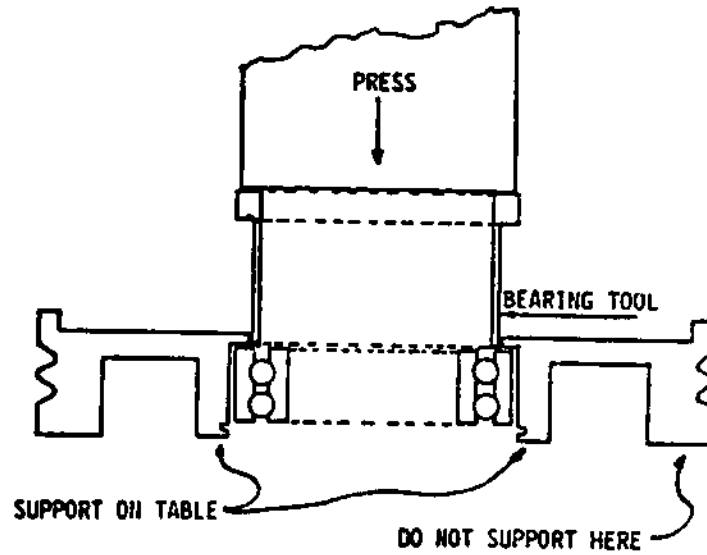


Figure 10 — Bearing Removal From Pulley

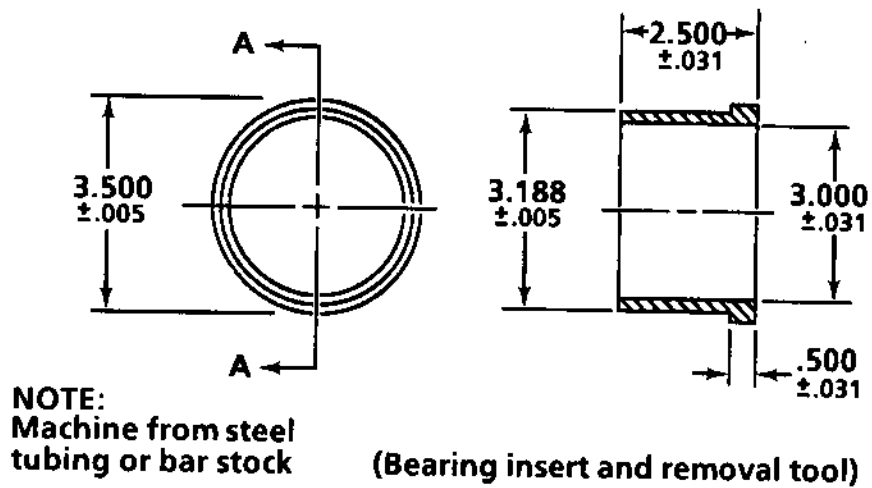


Figure 11 — Bearing Insert and Removal Tool

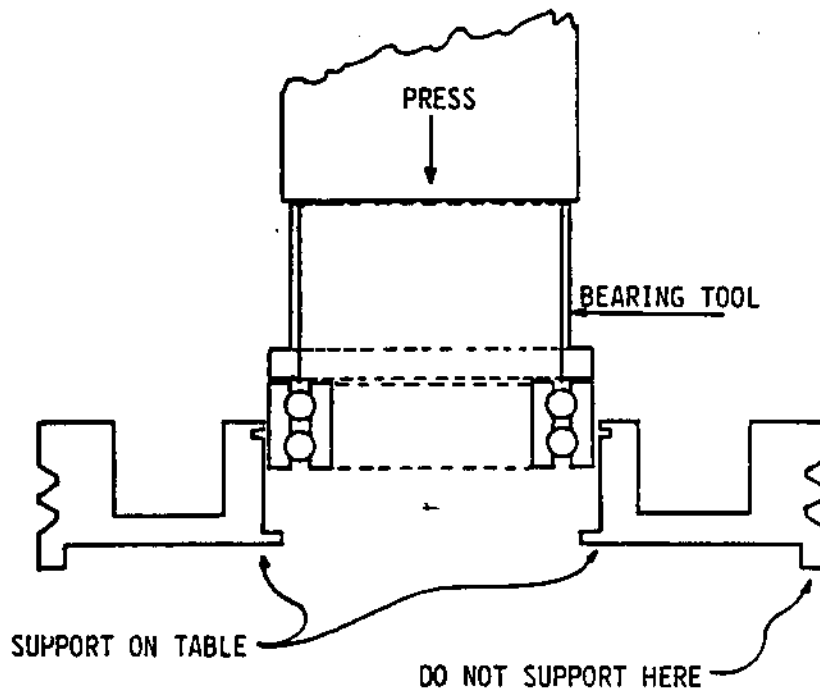


Figure 12 – Bearing Insertion to Pulley

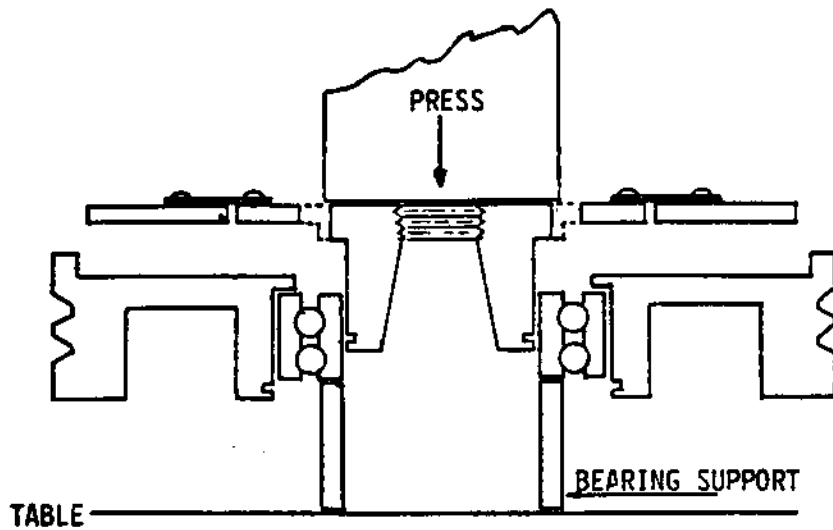


Figure 13 – Pressure Plate/Bearing Reassembly

Discharge Valve Inspection

Examine valve surfaces and replace the valves if there is evidence of copper plating, liquid slugging or wear approaching limits listed in the "Wear Rate Table" at the end of this section. Whenever the compressor is opened for servicing, replace the small valve springs if the compressor has operated for more than 5000 hours.

Discharge Valve Assembly

Key numbers in text refer to Figure 3.

1. Place the valve springs into the valve cage spring pockets and lay the valve ring on top of the springs (Figure 17). Insert valve seat (10) and bolt (11) through valve cage (7).
2. Work valve ring (9) up and down to make sure it moves freely (Figure 18).
3. Install locknut (6) and tighten to 24 foot-pounds (33 N·m) torque.

Cylinder Liner Removal

Key numbers in the text refer to Figure 11.

1. Remove the cylinder head and discharge valve as explained under "Cylinder Head and Discharge Valve Removal" previously.
2. Suction valve plate (14), attached to the top of the liner, is tapered inward at the top. Make a wood, plastic or soft metal puller block to dimensions shown in Figure 19 to fit inside the liner.
3. Rotate the crankshaft until the piston head is about two inches below the top surface of the suction valve plate.
4. Place the puller block in the cylinder so that the tapered ends engage the suction valve plate taper (Figure 19).
5. Rotate the crankshaft to drive piston head (30) up against the puller block thereby forcing cylinder liner (17) and suction valve plate (14) out of the housing.

NOTE: To prevent damaging the piston, do not bump the piston against the block. Use an even pressure. If the piston cannot be used to force the liner out, a tapped hole in the pullery block can be used with a puller bolt to pull the liner out.

6. After suction valve plate O-ring (12) has cleared the housing, pull the assembly out by hand as shown in Figure 20. Support the piston through the liner so that the piston does not bump against the compressor housing when the liner comes off the piston. If the liner has an unloader, the unloader lift pins, springs, and take-up ring will come out with the liner.

NOTE: DO NOT remove more than one cylinder liner without removing the piston and connecting rod. The piston and piston rings will be damaged if the crankshaft is rotated with one liner removed from the piston.

7. If a liner was removed from a cylinder equipped with an unloader assembly, work take-up ring (20) off bottom of the liner. Remove lift pins (19) and springs (18).

Suction Valve Disassembly

Key numbers in the text refer to Figure 3.

1. The suction valve assembly is secured to the liner with three 120-degree retainers (13).
2. Place the liner and valve assembly on a flat surface as shown in Figure 21 and pry the retainers outward to remove. Do not move the liner around on top of the valve assembly.
3. Cylinders 2 and 3 have a flexing ring valve plate not equipped with springs. Cylinders 1 and 4 have a spring pocket valve plate with springs. Do not mix valves between these cylinders. Lift liner away from the valve assembly and remove the valve (16), spring (15) and o-ring (12) as shown in Figure 22. Keep the valve plate with the liner until time of assembly.

NOTE: Cylinders 2 and 3 prior to S/N J1015J3158 (April 1981) also have a spring pocket valve plate. These units can be updated.

Cylinder Unloader Removal

Key numbers in the text refer to Figure 3.

1. The unloader assembly (Figure 23) is held in the cylinder by retaining ring (21).
2. Remove the cylinder head, discharge valve, suction valve and the cylinder liner as explained previously.
3. Reach inside the cylinder with large snap ring pliers and remove retaining ring (21).
4. Pull the unloader assembly and spring (items 22 through 27) out the cylinder.
5. Remove O-ring retainer (22), lower retaining ring (25) and O-rings (23 and 24) from the unloader piston (26).

NOTE: If the unloader assembly sticks in the compressor housing, a jet of low pressure air directed into the oil line which supplies the unloader at the handhole cover access port will separate the assembly from the cylinder housing. Normally there is no particular preparation needed to "catch the unloader." Since it is light weight and has a very short cylinder stroke, minimal inertia force is applied to the piston assembly.

Handhole Cover Removal and Disassembly

Key numbers in the text refer to Figure 4.

If only the cylinder liner is to be removed, it is not necessary to remove the handhole cover. Refer to "Cylinder Liner Removal" in this section.

1. The handhole cover on the bottom of the compressor contains the capacity control actuator which is an integral part of the cover.

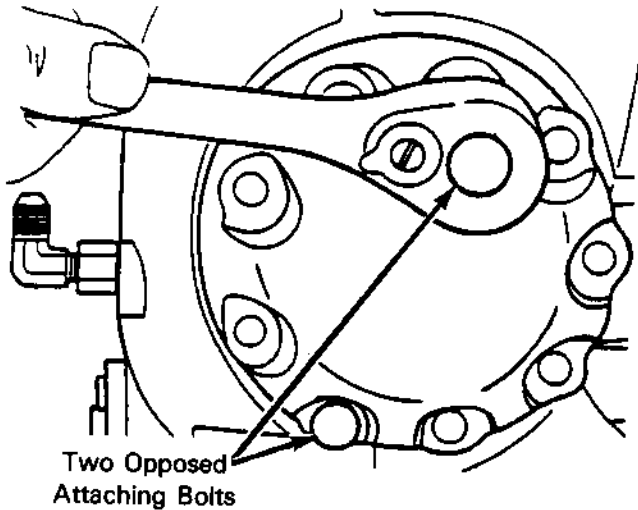
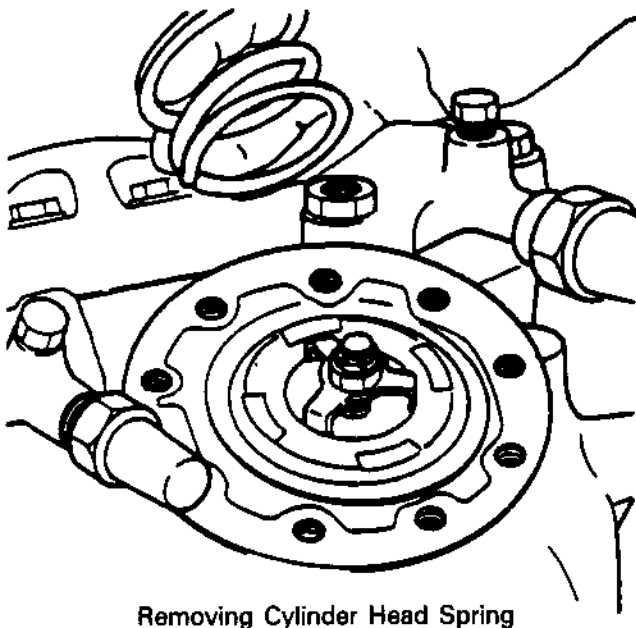


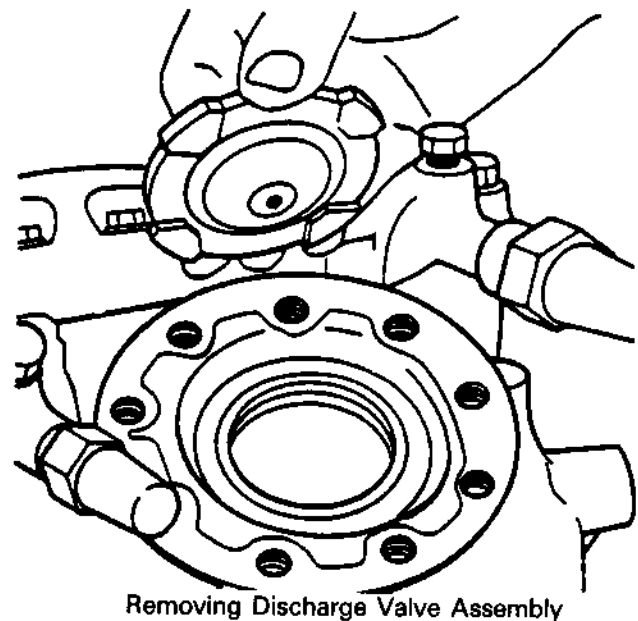
Figure 14 — Removing Cylinder Head Cover

NOTE: DO NOT attempt to adjust or remove the orifice screw and nut on the actuator orifice lever and bracket assembly (Figure 24). These parts have been factory set to control the orifice opening of the capacity control. If the setting is changed, a special factory test fixture is required to correct the setting.

2. Remove the cover attaching bolts (4, 6 and 21). Tap around the edge of the cover with a plastic or rawhide hammer to loosen cover (2), then remove the cover and cover gasket (1).
3. Disconnect oil strainer (27) by loosening compression fitting (28) on the oil supply line. Remove the oil strainer (Figure 25).
4. The capacity control distributor cover (16) is attached to the bottom of the handhole cover. Disassemble the capacity control assembly only to the extent covered below:
 - a. Referring to Figure 26, remove four cap screws which attach the distributor cover (16) to the handhole cover (2). It may be necessary to jar the cover to break the gasket seal. Remove the cover and cover gasket (15).



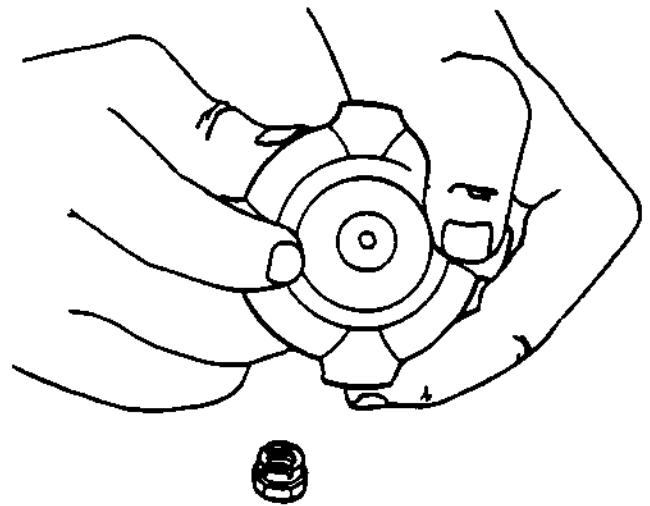
Removing Cylinder Head Spring



Removing Discharge Valve Assembly

Figure 15 — Removing Cylinder Head Spring and Discharge Valve

- b. Remove plunger (8), bellows (9), spring (11), lower and upper spring seats (10 & 12), sleeve (12) and o-ring (14) from the distributor cover.
- c. Remove oil strainer screen (7) from the handhole cover and clean with refrigerant parts cleaner.
- d. Remove plugs, detent ball screws, detent balls, springs and piston (22-26). Clean with refrigerant parts cleaner. Cleaning is required to free up parts seized due to foreign materials (metallic or other residue from failed parts, etc.). Complete cleaning assures unloader operation upon completion of the compressor overhaul.
- e. Remove orifice, bracket and lever assembly as required to clean and polish piston bore (Figure 26). Do not mix bracket/orifice assemblies or disturb orifice adjustment screw.



**Figure 18 –
Checking Discharge Valve Movement**

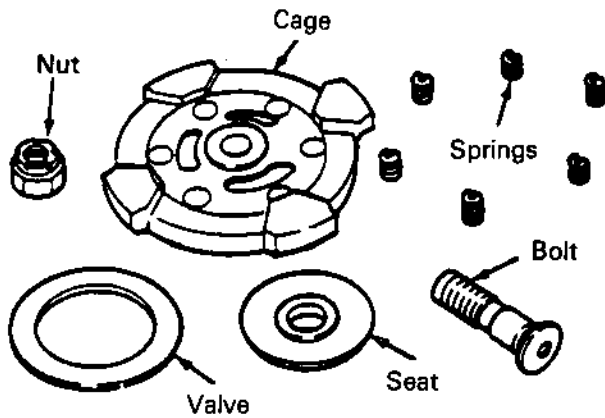


Figure 16 – Discharge Valve Components

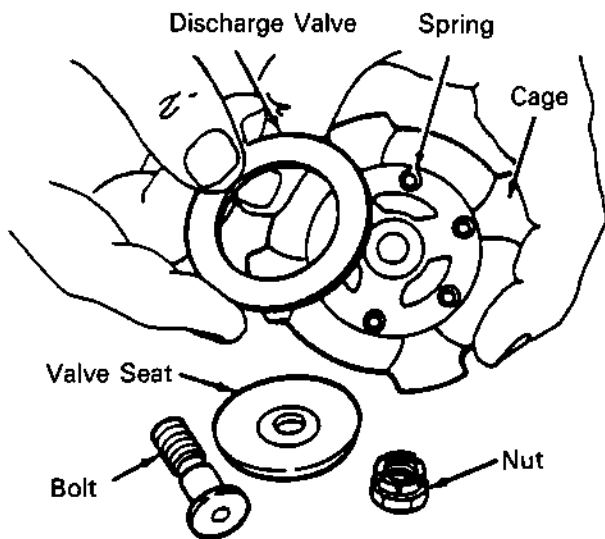
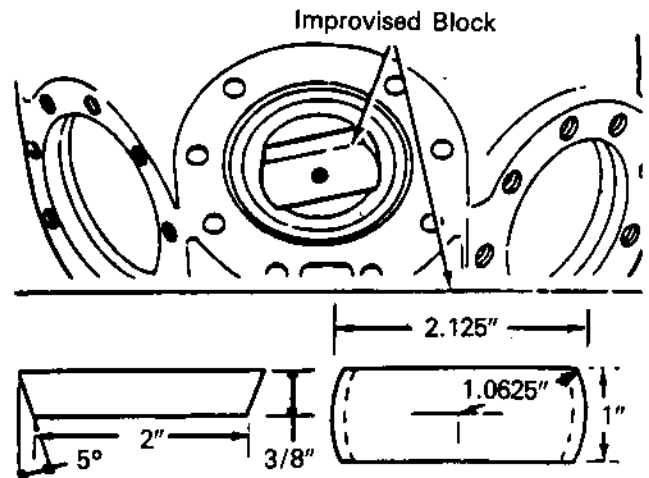


Figure 17 – Installing Discharge Valve Components



Soft Material – Wood, Plastic, Brass,
or Aluminum

**Figure 19 – Using Improvised Block to Remove
Suction Valve Liner**

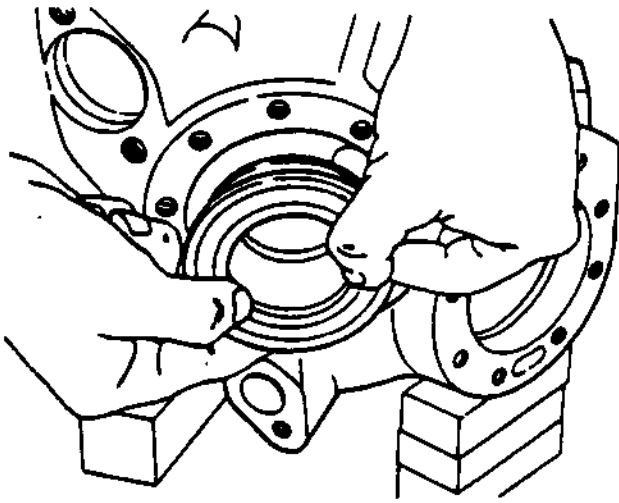


Figure 20 – Pulling Liner Off Piston

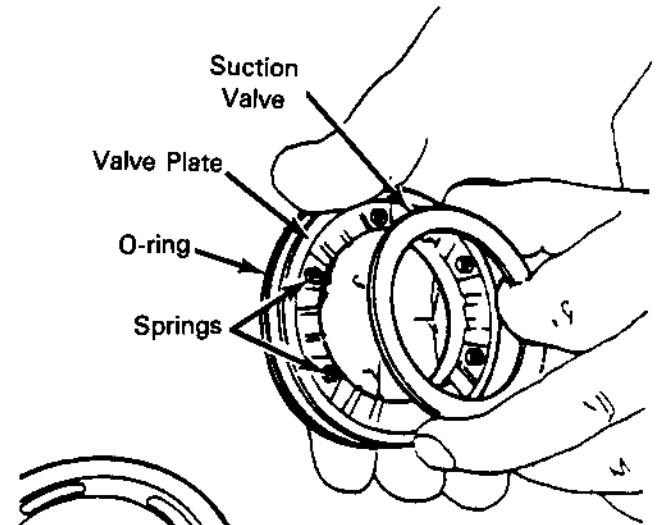


Figure 22 – Removing Suction Valve Components

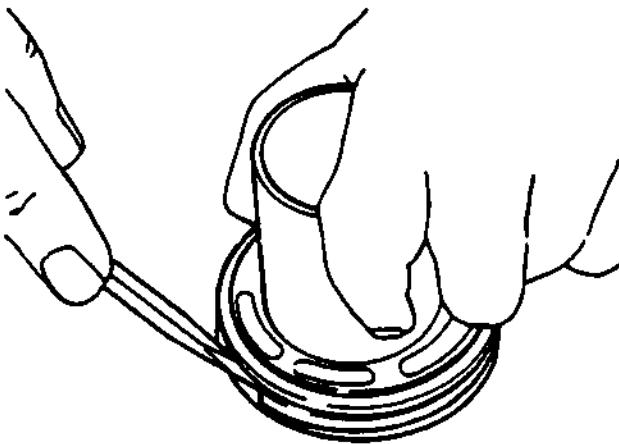


Figure 21 – Removing Suction Valve Retaining Ring

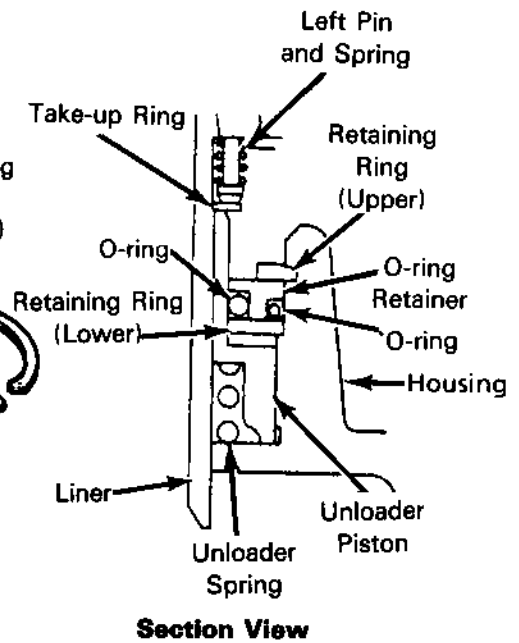
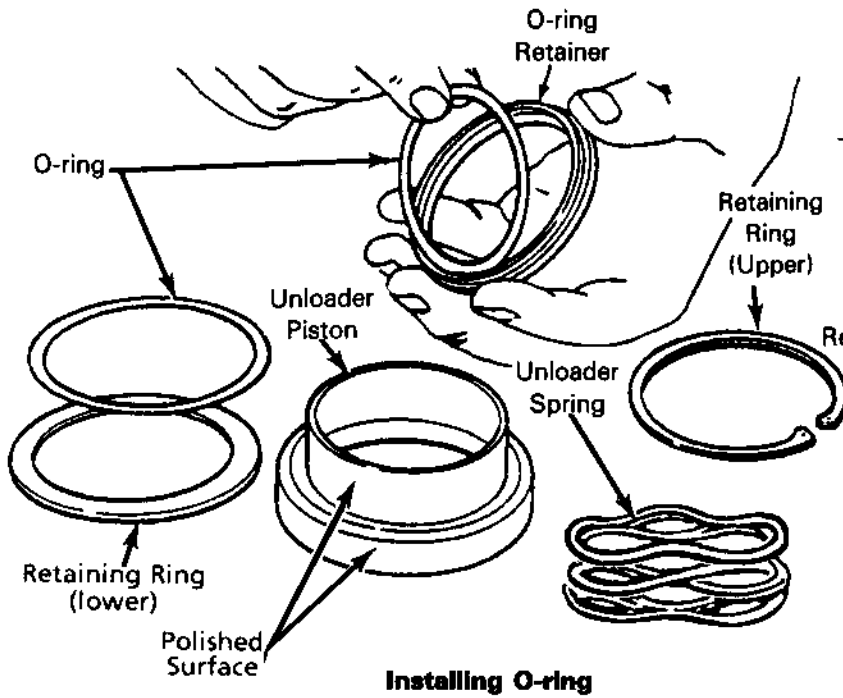
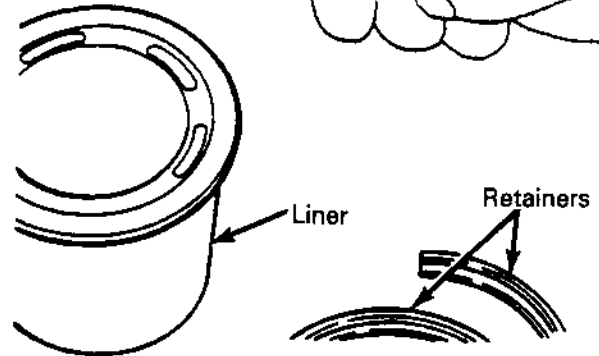


Figure 23 – Cylinder Unloader Components

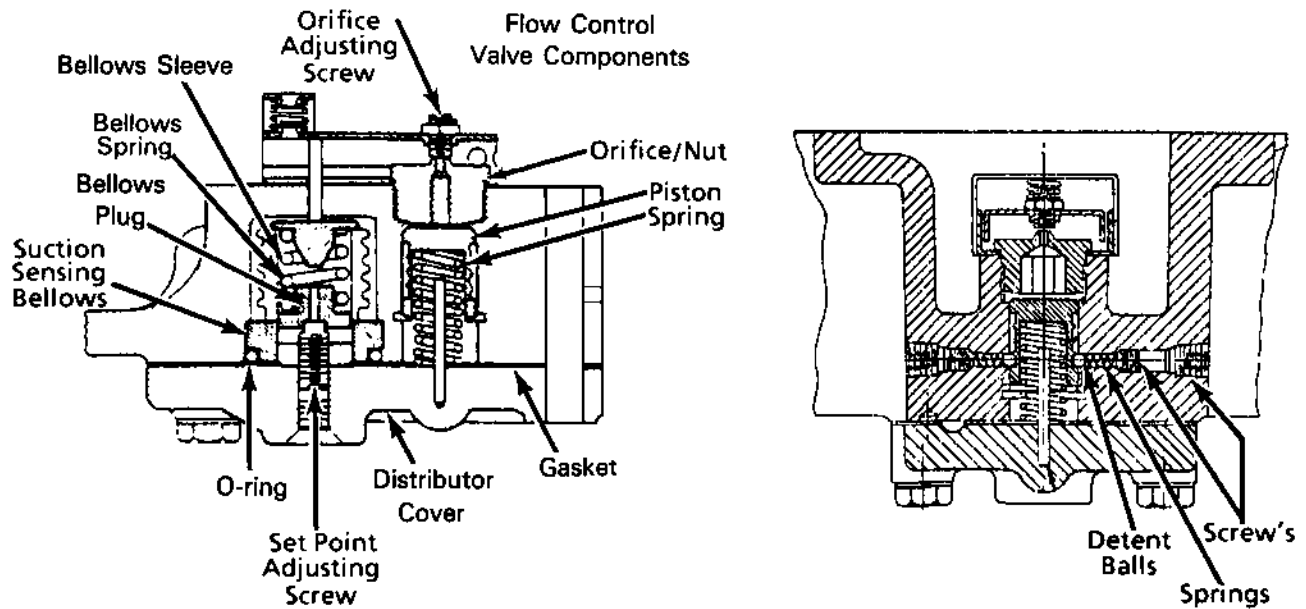


Figure 24 — Sectional Views of Capacity Control Actuator

Piston and Connecting Rod Removal

Key numbers refer to Figure 3.

1. Remove the cylinder head, discharge valve, cylinder liner and suction valve, and the handhole cover as explained previously.
2. Remove the oil strainer (21, Figure 4) by loosening compression fitting (22, Figure 4).
3. Rotate the crankshaft until the connecting rod cap bolts are accessible through the handhole cover opening.
4. Open tabs on connecting rod bolt lock strap (32) shown in Figures 27 and 28, then remove the cap bolts. Remove cap from bottom of the connecting rod.
5. Carefully pull the piston and rod assembly out through the top of the cylinder housing. Keep all liner, piston and rod assemblies separate and mark them in relation to the bore from which they were removed.

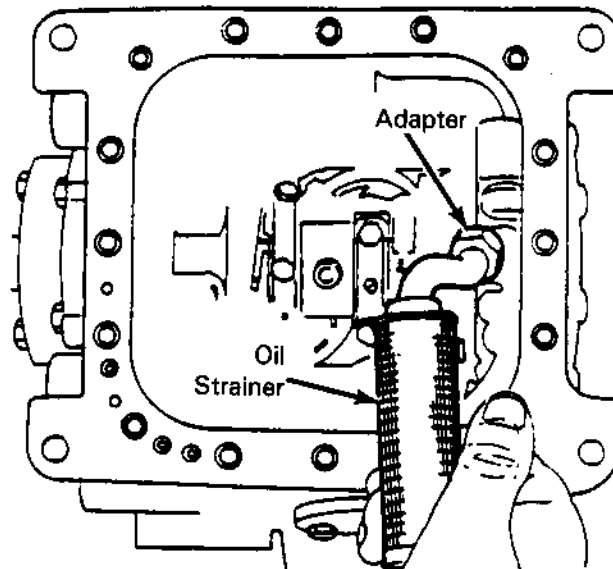


Figure 25 — Removing Crankshaft Oil Strainer

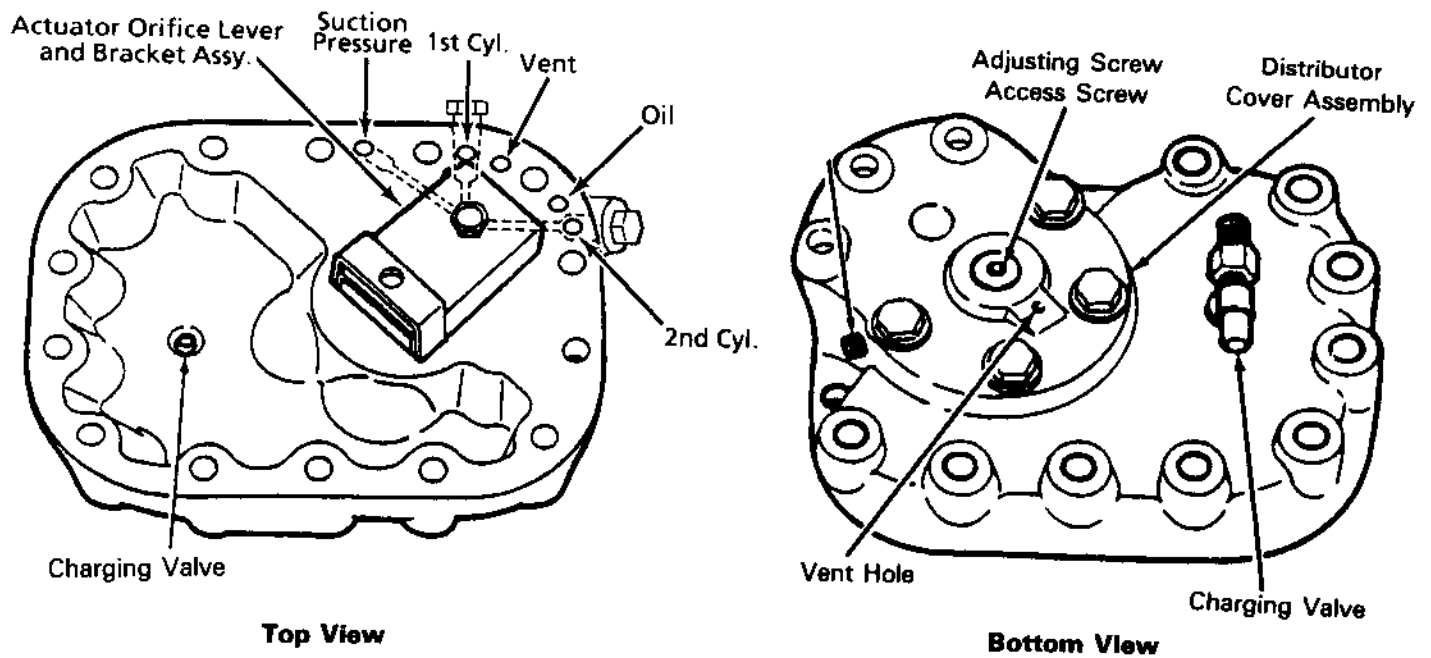


Figure 26 — Handhole Cover Assembly Views

Piston and Connecting Rod Disassembly

Key numbers refer to Figure 3.

1. Rings (28) are removed from the piston using a piece of thin shim stock inserted between the rings and the piston. Carefully work the rings out of the groove and slide them over the shim stock and off the piston. Rings (28) are not reused at overhaul.
2. Using Tru-Arc pliers, remove snap rings (29) from ends of the piston pin. Drive the pin from the piston pin using a brass driving rod or wood dowel. Be careful not to nick or damage the piston, rings, or distort the wrist pin hole. Figure 27 shows the piston and rod components.

Compressor Shaft Seal Removal

Key numbers in the text refer to Figure 5. Figure 29 shows compressor shaft seal replacement.

1. Loosen and remove all but two opposite cap screws (6) which attach the seal cover to the seal end bearing head (3). Slowly and alternately, loosen and remove the remaining two cap screws from the cover. If the cover does not follow the two cap screws, tap the rim of the cover lightly with a plastic hammer to free the cover from the bearing head.

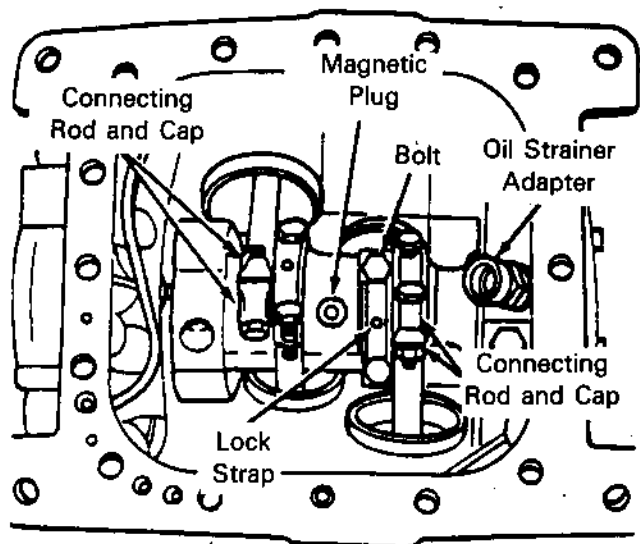


Figure 27 — Connecting Rod Cap Bolts Installed

NOTE: Be sure the cover is removed evenly so as not to distort the seal and cause breakage of the carbon ring within the seal. Also, do not pry on the cover with a screwdriver.

2. Remove gland plate O-ring (4) from groove in the seal end bearing head and discard. Install a new O-ring prior to installing the cover.
3. Carefully, work the shaft seal assembly off the end of the shaft using two screwdrivers. Use care when handling the carbon nose ring. It can be broken or damaged very easily. Be careful not to scratch the crankshaft.

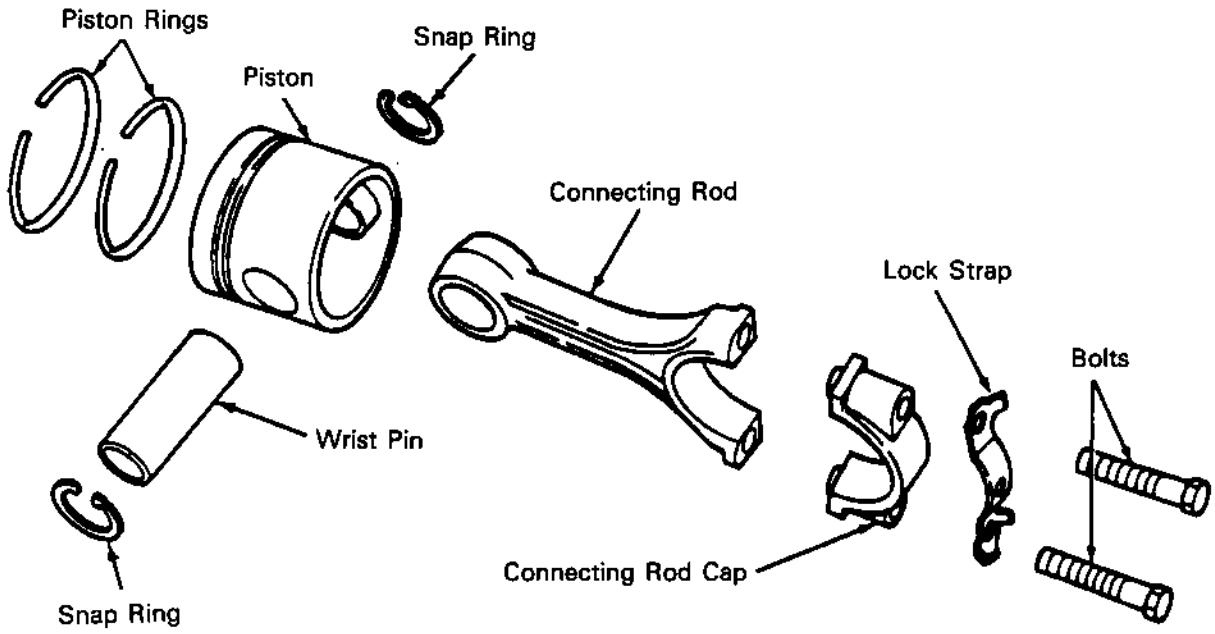


Figure 28 – Piston and Connecting Rod Components

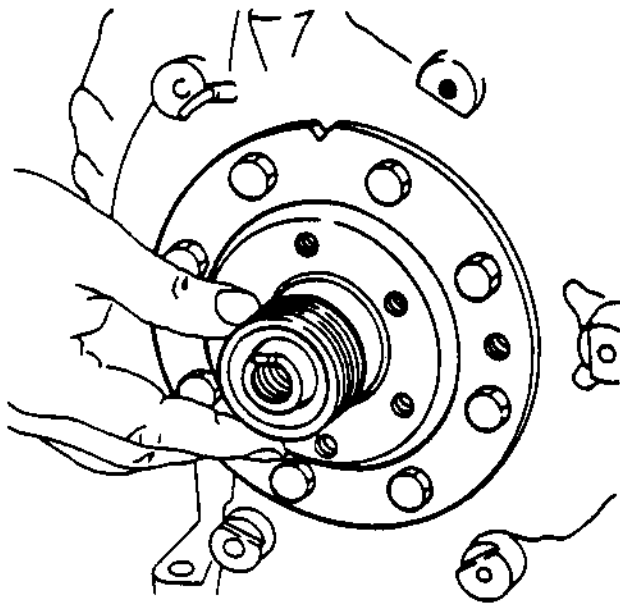


Figure 29 – Compressor Shaft Seal Replacement

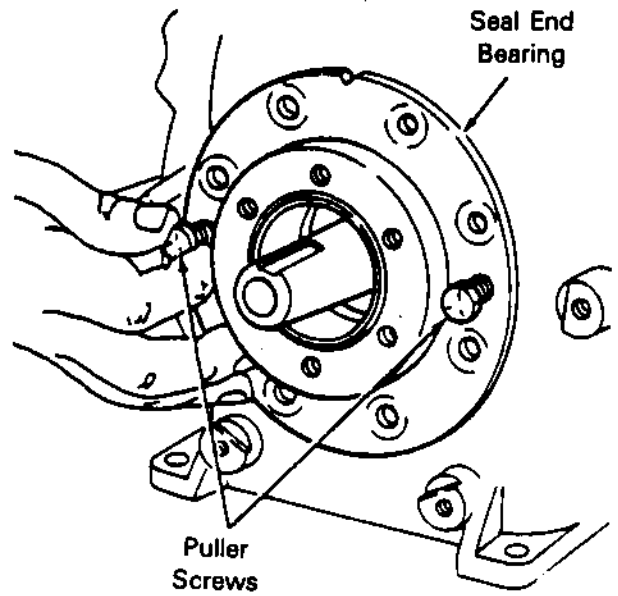


Figure 30 – Removing Seal End Bearing

Seal End Bearing Head Removal

Key numbers in the text refer to Figure 5.

1. Remove the compressor shaft seal as explained previously under "Compressor Shaft Seal Removal."
2. Remove the cap screws (6) from the seal end bearing head.
3. Insert two bearing head screws into the tapped holes in the bearing head (Figure 30). Tighten the screws alternately and evenly to force bearing head (3) out of the compressor housing until the bearing head moves freely, then pull the bearing head out of the housing. It may be necessary to tap the seal end of the crankshaft with a plastic hammer to slip the roller bearing out of the seal and bearing head.
4. Support the seal end of the crankshaft to prevent damage to the bearing outer face or housing.
5. Remove O-ring (1) and oil seal (2) from the housing.

Oil Pump Removal

Key numbers in the text refer to Figure 5.

1. Loosen and remove all but two opposite cap screws (14) which attach the oil pump cover (15) to the pump end bearing head (18). Slowly and alternately loosen and remove the remaining two cap screws from the cover to release pressure from the pressure relief valve assembly. If the cover does not follow the bolts, tap the cover with a plastic hammer to break it loose. Remove the oil pump cover and gasket (16) from the pump end bearing head.
2. Inspect the cover plate stop roll pin. If damaged, remove by gripping with pliers or in a vice and rotating plate pin while pulling to remove from cover.
3. Remove the oil pump and valve assembly (17) from the pump end bearing head (Figures 31 and 32). A pump cover screw inserted in the plunger (Figure 33) will aid in removing the plunger and spring assembly.

Pump End Bearing Head and Crankshaft Removal

Key numbers in the text refer to Figure 5.

1. Remove the oil pump and seal end bearing head from the compressor as explained previously.
2. Remove the piston and connecting rod assemblies as explained previously under "Piston and Connecting Rod Removal."

3. Remove the cap screws (6) which attach the pump end bearing head (18) to the compressor.
4. Thread two puller screws into tapped holes in the bearing head flange (Figure 34). Support the seal end of the crankshaft and remove the pump end bearing head and crankshaft from the housing (Figure 35). Grip the crankshaft through the hand-hole cover opening until it is out of the housing.
5. Remove the crankshaft from the bearing head by holding them in a vertical position. With the bearing head end down, tap around the bearing head flange with a plastic hammer.

Crankshaft Bearing Removal

Key numbers in the text refer to Figure 5.

The pump end roller bearing (11) and the seal end roller bearing (13) are slip on bearings. However, proper tooling should be used to remove the bearings from the crankshaft (8). Tooling may be manufactured locally (see Figure 36) or commercially available tools may be used (such as Owatonna Tool Co. Puller #1002 and Center #625-3). In any case, a proper center on the crankshaft must be used to prevent damage to the ends of the crankshaft.

CLEANING AND INSPECTION

Cleaning

1. Clean all the compressor components with refrigerant compressor parts cleaner. **DO NOT USE CARBON TETRACHLORIDE, NAPHTHA or GASOLINE.** Use a stiff bristle brush if necessary to loosen foreign particles. Direct air through all passages in castings.

CAUTION: DO NOT use abrasive cleaning pads, wire wheels, etc. on critical finish surfaces, particularly unloaded pistons. Disturbing the polished finish contributes and/or causes piston seizure in the O-ring.

2. Being careful not to gouge the flange surfaces, scrape all gasket flange surfaces to make sure all gasket and sealing material is removed.
3. Clean the crank shaft bearings (11 and 13, Figure 5) thoroughly with refrigerant parts cleaner and blow dry with air. **DO NOT spin the bearings with air;** revolve them slowly with your fingers as air is directed at right angles to the balls. Examine the bearings for pits and scores, then oil them with clean compressor oil.

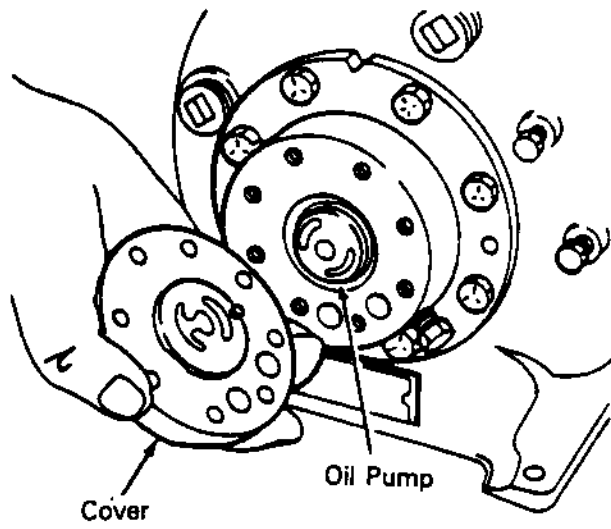


Figure 31 – Oil Pump Cover Removed

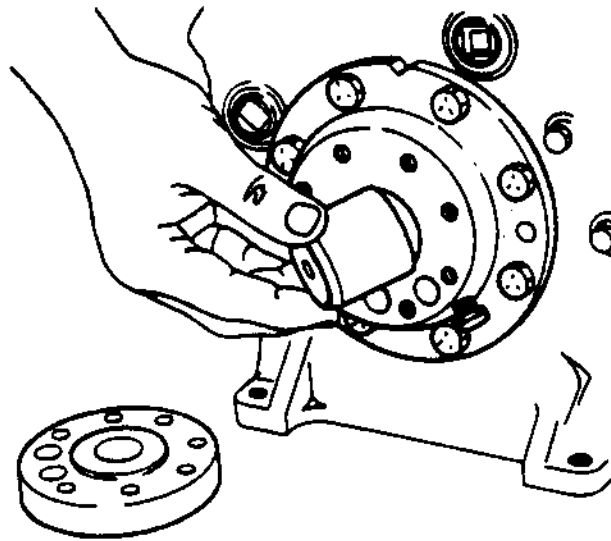


Figure 32 – Removing or Installing Oil Pump

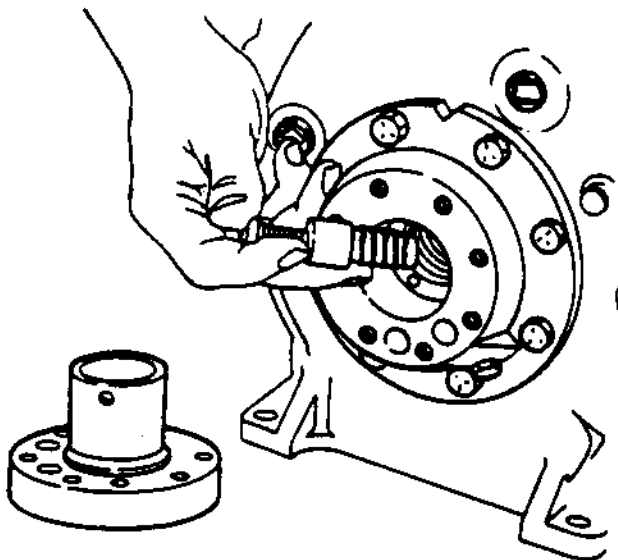


Figure 33 – Removing Plunger and Spring Assembly

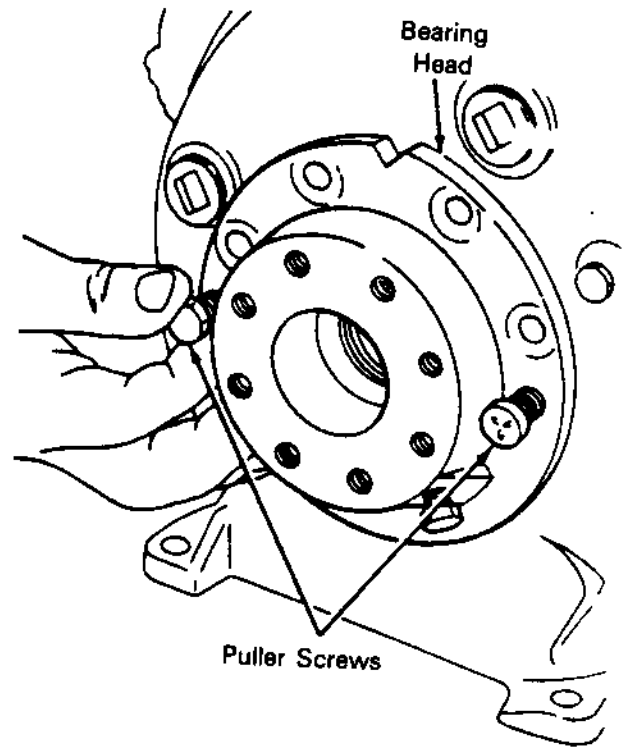


Figure 34 – Removing Pump End Bearing Head

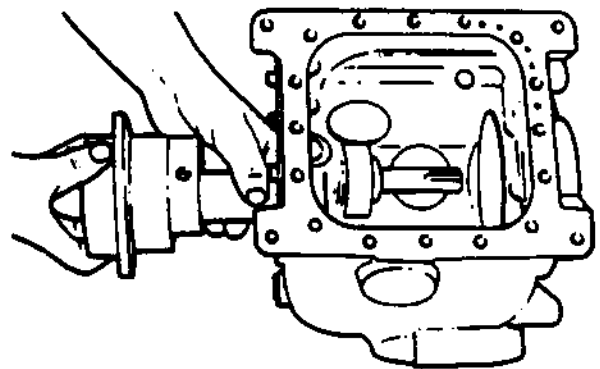


Figure 35 – Removing or Replacing Crankshaft and Pump End Bearing Head

Inspection

1. Inspect the compressor housing and cylinder head sealing surfaces for general appearance. They should be smooth, flat and contain no grooves, nicks or burrs. Check tapped holes for crossed threads or damage.
2. Check the components of the compressor for wear to dimensions shown in "Recommended Wear Limits and Tolerances" at the end of this section.
3. Check cylinder head springs (5, Figure 3) and replace if there is evidence of severe overheating or if the length is less than that shown in "Recommended Wear Limits and Tolerances" at the end of this section.
4. Examine the valve seat surfaces of the suction and discharge valve components. Check the suction and discharge valve seats on valve cages and restore by lapping, if necessary. Seats must be restorable to a flat square surface without pits, scoring or chipping. Replace the valve rings if there is evidence of copper plating, liquid slugging or when wear exceeds the limits listed under "Recommended Wear Limits and Tolerances" at the end of this section. Replace the small valve springs used in cylinders 1 and 4 (8 and 15, Figure 3) if the compressor has operated more than 5000 hours.
5. Examine the cylinder liner (17, Figure 3) and replace if there is evidence of excessive wear or scoring on the inside wall. Refer to "Recommended Wear Limits and Tolerances" at the end of this section. If the cylinder is to be reused, deglaze with cylinder hone. Check the suction valve seats machined on the cylinder liner flange and restore by lapping if necessary. Seats must be restorable to a flat square surface with no pits, scoring or chipping.
6. Examine the take-up rings, lift pins and spring (18, 19, and 20, Figure 3). Replace the springs and/or lift pins if they are less than the length listed in "Recommended Wear Limits and Tolerances" at the end of this section. Check take up ring end gap (spec. is .000 to .025 in.). The gap must not exceed .025 in.; otherwise the lift pin can work through the gap, seizing the unloader (see Figure 37).
7. Inspect piston (30, Figure 3) for scoring, cracks or damage. Check oil control holes on the piston head to be sure they are open. Check both sides of the piston head and wrist pin bore and replace if there is evidence of wear, grooving or copperplating on the bearing surfaces. Refer to "Recommended Wear Limits and Tolerances" at the end of this section.
8. Check fit of rings (28, Figure 3) in the piston ring grooves. Use the back edge of a ring to check the fit (Figure 38). Roll the back edge of the rings in the grooves to make sure the rings move freely in the piston grooves.
9. Examine the seal mounting surface on the crankshaft. It must be clean and smooth without nicks or burrs. If damaged, replace or rework the surface to spec. Do not reuse the shaft seal due to probability of microscopic defects that will cause failure/leaks. Also, the drive band area will probably have vulcanized to the shaft causing bellows damage upon removal.
10. Examine the seal end and pump end bearing head surface for nicks or burrs. If necessary, clean the bearing head oil passages. Replace the oil lip seal (2, Figure 5) with a new seal.
11. Examine the crankshaft journals and bearing surfaces for wear or damage. Remove plugs (7 and 12, Figure 5) from the crankshaft. Clean the plugs, blow out passages in the crankshaft, then replace the plugs. Refer to "Recommended Wear Limits and Tolerances" at the end of this section. Check to be sure that the oil orifice passage at the seal end main journal chamber is open. Oil flow is necessary to ensure oil supply for lubrication and cooling of seal cavity.
12. Examine crankshaft roller bearings (11 and 13, Figure 5) for damage, chips or excessive radial play. Examine connecting rod journals for damage or copperplating. Examine the shaft seal area of the crankshaft for a clean, smooth surface for the seal.
13. Examine flow control (actuator) piston for excessive wear and scaring of sealing surfaces and cleanliness of orifice slot machined in periphery of piston (closed end). Do not alter depth or width of this slot (oil control orifice). Sealing surfaces may be polished with 600 grit or finer abrasive as required, taking care not to remove any measurable material. Replace if damaged or worn. Refer to "Recommended Wear Limits and Tolerance" at the end of this section.
14. Examine flow control (actuator) piston bore on hand hole cover for excess wear, scoring, burrs that might contribute to poor sealing or piston seizure. Polish or deburr as required. Do not alter finish spec. Use only 600 grit or finer abrasive. Refer to "Recommended Wear Limit and Tolerances" at the end of this section.
15. Check orifice bracket to lever hinge for excess free play. Normal is .006 in. free play at hinge pin/lever. Excess play can contribute to erratic unloader operation and finally cause inoperative unloaders.

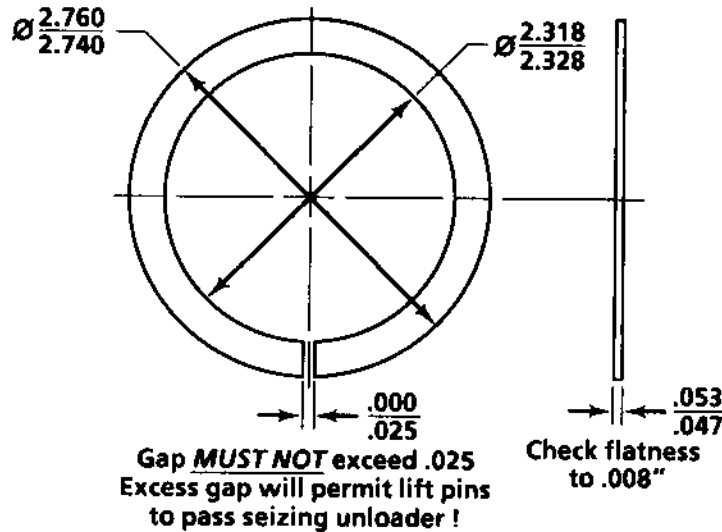


Figure 37 — Checking Take Up Ring End Gap and Flatness

16. Examine the oil pump cover plate for wear, scoring at the pump thrust surface and wear on the roll pin. Check the thrust surface height above gasket surface—maximum allowable wear down to .118 in. from new spec of .125 in. See Figure 39. Replace plate or pin as required.

NOTE: Do not disturb finish or dimensional tolerances. To do so will affect oil pressure relief valve spring tension setting and therefore the oil pressure.

17. Examine inner and outer gear rotor for wear and/or scoring on lobes (see Figure 40). Examine gear to shaft surface for wear, looseness or scoring. Examine port/thrust plate for wear on thrust surface and at roll pin engagement surface. Check drive pin/screw for looseness in housing. Normal roll pin surface wear pattern is 1/4 moon shape. Replace oil pump as required.
18. Examine oil piping for flattened or broken pipes. Check for loose pipes in housing drillings. Replace as required.

NOTE: Loose and leaking pipes will contribute to low oil pressure in the loaded mode.

19. Check and clean housing suction cavity to sump oil drain orifice/hole (see Figure 41). Later housings have precision drilled holes. Earlier housings have "T" drilled fitting threaded into housing. DO NOT leave "T" drilled fitting out of early housings or attempt to thread and install in later housing with precision drilling.

Seal End Bearing Head

Key numbers in the text refer to Figure 5.

1. Install oil lip seal (2) in the bearing head with sealing lip towards gland plate end as shown in Figure 42. Tap the seal in place using a plastic hammer.
2. Install new O-ring (1) on bearing head (3) flush with flange.
3. Lubricate the oil seal, O-ring and bearing head with clean compressor oil.
4. Slide the bearing head into the housing with the notch on the bearing head at the top (Figure 30).
5. Install the two cap screws at opposite sides of the bearing head and tighten evenly and alternately to draw the bearing head into the housing. Install remaining cap screws (6) in bearing head (3) and tighten to 24 foot-pounds (33 N·m) torque.

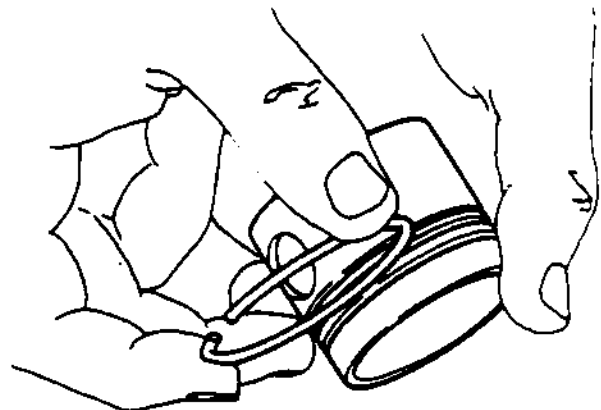


Figure 38 — Checking Piston Ring Groove Clearance

Compressor Assembly

NOTE: Before assembling the compressor, coat all parts, except the seal assembly, with clean, new compressor oil to provide initial lubrication and help prevent rusting. Use new O-ring seals and gaskets when assembling the compressor.

Crankshaft and Pump End Bearing Head

Key numbers in the text refer to Figure 5.

1. Press the pump end bearing (11) over the crankshaft making sure the bearing is not cocked. Bearing must be installed with press force exerted on inner race.
2. Press seal end bearing (13) on the crankshaft making sure the bearing is not cocked. Bearing must be installed with press force exerted on inner race.
3. Install a new O-ring (10) on the pump end bearing head (18).

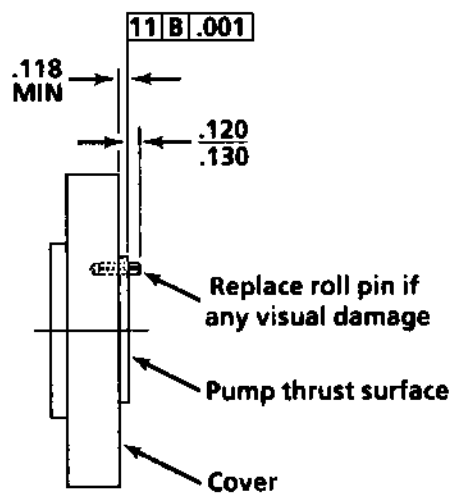
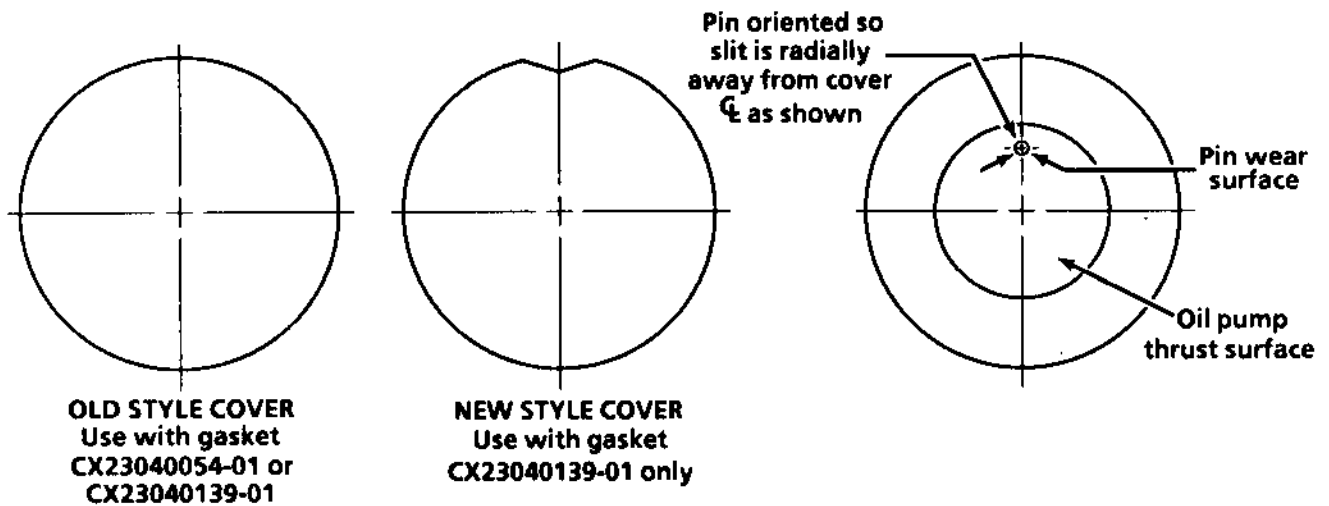


Figure 39 — Checking Cover Plate and Roll Pin for Wear

4. Align the bearing head with outer race of the bearing and tap lightly with a plastic hammer to slide the bearing head over the bearing.
5. Install a new O-ring (10) in groove in the compressor housing. Lubricate bearings (11 and 13), O-rings (10) and the bearing head with clean compressor oil.
6. Grip the pump end bearing head and the crankshaft as shown in Figure 36, then slide the pump end bearing head and crankshaft into the compressor housing. Reach through the handhole cover opening to support the crankshaft.
7. Align the seal end roller bearing (13) squarely with the bearing head and be sure the notch on the pump end bearing head is at the top (Figure 36).
8. Use a soft hammer to start the bearings and pump end bearing head into the compressor housing.
9. Install cap screws (6) in the bearing head (18) and tighten them evenly and alternately to 24 foot-pounds (33 N·m) torque.

Oil Pump

Key numbers in the text refer to Figure 5.

1. Clean and lubricate the oil pump plunger assembly.
2. Install spring assembly, cupped end first, and plunger into the end of the crankshaft. Check to be sure they bottom and that the plunger moves freely with spring compression.
3. Clean and lubricate the oil pump and cover (15). Check to be sure the drive screw on the oil pump is not cracked or damaged.
4. Align drive screw on the oil pump (shown in Figure 40) with the crankshaft slot (shown in Figure 5). Engagement of the drive screw in the crankshaft slot is easier if the slot is at the six o'clock position.
NOTE: The oil pump will be damaged if the pump drive tab is not correctly positioned.
5. Press/drive a replacement stop roll pin in to the cover plate to a height of .120 in. to .130 in. (Figure 39).
6. Place the gasket (16) on the pump cover (15). Align pin in pump cover with recessed area on face of the pump as shown in Figure 31.
7. Position the pump cover on the bearing head so that the oil holes in the cover align with the two oil holes at bottom of the bearing head.
8. Start two bolts (14) into opposite sides of the cover. Push cover against bearing head by hand and

tighten the bolts evenly and alternately until the cover is tight. Install the remaining bolts and tighten to 24 foot-pounds (33 N·m) torque.

Compressor Shaft Seal

NOTE: Check to be sure the seal end bearing is installed with the notch in the bearing head toward the top of the compressor. If notch is not properly positioned, seal cavity will not fill with oil, resulting in poor seal cooling/lubrication with reduced seal life.

1. Lubricate the seal bellows, carbon nose ring and seal surfaces on the crankshaft with clean compressor oil.
2. Clean the face of the cover (5, Figure 5) and matching flange on the bearing head. Use **only lint free wipes**.
WARNING: Be sure to check for and remove any burrs from the keyway and use a key sliver in the keyway to protect the seal drive band from damage as it is moved over the keyway.
3. Hold the seal assembly and slide the seal assembly onto the crankshaft with the carbon washer toward the cover (Figure 43).
4. Lubricate the cover O-ring (4, Figure 5) with clean compressor oil and place it in the O-ring groove.
5. Place the seal over the crankshaft and against the carbon nose ring. Push the seal cover and seal into the compressor until the cover contacts the bearing head mounting flange. Insert and tighten two bolts on opposite sides of the cover hand tight (Figure 44).

Install remaining bolts and tighten screws in criss-cross pattern in two stages (recommended to minimize possible gland plate warpage and to maximize carbon to plate sealing efficiency). First tighten each bolt to 12 ft-lb (16 N·m) and then tighten again to 24 ft-lb (33 N·m).

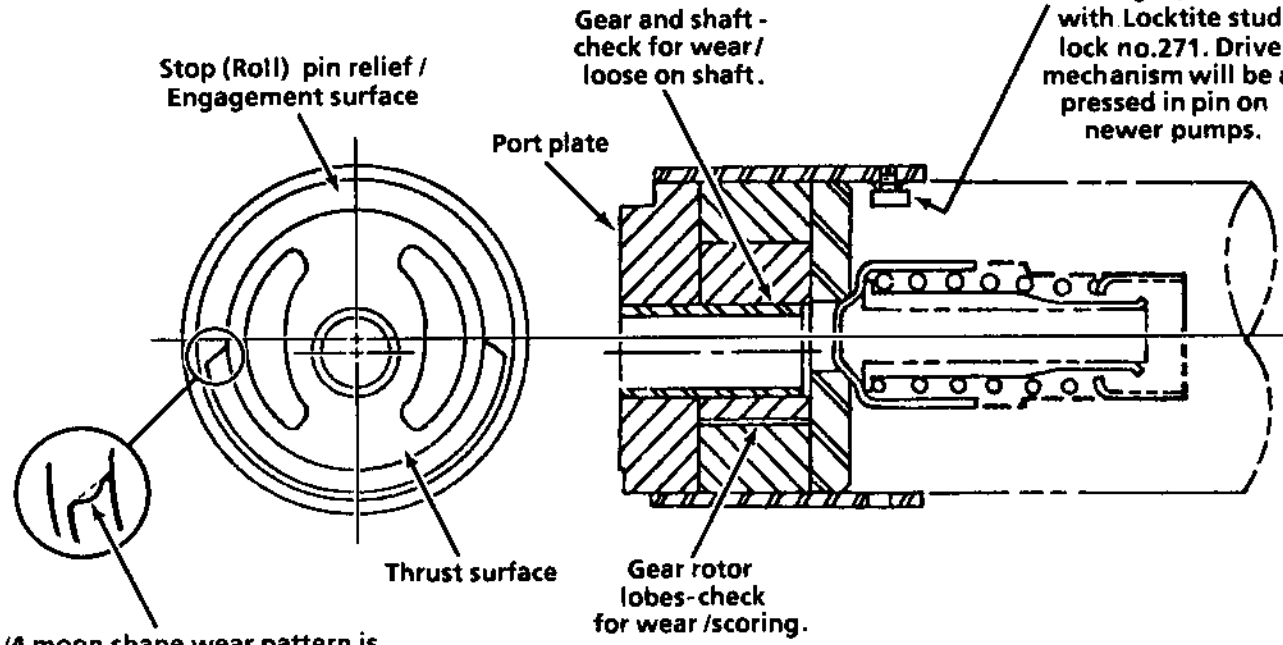
Cylinder Unloader

Key numbers in the text refer to Figure 3. Also refer to Figure 23 for disassembled and assembled views of the unloader components.

Lightly polish the unloader piston with a 400 wet or dry sandpaper (used dry).

CAUTION: DO NOT use abrasive coarser than 400 grit. To do so will modify the designed surface finish (to a rougher finish) which will contribute to O-ring gripping/seizing of the piston.

Always check for secured pin / screw. Drive screw must be properly aligned and tight, secured with Locktite stud lock no.271. Drive mechanism will be a pressed in pin on newer pumps.



1/4 moon shape wear pattern is normal. Check for wear pattern exceeding 1/4 moon to outer periphery of plate.

Figure 40 – Checking Oil Pump for Wear

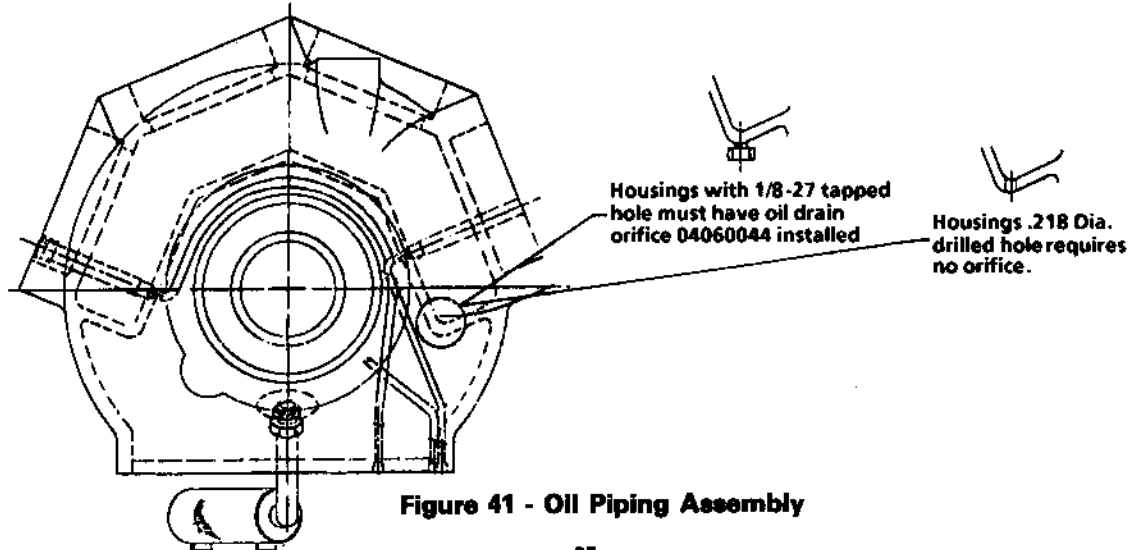
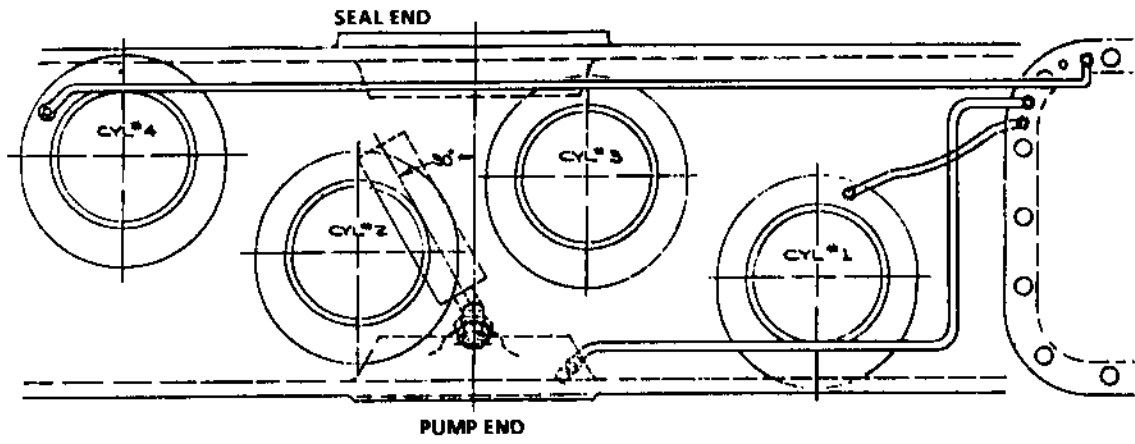


Figure 41 - Oil Piping Assembly

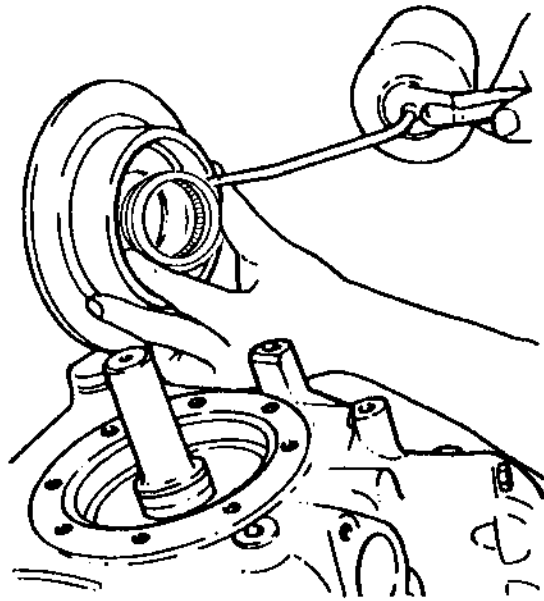


Figure 42—Installing Oil Seal in Seal End Bearing Head

Coat the sliding surfaces of the unloader piston and O-ring with a film of DowCorning Lubricant (881622-41), or equivalent. This is a molybdenum disulfide lubricant which will ensure the O-ring and piston are well lubricated during startup to prevent galling of the piston in the housing bore.

NOTE: *Lubrication of the piston to housing aluminum surfaces is extremely important on startup, particularly if compressor is shelved for a long period before usage. If compressor is to be returned to service immediately after service, compressor oil should provide adequate lubrication.*

Assemble O-rings (23 and 24), retaining ring (25) and O-ring retainer (22) with lower retaining ring down. Slide the assembly over unloader piston (26) seating it against the piston shoulder. Position the complete assembly with piston spring (27) down into the cylinder housing.

Using Tool L-75084-C (see Figure 45), compress the piston-retainer assembly against spring in housing bore. With snap ring pliers, secure the components in place with retaining ring (21).

NOTE: *Use of Tool #L-75084-C in place of screwdriver and snap pliers provides for easier piston assembly installation and prevents damage to critical piston surfaces.*

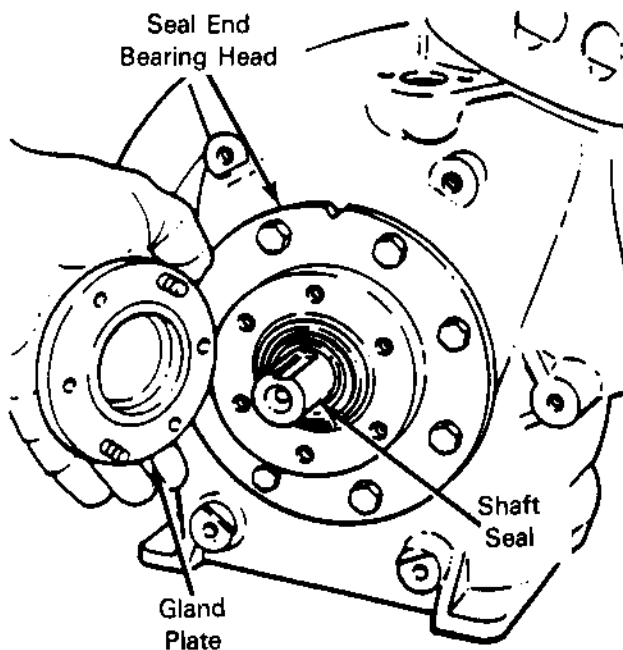


Figure 43 - Shaft Seal Positioned In Seal End Bearing Head

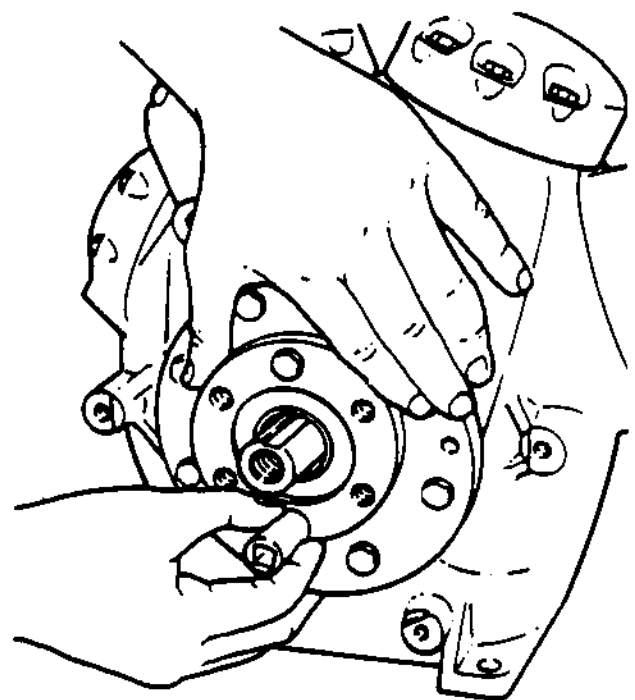


Figure 44 - Installing Shaft Seal Cover

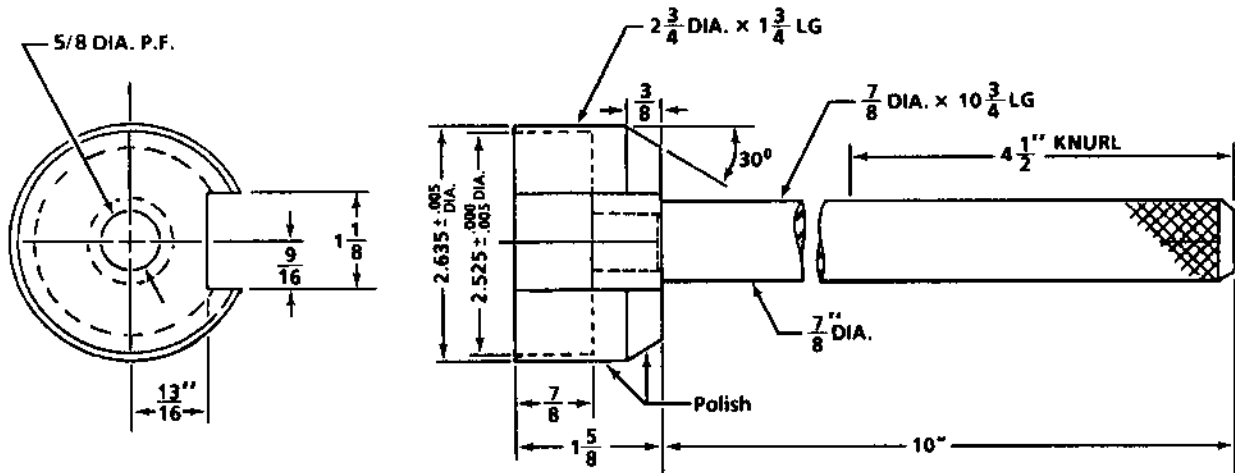


Figure 45 - Piston Assembly Tool

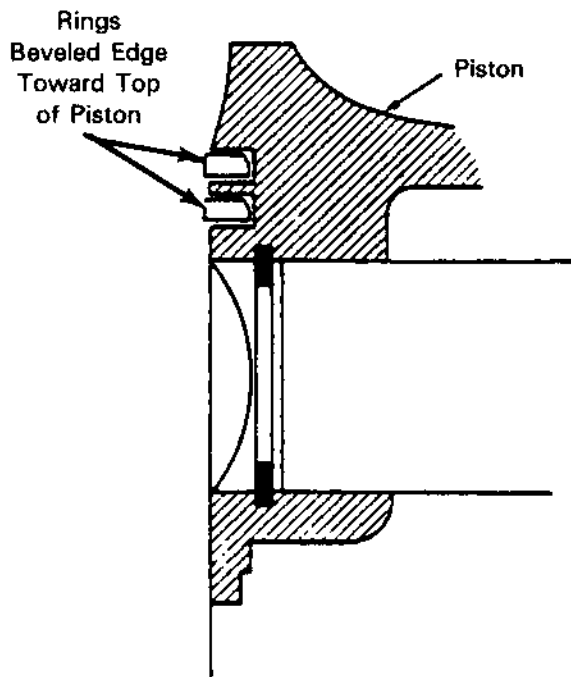


Figure 46 - Ring Position in Piston

Piston, Rings and Connecting Rod

Key numbers in the text refer to Figure 3.

1. Clean bearing surfaces on the connecting rod and crankshaft. Lubricate these surfaces with clean compressor oil.
2. Position connecting rod (31) in piston (30). Hand push the wrist pin through the piston and rod. Install two retaining rings (29) using Tru-Arc pliers.
3. Work the rings (28) carefully over the top of the piston with the beveled edge toward the top of the piston until the rings are in their respective grooves. A piece of shim stock will aid in moving the rings into position. Check to be sure the beveled edge of the rings are on top as shown in Figure 46 and that the rings are free in the grooves after installing.