



TRANE™

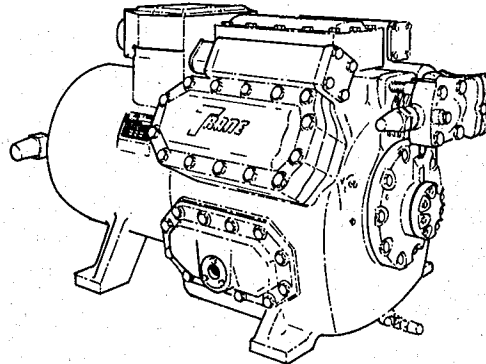
Maintenance

HCOM-M-6

Library	Service Literature
Product Section	Refrigeration
Product	Reciprocating Compressor - Condenser Units
Model	Semi-Hermetic R
Literature Type	Maintenance
Sequence	6
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Supersedes	HCOM-M-6 278

SEMI-HERMETIC RECIPROCATING COMPRESSORS

COMPRESSOR SERVICE AND
OVERHAUL
MODEL "R"
4 AND 6 CYLINDERS



The Trane Company urges that when servicing Trane equipment, or any other manufacturer's equipment, every effort should be made to eliminate the emissions of CFC, HCFC and HFC refrigerants to the atmosphere resulting from installation, operation, routine maintenance or major repair of the equipment. Conservation of refrigerants is important even when working with acceptable alternative refrigerants.

Conservation and emission reduction can be accomplished by following recommended Trane operation, maintenance, and service procedures with specific attention to the following:

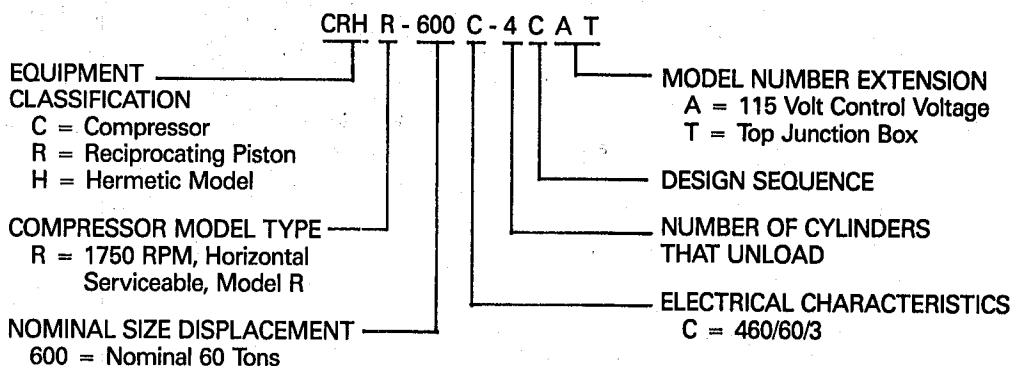
1. Refrigerant used in any type of air-conditioning or refrigerating equipment should be recovered for reuse, recovered and/or recycled for reuse, reprocessed (reclaimed), or properly destroyed, whenever it is removed from the equipment.
2. Always determine possible recycle or reclaim requirements of the recovered refrigerant before beginning recovery by any method. (Questions about recovered refrigerants and acceptable refrigerant quality standards are addressed in ARI Standard 700)
3. Use approved containment vessels and safety standards for the storage or transporting of new or used refrigerant. Comply with all applicable transportation standards when shipping refrigerant containers.
4. To minimize refrigerant emissions use recycling equipment when recovering refrigerant. Use methods which will pull the lowest possible system vacuum while recovering and condensing refrigerant into containment.
5. When leak checking with trace refrigerant and nitrogen, use HCFC-22 (R-22) rather than CFC-12 (R-12) or any other fully halogenated refrigerants. Remain aware of any new leak test methods which eliminate refrigerants as a trace gas.

6. When cleaning system components avoid using chemicals that have ozone depletion capability. Properly dispose of used materials in accordance with the manufacturers recommendations.
7. Take extra care to properly maintain all service equipment directly supporting refrigerant service work such as gages, hoses, vacuum pumps, and recycling equipment.
8. Remain aware of unit enhancements, conversion refrigerants, compatible parts and manufacturer's recommendations which will reduce refrigerant emissions and increase equipment operating efficiencies. Follow specific manufacturers guidelines for conversion of existing systems.
9. In order to assist in reducing power generation emissions, always attempt to improve equipment performance with improved maintenance and operations which will help conserve energy resources.

Before opening the compressor for service, operate the system to pumpdown the compressor and then close the service valves. If the compressor cannot be operated, close the service valves. After the compressor has been isolated with the service valves remove the refrigerant with a refrigerant recovery device. Do not relieve the refrigerant to the atmosphere. Follow the refrigerant recovery device manufacturer's operating instruction for proper operation.

Open the system disconnect switch and lock in the position or remove the fuses from the switch. As the suction and discharge service valves are disconnected from the housing, support the lines to prevent undue strain on the piping and joints. Plug the control lines to prevent entry of foreign matter and tag or mark the electrical leads for ease of reassembly.

UNIT MODEL NUMBER DESCRIPTION



Pre-selection fit is not required with Trane Model R Compressor parts. All parts may be replaced with standard stock items.

As parts are removed, do the following:

1. Clean parts with a refrigeration parts cleaner.
2. Inspect each part for wear, breakage or copper plating. As a guide for replacement, Table 1 lists tolerances and wear limits. When reinstalling parts do the following:
 - a. Use new gaskets and "O" rings.
 - b. Use a torque wrench when tightening bolts or nut and bolt combinations. Improper tightening may result in premature failure of a part. Table 2 lists the torques to be followed.
 - c. Lubricate all bearing surfaces with clean compressor oil before placing in the machine. This will enable the compressor to run with lubrication when it is first started and before oil pressure is built up.

The following procedures detail methods of removing, inspecting and re-installing assemblies of the compressor. While the sequence given is correct for complete compressor teardown, individual assemblies may be removed and serviced as required. For instance, the oil pump, suction and discharge valves may be serviced without complete compressor disassembly.

Table 2 — Bolt Torques

Item	Torque Ft. Lbs.
Discharge Valve Cage Assembly Locknuts	50
Cylinder Head Bolts	69
Unloader Solenoid Valve To Mounting Plate Bolts	7
Cover Plate to Cylinder Head Screws	24
Check Valve Nuts	20
Unloader Valve Stem Seal And Retainer Nuts	20
Unloader Valve Stem Washer Nuts	15
Suction Service Valve Mounting Bolts	150
Discharge Service Valve Mounting Bolts	69 (4 Cyl.) 150 (6 Cyl.)
Terminal Plate To Housing Bolts	42
Terminal Stud Hex Nuts	2-2.5 (4 Cyl.) 6-8 (6 Cyl.)
Handhole Cover Bolts	69
Stator Mounting Bolt	173
Rotor Bolt	90 (4 Cyl.) 135 (6 Cyl.)
Suction Cover Bolts	52 (4 Cyl.) 69 (6 Cyl.)
Oil Pump Cover Bolts	14
Bearing Head Bolts	42
Connecting Rod Bolts	24
Oil Level Sight Glass Mounting Bolts	50 In. Lbs.
Crankcase Heating Mounting Bolts	6

Table 1 — Recommended Wear Limits and Tolerances

Part Name	Original Specification	Recommended Limit	Maximum Recommended Diametral Clearance
Main Bearings	2.8755 - 2.8775 — 4 & 6 Cyl. 2.125 - 2.127 — 4 Cyl. Only	2.8790 2.1295	
Crankshaft Mains	2.8725 - 2.8735 — 4 & 6 Cyl. 2.1225 - 2.1235 — 4 Cyl. Only	2.8710 2.1210	.0055
Crankshaft End Play	.005 - .028	.030	
Thrust Bearing	.142 - .144	.140	
Con Rod - Crankpin	2.7510 - 2.7520	2.7545	.007
Crankshaft - Crankpin	2.7475 - 2.7485	2.7450	
Piston Pin	1.1245 - 1.1247	1.1241	.0011
Con Rod - Pin Bore	1.1250 - 1.1253	1.1253	
Cylinder Liner Bore	3.4400 3.4410	3.4425	.006
Piston	3.4325 - 3.4335	3.4300	
Motor Air Gap (Max. Variation)	.014 Min. - 6 Cyl. .010 Max. - 4 Cyl.	.014 Max. .010 Max.	
Piston Rings (Gap In 3.4400 Gauge)	.005 - .015	.030	
Valves - Discharge & Suction	Valves are .0384" - .0404" thick - replace when seat groove wear depth exceeds .008" (.0304" thinnest section)		
Valve Springs - Discharge & Suction	Replace springs whenever compressor is disassembled and they have operated in excess of 5,000 hours.		
Unloader Piston	1.995 - 1.996	1.993	.010
Unloader Piston Bore	2.000 - 2.001	2.003	
Unloader Valve Stem	.4945 - .4960	.4940	.010
Unloader Valve Stem Bore	.5000 - .5020	.5050	
Piston - Check Valve	1.994 - 1.995	1.994	.010
Piston - Check Valve Bore	2.000 - 2.001	2.003	
Unloader and Check Valve Brass Seats	Seats are .060" thick - replace when seat groove depth exceeds .030"		

Note:
1. The above recommended wear rates are for individual parts. For mating parts, the maximum recommended diametral clearance should predominate. In most cases, this would mean that both of the mating parts should not each be at the recommended limit dimension.

Table 3 — Operating Data

No. Cyl.	Bore	Stroke	R.P.M.	Service Valve Piping Connection		Weight	Operating Oil Pressure	Oil Capacity (Pints)
				Suction	Discharge			
4 (40T.)	3.440	2.75	1730	2.62E	1.625	815	30	20
6 (50T.)	3.440	2.30	1730	3.125	2.125	950	30	27
6 (60T.)	3.440	2.75	1730	3.125	2.125	977	30	27

Note:
See Service Bulletin HCOM-SB-4 "Recommended Oils and Oil Charges for Reciprocating and Scroll Compressors."

Cylinder Head

WARNING:

To prevent injury or death due to compressor cylinder heads being propelled by the compressor internal pressure and striking persons working on or observing the work insure that the service valves are tightly closed and that the internal compressor pressure as measured at the service valve(s) back seat port is at atmospheric pressure.

WARNING:

To prevent injury or death due to the compressor cylinder heads being propelled by the compressor safety head springs and striking persons working on or observing the work never remove all the head bolts and then jar the head with a hammer to loosen it. Always leave two bolts at opposite ends of the head and back them off two or three turns then use a mallet to loosen the head. Once the head is loose alternately loosen the remaining bolts to relieve the tension on the springs.

To Remove:

1. Loosen and remove all but two cylinder head bolts at opposite ends of the cylinder head (Figure 1).
2. Loosen the last two bolts alternately to relieve tension of the safety head springs. If the head does not follow the bolts, jar the head with a mallet, to relieve the spring tension. Caution must be exercised to prevent injury.
3. With all bolts removed, lift off the head and the safety head springs (Figure 2).

Inspection:

Inspect the cylinder head and housing sealing surfaces for nicks and grooves that would cause leaks. Replace head if necessary.

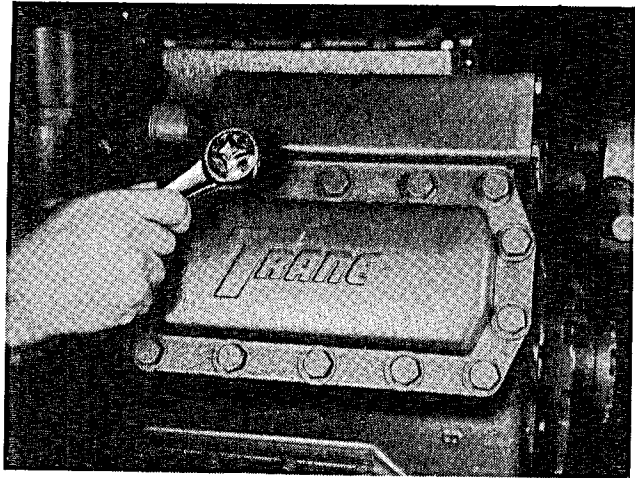


Figure 1

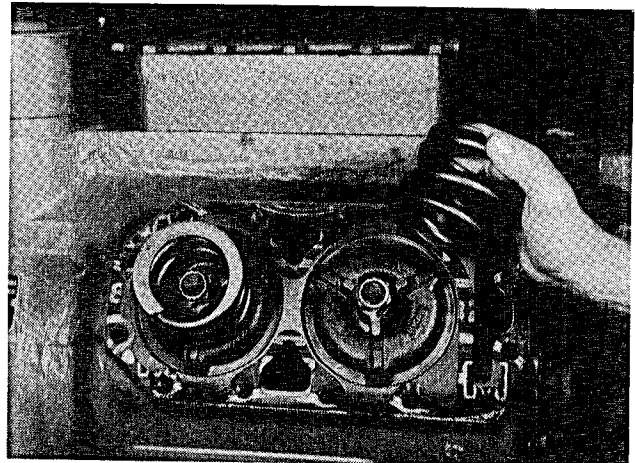
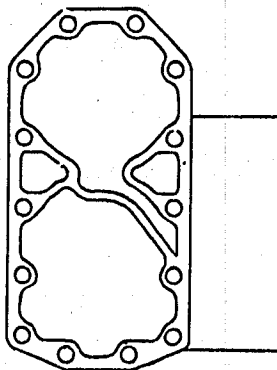
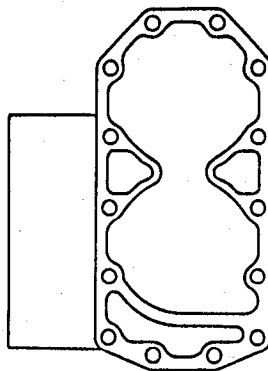


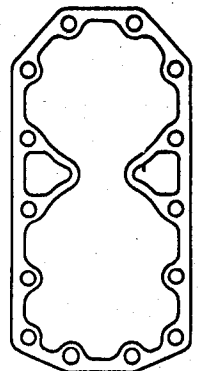
Figure 2



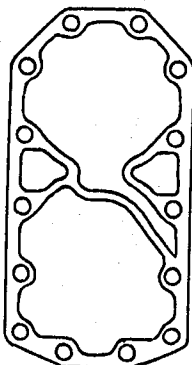
1. Cylinder Unloading Head



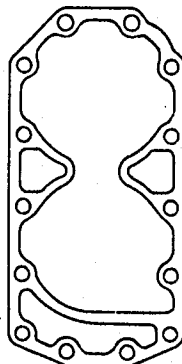
2. Cylinder Unloading Head



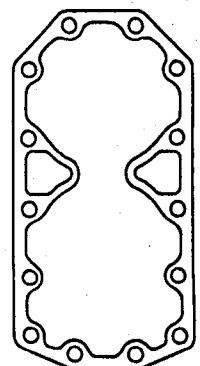
3. Non-Unloading Head



1. Cylinder Unloading Gasket



2. Cylinder Unloading Gasket



3. Non-Unloading Head

Figure 3

To Install:

1. Center the safety head springs on the discharge valve cage assemblies.
2. Insert two bolts at opposite ends of the cylinder head.
3. Oil the cylinder head gasket with clean compressor oil and place on the cylinder head using the two bolts as a guide. **BE SURE TO USE THE CORRECT GASKET ON THE CORRECT CYLINDER HEAD. SEE FIGURE 3.**
4. Set the cylinder head on the housing and turn the two bolts two or three full turns. Check the safety head springs to be sure they are still in proper position.

NOTE: When installing cylinder heads, be sure the unloader is on the upper side of the head (Note position in Figure 1). The unloader must be in this position to provide drainage of oil for proper operation.

5. Tighten the two bolts alternately to draw the head down evenly.
6. Insert the remaining bolts and tighten all bolts to final torque. **TORQUE — 69 FOOT POUNDS.**

Cylinder Loading and Unloading Sequence

Two Cylinder Unloading Head - Both Cylinders In Unloaded Position - Solenoid Valve Energized

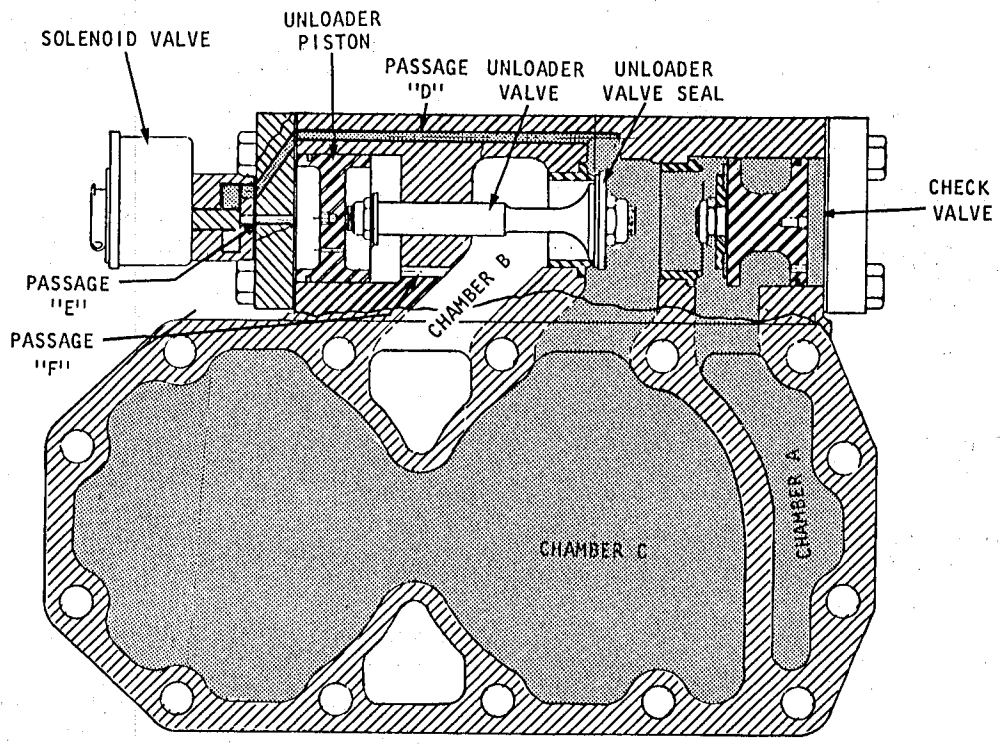
1. Unloader solenoid valve is energized.
2. High pressure gas from Chamber "C" flows through Passage "D" and, with solenoid valve open, into Passage "E."
3. Equal pressure is not applied to both the unloader piston and the unloader valve seal.
4. Pressure on the larger area of the unloader piston forces the loader valve to open.
5. High pressure gas from Chamber "C" is dumped into the suction side of the compressor through Chamber "B."
6. Pressure in Chamber "C" drops to a point slightly above that of suction Chamber "B."
7. Check valve closes, preventing other cylinders from unloading since Chamber "A" is common to all cylinders.
8. Discharge gas from cylinders entering Chamber "C" will not be compressed as long as the solenoid valve remains open and gas is being dumped back into the suction side of the compressor.

Two Cylinders Unloading Head - Both Cylinders In Loaded Position - Solenoid Valve De-Energized

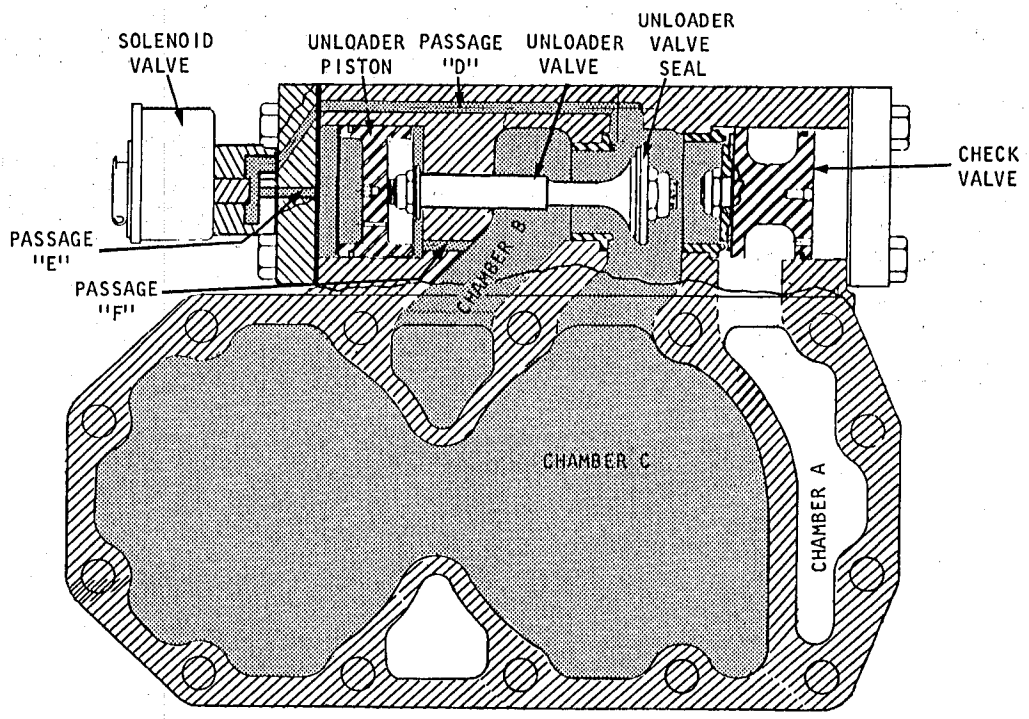
1. Unloader solenoid valve is de-energized.
2. Discharge gas from the cylinders enter Chamber "C" as a compressed gas.
3. High pressure gas in Chamber "C" holds the unloader valve closed, preventing compressed gas from flowing into the suction side of the compressor which is represented by Chamber "B."
4. As gas pressure in Chamber "C" reaches discharge pressure, the check valve opens and compressed gas enters discharge Chamber "A" and flows out to the common discharge line.

Single Cylinder Unloading Head

1. Single cylinder unloading head operation is the same as two cylinder heads except for the arrangement of cylinder head passages. See Figure 3 which illustrates the various cylinder head arrangements.



Cylinder Head In Loaded Position



Cylinder Head In Unloaded Position

Discharge Valve

WARNING

To prevent injury or death due to compressor cylinder heads being propelled by the compressor internal pressure and striking persons working on or observing the work insure that the service valves are tightly closed and that the internal compressor pressure as measured at the service valve back seat ports is at atmospheric pressure.

WARNING

To prevent injury or death due to the compressor cylinder heads being propelled by the compressor safety head springs and striking persons working on or observing the work never remove all the head bolts and then jar the head with a hammer to loosen it. Always leave two bolts at opposite ends of the head and back them off two or three turns then use a mallet to loosen the head. Once the head is loose alternately loosen the remaining bolts to relieve the tension on the springs.

To Disassemble:

1. Remove cylinder head and safety head springs.
2. Lift discharge valve cage assembly off the cylinder (Figure 4).
3. Remove valve bolt and locknut.
4. Remove seat, valve and springs (Figure 5) from the valve cage. Figure 6 illustrates the valve component.

Inspection:

Inspect all discharge valve parts for evidence of copperplating or wear. See Table 1 for valve and spring replacement data.

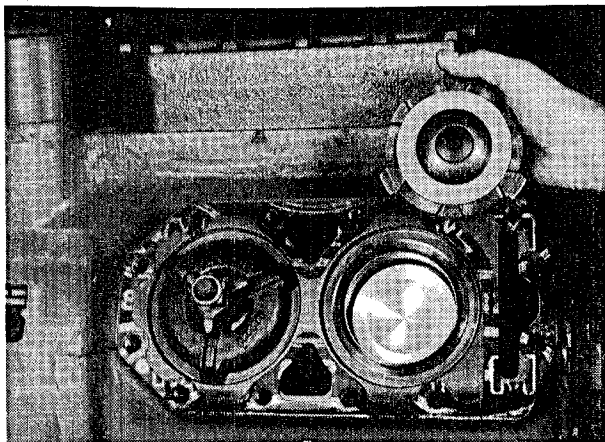


Figure 4

To Reassemble:

1. Place the springs in the valve cage.
2. Lay the valve over the springs and the seat over the valve.

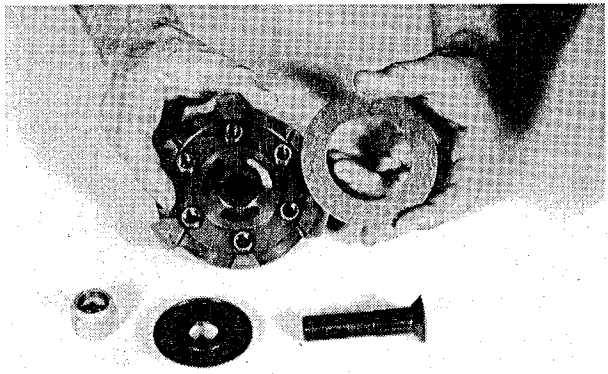


Figure 5

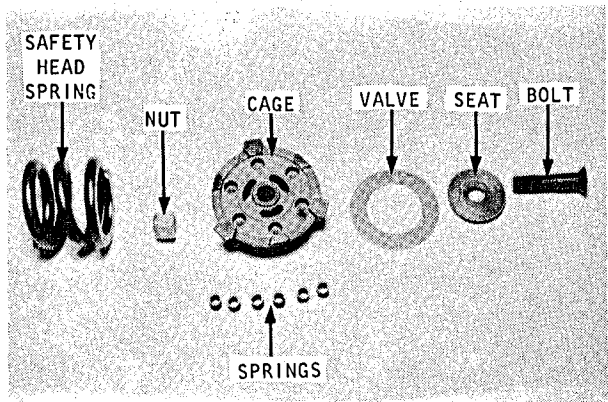


Figure 6

3. Insert the bolt and attach locknut.
4. Before tightening locknut, make sure the valve is free to move in the cage. Press valve down and then allow springs to return valve to its position against the seat as shown in Figure 7.
5. Tighten locknut to final torque. TORQUE — 50 FOOT POUNDS.

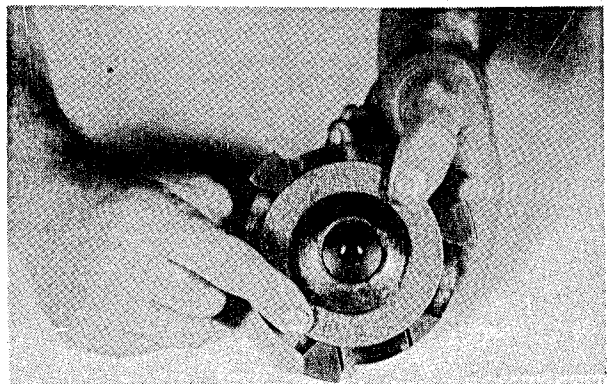


Figure 7

Solenoid Valve Assembly

To Remove:

1. Remove retainer on the end of the valve stem and pull the solenoid valve coil and housing off the stem (Figure 8).

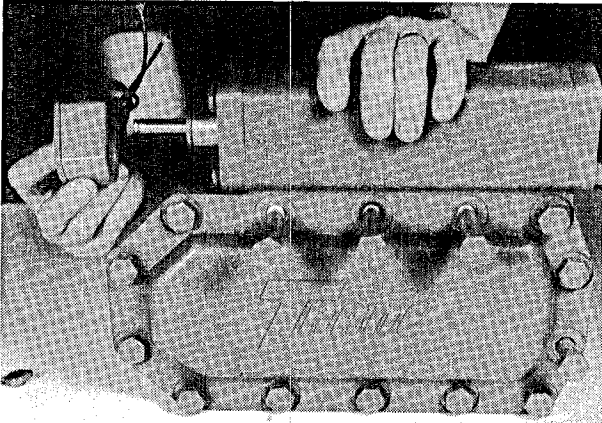


Figure 8

2. Install the mounting plate and square gasket to the unloader housing. TORQUE — 24 FOOT POUNDS.
3. Install the coil and housing over the valve stem and fasten in place with the coil retainer.

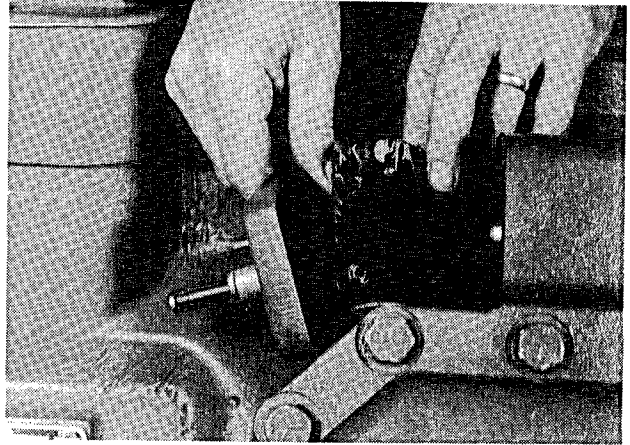


Figure 9

2. Remove the four mounting bolts and pull the valve body, mounting plate and gasket away from the unloader valve housing (Figure 9).
3. Remove the two Allen head bolts which hold the valve body to the mounting plate (Figure 10).
4. Figure 11 illustrates the disassembled solenoid valve assembly.

To Install:

1. Attach the valve body and round gasket to the mounting plate. Be sure the holes in the mounting plate, gasket and valve body match. Tighten the Allen head bolts to final torque. TORQUE — 6 FOOT POUNDS.

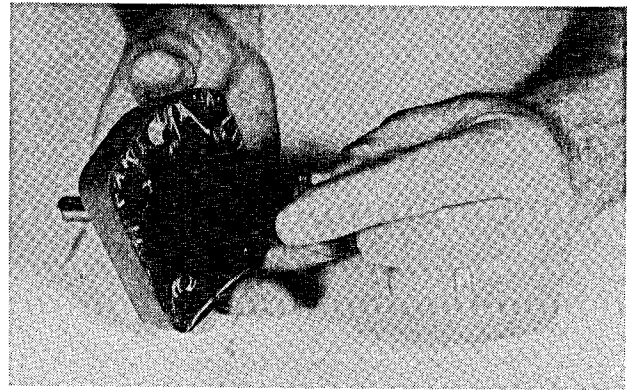


Figure 10

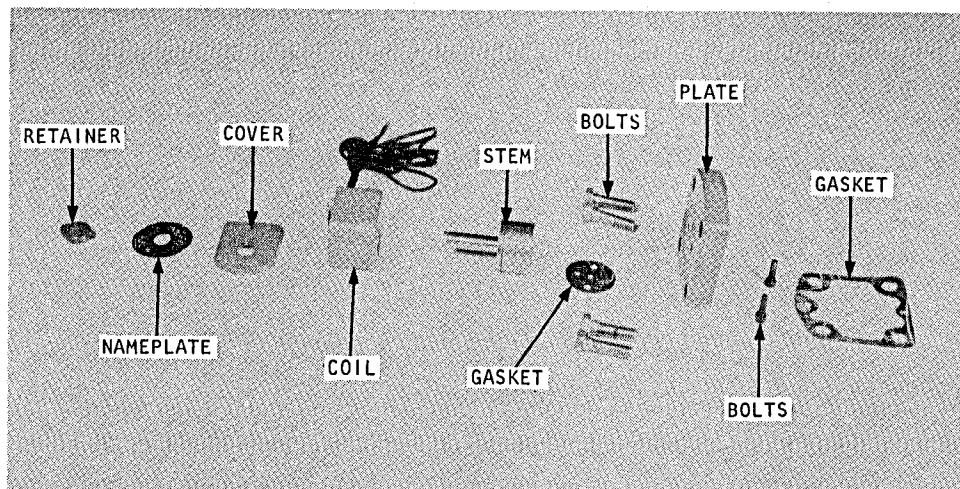


Figure 11

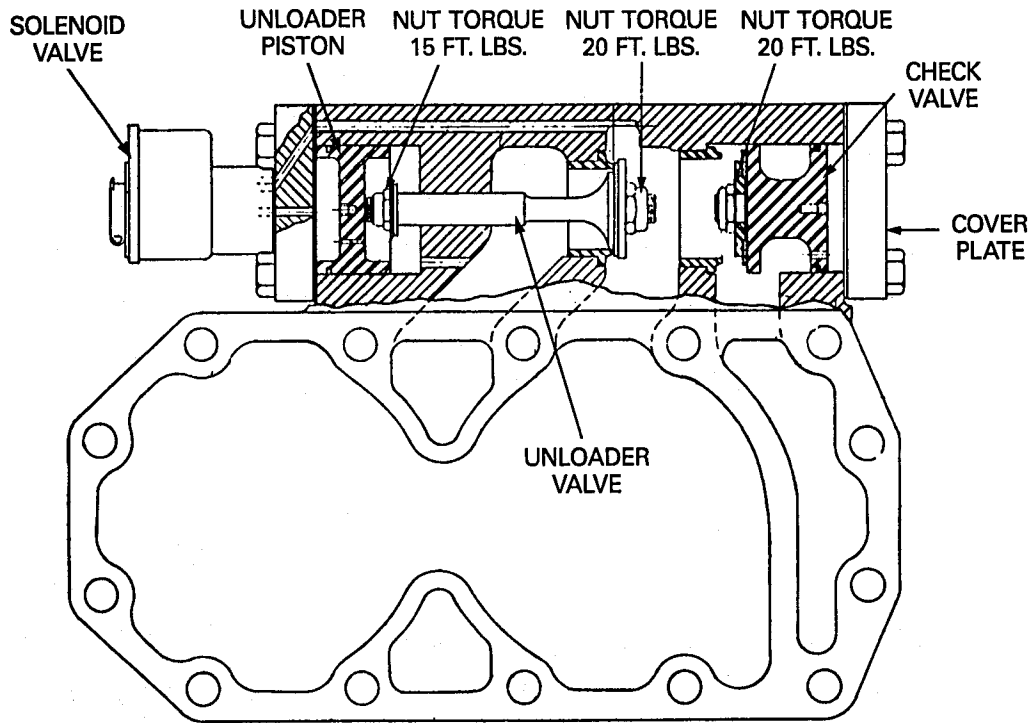


Figure 12a — Unloader Head For Design Sequence A - F

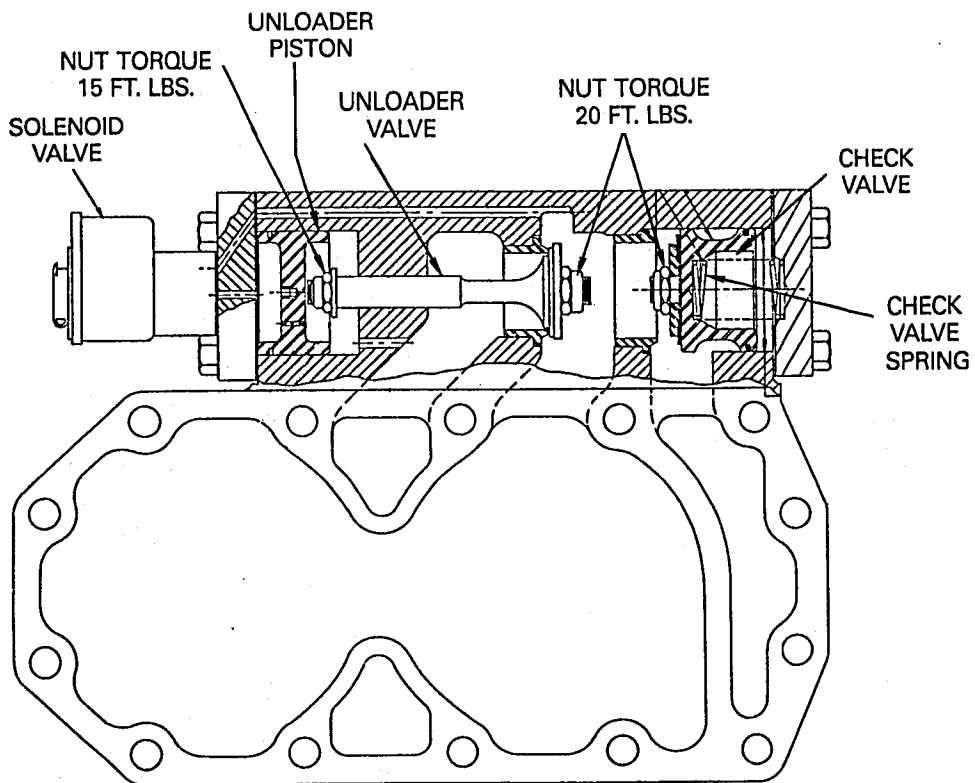


Figure 12b — Unloader Head For Design Sequence G & Later

Unloader Valve Assembly

Figure 12 illustrates the unloader valve and related components in the unloader housing. Note the torque of the locknuts located on both ends of the valve stem. To remove the unloader valve, the locknut located on the piston end of the valve stem must be removed.

To Remove:

1. Remove the solenoid valve assembly.
2. Remove the unloader piston (Figure 13).
3. Remove the check valve cover plate (Figure 14) and pull the check valve and gasket assembly out of the cylinder head (Figure 15).
4. To disassemble the check valve, remove the nut and pull the washer and seal off the valve (Figure 1).
5. Remove the lock nut and washer at the piston end of the valve stem (Figure 17). This is the nut with the 15 foot pounds torque.
6. Pull the unloader valve out of the cylinder head. Remove the nut and pull the seal and seat off the valve. Figure 18 illustrates the disassembled unloader valve, piston, cover plates and gaskets.

Model number designators prior to design sequence "E" utilized the 2 bolt solenoid mounting arrangement. If any parts of this assembly need replacing, the valve, gasket or plate, the entire assembly requires changing to the later design 3 bolt solenoid valve assembly since the 2 bolt parts are no longer available. Refer to parts list HCOM-UP-40

Figure 15 shows the check valve for design sequences A-F. Design sequences "G" and later used a spring loaded check valve as shown in figure 12 b.

NOTE: If the nut holding the retainer and seal breaks loose first, remove the retainer and seal. Install a collet-type stud remover to the valve stem and remove the lock nut and washer from the piston end.

Stud Remover Ordering Information: Snap On Tools Corporation P.O. Box 46, 21155 162 Street New Berlin, Wisconsin 53151 Housing - No. CG-500-2 Collett - 7/16" x 20 - No. CG-500-10

Inspection:

1. Check the unloader valve stem and piston for nicks, burrs, scoring or wear. Table 1 lists wear limits for the unloader valve stem.
2. Check the seal and retainer for wear. Replace if necessary.
3. Inspect the check valve seal for wear and replace if necessary.

To Install:

1. Attach the seat and seal to the unloader valve stem. Flat surfaces are provided on the valve stem to aid in tightening the lock nut. Use an open end wrench. Do not use a tool which could mar the close tolerance surface of the valve. Tighten the lock nut to final torque. TORQUE — 20 FOOT POUNDS.
2. Install the unloader valve in the unloader housing.

3. Attach the washer and lock nut at the piston end of the valve stem. Tighten the lock nut to final torque (Figure 17). TORQUE — 15 FOOT POUNDS.
4. Check movement of the valve to be sure it slides freely in the unloader housing.
5. Insert the piston into the unloader valve housing (Figure 13). Check the movement of the piston to be sure it slides freely in the housing.
6. Assemble the check valve and seal. Tighten the nut to final torque. TORQUE — 20 FOOT POUNDS.
7. Insert the check valve in the unloader housing.
8. Place the cover plate and gasket over the opening. Insert the bolts and tighten to final torque. TORQUE — 24 FOOT POUNDS.

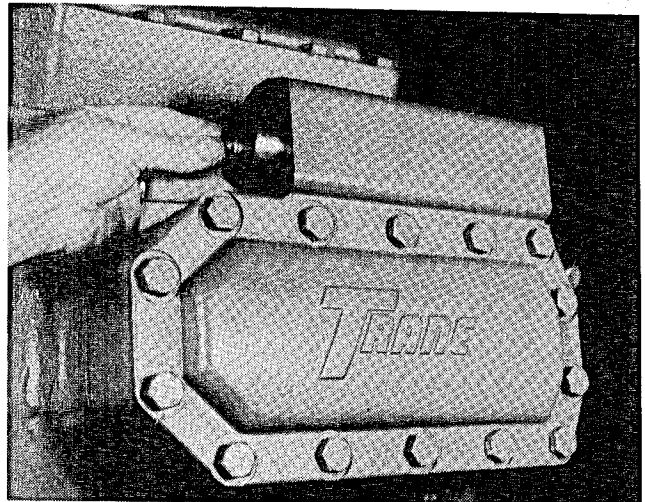


Figure 13

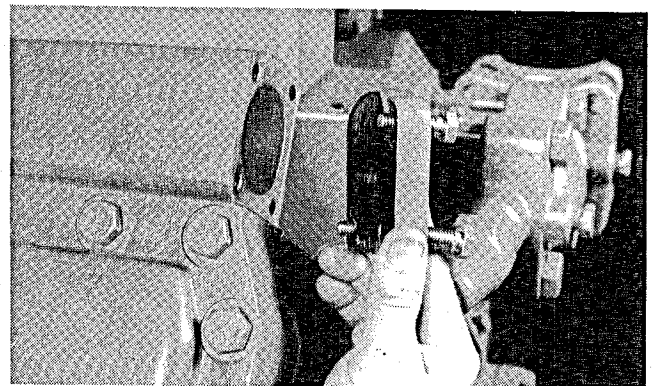


Figure 14

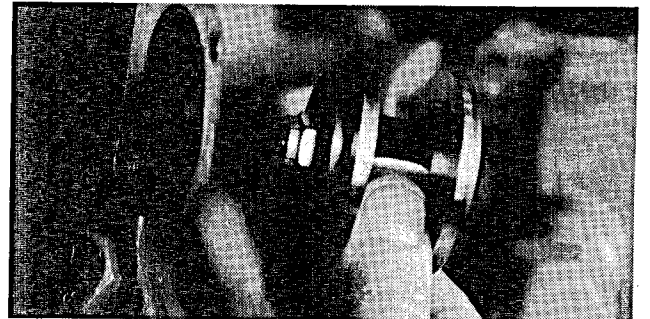


Figure 15

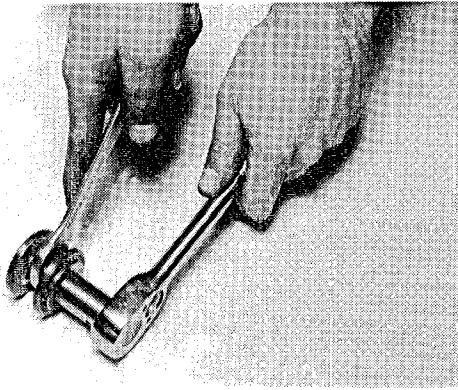


Figure 16

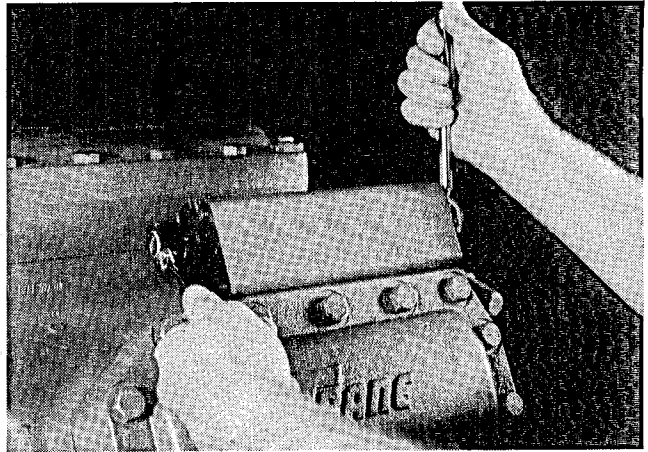


Figure 17

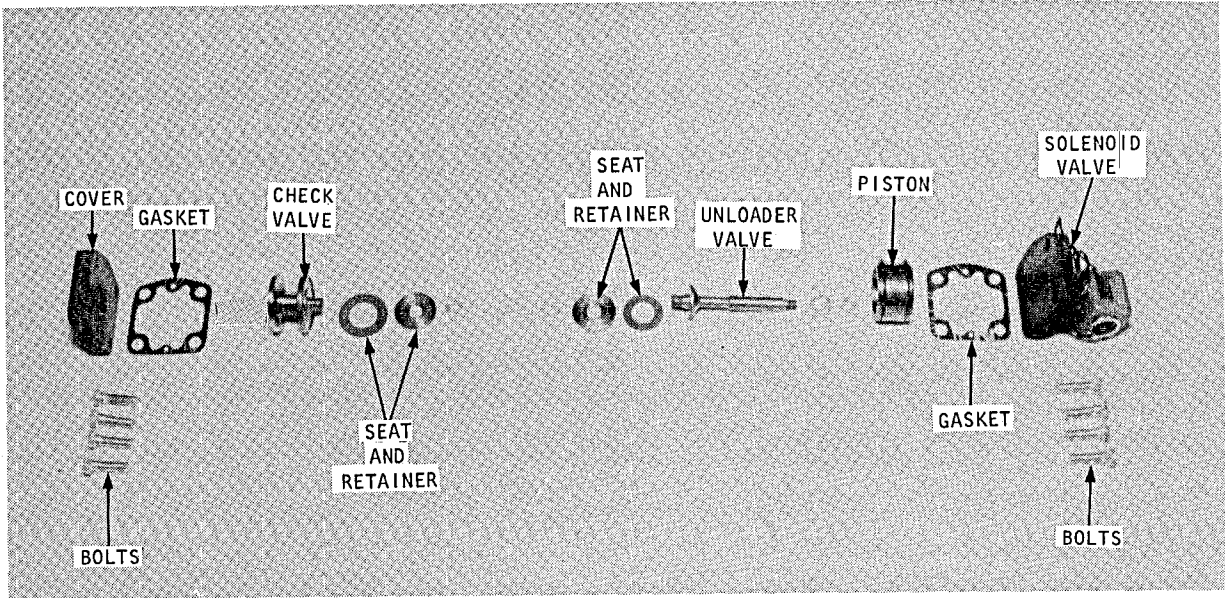


Figure 18

Crankcase Handhole Covers

NOTE: Drain crankcase oil.

To Remove:

1. Remove the bolts (Figure 19) and tap lightly around the rim of the cover to help break the gasket seal.

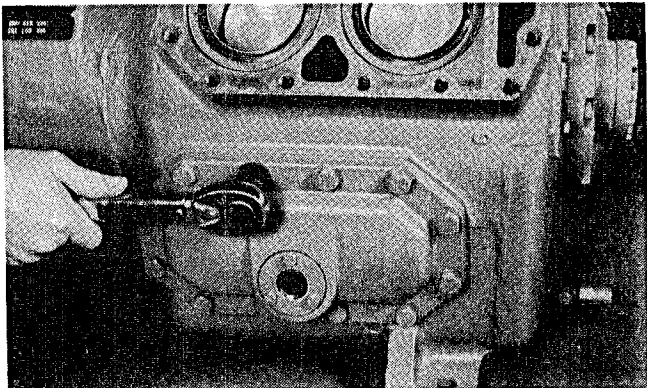


Figure 19

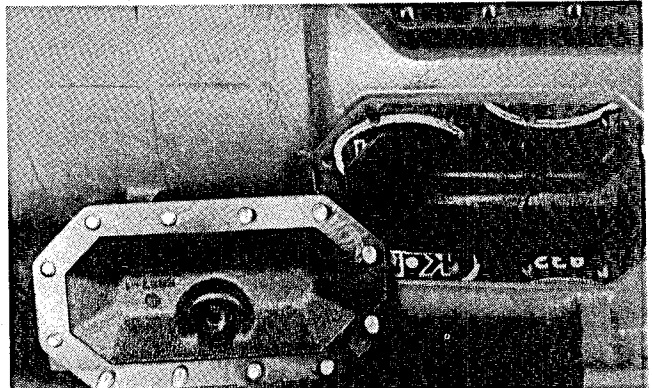


Figure 20

2. Lift cover off housing (Figure 20).

Inspection:

Inspect the handhole cover and housing sealing surfaces for nicks or grooves.

To Install:

1. Insert two bolts at opposite ends of the cover.
2. Oil the gasket with clean compressor oil and place down over the cover, using the two bolts as a guide.
3. Place the cover and gasket against the housing and draw the bolts up tight.
4. Insert the remaining bolts and draw all bolts up to final torque. TORQUE — 69 FOOT POUNDS.

Oil Level Sight Glass

To Remove:

1. Remove the three sight glass mounting bolts.
2. Lift the sight glass and "O"-ring off the handhole cover.

To Install:

1. Oil the "O"-ring with clean compressor oil. Place the "O"-ring in the groove of handhole cover.
2. Place the sight glass against the cover, install and tighten the bolts to final torque. TORQUE — 50 INCH POUNDS.

Suction Strainer

To Remove:

1. Loosen and remove the four suction service valve mounting bolts (Figure 21).
2. Lift the valve and gasket off the suction cover.
3. Pull the suction strainer out of the suction cover (Figure 22).

Inspection:

Inspect the suction strainer for dirt or damage to the wire mesh. If necessary, clean or replace.

To Replace:

1. Slide the strainer into the suction cover.
2. Oil the gasket with clean compressor oil and place on the suction cover.
3. Attach the suction service valve to the cover and tighten all mounting bolts to final torque.

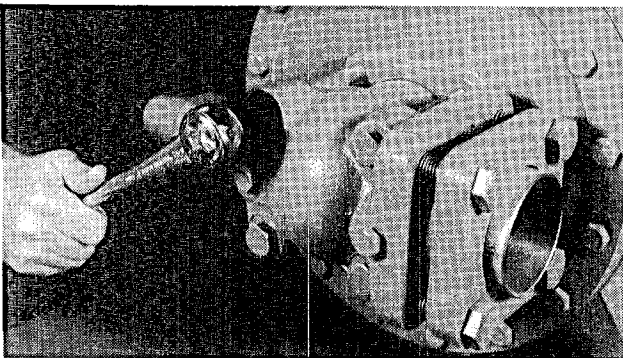


Figure 21

Suction Cover

To Remove:

1. Remove the suction cover mounting bolts (Figure 23) and lift the cover off the housing (Figure 24). If

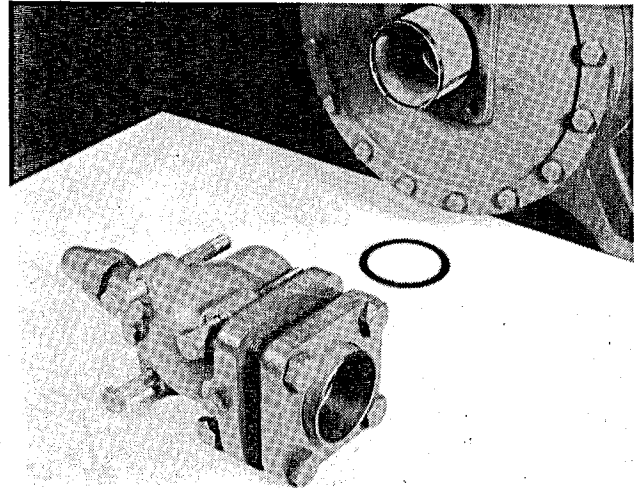


Figure 22

necessary, tap around the rim of the cover to help break the gasket seal.

To Install:

1. Insert two bolts in suction cover at opposite sides of the cover.
2. Oil the gasket with clean compressor oil. Place the gasket on the cover using the two bolts as a guide.
3. Set cover and gasket against the housing and tighten both bolts.
4. Insert the remaining bolts and tighten all bolts to final torque. TORQUE — 52 FOOT POUNDS (4 CYL.), TORQUE — 69 FOOT POUNDS (6 CYL.).

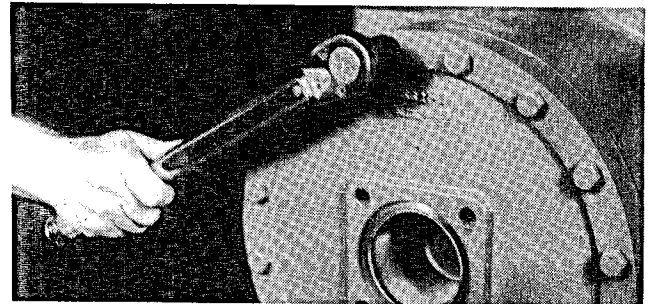


Figure 23

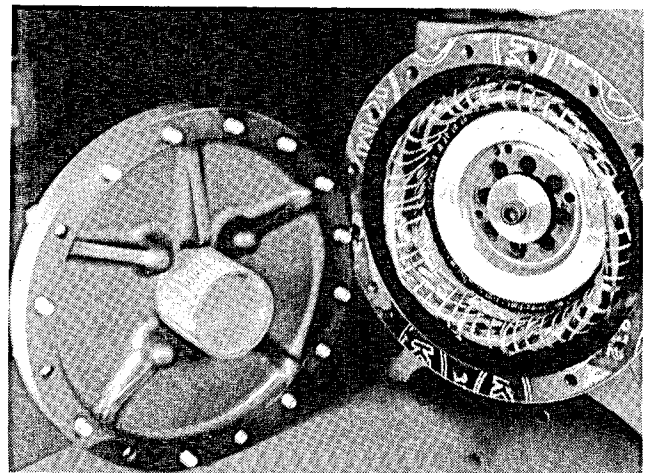


Figure 24

Cylinder Liners

To Remove:

1. Remove the cylinder head, safety head spring and discharge valve cage assembly from the cylinder liner to be removed.
2. The suction valve plate which is attached to the top of the liner is tapered toward the top. A liner extractor, Figure 25, will fit this taper. Also a valve retainer, Figure 26, may be used to clamp the suction valve to the plate.
3. It may be necessary to rotate the crankshaft to provide clearance above the piston for installing the liner puller. This can be done by applying a steady load to the piston using the liner extractor, Figure 25, and channel locks.
4. Rotate the crankshaft until the piston head is down about two inches from the top surface of the valve plate. Place liner puller block in the cylinder so that the tapered end fits inside of the valve plate and hold in position. Turn the eye bolt into the puller block.
5. Using channel locks and eye bolt, lift the liner assembly to a position where the valve plate retaining clip clear the housing. Remove the clip and lift the valve plate (with valve and valve springs) from the liner.

Inspection:

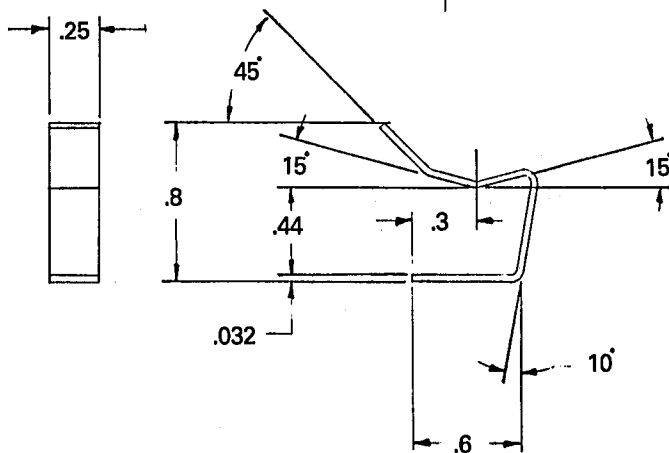
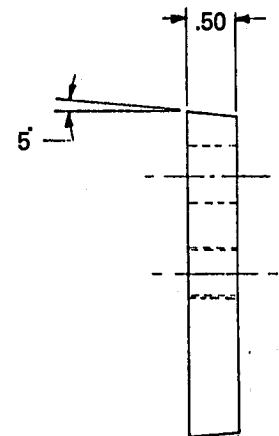
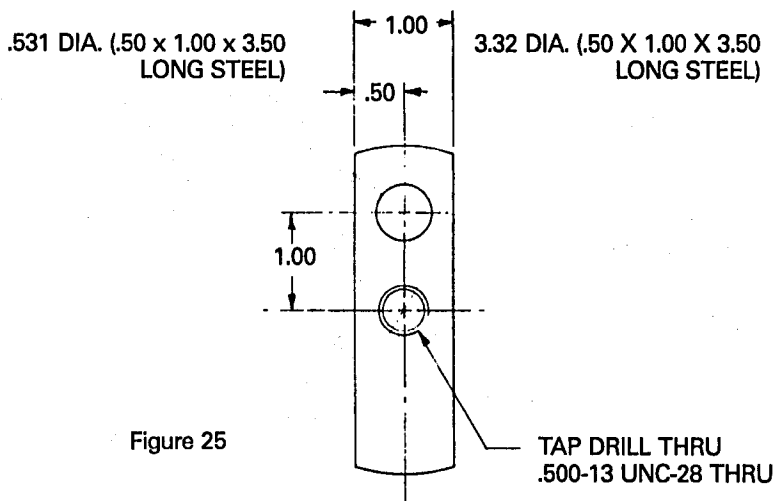
Replace the liner if there is evidence of wear or scoring on the inside wall or if the part is nicked or galled which can be detected by scraping a finger nail over the liner.

To Replace:

1. Rotate the piston rings on the piston to stagger the ring gaps.
2. Lubricate the walls of the cylinder bore with clean compressor oil.
3. Install new O-ring around O.D. of cylinder liner. Lubricate O-ring with compressor oil.
4. Rotate the crankshaft to place the piston near the top of its stroke. Guide the piston to prevent ring damage.
5. Insert the liner in the housing centering the piston in the bottom of the liner. Rock and rotate the liner on the piston and, at the same time, press down firmly to guide the rings into the liner. The bottom of the liner is tapered to allow entry of the rings.

CAUTION: Do not hammer or attempt to force the liner over the rings. Sudden shock can cause ring breakage.

6. With both rings in the liner, push the liner all the way down into the cylinder hole. Be sure the liner is seated in the housing.



Suction Valve Assembly

To Disassemble:

1. Invert the liner and suction valve assembly on a clean surface.
2. Pry loose the retainer or the three retainers which hold the suction valve plate to the liner.
3. Lift liner away from the valve plate and remove suction valve and springs from the plate. Figure 27 illustrates the liner and suction valve components.

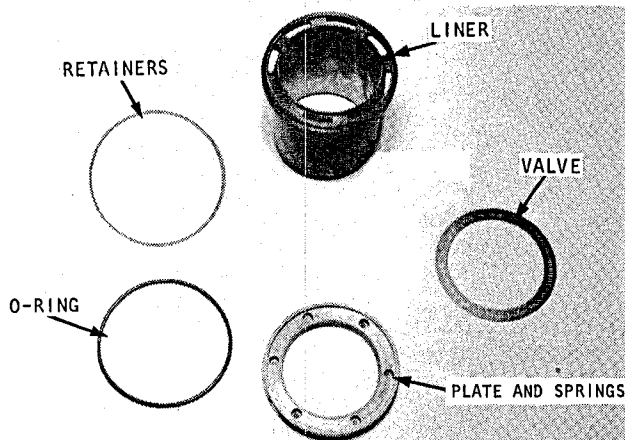


Figure 27

Inspection:

1. Inspect the suction valve for copperplating or wear. See Table 1 for wear limits and tolerances.
2. Replace the valve springs if the compressor has operated in excess of those hours listed in Table 1.

To Reassemble:

1. With the suction valve plate inverted, place the springs in their pockets and lay the suction valve down over the springs.
2. Set the liner down over the valve plate and attach with the three retainers.

NOTE: See parts list HCOM-UP-40 for interchangeability and availability of parts for design sequences B, C, D, E and G for 4 cylinder compressors and design sequences C, D, E, and G for 6 cylinder compressors. Design sequence F, H and later use different valve springs and plates than earlier design sequences.

Connecting Rods and Pistons

To Remove:

1. Remove the cylinder head and liner assemblies. Also remove the handhole covers and suction cover.
2. Remove the connecting rod bolts and connecting rod cap. Pull the piston and rod assembly out the cylinder opening.

NOTE: Mark each rod and cap assembly as removed to identify them as a unit and also to denote cylinder usage.

Inspection:

Follow the wear limits listed in Table 1 for connecting rods and crankpins.

To Install:

1. Lubricate the bearing surfaces on the rod and crankshaft with clean compressor oil.
2. All connecting rod and cap assemblies have two match marks as shown in Figure 28. **These match marks must be on the same side as assembled on the crankshaft.** Since the rods are chamfered on both sides it is not important whether the match marks face the pump end or motor end when the rod is assembled into the compressor.
3. Place the rod and piston assembly in the cylinder and seat the rod on the crankshaft.
4. Insert the bolts and washers in the cap, place in position and start the bolts into the rod. When drawing up the bolts, do so alternately to pull the cap up against the shaft and rod evenly.
5. It is essential that all connecting rod bolts be drawn tight with a torque wrench. Improper tension will cause distortion and premature wear or failure of the parts. **TORQUE — 24 FOOT POUNDS.**
6. After each cap has been tightened in place, rotate the crankshaft to make sure the rod turns freely on the shaft.



Figure 28

Pistons, Piston Rings and Wrist Pins

To Disassemble:

1. Remove the two snap rings that hold the wrist pin in the piston.
2. Push the wrist pin out of the piston and connecting rod.
3. Work the piston rings out of their grooves and off the piston. Figure 29 illustrates the piston and connecting rod components.

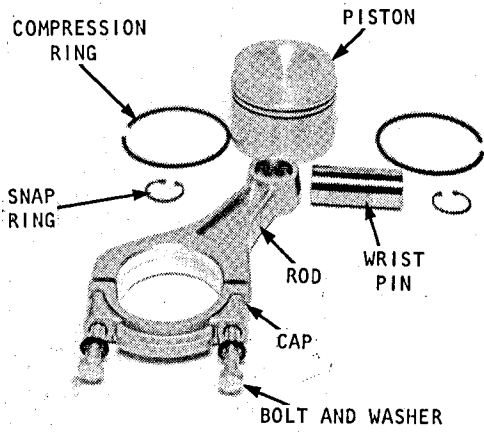


Figure 29

Inspection:

1. Check the wrist pin and pin bore tolerances as given in Table 1. If grooves are noted on any bearing surfaces, replace the pin and/or piston.
2. The ring grooves in the piston must be clean and free of nicks or burrs. Roll the back edge of the upper ring in both grooves to make sure the rings fit freely. Table 1 lists wear limits.

To Reassemble:

1. Place the connecting rod in the piston.
2. Push the wrist pin into the piston and fasten in place with the two snap rings.
3. Replace the piston rings. Note in Figure 30 that a set of rings includes an upper and lower ring. Each Ring is marked "TOP" OR with an "O" for proper positioning on the piston. These marks must face toward the top of the piston.

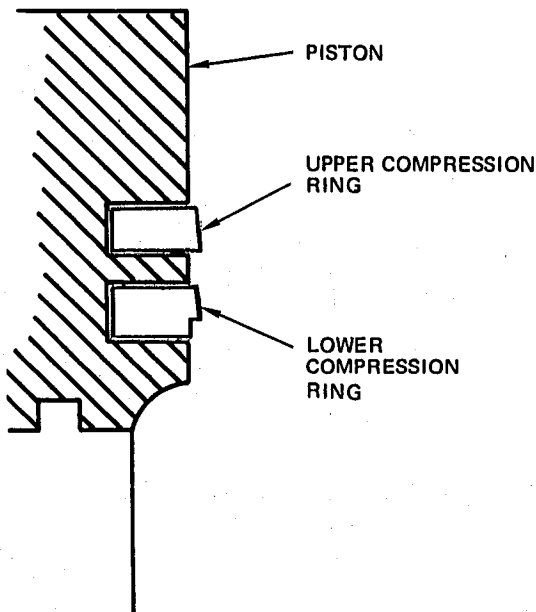


Figure 30

NOTE: When new rings are required, replace them as a set.

Motor Terminal Plate

Figure 31 illustrates the motor terminal plate and terminal assemblies.

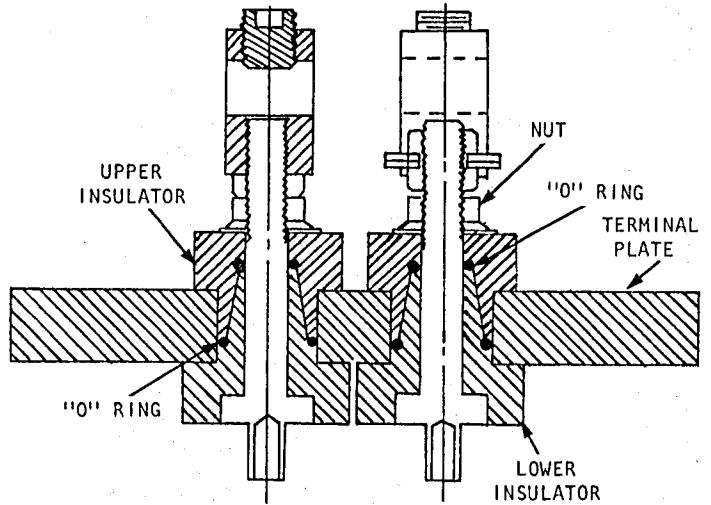


Figure 31

To Remove:

1. Remove the junction box cover (Figure 32) and junction box from the terminal plate.

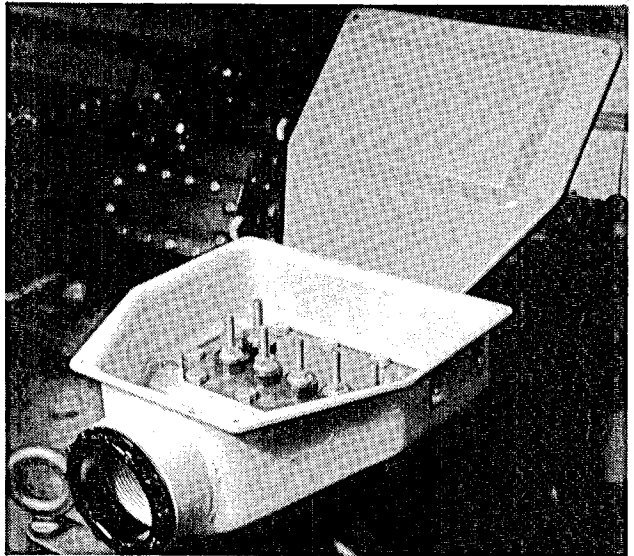


Figure 32

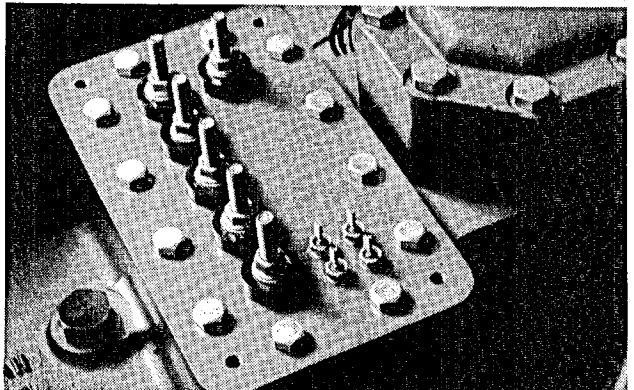


Figure 33

2. Disassemble the hex nuts, washers and buss bars from the top of the terminal studs (Figure 33).
3. Pull the upper insulators off the terminal studs. Work the "O" rings off the terminal studs.
4. Remove the terminal plate mounting bolts. Lift the plate and gasket and disconnect the four terminal spade connections.
5. Remove the terminal plate and gasket, working the terminal studs out of the plate carefully to avoid damage (Figure 34).
6. Pull the lower insulators and "O" rings off the terminals.

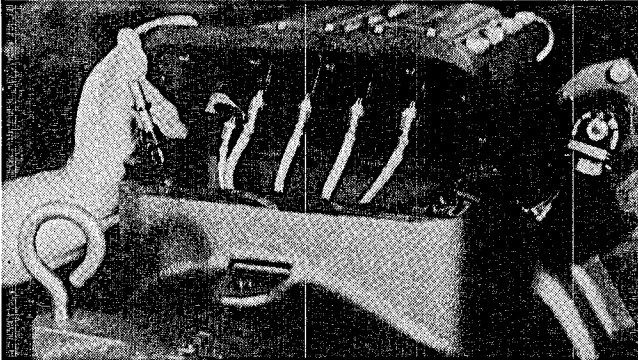


Figure 34

To Install: (For 4 Cylinder)

1. Oil the terminal plate gasket and place on the housing.
2. For each motor terminal lead, do the following:
 - a. Place the lower insulator and "O" ring over the terminal stud.
 - b. Insert the insulator and "O" ring in the terminal. Note that the number on the motor lead must match the number on the terminal plate.
 - c. Slide the upper "O" ring and insulator down over the terminal stud.
 - d. Secure the assembly with a washer and nut. Tighten the nut finger tight.
3. Connect the terminal space connectors. Attach the color coded lead to the common or "C" terminal connection. The other three leads attach to any of the other three terminal connectors S1, S2 and S3.
4. Recheck all connections to be sure they are correct and in proper position.

CAUTION: Do not overtorque terminal studs. This could lead to breakage or stretching of the terminal and may result in an inability of the terminal to stay tight and result in an electrical failure of the motor.

5. Tighten all terminal hex nuts to final torque. TORQUE — 24-30 INCH POUNDS.
6. Push the terminal plate into position on the suction cover and install two mounting bolts at opposite ends, finger tight. Do not use the four bolts that mount the junction box. All studs at the same height will insure they are located properly in the lower insulators.

7. Install the junction box and remainder of the terminal plate mounting bolts. Tighten to final torque. TORQUE — 52 FOOT POUNDS.

CAUTION: Do not overtorque terminal studs. This could lead to breakage or stretching of the terminal and may result in an inability of the terminal to stay tight and result in an electrical failure of the motor. TORQUE — 24-30 INCH POUNDS (4 CYL.).

9. Install the junction box cover. Figure 35 illustrates 6 wire lead connections to the terminals.

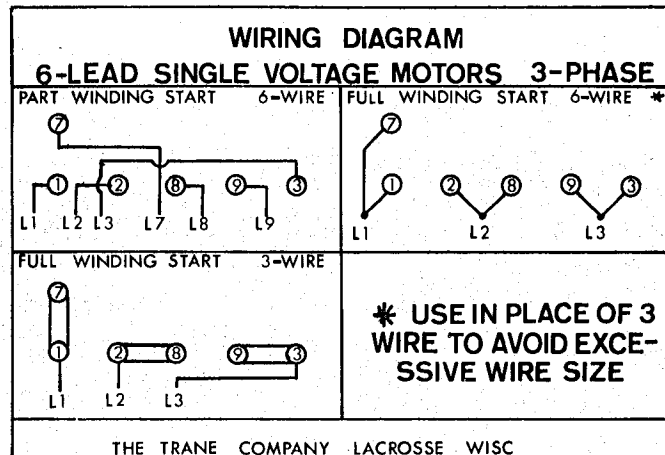


Figure 35

To Install: (For 6 Cylinder)

1. Set the lower insulators in place on the terminal plate (Figure 36).
2. Oil the large insulator "O" rings and install the "O" rings to the lower insulators using an upper insulator to push them in place (Figure 37).
3. Lightly oil the terminal plate gasket and set it in place on the suction cover.
4. Set terminal plate, with lower insulators installed, on the motor barrel. Install the motor studs to the plate (Figure 38). Numbers on the motor leads must match with numbers on the terminal plate.
5. Connect the terminal spade connectors. Attach the color coded lead to the common or "C" terminal connection. The other three leads attach to any of the other three terminal connectors S1, S2 and S3 (Figure 39).
6. Push the terminal plate into position on the suction cover and install two mounting bolts at opposite ends, finger tight. Do not use the four bolts that mount the junction box. All studs at the same height will insure they are located properly in the lower insulators (Figure 40).
7. Oil and install the small "O" rings. Follow with the upper insulators, washers and hex nuts. Tighten the nuts finger tight.

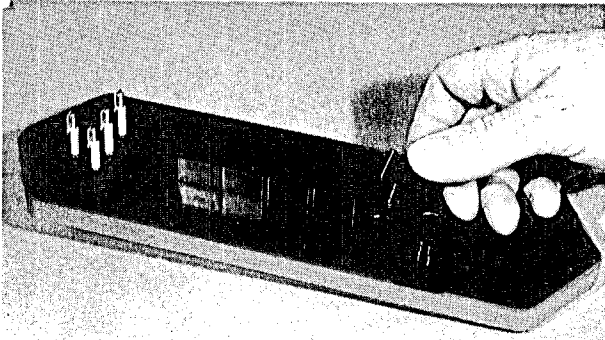


Figure 36

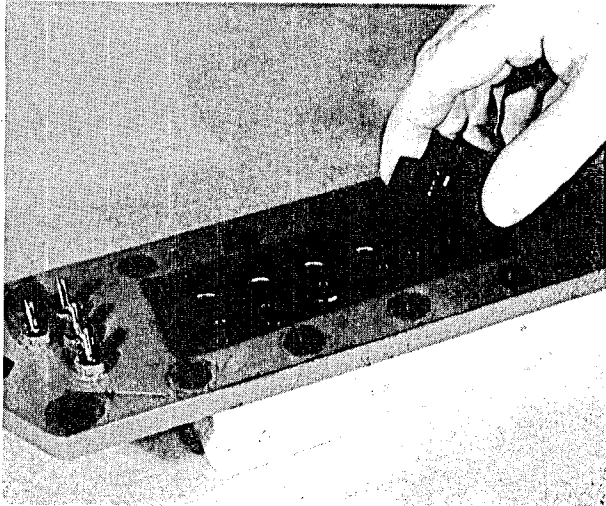


Figure 37

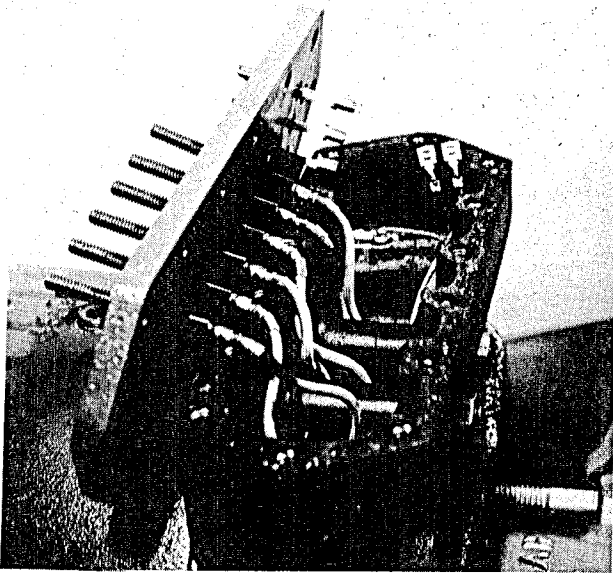


Figure 38

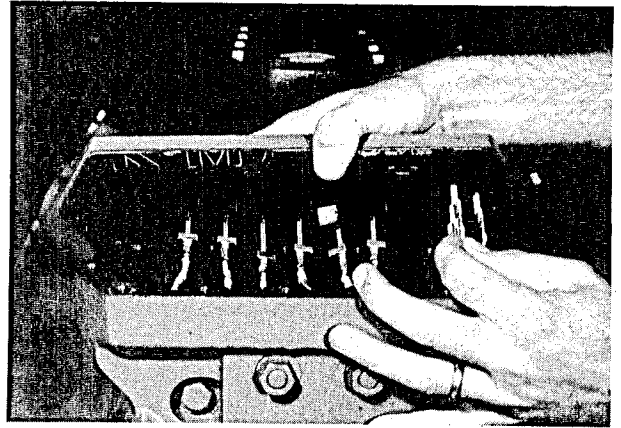


Figure 39

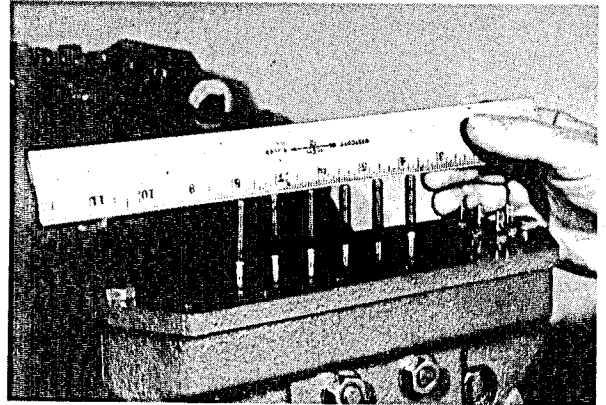


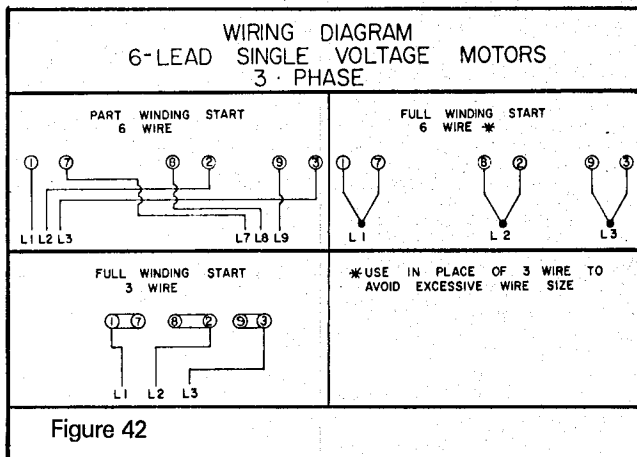
Figure 40

8. Hold the end of the stud while pushing the upper insulator in place (Figure 41).
9. Tighten the hex nuts to final torque.
TORQUE — 72-96 INCH POUNDS (6 CYL).
10. Install the junction box and remainder of the terminal plate mounting bolts. Tighten to final torque. TORQUE — 24 FT. LBS. (3/8"-16 bolt). TORQUE — 14 FT. LBS. (5/16"-18 bolt).
11. Install the buss bars, washers and hex nuts. Tighten to final torque. TORQUE — 2-2-1/2 FT. LBS.



Figure 41

12. Install the junction box cover. Figure 42 illustrates 6 wire lead connections to the terminals.



Motor Rotor and Stator

To Remove:

1. Remove the motor terminal plate, suction cover and handhole cover.
2. To remove the rotor bolt, it will be necessary to keep the crankshaft from turning. Place a block of soft wood or a mallet between one of the crankshaft counterweights and the housing (Figure 43 and 44).
3. Remove the rotor bolt and washers (Figure 45).
4. Ease the rotor off the crankshaft (Figure 46).
5. At the top of the motor barrel, remove the stator bolt (Figure 47).

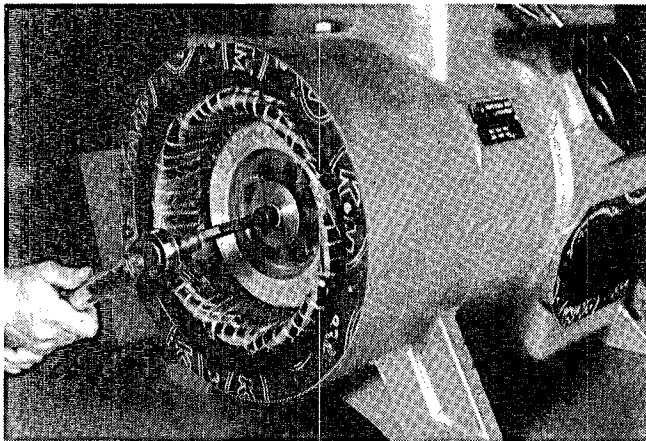


Figure 43

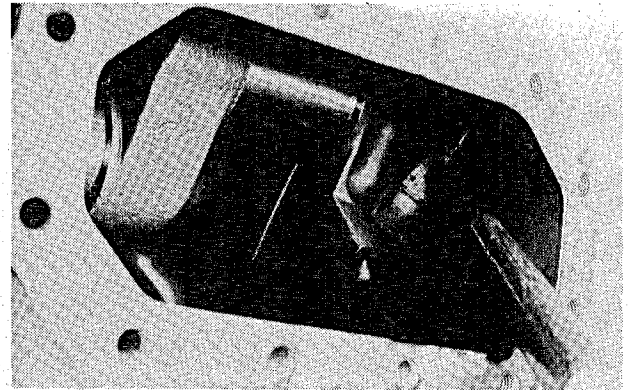


Figure 44

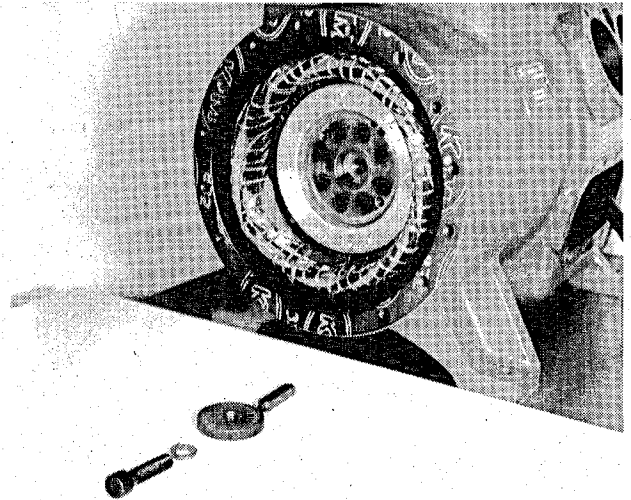


Figure 45

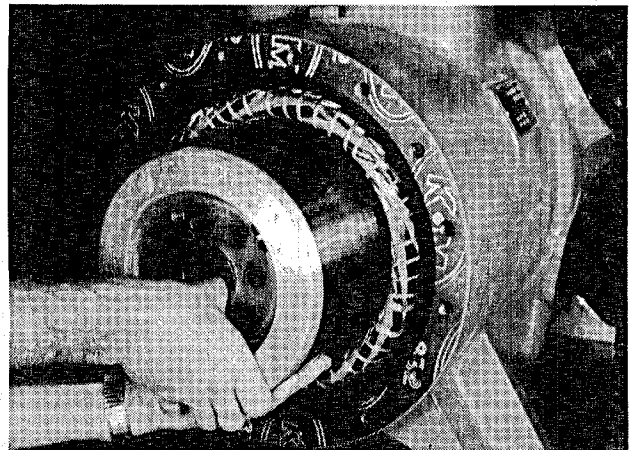


Figure 46

6. To support stator weight, provide cribbing next to the housing (Figure 48). Grasp the stator windings with both hands and pull the stator out of the housing (Figure 49). Guide the motor leads to prevent damage as the stator is pulled outward. A sharp rap on the side of the motor barrel with a plastic hammer may be necessary to start the stator moving.

7. Set the rotor and stator in a clean, dry area where the windings will be protected from damage.

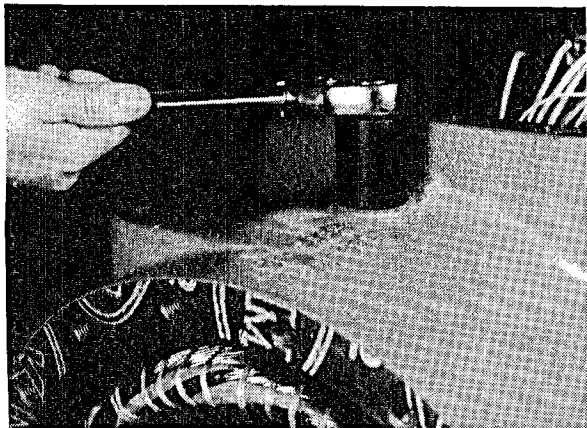


Figure 47

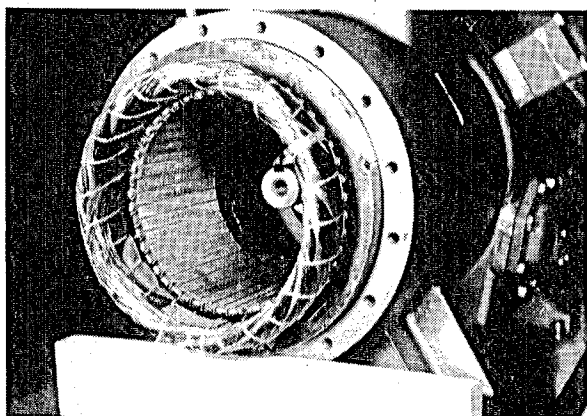


Figure 48

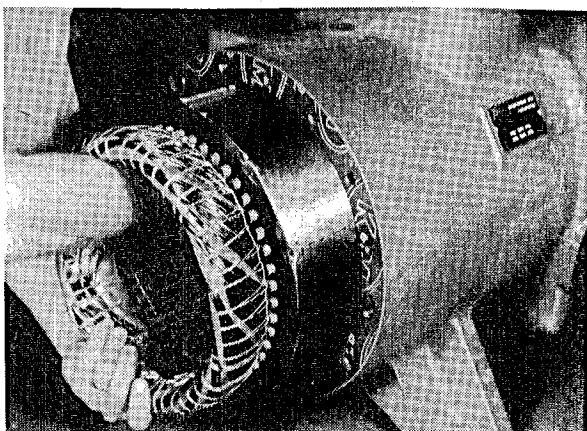


Figure 49

To Install:

As an aid in positioning the stator in the housing, scribe a guideline from the center of the stator bolt hole, across the stator laminations in the direction opposite the motor leads.

1. Start the stator into the housing (Figure 49) guiding the motor leads up through the housing. Follow the guideline until the stator bolt hole in the stator and housing match.
2. Install the stator bolt and "O" ring. Tighten to final torque. TORQUE — 173 FOOT POUNDS.
3. Place the rotor on the crankshaft and push into position, lining up the key ways.

4. Insert the key and tap into position.
5. Install the rotor bolt, washer and lock washer.
6. Block the crankshaft as described previously.
7. Tighten the rotor bolt to final torque. TORQUE — 90 FOOT POUNDS (4 CYL.), TORQUE — 135 FOOT POUNDS (6 CYL.).
8. Check the air gap between the rotor and stator with a feeler gauge. ALLOWABLE AIR GAP VARIATION - .014 MIN. AIR GAP (4 CYL.) .014 MAX. VARIATION SIDE TO SIDE (6 CYL.)

Discharge Service Valve and Relief Valve

The compressor pressure relief valve is located inside the housing directly behind the discharge service valve (Figure 50). Remove the discharge service valve to service the relief valve. If the relief valve has opened, check the compressor for internal damage. TORQUE (DISCHARGE SERVICE VALVE) — 69 FOOT POUNDS (4 CYL.), 150 FOOT POUNDS (6 CYL.).

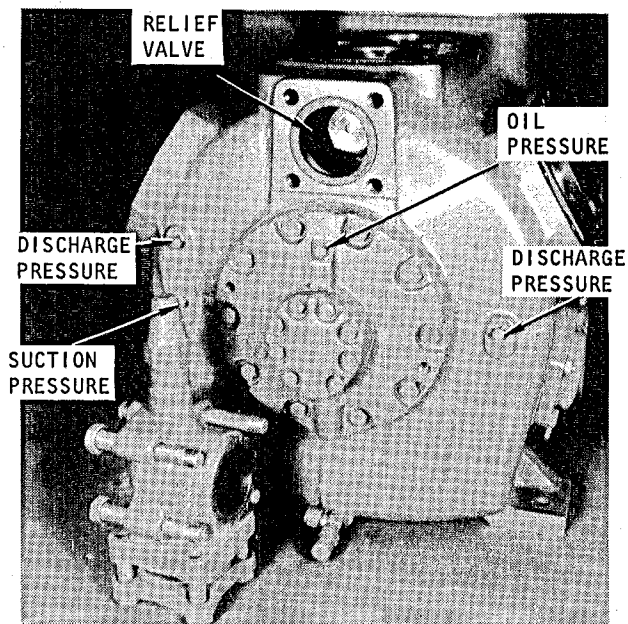


Figure 50

Oil Pump

The oil pump is driven by a roll pin in the end of the crankshaft and is held in position with a springloaded cover.

To Remove:

1. Remove all but two cover bolts at opposite sides of the cover (Figure 51).
2. Back off the two remaining bolts two or three turns. If the cover does not follow the bolts, jar the cover to break the gasket seal.
3. Remove the last two bolts and lift off the cover, gasket and spring.
4. Pull the oil pump plate off the oil pump assembly.

5. Remove the oil pump assembly from the bearing head.

6. Figure 52 illustrates the oil pump assembly.

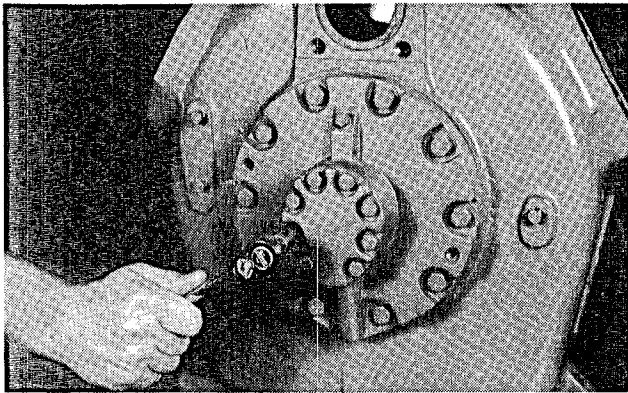


Figure 51

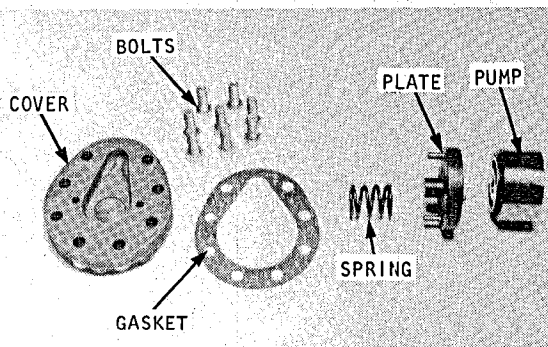


Figure 52

Inspection:

1. Clean the oil pump assembly and inspect for wear. The machine surfaces must be flat and free of nicks and burrs.

To Install:

1. Place the oil pump assembly in the bearing head against the crankshaft. The outside ring of the pump has a notch which is on a pin on the end of the crankshaft.
2. Set the oil pump plate in position against the pump. The slot, the kidney shaped opening, must be on top and the pin in the plate must fit the recess in the rotor retainer.
3. Lightly oil both sides of the cover gasket and place on the cover. Be sure the cover and gasket bolt holes match. Insert two bolts in the cover and gasket at opposite sides of the cover.
4. Place the spring over the protruding knob on the oil pump plate (Figure 53). Hold in position while placing the cover and bolts up against the bearing head. Push the cover toward the bearing and engage the two bolts.

NOTE: The two register pins on the oil pump plate must fit into matching holes in the cover.

5. Tighten the two bolts, placing the oil pump under spring tension. Insert the remaining bolts and tighten all bolts to final torque. **TORQUE — 14 FOOT POUNDS.**

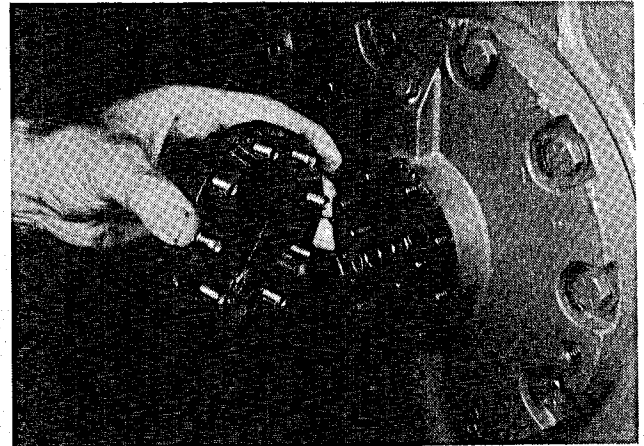


Figure 53

Bearing Head

To Remove:

1. Remove the bearing head cap screws.
2. To break the gasket seal, use two cover screws in the jack-screw holes provided in the bearing head (Figure 54).

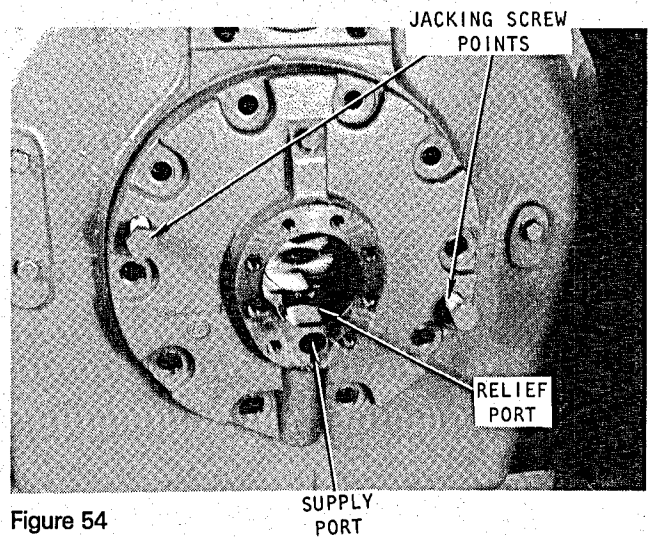


Figure 54

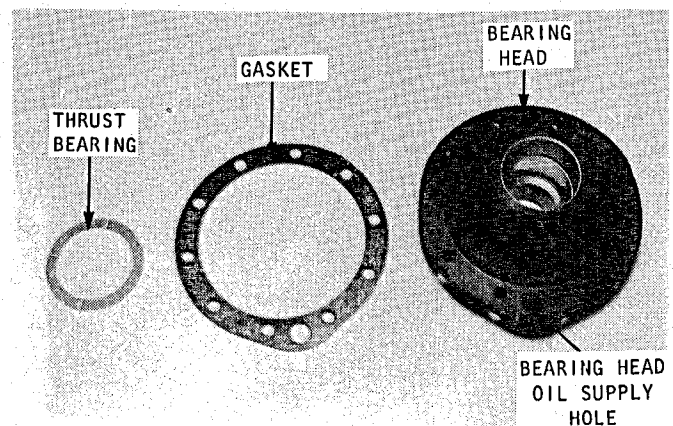


Figure 55

- Lift the bearing head and gasket off the housing. The thrust bearing on the end of the crankshaft may come with the bearing head. If it does not, lift the thrust bearing off the end of the crankshaft. Figure 55 illustrates the bearing head, gasket and thrust bearing.

Inspection:

- Examine the bearing insert for damage or copper plating. Clean the oil passages if necessary. Table 1 lists bearing wear limits.

To Install:

- Run a bead of oil on the bearing head thrust bearing mating surfaces. Set the thrust bearing in place on the bearing head.
- Lightly oil both sides of the gasket and place it on the bearing head. Be sure the holes in the gasket and bearing head match.
- Oil the bearing surface of the bearing head. Set the bearing head with thrust washer and gasket over the crankshaft and push it into the compressor housing. Match the bearing head oil supply hole, at the bottom of the bearing head, with the oil supply hole in the compressor housing.
- Insert and tighten the mounting bolts to final torque. **TORQUE — 52 FOOT POUNDS.**
- Measure crankshaft end play: .005 to .028. Push the shaft against the motor end thrust bearing. Using a feeler gauge, measure the distance between the shoulder of the shaft and the thrust bearing at the oil pump end of the shaft (Figure 59). Repeat the measurement of the motor end thrust bearing after pushing the shaft against the pump end thrust bearing. The measurement should be identical at both ends of the crankshaft. If it varies, check the position of the thrust bearings. Table 1 lists thrust bearing wear limits. **CRANKSHAFT END PLAY — .005-.028.**

Oil Strainer

To Remove:

- Remove the bearing head and handhole cover.
- Reach inside the housing and push the oil strainer toward the bearing head end of the housing. Pull the sleeve and "O" ring off the end of the oil strainer tube (Figure 56).
- Pull the oil strainer toward the motor end of the housing until the strainer tube is free of its mounting hole. Lift strainer out of the housing.
- Remove the 4 magnets in the bottom of the crankcase. Figure 57 illustrates the oil strainer and crankcase magnets.

Inspection:

- Clean the magnets with refrigeration parts cleaner. It is recommended that the oil strainer be replaced whenever the compressor is disassembled for repair of connecting rods, main bearings or after a motor electrical burnout.

To Install:

- Replace the magnets in the bottom of the crankcase.

- Place the oil strainer in the crankcase (must be positioned between casting webbing in bottom of crankcase) and insert the tube in the housing hole. Push the strainer toward the bearing end of the housing so the tube protrudes as shown in Figure 56.
- Oil the "O"-ring with clean compressor oil and slide over the end of the tube.
- Place the sleeve over the end of the tube against the "O"-ring. Push the tube and sleeve into the housing so the end of the tube is flush with the face of the housing. As the bearing head is replaced, the sleeve will be pressed against the "O"-ring to provide a seal.

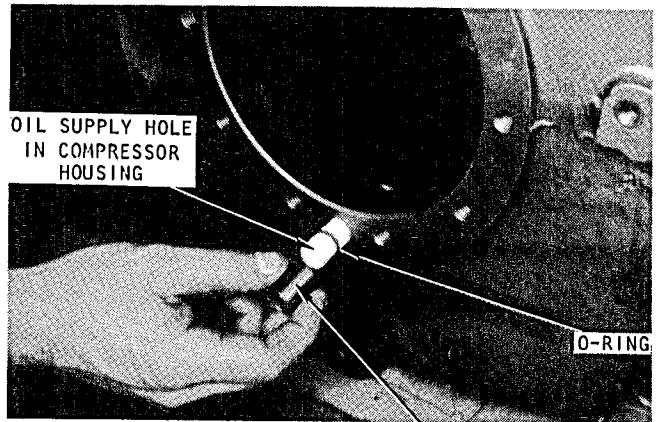


Figure 56

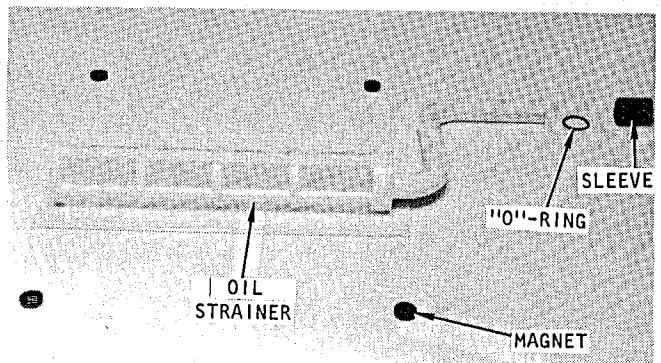


Figure 57

Crankshaft

To Remove:

- Remove the motor, piston and connecting rod assemblies and the pump end bearing head.
- Slide the crankshaft out of the motor end bearing and then out the pump and bearing head opening.
- Remove the thrust bearing on the motor end bearing. Figure 58 illustrates the crankshaft and thrust bearings.

Inspection:

- Examine the crankshaft journals and bearing surfaces for damage or copperplating. Remove the plugs and check the oil passages, clean if necessary. Table 1 lists crankshaft wear limits.
- Check the motor end bearing inserts for damage, wear or copperplating. Wear limits are given in Table 1.

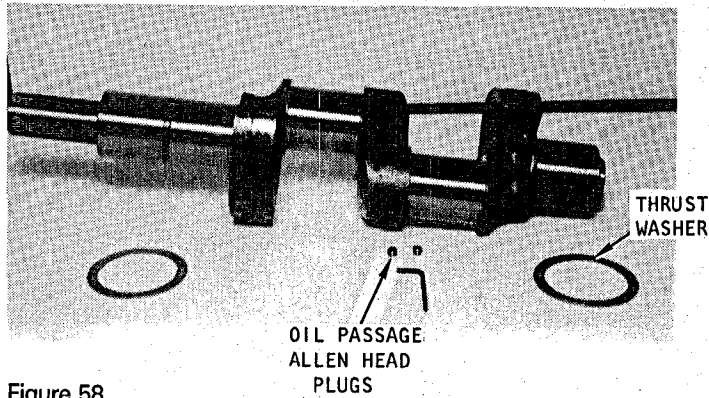


Figure 58

To Replace:

1. Oil the motor end thrust bearing and place it on the motor end bearing.
2. Check the motor end bearing inserts for damage, wear or copperplating.

NOTE: If bearing inserts are worn beyond the maximum wear limits shown in Table 1, the compressor main bearing inserts must be replaced. Installation of the new main bearing inserts will require special tools which are available through Trane offices.

3. Work the crankshaft into the housing through the pump end bearing opening. When inserting the crankshaft in the motor end bearing, use caution to prevent damage to the thrust bearing and main bearing surfaces.

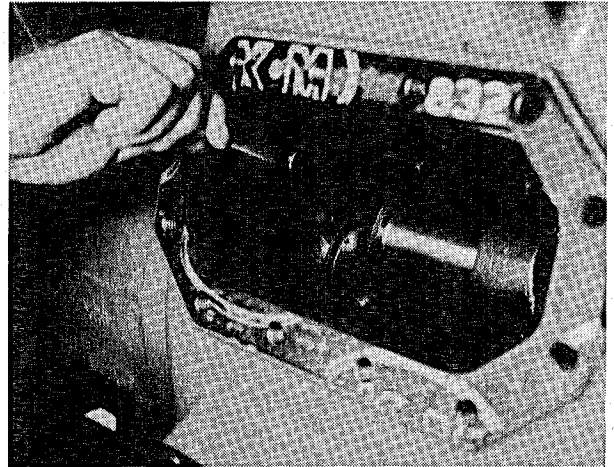


Figure 59

4. Reinstall the pump end bearing head and check crankshaft end play as follows:
 - a. Push the shaft against the motor end bearing.
 - b. Using a feeler gauge, measure the clearance between the shaft and the thrust bearing at the oil pump end of the shaft (Figure 59).
 - c. Repeat the clearance measurement at the motor end of the shaft after pushing the shaft against the pump end thrust bearing. The measurement should be identical at both ends of the crankshaft. If it varies, check position of the thrust bearings. Table 1 lists thrust bearing wear limits. **CRANKSHAFT END PLAY — .005 to .028.**