THERMO KING

X214, X418, X426 & X430 Compressor

TK 6875-8-OM (Rev. 7, 12/01)

Overhaul Manual

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Recover Refrigerant

At Thermo King, we recognize the need to preserve the environment and limit the potential harm to the ozone layer that can result from allowing refrigerant to escape into the atmosphere.

We strictly adhere to a policy that promotes the recovery and limits the loss of refrigerant into the atmosphere.

In addition, service personnel must be aware of Federal regulations concerning the use of refrigerants and the certification of technicians. For additional information on regulations and technician certification programs, contact your local THERMO KING dealer.

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Thermo King Compressors

The most significant part of the refrigeration system is the compressor. Its function is to pump low pressure gas out of the evaporator so that a rapid and continuous boiling action is maintained in the evaporator 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 liquefy (condense).

The compressors covered by this manual are reciprocating piston type pumps, constructed mainly of cast aluminum. The aluminum alloy pistons and cast iron sleeves are machined to close tolerances to that no rings are needed to seal the piston to the cylinder wall. The compressor is equipped with a high nickel alloy ductile iron crankshaft. To prevent leakage around the crankshaft, the compressor is fitted with a rotary type refrigeration seal.

Pressurized lubrication is provided to the connecting rods and bearings by a gerotor oil pump in the compressor body. The oil level in the compressor can be inspected through the oil level sight glass in the body. Since the refrigeration system is sealed, it should be necessary to add oil only if there has been a large refrigeration leak in the system, or if a major item in the refrigeration system, such as an evaporator coil or a condenser coil has been replaced.

A spring loaded discharge valve and spring loaded valve cage provide pressure relief if liquid refrigerant enters the compressor. The entire cage lifts and prevents breaking or deforming of the valves.

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 surfaces. Oil all parts with compressor oil during assembly, and be sure they are installed in the same position they were in before disassembly.

NOTE: When replacement parts are required, we recommend using only Factory Approved Thermo King Replacement Parts. Only Genuine Thermo King Replacement Parts deliver the reliability, productivity, quality, and performance you've come to expect from Thermo King.

NOTE: Most of the overhaul procedures for the compressors covered in this manual are the same. Photographs of an X426 compressor are used in this manual as examples. Other illustrations are provided in cases where the photograph is not applicable.

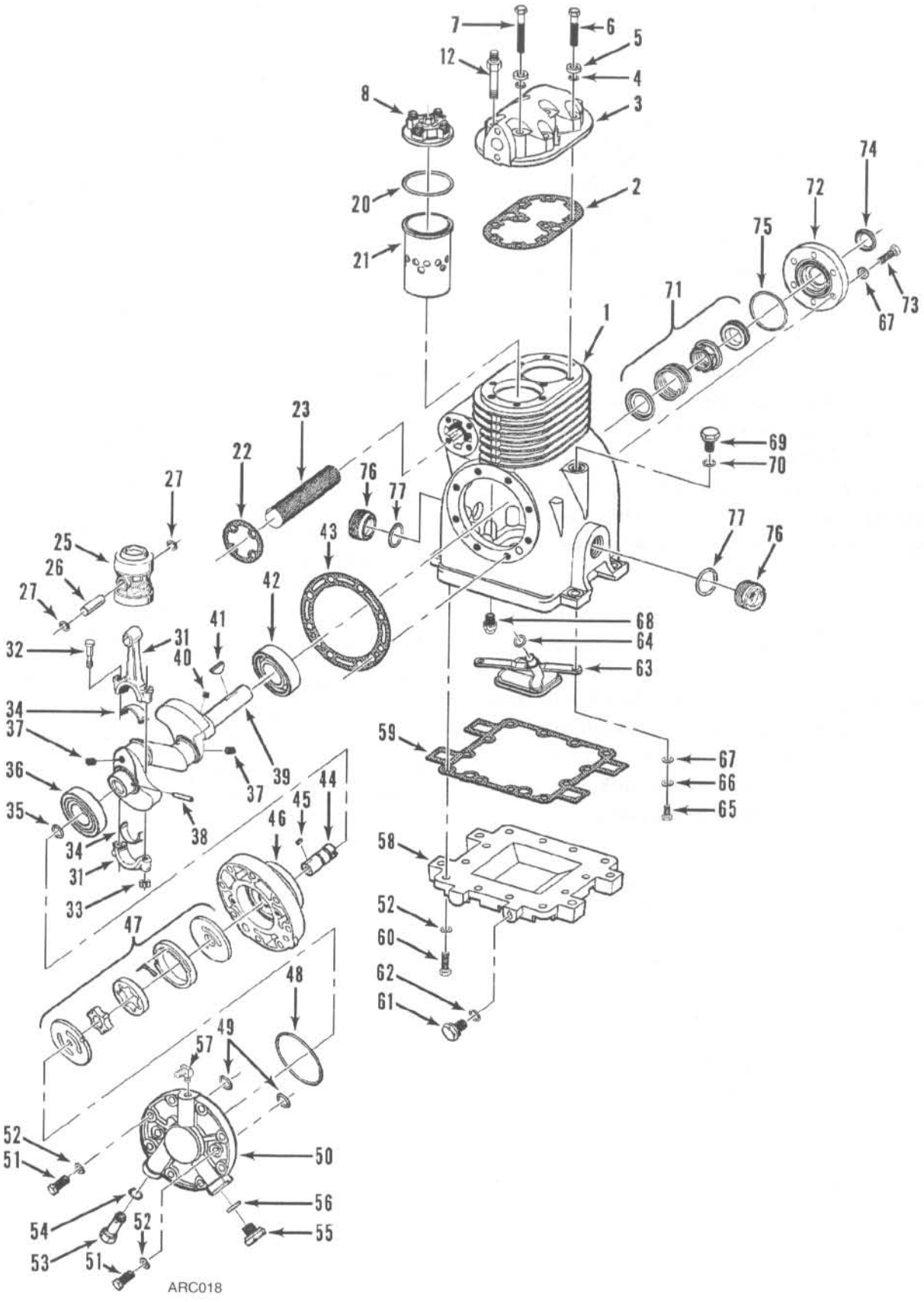


Figure 1: Two Cylinder Compressor

1.	Compressor Body	45.	Oil Pump Shaft Key
2.	Cylinder Head Gasket	46.	Oil Pump Housing
3.	Cylinder Head	47.	Oil Pump Assembly
4.	O-ring	48.	Oil Pump Cover O-ring
5.	Sealing Washer	49.	O-ring
6.	Bolt (3/8-16 x 2)	50.	Oil Pump Cover Plate
7.	Bolt (3/8-16 x 2-5/8)	51.	Bolt (5/16-18 x 1-1/8)
8.	Discharge Valve Assembly		Bolt (3/8-16 x 2-1/4)
12.	Stud	52.	Flatwasher
20.	Valve Plate O-ring	53.	Oil Pressure Regulator Assembly
21.	Cylinder Sleeve	54.	Regulator O-ring
22.	Adapter Gasket	55.	Plug
23.	Suction Port Screen	56.	Plug O-ring
25.	Piston Assembly	57.	Oil Line Fitting or Valve
26.	Piston Pin	58.	Oil Sump
27.	Piston Pin Retaining Ring	59.	Oil Sump Gasket
31.	Connecting Rod Assembly	60.	Bolt
32.	Connecting Rod Bolt	61.	Bolt
33.	Connecting Rod Nut	62.	Copper Washer
34.	Bearing Set (Standard)	63.	Oil Sump Screen
	Bearing Set (0.005)	64.	Oil Pickup O-ring
	Bearing Set (0.010)	65.	Bolt
	Bearing Set (0.020)	66.	Lockwasher
	Bearing Set (0.030)	67.	Flatwasher
35.	Pump Shaft O-ring	68.	Check Valve Assembly
36.	Crankshaft Pump End Bearing	69.	Oil Fill Screw
37.	Plug	70.	Oil Fill O-ring
38.	Dowel Pin	71.	Crankshaft Seal
39.	Crankshaft	72.	Crankshaft Seal Plate
40.	Metering Plug	73.	Bolt
41.	Key	74.	Lip Seal
42.	Crankshaft Drive End Bearing	75.	Seal Plate O-ring
43.	Housing Gasket	76.	Sight Glass
44.	Oil Pump Shaft	77.	Sight Glass O-ring

Two Cylinder Compressor

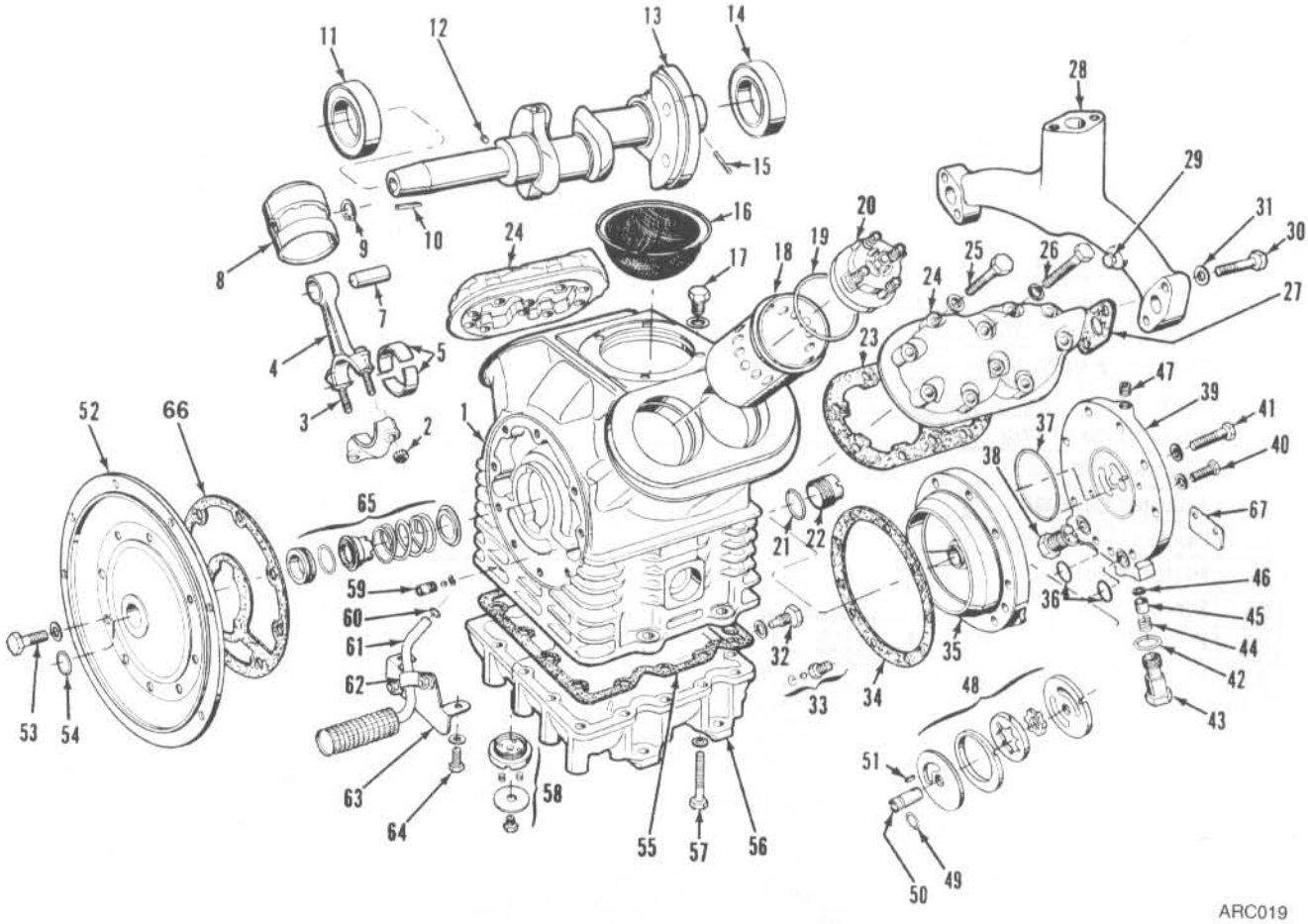


Figure 2: Early Style Four Cylinder Compressor

NOTE: The early style compressor had a spring loaded shaft seal, and the seal plate and mounting flange were made in one piece.

1.	Compressor Body	33.	Check Valve Assembly
2.	Connecting Rod Nut	34.	Pump End Gasket
3.	Connecting Rod Bolt	35.	Pump Housing
4.	Connecting Rod Assembly	36.	O-ring
5.	Bearing Set (Standard)	37.	O-ring
	Bearing Set (0.005)	38.	Oil Pump Cover Plug and Copper Washer
	Bearing Set (0.010)	39.	Oil Pump Cover
	Bearing Set (0.020)	40.	Oil Pump Cover Bolt and Washer
	Bearing Set (0.030)	41.	Oil Pump Cover Bolt and Washer
	Bearing Set (0.005)	42.	Regulator O-ring
7.	Piston Pin	43.	Oil Pressure Regulator
8.	Piston Assembly	44.	Regulator Spring
9.	Retaining Ring	45.	Plunger
10.	Key	46.	Regulator Retaining Ring
11.	Crankshaft Drive End Bearing	47.	Oil Line Fitting or Valve
12.	Metering Plug	48.	Oil Pump Assembly
13.	Crankshaft	49.	O-ring
14.	Crankshaft Oil Pump End Bearing	50.	Oil Pump Shaft
15.	Dowel Pin	51.	Oil Pump Drive Key
16.	Suction O-ring and Screen	52.	Seal Plate/Mounting Flange
17.	Copper Washer and Bolt	53.	Screw and Washer
18.	Cylinder Sleeve	54.	O-ring
19.	O-ring	55.	Oil Sump Gasket
20.	Discharge Valve Plate Assembly	56.	Oil Sump
21.	Sight Glass O-ring	57.	Oil Sump Bolt and Washer
22.	Sight Glass	58.	Check Valve Assembly
23.	Cylinder Head Gasket	59.	Check Valve Assembly
24.	Cylinder Head	60.	O-ring
25.	Cylinder Head Bolt and Flat Washer	61.	Oil Suction Screen Assembly
26.	Cylinder Head Bolt and Flat Washer	62.	Mounting Screen Hardware
27.	Manifold Gasket	63.	Screen Bracket
28.	Manifold	64.	Mounting Bracket Bolt and Washer
29.	Pipe Plug	65.	Crankshaft Seal Assembly
30.	Manifold Mounting Bolt	66.	Seal Plate Gasket
31.	Flatwasher	67.	Rotation Nameplate
32.	Magnetic Plug and Copper Washer		

Early Style Four Cylinder Compressor

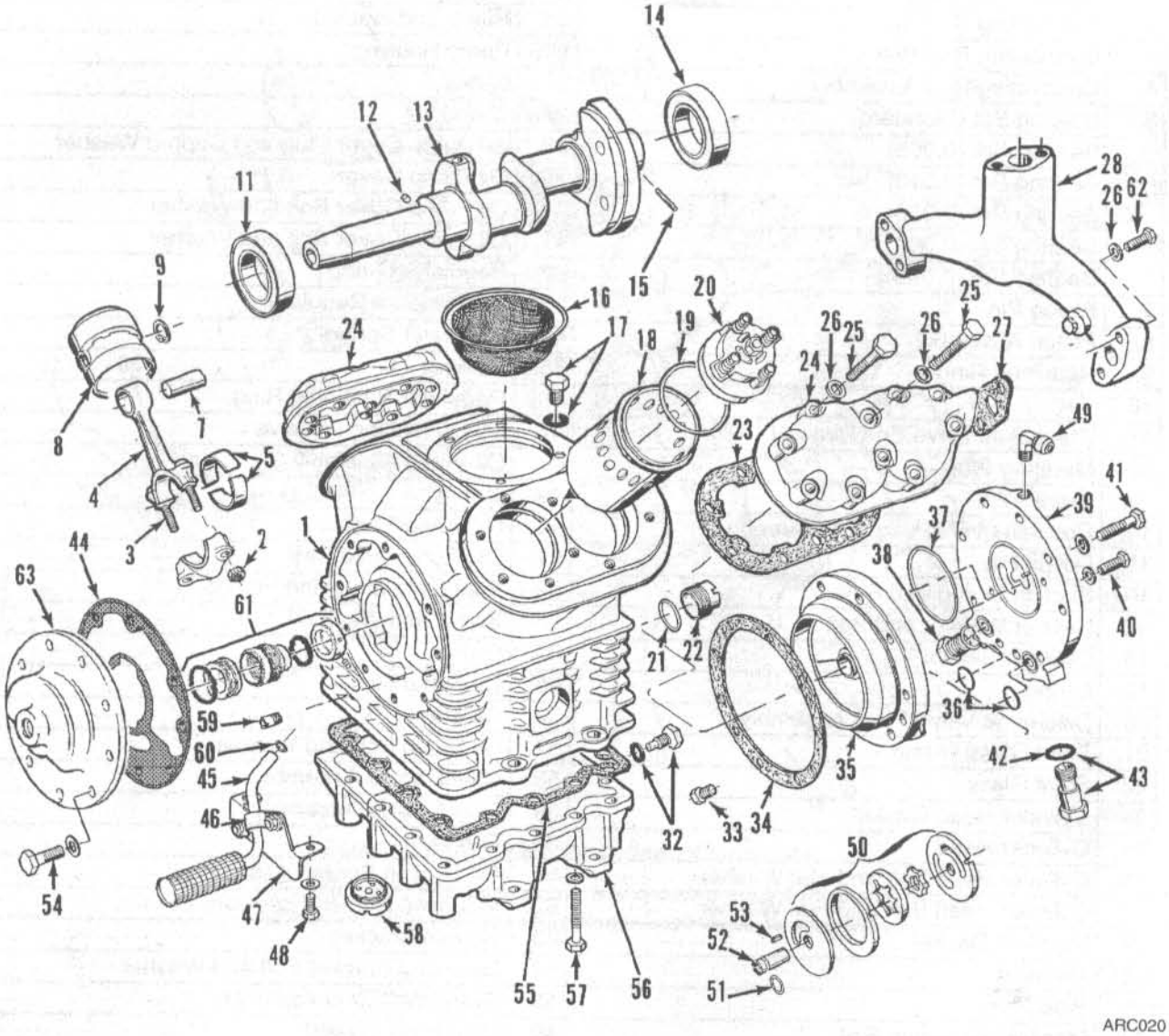


Figure 3: Late Style Four Cylinder Compressor

NOTE: The late style compressor has a metal bellows type shaft seal. Because of the various types of mounting required on different installations, the mounting flange and seal plate are made as a separate parts.

1.	Compressor Body		
2.	Connecting Rod Nut		
3.	Connecting Rod Bolt	32.	Magnetic Plug and O-ring
4.	Connecting Rod Assembly	33.	Check Valve Assembly
5.	Bearing Set (Standard)	34.	Pump End Gasket
	Bearing Set (0.005)	35.	Oil Pump Housing
	Bearing Set (0.010)	36.	O-ring
	Bearing Set (0.020)	37.	O-ring
	Bearing Set (0.030)	38.	Oil Pump Cover Plug and O-ring
	Bearing Set (0.005)	39.	Oil Pump Cover
7.	Piston Pin	40.	Oil Pump Cover Bolt and Washer
8.	Piston Assembly	41.	Oil Pump Cover Bolt and Washer
9.	Retaining Ring	42.	Regulator O-ring
11.	Crankshaft Drive End Bearing	43.	Oil Pressure Regulator
12.	Metering Plug	44.	Seal Plate Gasket
13.	Crankshaft	45.	Oil Pickup Tube and Screen
14.	Crankshaft Oil Pump End Bearing	46.	Oil Pickup Tube Clamp and Hardware
15.	Dowel Pin	47.	Oil Pickup Tube Mounting Bracket
16.	Suction O-ring and Screen	48.	Bolt and Lockwasher
17.	Oil Fill Plug and O-ring	49.	Oil Line Fitting or Valve
18.	Cylinder Sleeve	50.	Oil Pump Assembly
19.	O-ring	51.	O-ring
20.	Discharge Valve Plate Assembly	52.	Oil Pump Drive Shaft
21.	Sight Glass O-ring	53.	Oil Pump Drive Key
22.	Sight Glass	54.	Seal Plate Mounting Bolt
23.	Head Gasket	55.	Oil Sump Gasket
24.	Cylinder Head	56.	Oil Sump
25.	Cylinder Head Bolt Assembly	57.	Oil Sump Bolt
26.	Cylinder Head Bolt Assembly	58.	Check Valve Assembly
27.	Manifold Gasket	59.	Check Valve Assembly
28.	Manifold	60.	O-ring
		61.	Crankshaft Seal
		62.	Bolt
		63.	Seal Plate

Late Style Four Cylinder Compressor

Safety Precautions

GENERAL PRACTICES

1. ALWAYS WEAR GOGGLES OR SAFETY GLASSES. Refrigerant liquid and battery acid can permanently damage the eyes (see First Aid under Refrigeration Oil).
2. Never operate the unit with the compressor discharge valve closed.
3. Keep your hands clear of the fans and belts when the unit is running. This should also be considered when opening and closing the compressor service valves.
4. Make sure the gauge manifold hoses are in good condition. Never let them come in contact with a belt, fan motor pulley, or any hot surface.
5. Never apply heat to a sealed refrigeration system or container.
6. Fluorocarbon refrigerants, in the presence of an open flame or electrical short, produce toxic gases that are severe respiratory irritants capable of causing death.
7. Make sure all mounting bolts are tight and are the correct length for their particular application.
8. Use extreme caution when drilling holes in the unit. The holes may weaken structural components. Holes drilled into electrical wiring can cause fire or explosion.
9. Use caution when working around exposed coil fins. The fins can cause painful lacerations.
10. Use caution when working with a refrigerant or refrigeration system in any enclosed or confined area with a limited air supply (for example, a bus or garage). Refrigerant tends to displace air and can cause oxygen depletion, resulting in suffocation.
11. EPA Section 608 Certification is needed to work on refrigeration systems.

REFRIGERANT

Although fluorocarbon refrigerants are classified as safe refrigerants, certain precautions must be observed when handling them or servicing a unit in which they are used. When exposed to the atmosphere in the liquid state, fluorocarbon refrigerants evaporate rapidly, freezing anything they contact.

First Aid

In the event of frost bite, the objectives of First Aid are to protect the frozen area from further injury, to warm the affected area rapidly, and to maintain respiration.

- EYES: For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- SKIN: Flush area with large amounts of lukewarm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection/injury. Get medical attention. Wash contaminated clothing before reuse.
- INHALATION: Move victim to fresh air and use CPR or mouth-to-mouth ventilation, if necessary. Stay with victim until arrival of emergency medical personnel.

REFRIGERANT OIL

Avoid refrigeration oil contact with the eyes. Avoid prolonged or repeated contact of refrigeration oil with skin or clothing. Wash thoroughly after handling refrigeration oil to prevent irritation.

First Aid

In case of eye contact, immediately flush with plenty of water for at least 15 minutes. CALL A PHYSICIAN. Wash skin with soap and water.

Specifications

X214 COMPRESSOR

No. Cylinder	Two
Bore/Stroke	2.25 in. (57 mm)/1.75 in. (45 mm)
Cubic Inch Displacement	13.92 cu. in. (228 cm^3)
Weight	45 lbs (20 kg)

X418 COMPRESSOR

No. Cylinder	Four
Bore/Stroke	2.25 in. (57 mm)/1.62 in. (41 mm)
Cubic Inch Displacement*	18 cu. in. (295 cm^3)
Weight	78 lbs (35 kg)

X426 COMPRESSOR

No. Cylinder	Four
Bore/Stroke	2.25 in. (57 mm)/1.62 in. (41 mm)
Cubic Inch Displacement*	25.84 cu. in. (424 cm^3)
Weight	78 lbs (35 kg)

X430 COMPRESSOR

No. Cylinder	Four
Bore/Stroke	2.25 in. (57 mm)/1.88 in. (48 mm)
Cubic Inch Displacement	29.82 cu. in. (489 cm^3)
Weight	78 lbs (35 kg)

OPERATING CLEARANCES

	Inches	Millimeters
Crankshaft End Play @ 70 F (21 C)		
Bearing locked in bore	0.0070 to 0.0125	0.1778 to 0.3175
Bearing unlocked in bore	0.0070 to 0.0470	0.1778 to 1.1938
Connecting Rod Bearing To Crankshaft Rod Journal	0.0008 to 0.0024	0.0203 to 0.0610
Oil Pump Cover Clearance (distance below housing)	0.0010 to 0.0040	0.0254 to 0.1016
Piston to Sleeve	0.0018 to 0.0027	0.0457 to 0.0686
Piston Wrist Pin to Bushing	0.0001 to 0.0006	0.0025 to 0.0152
Unloader Check Valve to Bore	0.0020 to 0.0040	0.0508 to 0.1016
Unloader Piston to Bore	0.0020 to 0.0040	0.0508 to 0.1016

The X418 and X426 compressors have the same bore/stroke but differ in cubic inch displacement. This is accomplished by using different port locations in the cylinder sleeve. The closer the ports are to the top of the cylinder sleeve, the smaller the total displacement.

PART DIMENSIONS

		Inches	Millimeters
Connecting Rod Bearing Insert—Standard	I.D.	1.3755 to 1.3766	34.9377 to 34.9656
Crankshaft Rod Journal—Standard	O.D.	1.3742 to 1.3747	34.9047 to 34.9174
Compressor Body Main Bearing Bore	I.D.	3.9355 to 3.9370	99.9617 to 99.9998
Crankshaft Main Journal—Drive End	O.D.	1.7715 to 1.7719	44.9961 to 45.0063
Crankshaft Main Journal—Oil Pump End	O.D.	1.5746 to 1.5750	39.9948 to 40.0050
Cylinder Sleeve	I.D.	2.2495 to 2.2500	57.1373 to 57.1500
Piston	O.D.	2.2473 to 2.2477	57.0814 to 57.0916
Connecting Rod Wrist Pin Bushing—Standard	I.D.	0.6255 to 0.6258	15.8877 to 15.8953
Piston Wrist Pin—Standard	O.D.	0.6250 to 0.6252	15.8750 to 15.8801
Oil Pump Gerotor Assembly	Thickness	0.3430 to 0.3440	8.7122 to 8.7376
Oil Pump Inner Wear Plate	Thickness	0.1867 to 0.1873	4.7422 to 4.7574
Oil Pump Outer Wear Plate	Thickness	0.1867 to 0.1873	4.7422 to 4.7574
Check Valve—Unloader Head	O.D.	1.1240 to 1.1250	28.5496 to 28.5750
Piston—Unloader Head	O.D.	0.9970 to 0.9980	25.3238 to 25.3492
Bore in Unloader Head—Check Valve	I.D.	1.1270 to 1.1280	28.6258 to 28.6512
Bore in Unloader Head—Piston	I.D.	1.0000 to 1.0010	25.4000 to 25.4254

TORQUE VALUES

Location of Screw or Component	THREAD SIZE			TORQUE					
	Dia. in.	Pitch	Length in.	in-lb	ft-lb	kgm	Nm	Part No.	Req.
Cylinder Head	3/8	16	2-5/8	275	22.9	3.17	31.1	55-6806	8
Cylinder Head	3/8	16	2	275	22.9	3.17	31.1	55-6805	12
Cylinder Head w/Unloaders	3/8	16	1-1/8	275	22.9	3.17	31.1	55-9106	1
Cylinder Head w/Unloaders	3/8	16	4-1/8	275	22.9	3.17	31.1	55-6823	3
Cylinder Head w/Unloaders	5/16	18	1-1/8	150	12.5	1.73	17.0	55-681	3
Cylinder Head w/Unloaders	1/4	20	1-1/4	120	10.0	1.38	13.6	55-544	4
Center Screw in Large Check Valve Assembly	1/4	28	-	25	2.1	0.29	2.8	55-4281	1
Check Valve Assembly—Large	1-1/4 NEF	18	-	336	28.0	3.87	38.0	22-787	1
Check Valve Assembly—Upper	1/4 NPT	-	-	300	25.0	3.46	33.9	22-653	2
Check Valve Assembly—Lower	1/4 NPT	-	-	120	10.0	1.38	13.6	22-568	2
Connecting Rod Nut	5/16	24	-	300	25.0	3.46	33.9	55-1681	A/R
One Piece Seal Plate and Mounting Flange—Early Style Four Cylinder	3/8	16	1-5/8	335	28.0	3.86	3.79	55-2306	9
Mounting Flange—Late Style Four Cylinder	3/8	16	1-5/8	335	28.0	3.86	3.79	55-2306	6
Seal Plate—Late Style Four Cylinder	3/8	16	1-1/8	335	28.0	3.86	3.79	55-9106	3
Seal Plate—Four Cylinder without Mounting Flange	3/8	16	1-1/8	335	27.9	3.86	3.79	55-9106	9
Seal Plate—Two Cylinder	5/16	18	1-1/4	150	12.5	1.73	17.0	55-172	6
Sight Glass	-	-	-	600	50	6.91	67.8	22-350	A/R
Manifold	3/8	16	1-3/4	335	28.0	3.86	37.9	55-3641	4
Manifold	3/8	16	2-3/8	335	28.0	3.86	37.9	55-6822	4
Oil Drain Plug	5/8	18	-	450	37.5	5.18	50.9	55-6751	A/R
Oil Fill Plug	1/2	13	1	450	37.5	5.18	50.9	55-6750	1

TORQUE VALUES (CONTINUED)

Location of Screw or Component	THREAD SIZE			TORQUE					
	Dia. in.	Pitch	Length in.	in-lb	ft-lb	kgm	Nm	Part No.	Req.
Oil Pickup Tube Bracket	1/4	20	1/2	120	10.0	1.38	13.6	55-165	2
Oil Pickup Plug	5/8	18	-	450	37.5	5.18	50.9	55-6751	1
Oil Pressure Relief Valve	9/16	18	-	225	18.8	2.59	25.4	22-784	1
Oil Pump Cover/Housing	3/8	16	2-1/4	275	22.9	3.17	31.1	55-183	8
Oil Pump Cover	5/16	18	1-3/8	150	12.5	1.73	17.0	55-681	2
Oil Sump	3/8	16	3	335	27.9	3.86	37.9	55-1417	16
Oil Sump	3/8	16	1-1/4	335	27.9	3.86	37.9	55-129	16
Piston Head Nut, FlexLoc Type without Oil	5/16	24	-	160	13.3	1.85	1.80	-	A/R
Piston Head Nut, Flangenut Type with Oil	5/16	24	-	130	10.8	1.50	14.7	55-318	A/R
Throttling Valve Body	3/8	16	1-1/8	275	22.9	3.17	31.1	55-9106	4
All Other Bolts	5/16	18	-	150	12.5	1.73	17.0	-	A/R
All Other Bolts	3/8	16	-	275	22.9	3.17	31.1	-	A/R

NOTE: Torque (in-lb) x 0.08333 = torque (ft-lb)
Torque (in-lb) x 0.01152 = torque (kgm)
Torque (in-lb) x 0.1130 = torque (Nm)

General Compressor Repair Techniques

Because of the various refrigeration unit models a given compressor may be used on, no attempt is being made in this manual to show a removal procedure. This manual assumes that the compressor has been removed properly in accordance to the maintenance manual for the appropriate model.

This manual does cover the drive coupling removal and re-installation. The illustrations used are typical, your installation may vary from what is shown.

DIRT AND MOISTURE CAN EASILY RUIN COMPRESSORS!

Compressors are assembled at the factory in special clean rooms with filtered, conditioned air. Field conditions will not always allow factory clean repair areas but every effort should be taken to keep the compressor work area as clean as possible. Follow these rules to protect compressors from dirt and moisture.

- Pump down the system and recover the refrigerant in compliance with Federal, State and local regulations.
- Use dry nitrogen to break the vacuum. This prevents dirt and moisture from getting into the compressor.
- Use cap plugs or tape instead of rags to cover compressor openings as soon as vibrasorbers or service valves are removed. Poloyol ester oil draws in moisture like a sponge and rags will not stop moisture from entering the compressor.
- Remove all dirt and debris from the compressor prior to disassembly.
- Work in a clean, closed area. Stay away from open doors or windows that allow dirt to blow in parts cleaning areas, grinding areas and bead blasting machines.
- Keep your tools and workbench spotless. Keep your hands as clean as possible.
- Once the compressor is opened to the atmosphere, get the job done quickly. Plan ahead. Have your parts and tools ready.
- Only use chemical solvents that leave no oily residue, such as naphtha, lacquer thinner, or brake cleaner to clean compressor components. **Do Not Bead Blast compressor components clean.**
- If the job must be interrupted, cover the compressor. A fresh, clean piece of plastic sheeting wrapped tightly around the compressor is best. Cloth should not be used as it does not block moisture.
- Be sure to use the correct oil to prevent contamination of the system.
- Always keep your refrigeration oil capped. A few minutes with the cap off can ruin it!
- Do not dip seal parts in oil. Containers of oil used for dipping parts sit open and collect moisture, dirt and dust. Instead, use a small, clean oil can dedicated for use only with the correct oil for the compressor you are repairing.
- Discard all the old O-rings and gaskets that are exposed while working on the compressor. O-rings and gaskets should not be reused. Replace them with new ones.

COMPRESSOR OIL INDICATIONS

Discoloration of the oil is an indication of a contaminated system and future problems. Refer to the following compressor Oil Color Code to diagnose the conditions and correct it.

COMPRESSOR OIL COLOR CODE

COLORLESS or LIGHT YELLOW. Indicates good compressor oil.

BLACK OIL. Indicates carbonization caused by air in the system or the presence of wear particles that contain iron. Change the compressor oil and oil filter.

LIGHT BROWN OIL. Use an acid test kit to test the acidity of a sample of the compressor oil. For alkyl benzine oil use acid test kit P/N 203-346. For polyol ester oil use acid test kit P/N 203-518. Change the compressor oil if the test indicates the oil is acidic.

BROWN OIL. Indicates copper plating caused by moisture in the system. Air in the system or high compressor temperatures can cause oxidation which will turn the oil brown. Change the compressor oil if the test indicates the oil is acidic

GRAY OR METALLIC OIL. Indicates the presence of wear particles that contain aluminum. This is usually caused by bearing wear or piston scoring. The compressor should be disassembled and inspected for worn or damaged components. The oil and oil filter should be changed.

GREEN OIL. Green compressor oil indicates there is water in the system and copper plating may have occurred. The compressor should be disassembled and the shaft seal, bearings, gears, and rotors should be inspected. Parts with significant copper plating should be replaced, the oil separator should be replaced, and the oil and oil filter should be changed.

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 rings and break down the refrigerant and affects 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 or the use of suction filters 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. See TK 40229 "Clean-up of Refrigeration Systems with Thermo King Compressors."

Disassembly and Reassembly

The following are suggested sequences for a full disassembly and reassembly of the compressor.

CAUTION: When servicing compressors, make sure all parts are reinstalled in their original locations. Carefully mark similar components, and pay special attention to fastener length to ensure they are reinstalled correctly.

DISASSEMBLY SEQUENCE

1. Remove drive coupling.
2. Drain residual oil.
3. Remove manifold (four cylinder compressors only).
4. Remove head, or heads from compressor body.
5. Remove discharge valve plates from cylinders.
6. Remove seal plate/mounting flange and crankshaft seal.
7. Remove oil sump and oil pickup screen.
8. Remove connecting rods, pistons and sleeves.
9. Remove oil pump.
10. Remove crankshaft.
11. Remove check valves.

REASSEMBLY SEQUENCE

1. Install check valves.
2. Install crankshaft.
3. Install oil pump.
4. Install connecting rods, pistons and sleeves.
5. Install oil pickup screen.
6. Install oil sump.
7. Install discharge valve plates.
8. Install head, or heads and manifold.
9. Install crankshaft seal and seal plate/mounting flange.
10. Install drive coupling.

FASTENER TORQUE PROCEDURE

Use the following procedure when specific steps are not provided.

1. Carefully remove any remaining gasket material and clean both gasket surfaces thoroughly.
2. Always use a new gasket and coat the gasket with clean compressor oil just prior to assembly.
3. Install all bolts (and washers) and pre-tighten to 70% of the recommended torque, following a criss-cross pattern.
4. Use a hand torque wrench and the same criss-cross pattern to bring all bolts to final torque. Hold bolts "On Torque" for a few seconds.

CLEANING COMPONENTS

CAUTION: Do not bead blast compressor components clean. The abrasive media can become embedded in castings, free itself during compressor operation, and damage the compressor. Only use chemical solvents that leave no oily residue, such as naphtha, lacquer thinner, or brake cleaner to clean compressor components. Crocus cloth may be used to remove rust or oxidation from external compressor components

DRIVE COUPLING

Removal

There are several different types of drive couplings and clutches used on the four cylinder compressors in units

manufactured by Thermo King, but they are all held on by a single bolt threaded into the end of the compressor crankshaft. Once this bolt is removed, the coupling or clutch can be removed from the shaft. Remove the bolt and then use a puller to remove the coupling or clutch.

CAUTION: Use a puller to remove the drive coupling or pulley from the crankshaft. Puller (P/N 204-139) or puller with handle (P/N 204-991) are available for use on compressor couplings with threaded holes. DO NOT use a hammer to pound the coupling or pulley off. This will damage the compressor.

Installation

Thermo King employs a tapered joint to secure the drive coupling or drive pulley to the compressor shaft. This has two advantages: first it prevents any looseness that might occur as when using a sliding fit on a shaft. The second advantage is that when torqued properly the friction between the two tapers can be used to drive the compressor under most loads.

A key is used in the tapered joint to guarantee proper positioning of the coupler to the compressor, and to the engine or drive pulley. Using a key can also prevent slippage between the taper surfaces in case of extreme shock loads. If the tapers are allowed to slip, galling of the surfaces occurs. Galled surfaces make disassembly difficult, and reassembling galled parts will not assure proper alignment.

Keyways are cut with a tool which leaves a radius at the end of the keyway. If the key being installed is pushed onto the radius at the end of the keyway, the taper will not seat properly and the coupling will wobble. This causes stress to be put on the crankshaft and reduces its life. Make sure keys are of the correct length to fit entirely in their respective keyway prior to installation.

The following procedure should be used to install a compressor coupling onto the compressor shaft.

1. Clean the compressor shaft and taper and the tapered bore of the coupling with a solvent that leaves no oily residue, such as naphtha, lacquer thinner, brake cleaner or the like.

2. Inspect both mating surfaces for burrs, oxidation and other surface imperfections. Dress with crocus cloth if necessary and reclean as required.

NOTE: Do not sand or lap the tapered area as component fracture may result.

3. Using no lubricants, set the coupling on the crankshaft and align the keyway using the Keyway Tool (P/N 204-972). Insert the tapered end of the tool into the keyway and gently move the coupling on the shaft while pressing the tool into the keyway. This will align the keyway in the crankshaft with the keyway in the coupler.

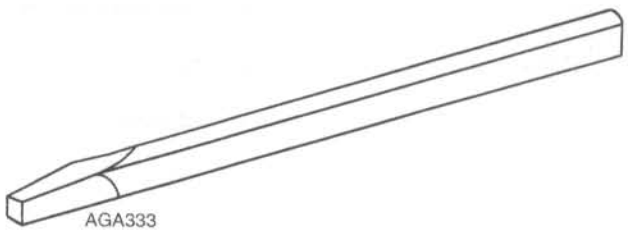
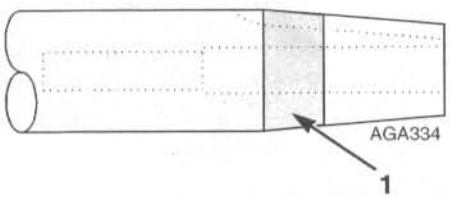


Figure 4: Keyway Tool P/N 204-972

CAUTION: If you are assembling a used coupler or crankshaft and the tool does not fit easily there is a problem with one of the keyways! Do not remove the coupler and place the key in the crankshaft keyway and then drop the coupler on. If the tool does not fit, the key will not fit, and it will hold the taper in the coupling off the taper on the shaft. Check both keyways for burrs or corrosion. A key can be coated with fine lapping compound and used as a lapping tool to clean the keyways. Clean the key and keyway with solvent before final installation.

4. Remove the Keyway Tool and check the fit of the new key. It should fit into the keyway with a light press fit requiring only a minimum of light tapping. If the key does not fit properly, remove the coupling and inspect the keyways and key for burrs or other problems. Recheck the fit as shown above.

5. When the key fits properly, remove the coupling from the crankshaft and apply a very thin even coating of blue Loctite 242 to the back one third of the taper for the 1.0 in. diameter crankshaft. Do not use Loctite on the taper for the 1.187 in. diameter crankshaft taper because it makes it very difficult to remove the coupling later.



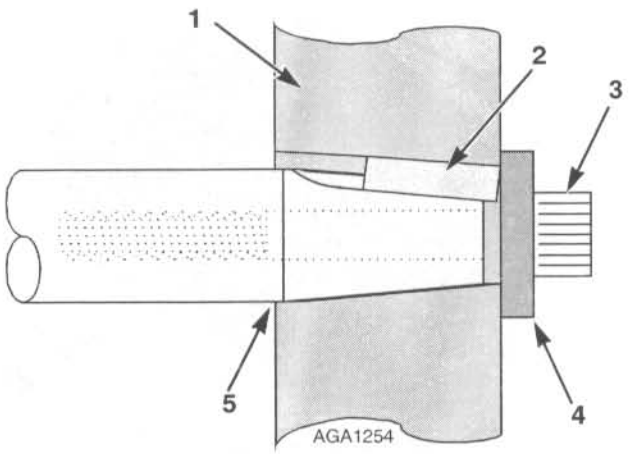
1.	Coat area shown with Blue Loctite 242.

Figure 5: Compressor Shaft

6. Re-install the coupling and align the keyways with the Keyway Tool.

7. Do not install the key at this time. Install the flatwasher and bolt and pre-torque to 20 ft-lbs (27 Nm). Remove the bolt and washer.

8. Install the key in the keyway. It should fit with a light press fit requiring only a minimum of light tapping. Do not install the key into the keyway beyond the front face of the coupling. If tapped in further, it may cause the coupler to move off center on the crankshaft.



1.	Coupling or Clutch
2.	Key tapped flush with outside of coupling. Do not tap key any farther into keyway.
3.	Bolt
4.	Washer
5.	Spray this area with corrosion inhibitor after assembling.

Figure 6: Compressor Coupling Installation

9. Install the bolt and washer and torque the bolt as shown in "Coupling Bolt Torque Specifications" below.

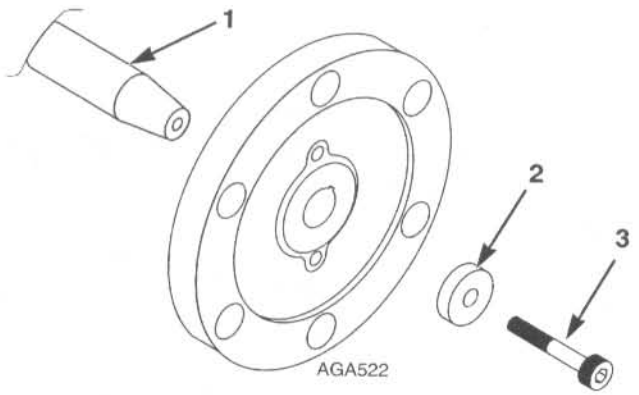
10. Spray a corrosion inhibitor on the exposed part of the crankshaft after tightening the coupling bolt.

Coupling Bolt Torque Specifications

The couplings used on Thermo King compressors will fall into three groups described by the figures below. Depending on when they were manufactured, they may have either 6 pins or 8 pins.

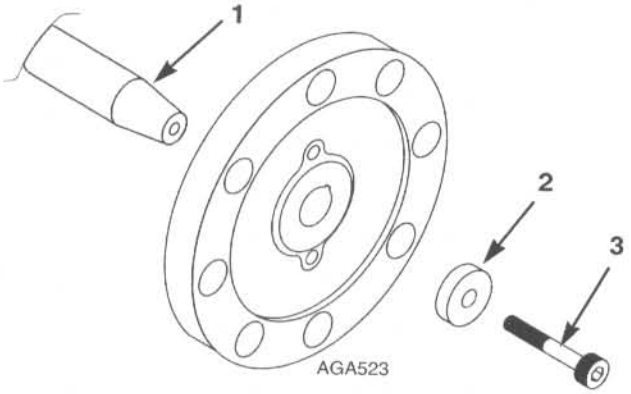
If a black washer is found when the coupling is removed from compressors with 1.0 in. diameter crankshafts, the

washer should be replaced with a silver washer P/N 77-2498. Torque to 54 ft-lb (73 Nm).



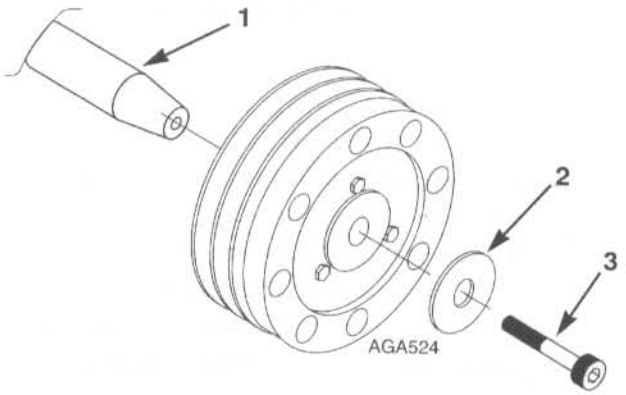
1.	1.0 in. Diameter Crankshaft
2.	0.23 in. Thick Silver Washer P/N 77-2498
3.	3/8-16 in. Bolt—Torque to 54 ft-lb (73 Nm)

Figure 7: Small Crankshaft Installation



1.	1.187 in. Diameter Crankshaft
2.	0.23 in. Thick Silver Washer P/N 77-2505
3.	M12 X 1.75 Metric Bolt—Torque to 90 ft-lb (122 Nm)

Figure 8: Large Crankshaft Installation



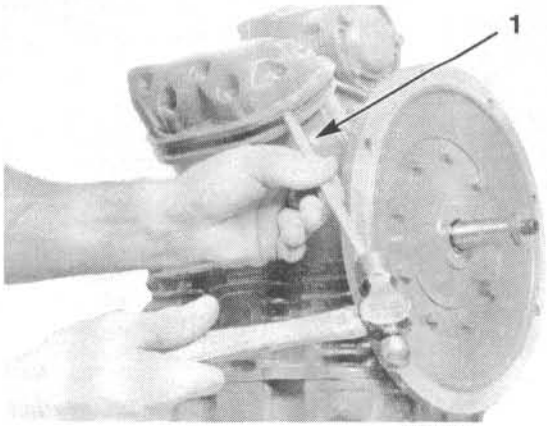
1.	1.0 in. or 1.187 in. Diameter Crankshaft
2.	Thin Washer P/N 55-4002 for 1.0 in. Crankshaft P/N 55-9232 for 1.187 in. Crankshaft
3.	3/8-16 in. Bolt—Torque to 45 ft-lb (61 Nm) for 1.0 in. Crankshaft M12 X 1.75 Metric Bolt—Torque to 90 ft-lb (122 Nm) for 1.187 in. Crankshaft

Figure 9: Clutch Installation

CYLINDER HEAD

Removal

1. Four Cylinder Only—Remove the manifold bolts and manifold.
2. Remove all head bolts.
3. Tap the head with a soft hammer or a soft punch to loosen the head. Remove the head.



1.	Soft Punch

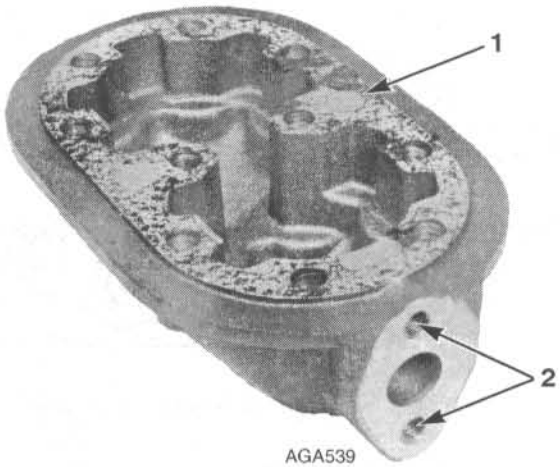
Figure 10: Cylinder Head Removal

CAUTION: Do not pry on head or wedge any object between head and block.

4. Carefully remove any gasket material from the crankcase or cylinder head.

Repair

1. Check all gasket surfaces for cracks, deep scratches, pitting, or anything that may prevent proper sealing.
2. Check head for warping with straight edge. The maximum allowable warpage is 0.0005 in. over any 2 in. span, or a total of 0.002 in. over the entire head. To maintain critical alignment of assembled components, Thermo King does not recommend resurfacing cylinder heads.
3. Inspect all thread holes for striped threads. Do not use threaded inserts (Helicoils) to repair damaged threads.



1.	Inspect Surface
2.	Check Threads

Figure 11: Inspection of Cylinder Head

Installation

1. Apply clean refrigerant oil to the gaskets.
2. Two Cylinder Only—Install the cylinder head gasket and head with all the bolts assembled loosely. Tighten the bolts in a criss-cross pattern to 70% of recommended torque. See "Torque Values" on page 3. Use a hand torque wrench to tighten the head bolts to final torque.
2. Four Cylinder Only—Install the gaskets, cylinder heads, and discharge manifold with all bolts assembled loosely. Tighten the discharge manifold bolts in a criss-cross pattern to 70% of final torque. See "Torque Values" on page 3. Tighten the cylinder head bolts in a criss-cross pattern to 70% of recommended torque. See "Torque Values" on page 3. Use a hand torque wrench to tighten the cylinder head bolts to final torque. Use a

hand torque wrench to tighten the discharge manifold bolts to final torque.

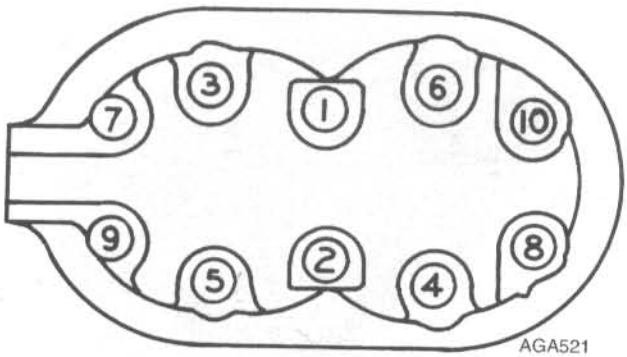


Figure 12: Cylinder Head Torque Sequence

DISCHARGE VALVE PLATES

Removal

1. Remove the cylinder head. See "Cylinder Head" on page 11.
2. After removing the head and gasket, remove the discharge valve plates. It may be necessary to turn the valve plate slightly clockwise to loosen it.

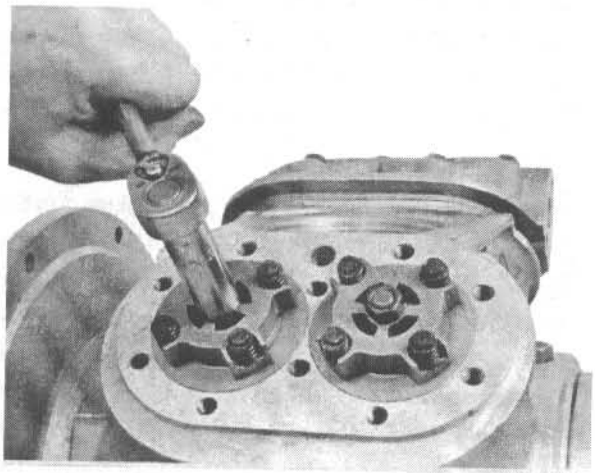


Figure 13: Valve Plate Removal

3. When the valve plate is free, turn it by hand and lift it straight out of the compressor body. The discharge valve assembly can skew and wedge itself into the compressor body during removal. If this happens, gently tap the assembly back into the cylinder and start over.

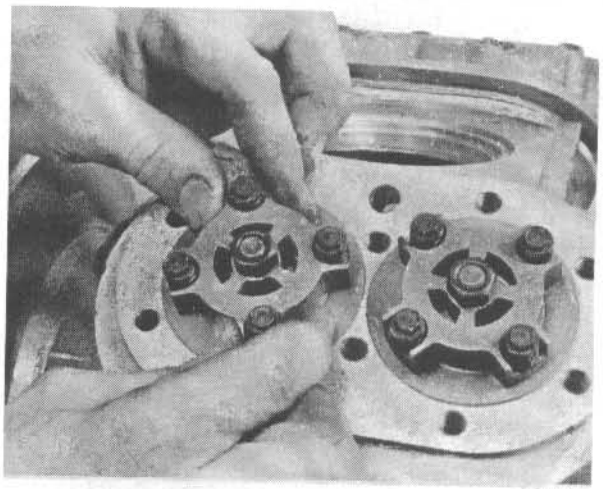


Figure 14: Valve Plate Removal or Installation

4. Remove and discard the O-rings.

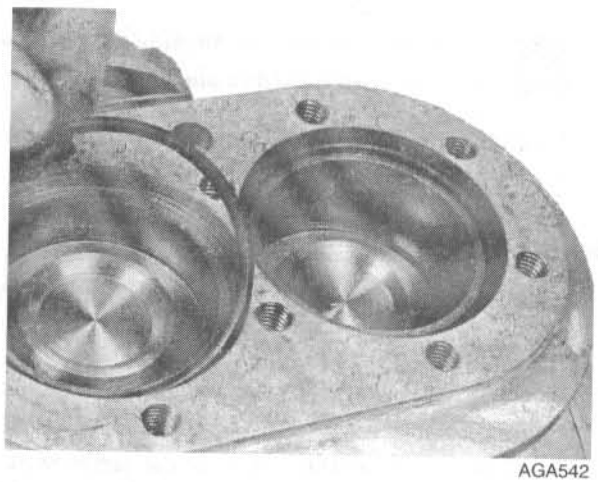
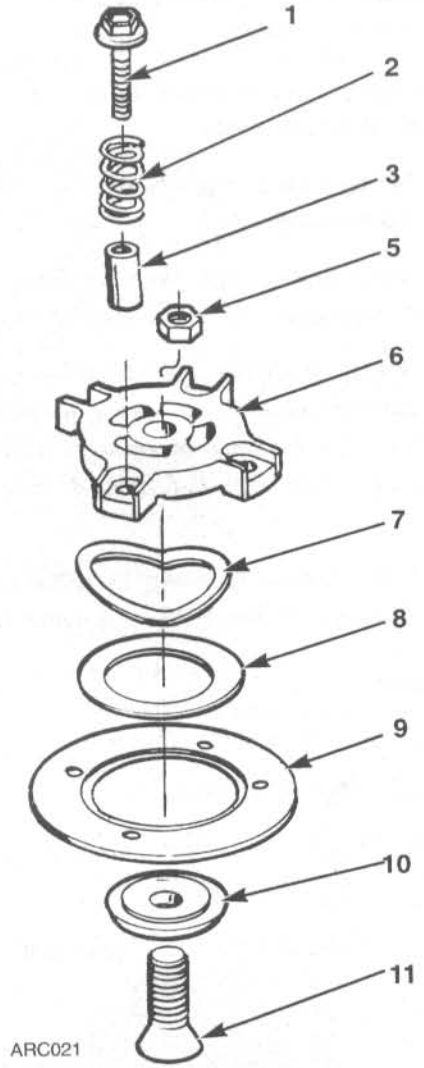


Figure 15: O-ring Location



1.	Bolt	7.	Wave Washer
2.	Spring	8.	Ring Valve
3.	Sleeve	9.	Support
5.	Hex Nut	10.	Plate
6.	Cage	11.	Support Screw

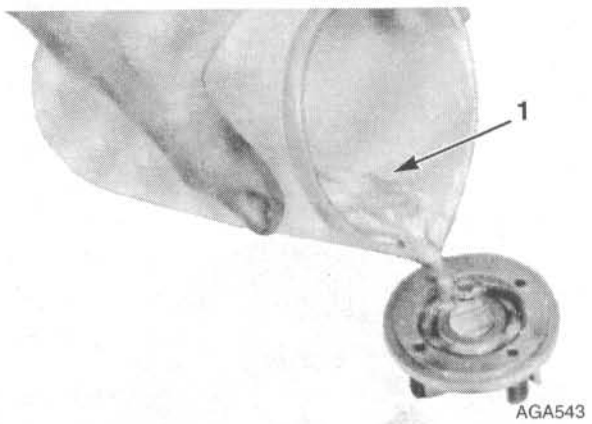
Figure 16: Valve Plate

NOTE: Parts shown for reference only. Valve plate is sold only as assembled unit.

Repair

NOTE: Valve plates must seal completely or the compressor will lose capacity.

1. Inspect the cage, ring valve, valve spring, and retainer for wear or damage.
2. Valve plates may be tested by pouring clean fluid (Stodard solvent) into the depression of the valve plate. The solvent should not leak through. If the valve plate assembly is worn, damaged or leaks, replace it with a new assembly. Remove all traces of solvent before installing the valve plate assembly.



1.	Solvent

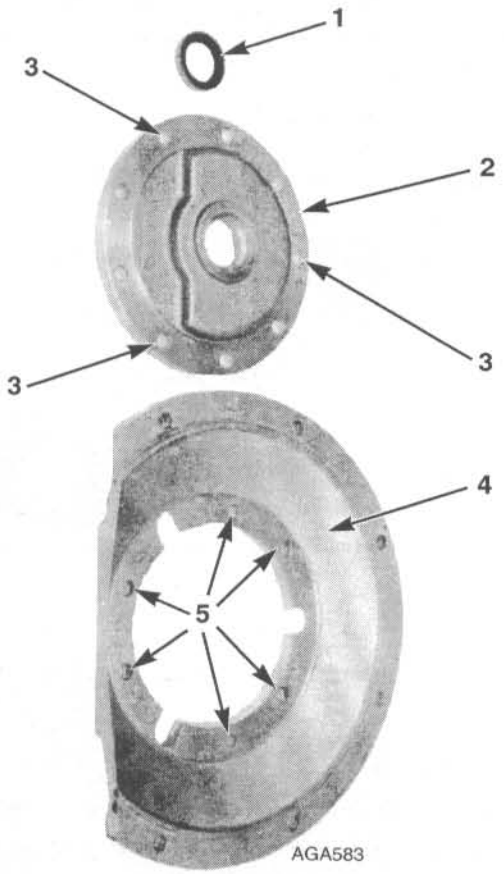
Figure 17: Testing Valve Plate Assembly for Leakage

Installation

1. Apply clean refrigerant oil to the new O-rings and install them in the compressor body above the cylinder sleeve. See "Figure 15: O-ring Location" on page 12.
2. Apply clean refrigerant oil to the valve plate assembly and install the valve plate assembly. Turn it slightly to prevent binding. See "Figure 14: Valve Plate Removal or Installation" on page 12.
3. Install the cylinder heads. See "Installation" on page 11.

TWO-PIECE COMPRESSOR SEAL PLATE AND MOUNTING FLANGE ASSEMBLY

In the third quarter 1988 the compressor seal plate/mounting flange was changed to a two-piece assembly. This change allows removal of the mounting flange without losing the refrigeration charge. The two-piece assembly uses nine bolts, six mount the flange, and three mount the seal plate.



1.	Dust Seal (Lip Seal)
2.	Seal Plate
3.	Three Seal Plate Mounting Holes.
4.	Mounting Flange
5.	Six Mounting Flange Holes

Figure 18: Two-Piece Seal Plate/Mounting Flange

SEAL PLATE ASSEMBLY

Over the past several years the following three types of seals have been used to seal the drive end of the crankshaft from leaking refrigerant.

- Spring Loaded Neoprene Bellows Type—Two Cylinder Compressors
- Metal Bellows Type With Set Screws—Four Cylinder Compressors with 1.0 in. diameter crankshafts

  NOTE: Early four cylinder compressors with 1.0 in. diameter crankshafts used a neoprene bellows seal. These seals should be replaced with a metal bellows type if using R404A, R407C, R134A, or R22 refrigerants.
- Metal Bellows Type With Drive Tangs—Four Cylinder Compressors with 1.187 in. diameter crankshafts

Removal

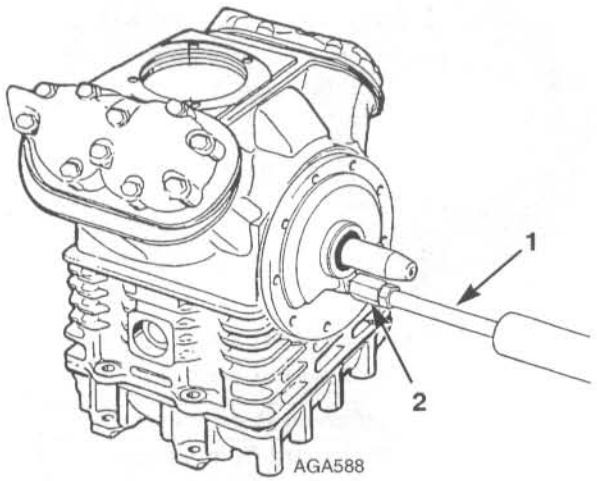
1. Remove the Seal Plate/Mounting Flange.

   Two-Piece Seal Plate/Mounting Flange Only

   a. Remove the six mounting flange bolts and remove the mounting flange.

   b. Use a slide hammer to remove the seal plate.

NOTE: Use slide hammer P/N 204-638 and adapter P/N 204-640 to obtain the 5/16-18 male thread needed to fit the seal plate.

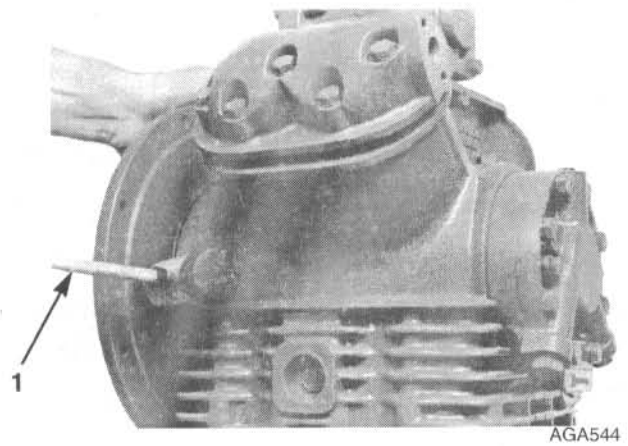


1.	Slide Hammer
2.	Adapter P/N 204-640

Figure 19: Two-Piece Seal Plate Removal

One-Piece Seal Plate/Mounting Flange Only

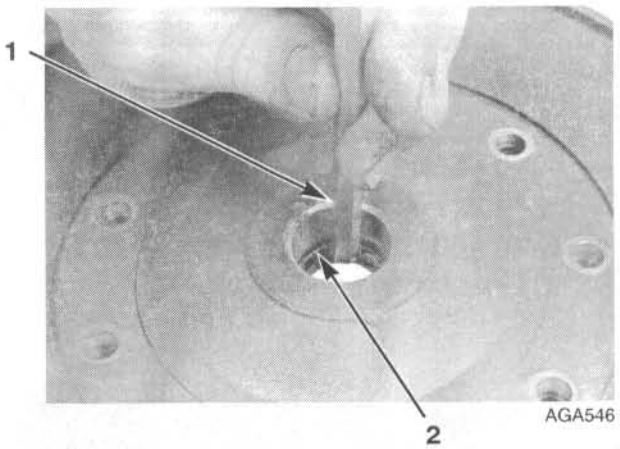
a. Remove the seal plate bolts. Tap the seal plate with a soft hammer or soft punch to remove the seal plate.



1.	Tap Lightly

Figure 20: One-Piece Seal Plate Removal

2. Place the seal plate gasket side down on a work bench and push the hard ring out of the seal plate.



1.	Punch
2.	Hard Ring

Figure 21: Hard Ring Removal

3. Metal Bellows Type Seal With Set Screws Only—Loosen the set screws that fasten the seal to the crankshaft.

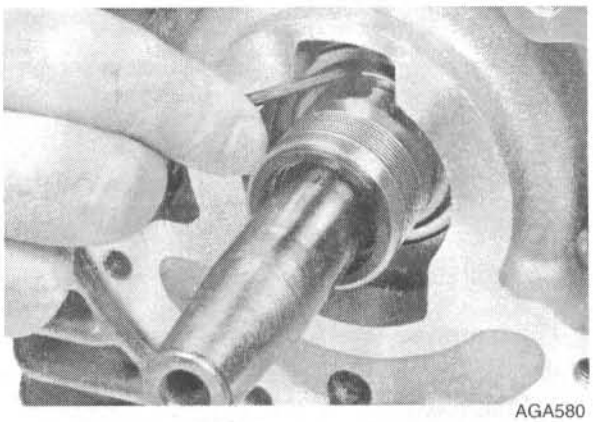


Figure 22: Set Screw Location

NOTE: A modified (shortened) 3mm or 1/8 inch Allen wrench is needed to loosen the set screws. New seals are shipped with a modified 1/8 inch Allen wrench. Make sure the wrench fits squarely into the bottom of

the socket hole before attempting to loosen the set screws.

Figure 23: Special Allen Wrench

4. Remove the bellows assembly from the shaft by prying evenly on each side with small pry bar.

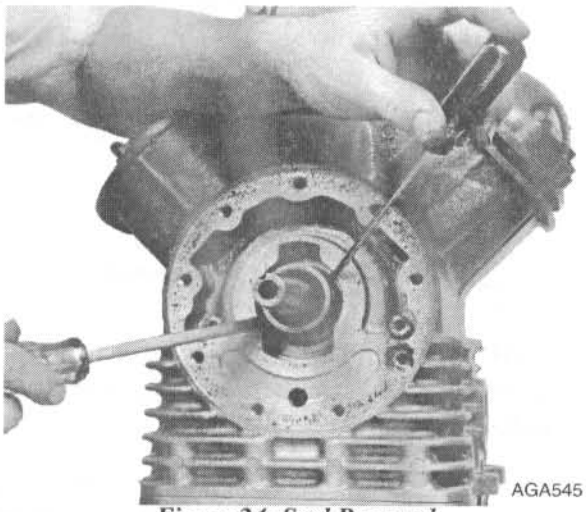


Figure 24: Seal Removal

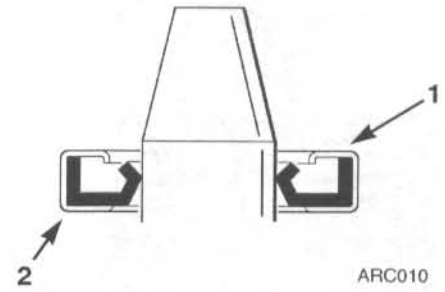
5. Discard all seal parts.

Repair

1. Clean all parts thoroughly to remove all oil and gaskets.
2. Polish the crankshaft with crocus cloth if it is rusted or dirty. Do not allow abrasives to contaminate the compressor.
3. Inspect each side of the crankshaft for flatness with a straight edge. No light should be visible between the shaft and the straight edge (especially in the bearing contact areas).

Installation of Spring Loaded Neoprene Bellows Type Seal

1. Install the lip seal in the seal plate with the lip side facing out and the flat side facing toward the compressor.



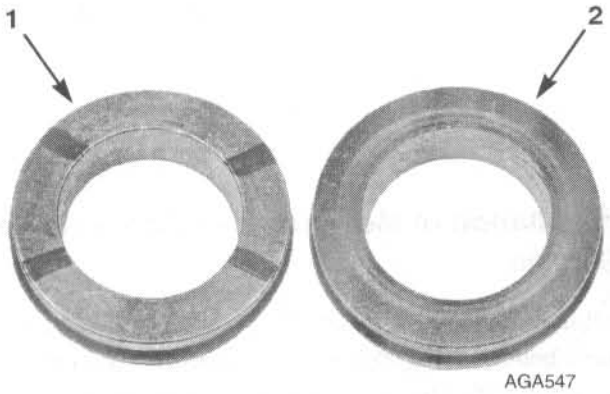
1.	Lip Side Facing Out
2.	Flat Side Toward Compressor

Figure 25: Lip Seal Installation

NOTE: Some early style seal plates do not use the lip seal.

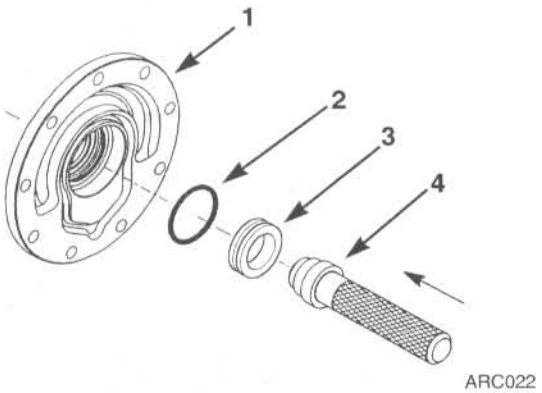
2. Install a new O-ring onto the new neoprene seal and apply clean compressor oil to the seal assembly. Ensure that the installation tool (P/N 204-953) is clean. Use the installation tool to push the seal (with the polished surface toward the installation tool) fully into the seal plate.

   If the insertion tool is not available, use the pad in the new seal packaging to protect the polished surface of the seal during assembly.



1.	This Side Toward Seal Plate
2.	This Side Toward Compressor

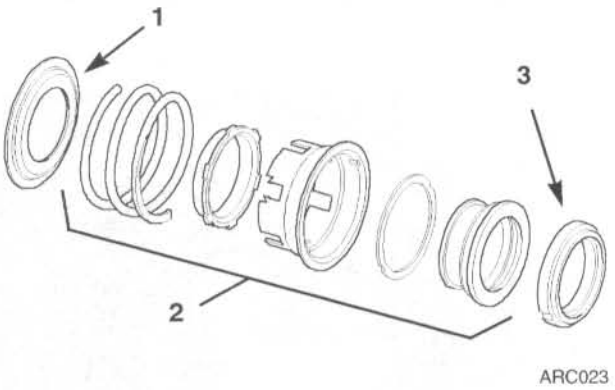
Figure 26: Hard Ring Positions



1.	Seal Plate
2.	O-ring
3.	Neoprene Seal—Install with Polished Surface Toward Compressor
4.	Installation Tool P/N 204-953

Figure 27: Hard Ring Installation

CAUTION: Do not touch the hard ring or the carbon ring surface (bronze seal for.875" shaft compressors) with your hands, hold them by the edges.

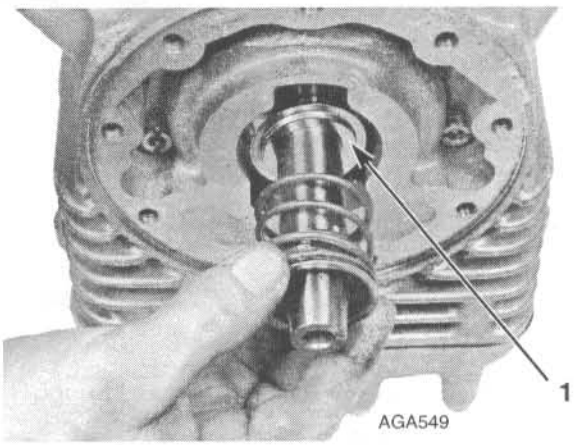


1.	Centering Washer
2.	Bellows Assembly
3.	Primary Ring

Figure 28: Spring Loaded Neoprene bellows Type Seal

NOTE: Steps 3 through 6 must be performed within 30 seconds to keep the neoprene inside the bellows assembly from bonding to the crankshaft.

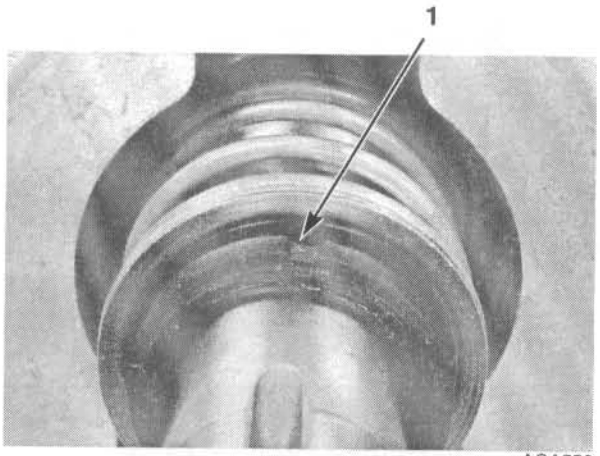
3. Apply refrigerant oil to the bellows assembly and install the centering washer, the spring, and the bellows assembly.



1.	Centering Washer

Figure 29: Seal Assembly Installation

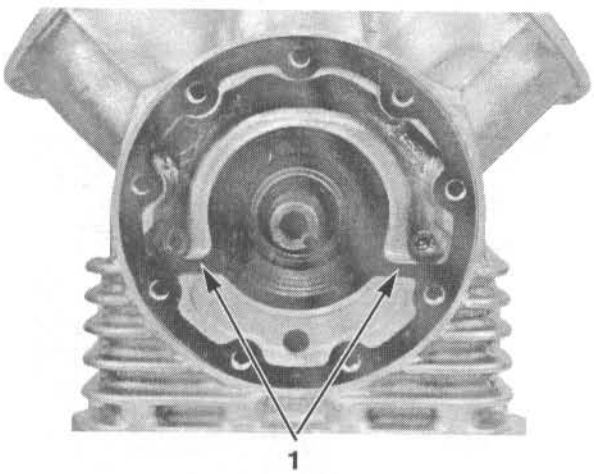
4. Apply refrigerant oil to the primary ring and place it in the bellows. Make sure to align the notches.



1.	Notch Must Line Up

Figure 30: Align Primary Ring

5. Apply refrigerant oil to the front gasket and place it on the compressor body.



1.	Gasket Must Seal Here

Figure 31: Gasket Positioning

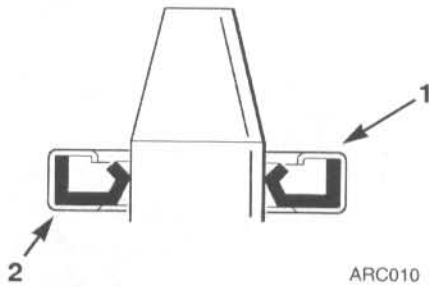
6. Install the seal plate on the compressor. Hold the seal plate against the spring tension of the bellows until bolts are snug.

7. Torque the seal plate bolts in two steps using a criss-cross pattern. See "Torque Values" on page 3.

Installation of Metal Bellows Seal with Set Screws

In May of 1992 Thermo King Corporation introduced a new metal bellows crankshaft seal. The current service part number is 22-1100. The current replacement procedure follows:

1. Install the new lip seal in the seal plate with the lip side facing out and the flat side facing toward the compressor.

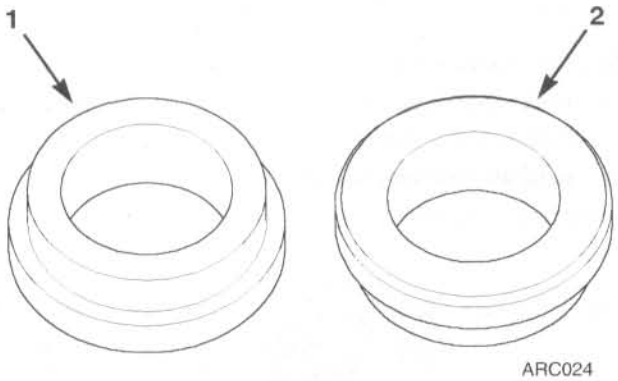


1.	Lip Side Facing Out
2.	Flat Side Toward Compressor

Figure 32: Lip Seal Installation

2. Apply clean compressor oil to the new O-ring and install it in the seal plate. Apply clean compressor oil to the new hard ring. Ensure that the hard ring installation tool (P/N 204-953) is clean. Use the hard ring installation tool to push the hard ring (with the polished sur-

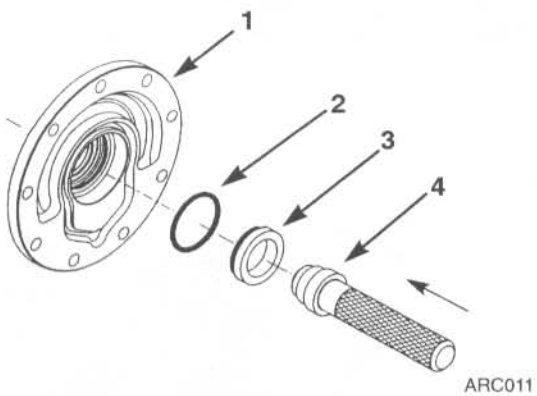
face toward the installation tool) fully into the seal plate. Do not pinch the O-ring.



1.	This Side Toward Seal Plate
2.	This Side Toward Compressor

Figure 33: Hard Ring Positions

If the installation tool is not available, use the pad in the new seal packaging to protect the polished surface of the hard ring during assembly.



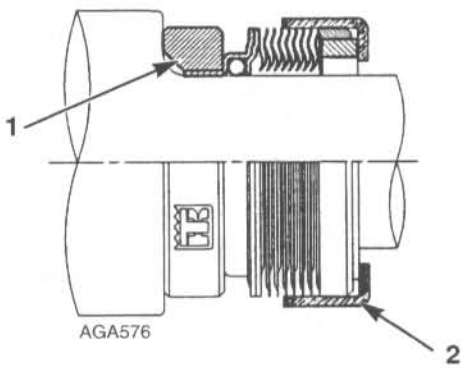
1.	Seal Plate
2.	O-ring
3.	Hard Ring—Install with Polished Surface Toward Compressor
4.	Hard Ring Installation Tool P/N 204-953

Figure 34: Hard Ring Installation

CAUTION: Do NOT touch or damage the polished seal face surfaces.

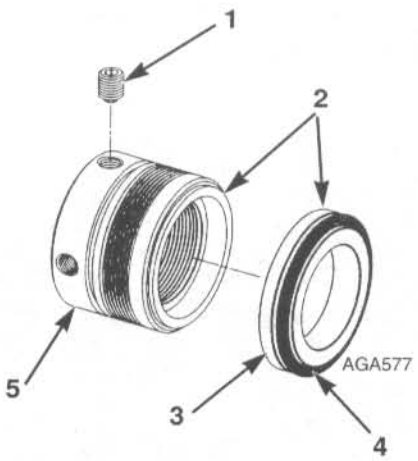
3. Back out the set screws from the new seal and apply a small amount of removable thread locking compound (Loctite 242-31-blue P/N 203-400) to the set screw threads.

CAUTION: Keep the orange protective cap in position until final assembly.



1.	Clamp Ring
2.	Orange Protective Cap

Figure 35: Cross Section of Set Screw Type Bellows Seal

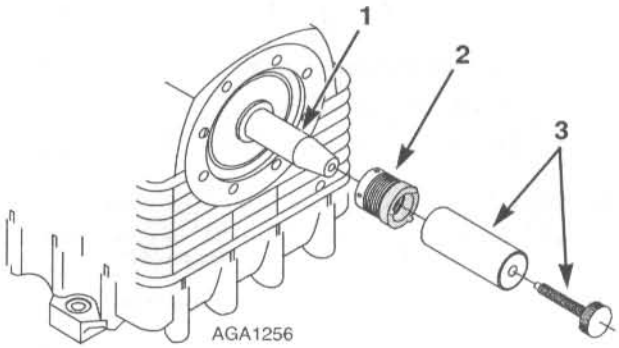


1.	Set Screw
2.	Seal Faces
3.	Hard Ring
4.	O-ring
5.	Bellows

Figure 36: Set Screw Type Bellows Seal

4. Apply clean compressor oil to the O-ring inside the bellows and place the bellows on the crankshaft. Leave the orange protective cap on the bellows.

5. Use seal installation tool P/N 204-995 to install the bellows squarely on the crankshaft. Clean the seal installation tool and place it on the crankshaft. Turn the knob until the tool bottoms out.



1.	Crankshaft
2.	Bellows
3.	Seal Installation Tool P/N 204-995

Figure 37: Bellows Installation with Tool P/N 204-995

6. Tighten the set screws to approximately 45 in.-lb (5.0 Nm) with the Allen wrench provided.

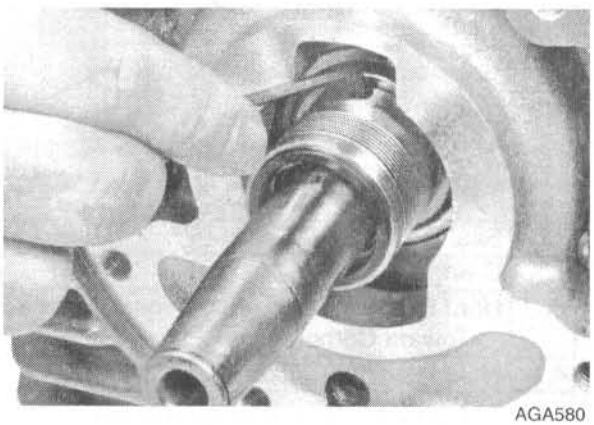


Figure 38: Set Screw Location

7. Remove the seal installation tool.

8. Remove the orange protective cap. Clean the hard ring and the primary ring (bronze ring) with the alcohol wipes found in package labeled "1". Then clean the polished mating surfaces of both rings with the lint free dry wipes from package number "2". Apply clean compressor oil to the polished surfaces of the seal, the lip seal, and the seal plate gasket from package number "3" before assembling.

   CAUTION: Oil applied to the seal faces must be absolutely clean.

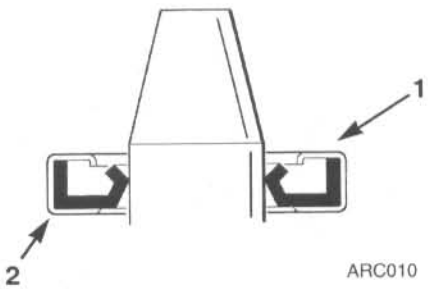
9. Install the seal plate and gasket to the compressor body. Do not bump the seal hard ring on the end of the crankshaft during assembly.

10. Install the seal plate mounting bolts and washers. Torque the seal plate bolts in two steps using a criss-cross pattern. See "Torque Values" on page 3.

Installation of Metal Bellows Seal with Drive Tangs

In August of 1998 Thermo King introduced a new crankshaft with a larger input shaft which afforded more surface area on the coupling taper. At the same time a new method of attaching the bellows to the crankshaft was implemented. The new crankshaft is machined with two flat surfaces and the new bellows has two tangs which slide over these surfaces. The current replacement procedure follows:

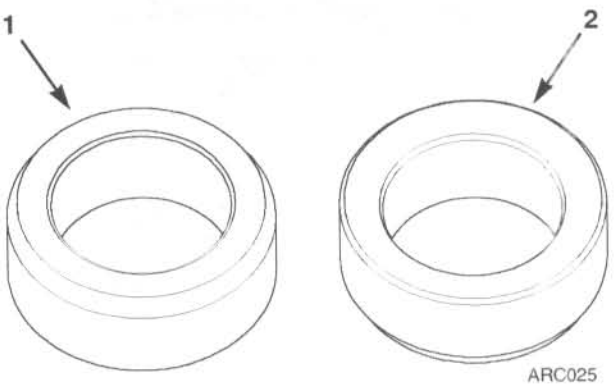
1. Install the new lip seal in the seal plate with the lip side facing out and the flat side facing toward the compressor.



1.	Lip Side Facing Out
2.	Flat Side Toward Compressor

Figure 39: Lip Seal Installation

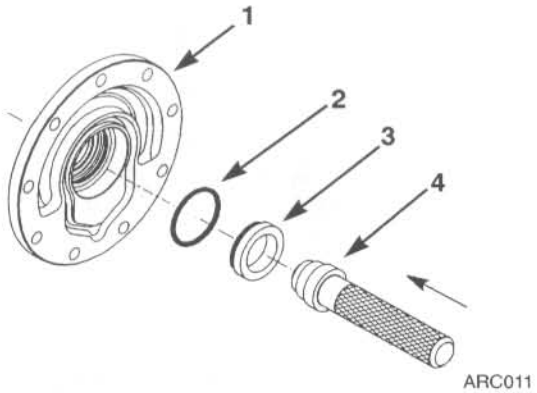
2. Apply clean compressor oil to the new O-ring and install it in the seal plate. Apply clean compressor oil to the new hard ring. Ensure that the hard ring installation tool (P/N 204-953) is clean. Use the hard ring installation tool to push the hard ring (with the polished surface toward the installation tool) fully into the seal plate. Do not pinch the O-ring.



1.	This Side Toward Seal Plate
2.	This Side Toward Compressor

Figure 40: Hard Ring Positions

3. If the installation tool is not available, use the pad in the new seal packaging to protect the polished surface of the hard ring during assembly.

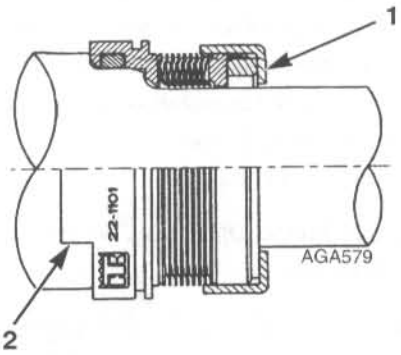


1	Seal Plate
2	O-ring
3.	Hard Ring—Install with Polished Surface Toward Compressor
4.	Hard Ring Installation Tool P/N 204-953

Figure 41: Hard Ring Installation

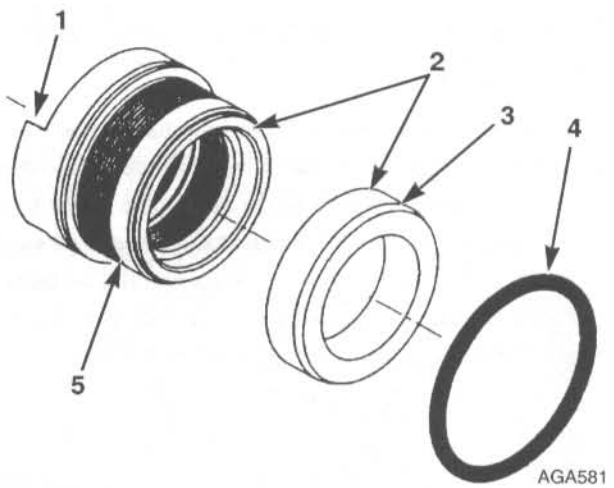
CAUTION: DO NOT touch or damage the polished seal face surfaces. Keep the protective cap in position until final assembly.

4. Apply clean compressor oil to the O-ring inside the bellows. Slide the bellows on the crankshaft, align the drive tangs with the drive flats, and then push the bellows firmly against the crankshaft shoulder.



1.	Yellow Protective Cap
2.	Drive Tang

Figure 42: Cross Section of Drive Tang Type Bellows



1.	Drive Tang
2.	Seal Faces
3.	Hard Ring
4.	O-ring
5.	Bellows

Figure 43: Drive Tang Type Bellows Seal

5. Remove the yellow protective cap. Clean the hard ring and the primary ring (bronze ring) with the alcohol wipes found in package labeled "1". Then clean the polished mating surfaces of both rings with the lint free dry wipes from package number "2". Apply clean compressor oil to the polished surfaces of the seal, the lip seal, and the seal plate gasket from the package number "3" before assembling.

   CAUTION: Oil applied to the seal faces must be absolutely clean.

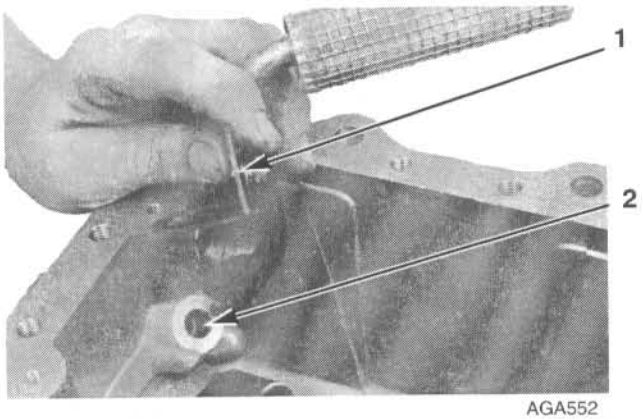
6. Install the seal plate and gasket to the compressor body. Do not bump the seal hard ring on the end of the crankshaft during assembly.

7. Install the seal plate mounting bolts and washers. Torque the seal plate bolts in two steps using a criss-cross pattern. See "Torque Values" on page 3.

OIL SUMP AND OIL PICKUP SCREEN

Removal

1. Remove all the bolts from the oil sump.



1.	Mounting Bracket
2.	Oil Intake Hole

Figure 44: Pickup Screen and O-ring

2. Tap the sump with a soft hammer or punch to loosen the gasket.

   CAUTION: Do not pry or drive any object between the sump and the compressor body.

3. Remove bolts from the mounting bracket and remove the oil pickup screen.

4. Remove the O-ring from the oil intake hole.

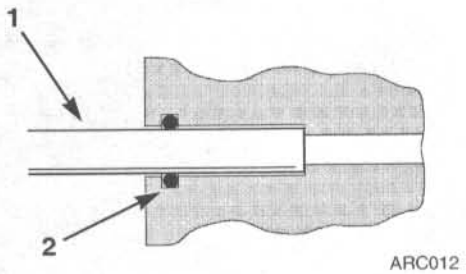
Repair

1. Remove all old gasket material from the sump and the compressor body.

2. Clean the oil pickup screen.

Installation

1. Early style compressor body with groove for oil pickup tube O-ring in the oil intake hole—Apply refrigerant oil to the O-ring and place it in this groove. Insert the pickup tube.

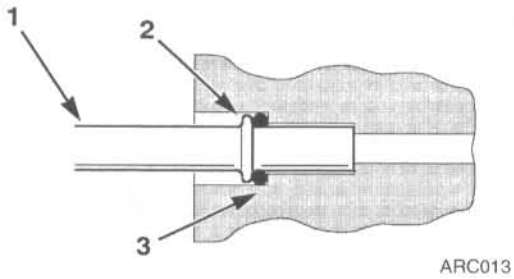


1.	Oil Pickup Tube
2.	O-ring

Figure 45: Early Style Pickup Tube Installation

1. Later style compressor body with groove for oil pickup tube O-ring in the oil intake hole—Apply refrigerant oil to the O-ring and place it on the pickup tube. Push the pickup tube into the oil intake hole in the compressor

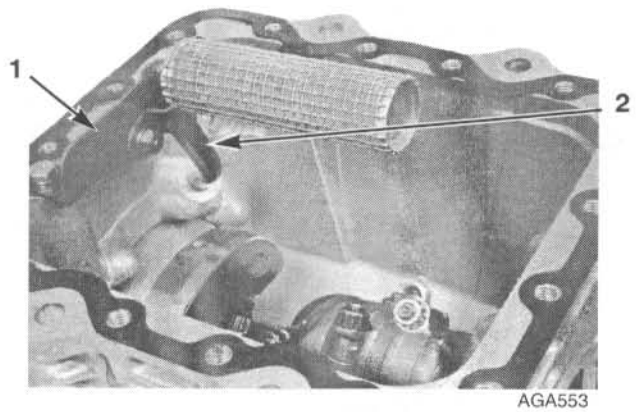
body until it bottoms out. The flange on the pickup tube will force the O-ring into the oil intake hole.



1.	Oil Pickup Tube
2.	Flange
3.	O-ring

Figure 46: Later Style Pickup Tube Installation

2. Hold the mounting bracket in place and install and torque the mounting bracket bolts. See "Torque Values" on page 4.



1.	Mounting Bracket
2.	Oil Pickup Tube

Figure 47: Pickup Tube Installation

3. Apply refrigerant oil to the sump gasket and place it on the compressor body. The gasket fits properly in only one position.

4. Install the oil sump. Install the oil sump bolts and washers. Torque the oil sump bolts in two steps using a criss-cross pattern. See "Torque Values" on page 4.

OIL PUMP

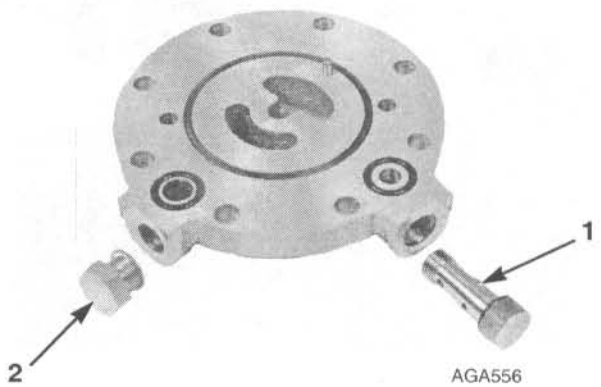
Removal

CAUTION: The oil pump assembly is a precision device with close clearances. All parts must be kept clean, the work area must be kept clean, and oil applied to the pump must be clean. Contamination by dirt, debris, chips, or burrs could cause the oil pump to fail prematurely. Parts must be protected from nicks and scratches.

1. Remove the oil pressure relief valve and oil pickup plug.

2. Check the operation of the oil pressure regulator by pressing on the plunger and checking the movement. The plunger should move free and smooth. You should feel constant resistance from the plunger spring throughout the entire stroke of the plunger.

3. Remove the oil pump cover.

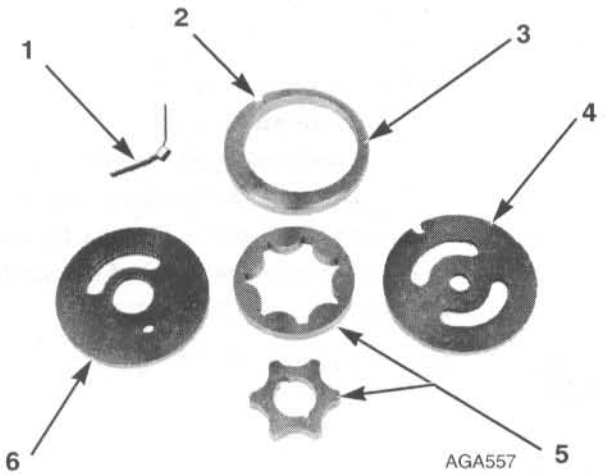


1.	Oil Pressure Relief Valve
2.	Oil Pickup Plug

Figure 48: Oil Pump Cover

4. Remove the outer wear plate and the gerotor assembly. See "Figure 49: Oil Pump Components" on page 25.

   NOTE: Because of the close fit of the oil pump assembly, the wear plates must be removed very carefully or they will bind in the housing. If they bind, square them up by tapping very lightly and attempt to remove again.

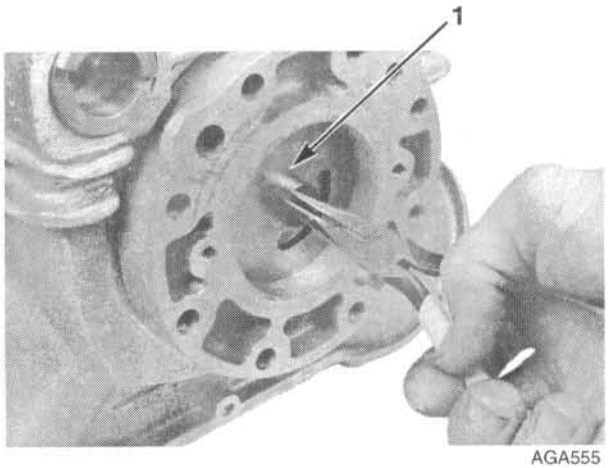


1.	Y Spring
2.	Notch Toward Cover
3.	Eccentric Ring
4.	Outer Wear Plate
5.	Gerotor
6.	Inner Wear Plate

Figure 49: Oil Pump Components

5. Remove the inner wear plate.

6. Remove and discard the square key See "Figure 50: Square Key Removal" on page 25.



1.	Square Key

Figure 50: Square Key Removal

7. .Remove the oil pump shaft. Protect the oil pump shaft with cloth and use pliers to pull it straight out.

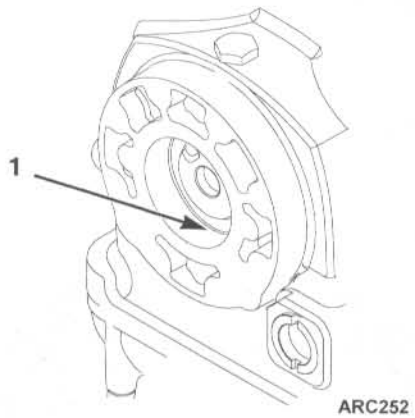
NOTE: It is not necessary to remove the oil pump housing to service the oil pump. Use puller plate P/N 204-483 or slide hammer P/N 204-638 to remove the oil pump housing if necessary.

Repair

1. Inspect the oil pump cover and housing for damage and nicks.

2. Inspect the oil pump cover and housing for dirt, debris, chips, and burrs. Carefully remove any contamination. Use a clean shop wipe and solvent (clean Stodard solvent or clean mineral spirits) and wipe the oil pump housing and pump cover clean.

   NOTE: Pay particular attention to the lower inner groove in the oil pump housing. Debris often collects in this area.



1.	Check for Debris in This Area of the Inner Groove

Figure 51: Checking Pump Housing

3. Check the condition of the oil pump drive pin. In most cases the drive pin will remain in the crankshaft after the oil pump is removed. It is not necessary to remove the drive pin from the crankshaft for inspection.

4. Discard the old O-rings, square key, and Y spring.

NOTE: It is strongly recommended you discard <u>all</u> of the oil pump components and replace them with Oil Pump Kit P/N 22-1160 during rebuild.

NOTE: If you choose to reinstall existing oil pump components, make sure all components are not worn or damaged. Accurately check the gerotor gears, inner wear plate, and outer wear plate to make sure they are within thickness specifications (see "Part Dimensions" on page 2).

Pre-Lubrication of Oil Pump Parts

The oil pump parts must be completely immersed in clean refrigerant oil to lubricate the pump assembly thoroughly. **Do not smear oil on with your fingers!** It cannot be stressed enough that the oil must be absolutely clean and that it thoroughly covers the part. Compressor oil and an oil cup for holding clean compressor oil are provided in Oil Pump Kit P/N 22-1160. If a number of pumps are going to be done in quick succession, the oil may be used for three or four pumps if it is kept covered and checked frequently for contamination.

CAUTION: Do not save oil from one day to the next.

Installation

1. Install a new O-ring on the oil pump shaft.

2. Immerse the O-ring and shaft in oil and then install the pump shaft into the crankshaft.

3. Immerse the inner wear plate in oil and install it in the pump housing. Make sure it lines up with the pin in the bottom of the housing. Check the plate for proper seating against the housing, it should not wobble.

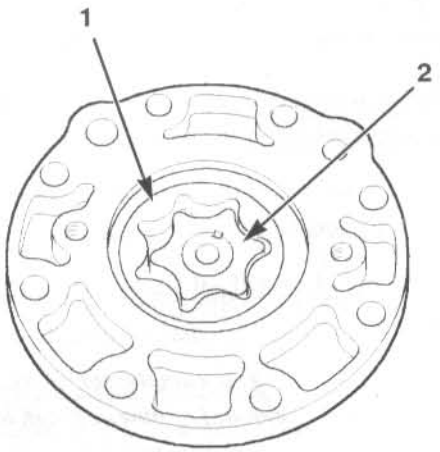
   NOTE: Both of the pump wear plates and the gerotor gears can be installed with either face in or out.

   NOTE: The new oil pump gerotor and wear plates must be kept clean. If the parts pick up any debris, they must be wiped clean. Parts must be handled carefully to prevent damage or contamination.

4. Install the key into the keyway on the shaft.

5. Immerse the inner gerotor gear in oil and carefully slide it on the shaft. Make sure the key stays in place.

6. Immerse the outer gerotor gear in oil and install it.



1.	Outer Gerotor Gear
2.	Inner Gerotor Gear

Figure 52: Install Gerotor Gears

7. Immerse the eccentric ring and roll it into pump. The ring should be positioned so that the pin in the pump cover will align with the slot in the eccentric ring.

8. Install the Y spring. Roll the pump so it ends up in the 12:00 o'clock position.

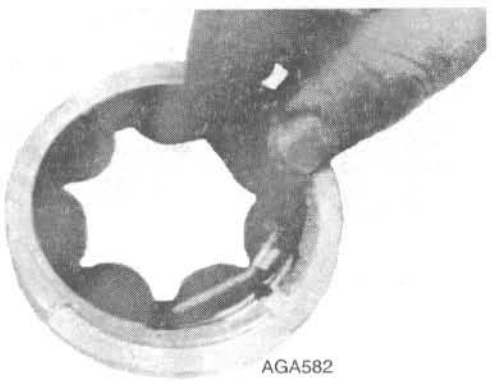
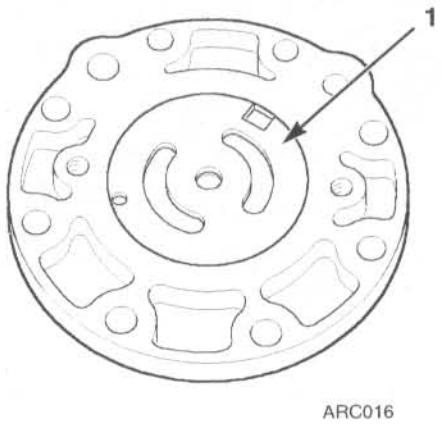


Figure 53: Install Y Spring

9. Immerse the outer wear plate in oil and install it in the pump housing. Install the outer wear plate with the notch aligned with the eccentric ring.



1.	Outer Wear Plate

Figure 54: Install Outer Wear Plate

10. Using a calibrated depth micrometer, measure the oil pump cover clearance (see "Operating Clearances" on page 1). Check this clearance in multiple locations. If the depth is below specification, recheck the pump cavity for debris or part damage. If the depth is above specification, replace the pump assembly or pump housing.

CAUTION: The oil pump cover clearance is critical. Even when new parts are machined correctly, a small piece of debris may not allow the pump to seat in the housing correctly. The resulting interference and reduced lubrication on initial start-up can cause premature pump failure.

NOTE: A depth micrometer must be used to measure the pump cover clearance. The micrometer calibration must be checked before use. Place the micrometer on flat machined surface and measure the depth (a used compressor seal hard ring can be used). The micrometer should read exactly zero inches or it must be adjusted.

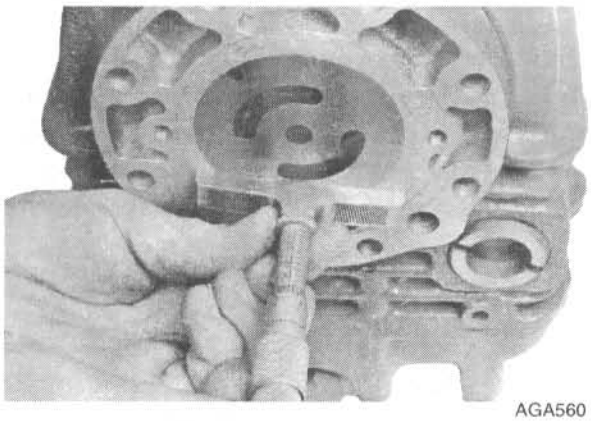
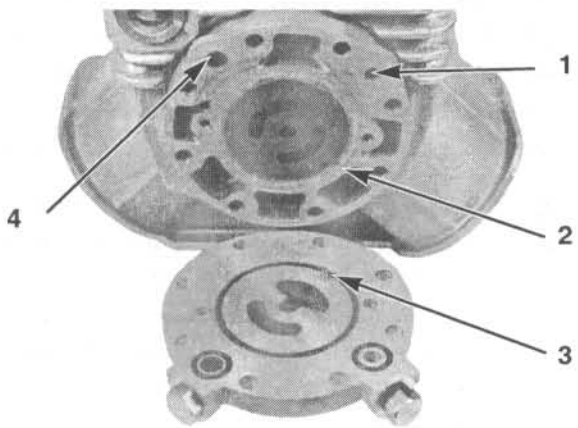


Figure 55: Measure Oil Pump Cover Clearance

11. Immerse new pump cover O-rings in oil and install them in the pump cover.

12. Install the pump cover. Make sure the alignment pin in the cover fits into the outer wear plate alignment hole.



1.	Bypass Hole
2.	Outer Wear Plate Alignment Hole
3.	Alignment Pin
4.	Oil Pickup Hole

Figure 56: Install Oil Pump Cover

NOTE: The pump cover and outer wear plate must be clean and free of debris.

13. Install the oil pump cover bolts and washers. Torque the oil pump cover/housing bolts in two steps using a criss-cross pattern (see "Torque Values" on page 4).

14. Immerse new O-rings in oil and install them on the oil pressure relief valve and the oil pickup plug.

15. Install the oil pressure relief valve and the oil pickup plug (see "Torque Values" on page 4).

16. Install any additional oil fittings that may have been removed.

CAUTION: After a compressor is rebuilt and/or stored for any amount of time, a break in procedure must be done when the compressor is installed or the oil pump could fail (see "Break In" on page 43).

CONNECTING ROD, PISTON AND SLEEVE

Removal

1. Remove the cylinder heads ((see "Cylinder Head" on page 11).), the discharge valve plates ((see "Discharge Valve Plates" on page 12).) and the oil sump and the oil pickup screen ((see "Oil Sump and Oil Pickup Screen" on page 23).).
2. Remove the connecting rod nuts.
3. Tap the connection rod cap lightly with a soft hammer to loosen it from the rod.
4. Remove the piston, rod and sleeve as an assembly from the cylinder and keep them in sets. This will aid in the evaluation of the components.

CAUTION: There are no marks on the rods and caps that identify them as sets, but they must be kept in matched sets. It is helpful to mark them as such.

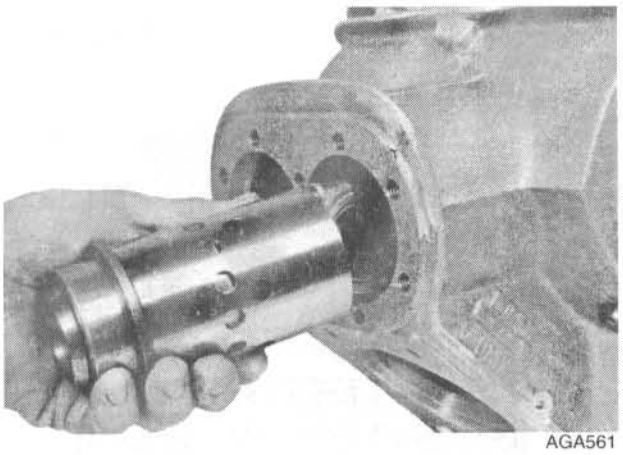
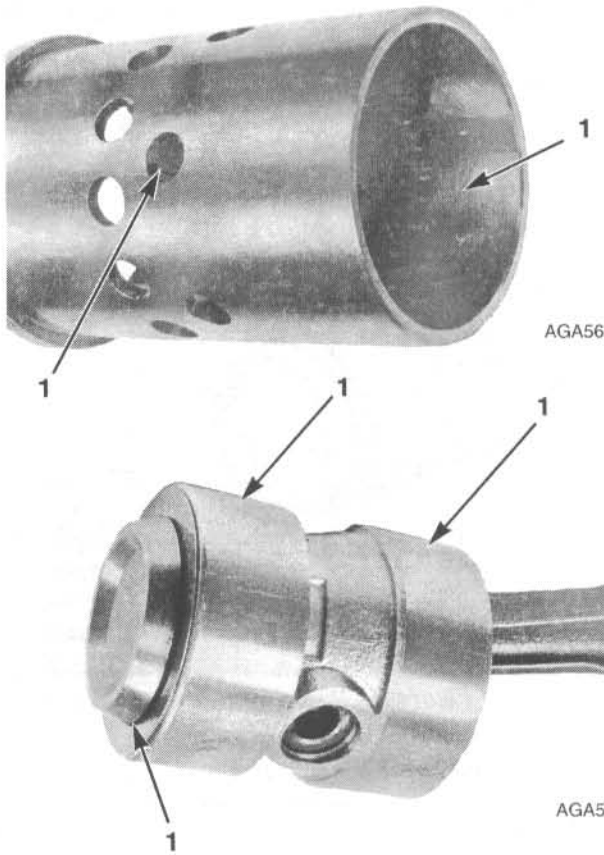


Figure 57: Piston and Sleeve Removal

Repair

1. Remove the piston and rod from the sleeve.
2. Inspect the sleeve for scoring, damage or cracks near the ports. The cross hatching or honing marks should still be visible in the sleeve. There should be no large scratches in the sleeve.
3. Inspect the piston for wear and damage. Check for large scratches in the piston surfaces.
4. Measure piston and the sleeve. If the piston or sleeve are worn beyond the maximum allowable operating clearance shown in "Operating Clearances" on page 1, they should be replaced.



1.	Check for Damage and Wear

Figure 58: Inspecting Pistons and Sleeve

5. Remove the snap rings from the piston.

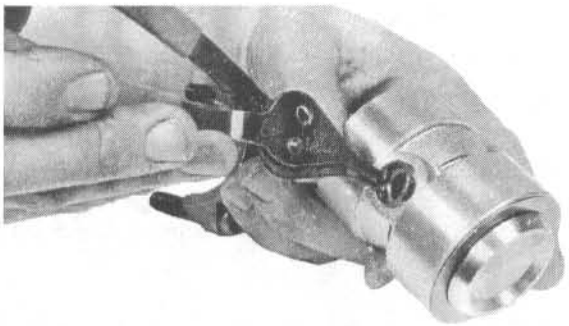
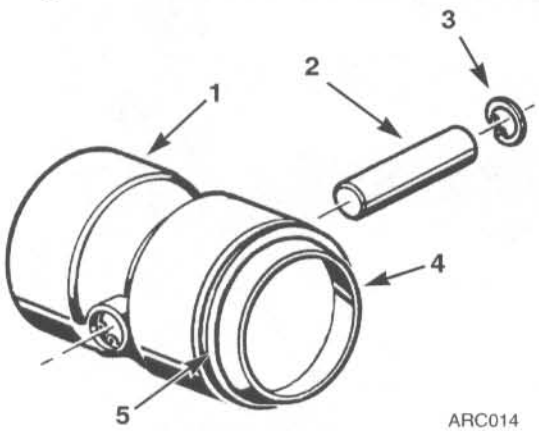


Figure 59: Removal of Snap Ring from Piston

6. Remove the wrist pin from the piston and rod. The wrist pin is a float fit so you should be able to press it out by hand.



1.	Piston	4.	Piston Head
2.	Wrist Pin	5.	Ring Valve
3.	Snap Ring		

Figure 60: Piston Components

7. Remove the piston from the rod.

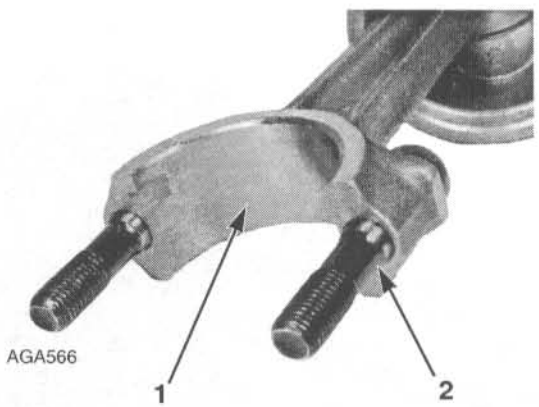
8. Inspect the piston, piston head, and ring valve for wear or damage. Replace the complete piston assembly if the ring valve is worn, cracked, broken or missing, if excessive grooves are worn into the ring valve from the piston grooves, or if the piston grooves are worn flat from the ring valve.

NOTE: The grooved piston supersedes the flat top piston. The grooved piston has small concentric grooves on the top of the piston under the ring valve. These grooves reduce the stiction between the top of the piston and the ring valve. The grooved and flat top pistons are interchangeable, but the piston components are not. Do Not Use Flat Top Pistons.

9. Inspect the wrist pin for wear or damage. Measure the wrist pin if it shows signs of wear. If the outside diameter of the wrist pin is less than 0.6250 in. (15.8750 mm), replace the piston assembly.

10. Inspect the wrist pin bushing in the small end of the connecting rod for wear or damage. Measure the wrist pin bushing. Replace the wrist pin bushing if its inside diameter is more than 0.6258 in. (15.8953 mm).

11. Inspect large end of connecting rod for wear or damage.



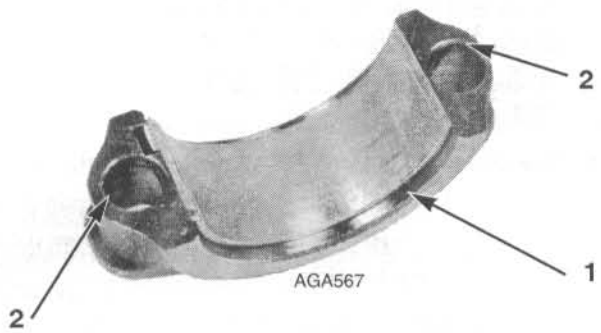
1.	Check Bearing Fit
2.	Check Bolt for Damage

Figure 61: Inspect Connecting Rod

NOTE: Thermo King does not recommend reinstalling used connecting rod bearings. Use new bearings for inspecting the connecting rod and the crankshaft

12. Place the bearing in the rod. It should fit into the machined radius snugly when pushed with the thumb. When the bearing is bottomed out, both ends of the bearing should be flush with the mating surfaces of the rod. The bearing should fit into the rod cap in the same manner.

NOTE: Be sure to align the tabs in the bearings with the notches in the mating parts.



1.	Check Bearing Fit
2.	Check Bolt Holes for Damage

Figure 62: Inspect Connecting Rod Cap

13. Use plastigauge to check the clearance between the connecting rod bearings and the corresponding crankshaft rod journal.

    a. Place a piece of plastigauge on the crankshaft rod journal.

    b. Install the bearings in connecting rod and rod cap.

    c. Remove the connecting rod cap, then measure and remove the plastigauge.

    d. Install the connecting rod and rod cap with the index marks aligned as shown in "Figure 64: Connecting Rod and Cap Installation" on page 32.

    e. Install the connecting rod nuts and torque them to 25.0 ft-lb (33.9 Nm). Do not allow the connecting rod to rotate on the crankshaft rod journal.

    f. Check the crankshaft assembly for free rotation after each connecting has been properly tightened.

    g. Remove the rod cap and check the plastigauge to determine the clearance of the connecting rod bearing. The recommended rod bearing clearance is 0.0008 to 0.0024 in. (0.0203 to 0.0610 mm).

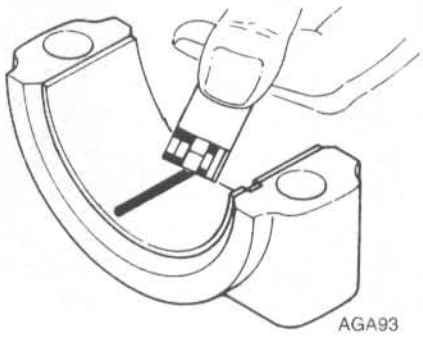


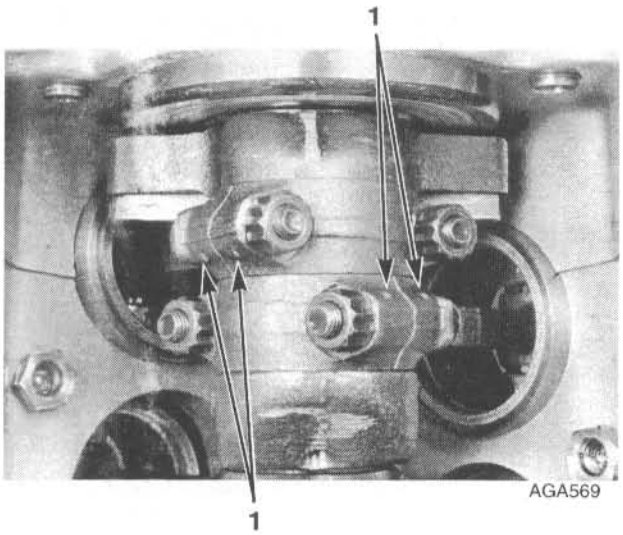
Figure 63: Check Plastigauge

14. If the rod bearing clearance is too large, use undersize bearings and have a competent machine shop grind the crankshaft to fit the undersize bearings.

Assembly

1. Place the piston on the connecting rod and install the wrist pin and the snap rings.
2. Install the bearings in connecting rod and rod cap.
3. Apply apply refrigerant oil to the piston and place it in the sleeve.
4. Place the piston and sleeve in the compressor body. Take care to prevent damage to crankshaft from the rod bolts. Install the rods so the index marks face the other rod on the same rod journal. See "Figure 64: Connecting Rod and Cap Installation" on page 32.
5. Install the connecting rod cap. Make sure the index mark on the cap is aligned next to the index mark on the

connecting rod as shown. Index marks may point toward the front or rear of the compressor.



1	Index Marks

Figure 64: Connecting Rod and Cap Installation

6. Install the connecting rod nuts and torque them to 25.0 ft-lb (33.9 Nm). Rotate the crankshaft after each rod assembly is torqued to check that the components move freely.

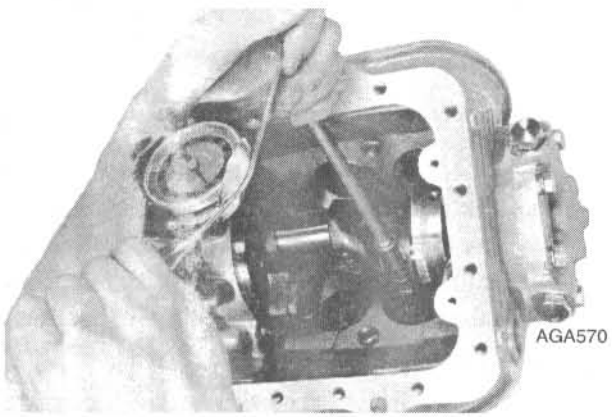


Figure 65: Torque Rod Bolts

CRANKSHAFT

Removal

1. Remove the cylinder heads ((see "Cylinder Head" on page 11).), the discharge valve plates ((see "Discharge Valve Plates" on page 12).), the seal plate ((see "Seal Plate Assembly" on page 14).), the oil sump and the oil pickup screen ((see "Oil Sump and Oil Pickup Screen" on page 23).), the oil pump ((see "Oil Pump" on page 24).) and the connecting rods, pistons and sleeves ((see "Connecting Rod, Piston and Sleeve" on page 29).).

2. Use slide hammer P/N 204-638 to remove the oil pump housing. Attach the slide hammer to the oil pump housing with two 5/16 bolts. Use caution to prevent damage to the oil pump housing.

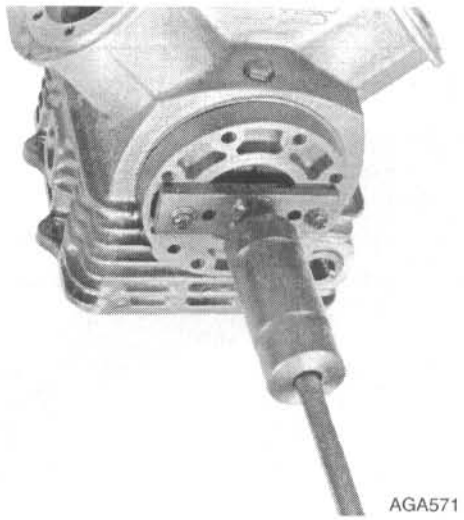


Figure 66: Remove Oil Pump Housing

3. To remove the crankshaft, set the compressor on the oil pump end with the seal end up. Use a torch to carefully heat the area around the seal end bearing. Catch the crankshaft when the bearing slips out of the compressor body. Do not attempt to drive the bearing out of the

housing without heating or it will damage the housing or the bearing.

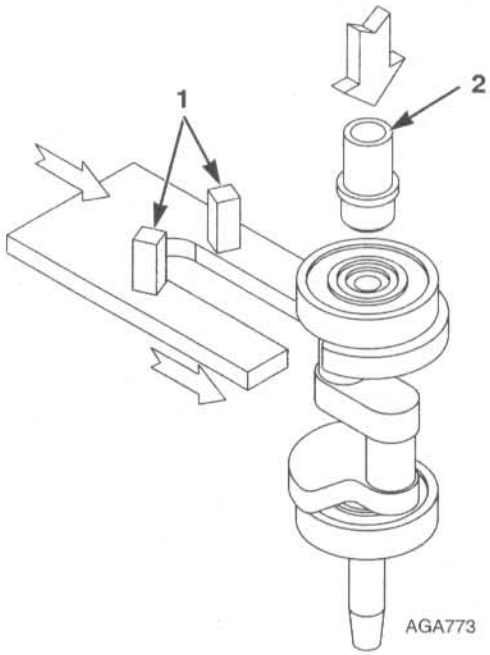
Repair

1. Check smoothness of main bearings by pressing on the bearing while turning it.

   NOTE: Although there is no sure way to determine condition or life expectancy of ball bearings, if there is any roughness when you turn the inner race inside the outer race, if there is excessive axial looseness in the bearing or if you have any doubts because of noise in service, it is better to replace the bearing during an overhaul than to have it fail once it is back in service.

2. If necessary use the bearing puller tool P/N 204-1000 to remove the ball bearings from the compressor crankshaft.

3. Place the crankshaft in the tool so that two vertical bars support the inner race of the ball bearing.

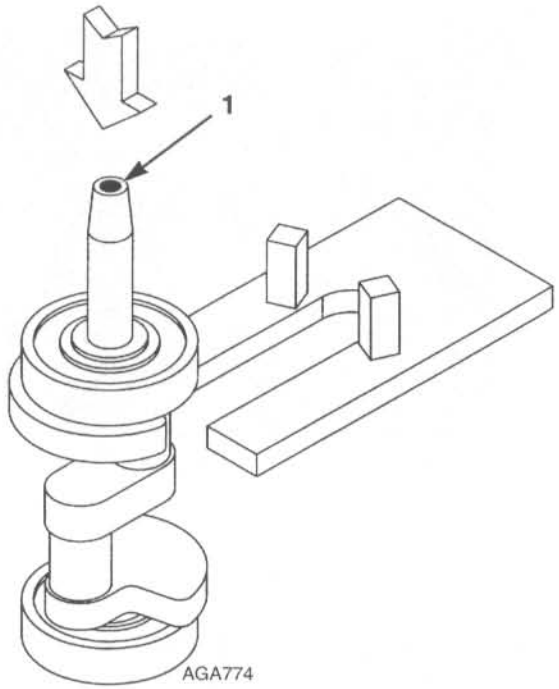


1.	Vertical Bars Support Inner Race
2.	Spindle for Oil Pump End

Figure 67: Pressing Bearing Off Oil Pump End

4. Place the included spindle on the pump end of the crankshaft and press off the bearing.

5. Rotate the crankshaft 180 degrees and press off the other bearing. **DO NOT** use the spindle because it could jam on the taper of the crankshaft nose.



1.	**DO NOT** Use Spindle

Figure 68: Pressing Bearing Off Drive End

6. Use a micrometer to measure the rod journals. If the outside diameter of a rod journal is less than 1.3742 in. (34.9047 mm), replace the crankshaft or have a competent machine shop grind the crankshaft to use undersize bearings.

7. Remove the plugs and the metering jet from the oil passageways. Clean the passageways thoroughly.

8. Reinstall all the plugs and the front seal metering jet. Torque to 60 in.-lb (6.8 Nm).

9. Install the oil pump drive pin in the rear main journal before installing the ball bearings.

10. Press the ball bearings onto the crankshaft. Press on the inner race of the bearing and support the crankshaft under main journal while performing this operation.

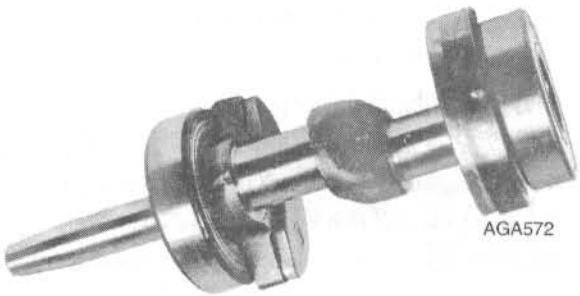


Figure 69: Install Bearings

Installation

1. Inspect the crankshaft to be certain it is completely assembled before installing it.

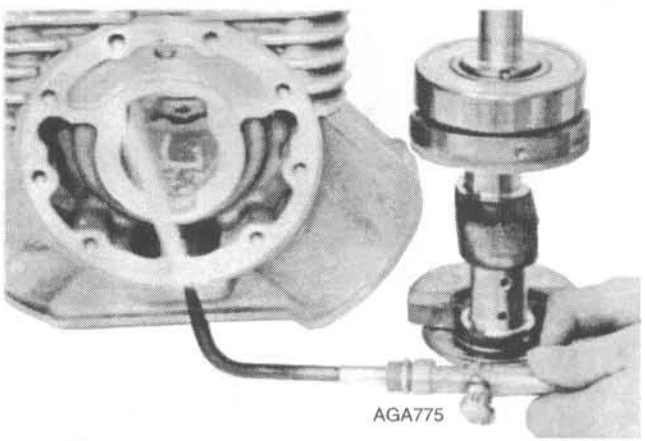


Figure 70: Heat Compressor Body

2. Use a torch to carefully heat the compressor body in the area around the seal end bearing. When it feels hot to the touch, position the compressor body with seal end down and support it to allow clearance for the drive end of the crankshaft.
3. Place the crankshaft in the compressor body and tap the crankshaft lightly till it comes in contact with the shoulder in the compressor body.
4. Apply refrigerant oil to the oil pump housing gasket and place it on the compressor body. Align the oil holes in oil pump housing gasket with oil holes in compressor body.
5. Place the oil pump housing in position and tap it lightly till it contacts the compressor body.
6. Place two 3/8-16 X 1-1/4 in. bolts and two 3/8 in. washers in mounting holes on opposite sides of the oil pump housing. Snug the bolts down and turn the crankshaft to make sure it rotates freely. Leave these bolts in place to check the end play. After checking the end play remove these bolts to install the oil pump.
7. Use a dial indicator to check end play of crankshaft. If the end play exceeds 0.047 in. (1.19 mm), refer to "Crankshaft End Play" below.

Crankshaft End Play

Crankshaft end play on a warm compressor can be as much as 0.047 in. (1.19 mm) as measured with a dial indicator. As much as 0.007 to 0.013 in. (0.18 to 0.33 mm) of this end play can be attributed to the accumulated internal clearances in the crankshaft main bearings. The balance of the end play is the result of the crankshaft main bearing outer races moving in the bores in the compressor body and oil pump housing.

NOTE: Crankshaft end play of up to 0.047 in. (1.19 mm) has not been shown to be a factor in seal leaks in testing conducted by Thermo King.

On compressors where the crankshaft end play (or axial clearance) is considered to be excessive, the outer race of the main bearing on the seal end can be fixed in the compressor body by using Loctite RC/620 Retaining Compound. Never use Loctite on both crankshaft main bearings.

Using Loctite RD/620

1. Remove the crankshaft from the compressor body.
2. Clean the outer race of the seal end main bearing and the bore in the compressor body with a chlorinated solvent to remove all oils.
3. Apply a thin coating of Loctite RC/620 to both the outer race of the bearing and the bore in the compressor body.
4. Seat the crankshaft assembly fully into the bore on the seal end of compressor body. Be sure the crankshaft assembly in seated as far as possible into the compressor body.
5. Place the oil pump housing in position and tap it lightly till it contacts the compressor body.
6. Place two 3/8-16 X 1-1/4 in. bolts and two 3/8 in. washers in mounting holes on opposite sides of the oil pump housing and snug the bolts down.
7. Allow 15 minutes for the Loctite to fix the parts. Full cure of the Loctite requires 12 hours at room temperature or 30 minutes at 250 F (121 C).

CAUTION: Do not use an excessive amount of Loctite. Use care in application and assembly to prevent contamination of the bearing or internal area of the compressor or refrigeration system with Loctite.

Compressor Crankshaft Precautions

1. Alignment of the compressor to the engine flywheel is controlled by the position of the engine flywheel housing. Two checks should be made to assure that alignment is correct. Refer to the appropriate Engine Overhaul Manual to correct an alignment problem.

   a. Use a dial indicator to check the radial run out, which is the concentricity of the flywheel to the flywheel housing. Maximum total indicated radial run out is 0.004 in. (0.10 mm).

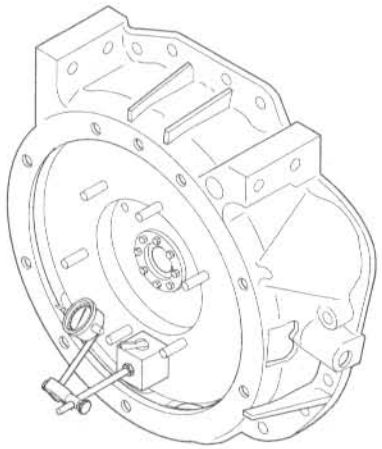


Figure 71: Checking Radial Run Out

   b. The flywheel housing should fit tightly against the engine block. Nicks, burrs and debris between the block and flywheel housing can cause misalignment and result in a loosely mounted flywheel housing. Use a dial indicator to check the axial run out, which is measured from the flywheel to end surface of the flywheel housing. Maximum total indicated axial run out is 0.010 in. (0.25 mm). See "Figure 72: Checking Axial Run Out" on page 36.

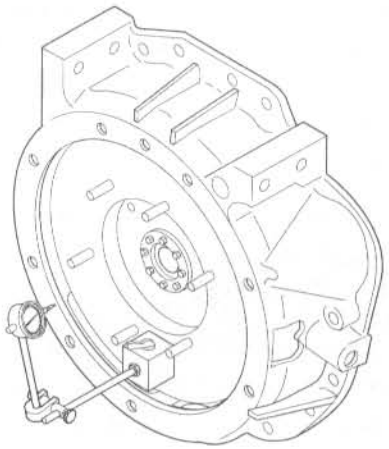
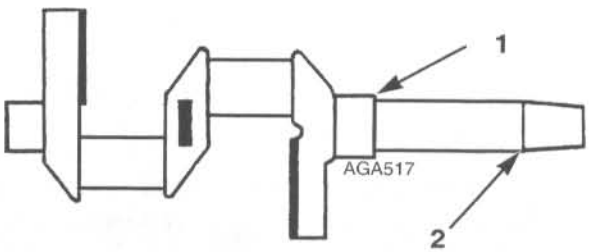


Figure 72: Checking Axial Run Out

CAUTION: Misalignment of the flywheel housing to the engine will cause crankshaft fracture as indicated below:



1.	Misalignment Fractures Occur Here
2.	Coupling Problem Fractures Occur Here

Figure 73: Crankshaft Fractures

2. Fitting the drive coupling to the crankshaft of the compressor is a critical operation when installing a compressor. When the coupling is removed, inspect the crankshaft taper and the coupling for rust and pitting. A crankshaft or coupling that has significant pitting on the taper should be replaced. Crankshaft failures in the taper area generally are the result of improper fit between the coupling and the crankshaft. Refer to "Drive Coupling" on page 7 for the proper removal and installation procedures.

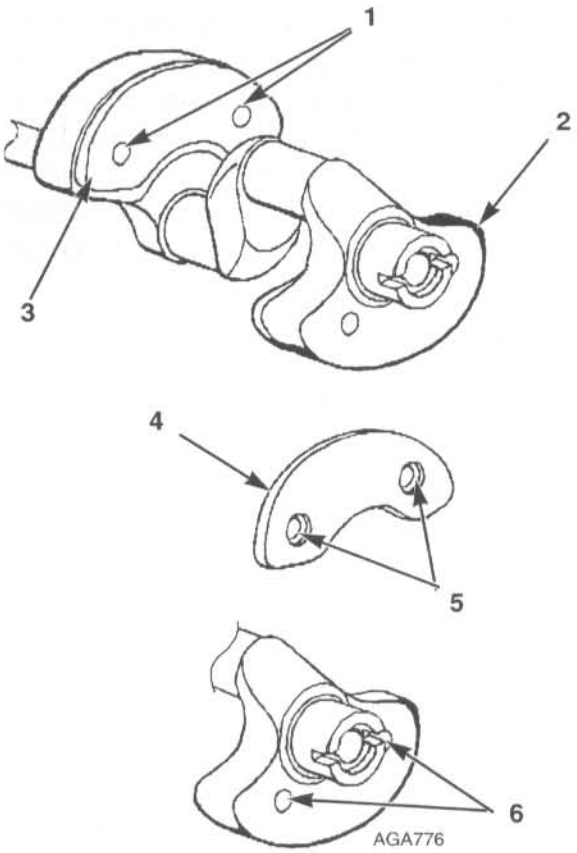
Removal and Installing Crankshaft Counterweights

Long stroke compressors have two add-on counterweights riveted to the integral counterweight portion of the cast crankshaft. When regrinding crankpin journals, it is necessary to remove the add-on counterweights which must be plainly marked so they may be replaced exactly as they were removed.

There have been some cases where a crankshaft from a long stroke compressor was reground and then installed without the add-on counterweights being reinstalled. The result can be cracked refrigerant lines, cracked frames and loose screws due to an unbalanced condition.

To properly regrind a long stroke crankshaft, the following procedure must be adhered to:

1. Mark the add-on counterweights, so they will be reinstalled on the same integral counterweight.
2. Drill off rivet head and drive out rivet with a punch.
3. Regrind the crankshaft shaft to the new undersized diameter. Bearing sets are available in 0.005 in. (0.127 mm), 0.010 in. (0.254 mm), 0.020 in. (0.508 mm) and 0.030 in. (0.762 mm) undersize. The standard diameter of connecting rod journal is 1.3742 to 1.3747 in. (34.9047 to 34.9174 mm). The clearance for the connecting rod bearing to the crankshaft rod journal is 0.0008 to 0.0024 in. (0.0203 to 0.0610 mm).
4. Tap holes in the integral counterweight with a 5/16-18 UNC tap.
5. Countersink the holes in the add-on counterweight with an 82 degree tool to accept 5/16 flat head screws. This must be done because the original countersink is 90 degrees.
6. Reinstall the add-on counterweights with 5/16-18 UNC flat head screws. Be sure to install them on same integral counterweight from which they were removed. Cut off the excess screw length if required. Stake the screws with a centerpunch to prevent screw from backing out.
7. Thoroughly clean the crankshaft to remove all metal chips and coat with compressor oil.



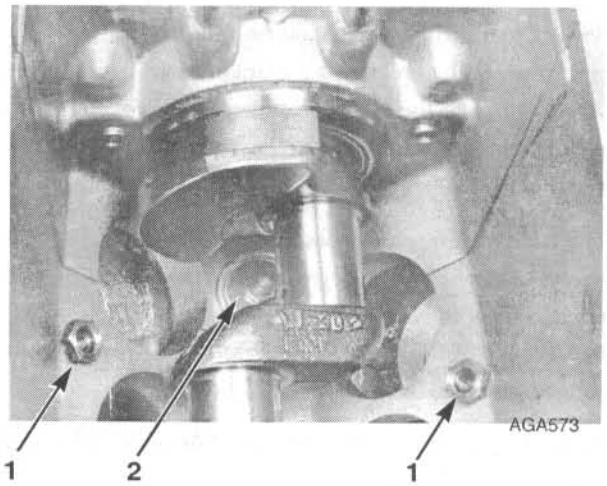
1.	Remove Rivets
2.	Integral Counterweight
3.	Mark Counterweights
4.	Add-On Counterweight
5.	Counter Sink 82°
6.	Tap with 5/16-18 UNC Threads

Figure 74: Installing Counterweights

COMPRESSOR BODY REPAIR

Removal

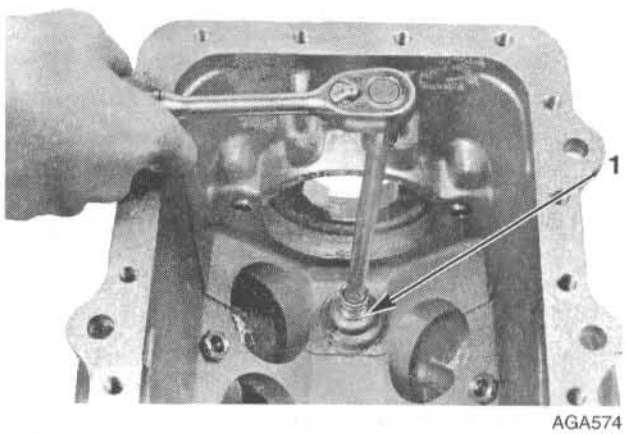
1. Remove the cylinder heads ((see "Cylinder Head" on page 11).), the discharge valve plates ((see "Discharge Valve Plates" on page 12).), the seal plate ((see "Seal Plate Assembly" on page 14).), the oil sump and the oil pickup screen ((see "Oil Sump and Oil Pickup Screen" on page 23).), the oil pump ((see "Oil Pump" on page 24).), the connecting rods, pistons and sleeves ((see "Connecting Rod, Piston and Sleeve" on page 29).) and the crankshaft ((see "Crankshaft" on page 32).).
2. If necessary, remove all the check valves.
   a. The two lower check valves are located in the front seal area.
   b. The two upper check valves are located in the sump area.
   c. The large check valve is located in the passageway between the suction cavity and the sump. Use tool P/N 204-464 to remove the large check valve.



1.	Upper Check Valves
2.	Large Check Valve

Figure 75: Check Valve Locations

NOTE: In order to remove the large check valve from four cylinder compressors built after April 1987, it will be necessary to apply heat to soften the factory-applied Loctite.



1.	Tool P/N 204-464

Figure 76: Removing Large Check Valve

Inspection

1. Inspect all passageways for plugging or damage.
2. Inspect all threads for damage.
3. Inspect all gasket surfaces for flatness.
4. Scrape all gasket material off, and clean the compressor body thoroughly.

Check Valve Installation

1. Install the lower check valves. Torque to 10.0 ft-lb (13.6 Nm).
2. Install the upper check valves. Torque to 25.0 ft-lb (33.9 Nm).
3. Clean the threads of the large check valve. Apply four drops of Loctite 277 equally spaced on the threads. Do not use an excessive amount of Loctite.
4. Install the large check valve with tool P/N 204-464. Torque to 28.0 ft-lb (38.0 Nm).

Unloader Head

Operation

During normal operation, the unloader head allows refrigerant to pass from the discharge valve plates through the check valve located in the head. The solenoid valve is de-energized in this position. Discharge pressure passes from Port "A" through the solenoid valve to the center port, Port "C", which forces the unloader piston down and seals up the discharge hole to the suction cavity.

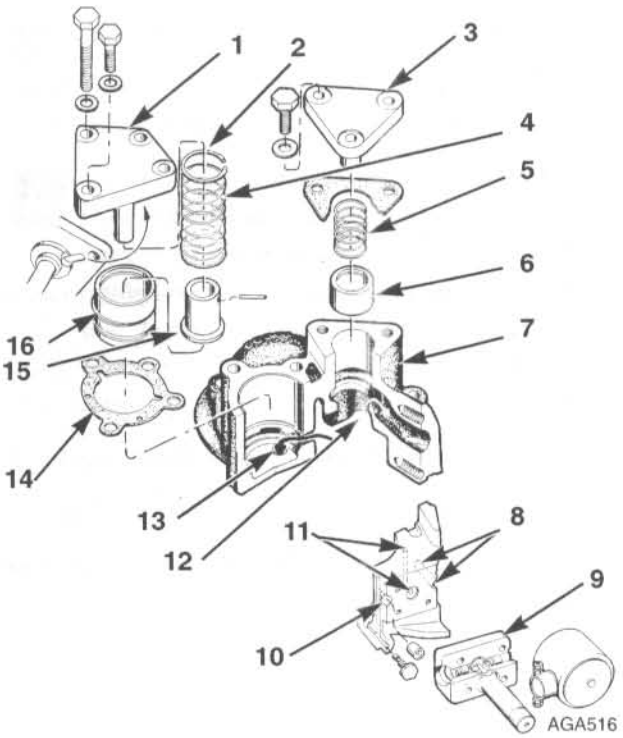
During the unload operation, the unloader solenoid is energized, the pressure passes from Port "B" to Port "C". This allows the refrigerant to pass from the suction chamber to the top of the unloader. This reduction in pressure and the spring in the unloader piston allows the valve to lift. This will cause the refrigerant to pass back into the suction cavity of the compressor at the same time the check valve located in the head seats and prevents the discharge pressure from short cycling in the compressor. This continues until the solenoid de-energizes. At this time the discharge pressure builds up, seals off the port to the suction cavity and the system pumps with four cylinders.

CAUTION: Unloader heads are used on special compressor bodies that have a return gas passage. Do not use unloader heads on compressor bodies that do not have the return gas passage.

Check Out

1. With unloader de-energized, compressor should pump down normally 15 to 20 in. Hg vacuum (-51 to -68 kPa) and should hold a 15 in. Hg vacuum (-51 kPa) for three minutes.

2. Using an auxiliary battery, energize and de-energize unloader solenoid on compressor cylinder head while the compressor is running. An audible noise will be made when unloading, as well as a pressure change in both suction and discharge.



1.	Unloader Valve Cover
2.	Retaining Clip
3.	Check Valve Cover
4.	Unloader Spring
5.	Check Valve Spring
6.	Check Valve Piston
7.	Unloader Cylinder Head
8.	Port "A"
9.	Solenoid
10.	Port "B"
11.	Port "C"
12.	Normal Flow
13.	Unload Flow
14.	Gasket
15.	Unloader Spring Sleeve
16.	Unloader Piston

Figure 77: Unloader Head Components

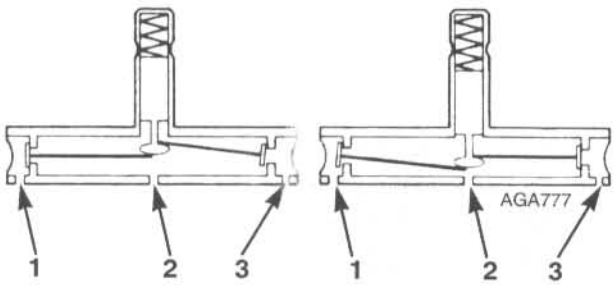
Disassembly

1. Remove cylinder head from body same as standard head.
2. Remove solenoid valve.
3. Remove check valve.
4. Remove unloader valve.

NOTE: It may be necessary to tap valves slightly to loosen from head.

Repair

1. Inspect solenoid valve for physical change.
2. Measure resistance of coil or check for amperage.
3. With valve de-energized, flow will be from Port A to C and none from B to C.



1.	Port A
2.	Port C
3.	Port B

Figure 78: Solenoid Valve Ports

4. With valve energized, flow will be from B to C and A to C closed.

   NOTE: The valve is non-repairable.

5. Inspect check valve for wear on sides. If wear is present, valve must be replaced.
6. Inspect unloader valve.

   NOTE: It may be necessary to disassemble valve assembly to check spring and clean internal portion of piston. To disassemble piston from cover, depress piston and remove roll pin. Compress spring and remove retaining ring.

   a. Inspect piston sides for wear.

   b. Remove ring, insert into bore, check end gap clearance. Gap must not exceed 0.016 in. (0.406 mm).

   c. Inspect spring ends, cover and unloader piston and sleeve for wear.

To reassemble, reverse the disassembly procedure.

Leak Testing, Storage, and Break In

LEAK TESTING

Leak test the compressor with refrigerant gas such as R-134a at approximately 70 psi (483 kPa).

STORAGE

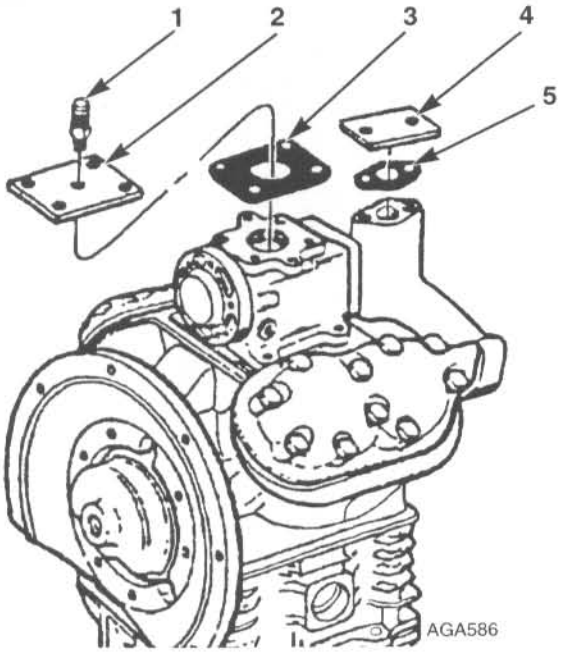
Thermo King compressors rebuilt in the field should be properly sealed, leak checked, evacuated and charged with 20 ± 5 psi (138 ± 34 kPa) dry nitrogen to ensure that they do not become contaminated if they are to be stored for any length of time after overhauling. Cover plates are available for all compressors for this purpose.

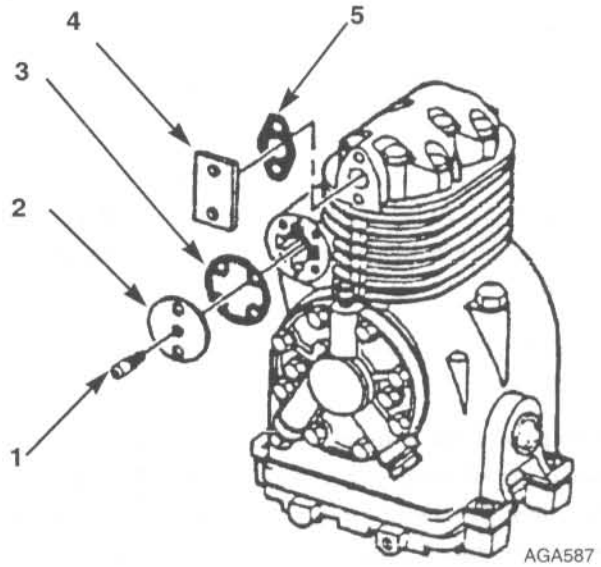
BREAK IN

The following procedure must be followed for any compressor that has had an oil pump installed and/or has been stored for any length of time.

CAUTION: If a non factory remanufactured compressor is rebuilt and stored for any amount of time, a break in procedure must be done when the compressor is installed or the oil pump could fail. If a non factory rebuilt compressor is sold over the counter a tag describing the break in procedure must accompany the compressor.

1. Once the compressor is installed in the unit, attach a suitable gauge on the compressor oil filter pressure access port (if equipped). You can also use the oil pressure fitting on the oil pump cover.





1.	Schrader Valve Assembly
2.	Suction Cover Plate
3.	Suction Cover Plate Gasket
4.	Discharge Cover Plate
5.	Discharge Cover Plate Gasket

Figure 79: Cover Plates

2. Install a suction gauge below the throttling valve.
3. Disconnect the wires to the fuel solenoid.
4. Disconnect the wires to the high speed solenoid.
5. Turn the unit on and crank it for 30 seconds.
6. Check the suction and oil pressure gauges while cranking. Oil pressure is determined by subtracting suction pressure from the pressure on the gauge at the oil pressure port.

CAUTION: Do not crank the unit for more than 30 seconds or damage to the starter motor may occur.

7. If at least ten pounds of oil pressure is not developed in the first thirty seconds, allow the starter to cool for a few minutes and crank again for 30 seconds. If oil pressure still does not develop, check the compressor oil level. If the level is above the oil pickup screen, the oil pump or relief valve will need to be rechecked.
8. As soon as oil pressure is developed, reconnect the fuel solenoid (not the high speed solenoid).
9. Start and run the engine on low speed for at least five minutes. If the oil pressure is above 20 psi for this period, stop the unit and reconnect the high speed solenoid
10. Run the engine on high speed for at least five more minutes.

NOTE: Thermo King remanufactured compressors have had a special break in process to assure that the oil pump is primed, functioning and broken in. The break in procedure previously described is recommended, but not required for factory remanufactured compressors.

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