

MC-9 MAINTENANCE MANUAL

SECTION 16

HEATING AND AIR CONDITIONING

<u>SUBJECT</u>	<u>PAGE</u>
Air Conditioning Compressor	16-20
Air Conditioning Compressor Belt Tension	16- 9
Air Conditioning Condenser	16-11
Air Conditioning Cycle	16- 6
Air Conditioning Evaporator	16-11
Air Conditioning Evaporator Fans & Motor	16-12
Air Conditioning Filter	16-12
Air Conditioning & Heater Switch	16- 5
Air Conditioning Receiver Tank	16-12
Air Conditioning System	16- 5
Air Conditioning System Maintenance	16- 7
Air Conditioning System Test Equipment	16- 7
Air Conditioning System Troubleshooting	16-19
Blower Motors	16- 5
Compressor Clutch	16-30
Compressor Disassembly	16-23
Compressor Lubrication System	16-21
Compressor Reassembly	16-27
Compressor Removal	16-22
Compressor Replacement & Installation	16-23
Compressor Wear Limits	16-39
Driver's Heater Water Valve	16- 4
Expansion Valve	16-13
Expansion Valve Troubleshooting	16-17
Fast Idle	16- 7
Filter Dryer	16-12
Fresh Air Ventilation	16- 2
Heating System	16- 1
High & Low Switch Tests & Unloader Check	16-22
Leak Testing Lines & Fittings	16-18
Liquid Line Solenoid Valves	16-13
Main Heater Water Valve (Air Operated)	16- 3
Manual Switch Controls	16- 7
Purging A/C System at the Receiver Tank	16-12
Service Tools	16-40
Specifications	16-38
Suction & Discharge Service Valves	16-21

MC-9 MAINTENANCE MANUAL

HEATING AND AIR CONDITIONING

HEATING SYSTEM

The coach is provided with a hot water forced-air heating system which uses the engine cooling medium for heating the interior of the vehicle and windshield defrosting. Two heating radiator cores are provided, one for the main interior heating system and one for the driver's heater and defroster.

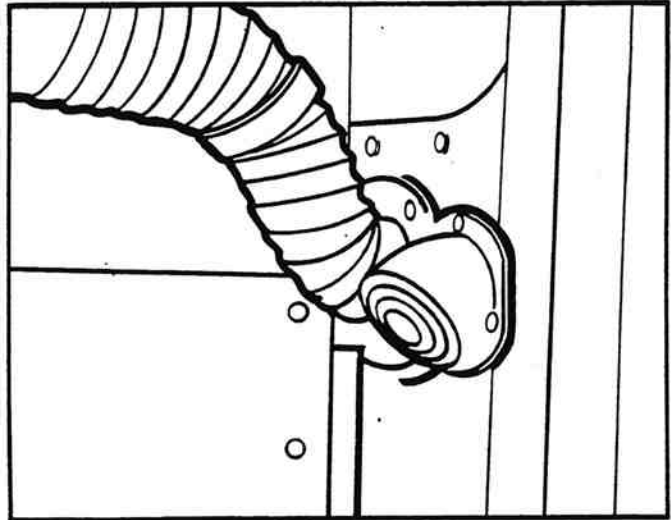
Heating in the stepwell area is provided by the introduction of heated air from the main right hand passenger heating duct into the stepwell. The heat enters the stepwell through louvers at the rear of the stepwell.

A complete air conditioning system is installed as standard equipment. The same duct system is used for both air conditioning and heating.

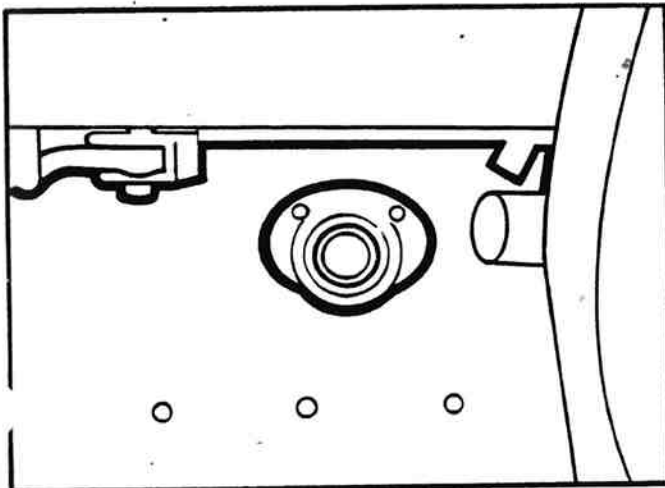
An optional auxiliary air conditioning evaporator and blower unit is mounted at the extreme rear of the left hand side parcel rack. This unit operates in conjunction with the main coach air conditioning system and is controlled by its own coach temperature sensing unit. This auxiliary air conditioner can be used with either Freon 12 or with Freon 500. The purpose of this unit is to provide additional cooling at the rear of the passenger compartment.

Flow of hot water to the main heater core is controlled by an electric water valve. A manually-operated water valve controls the flow to the driver's heater core. In the engine compartment, manually-operated shut-off valves are provided to isolate the heating system in the event of system failure or when the cooling system is to be drained.

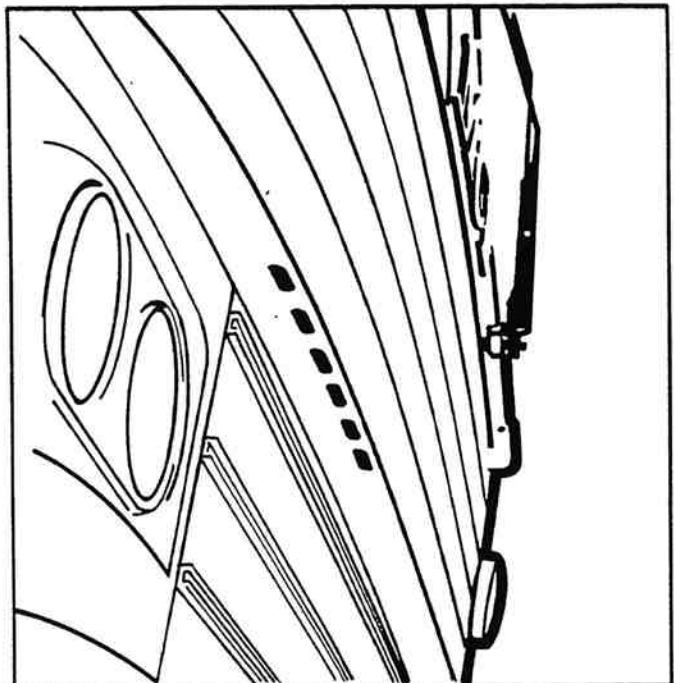
A temperature sensing unit is located in the front L.H. baggage compartment at the center control duct and through relays, controls the main heater water valve within limits selected by means of the heat control dial on the driver's switch panel.



Driver's heater or air conditioning Gasper located to the right of the driver under the dash.

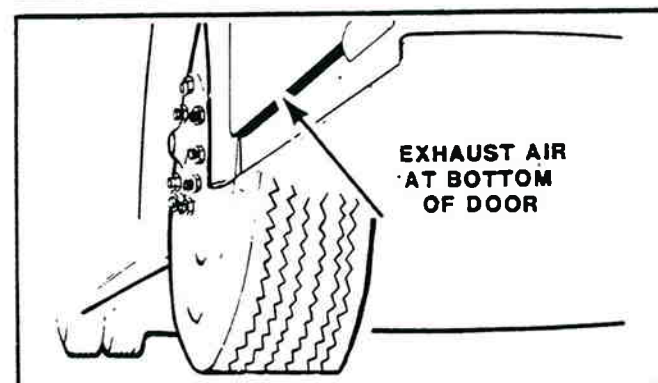
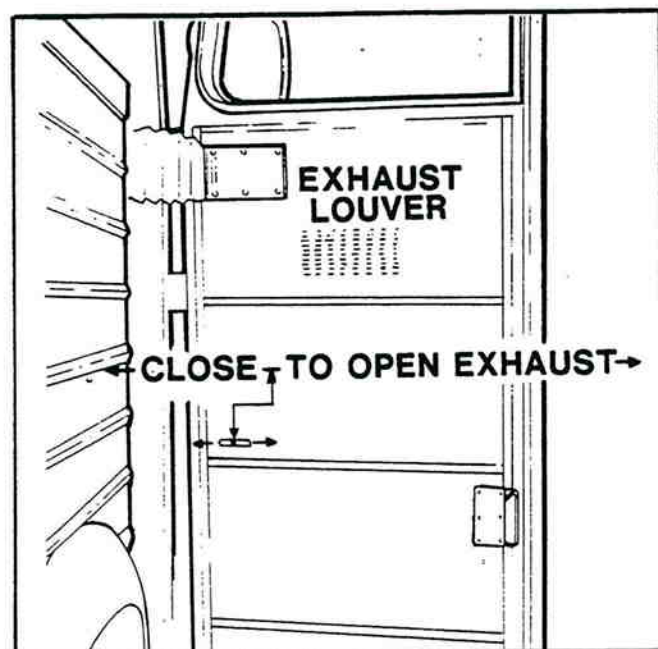


Driver's fresh air located to the left of the driver under the dash.



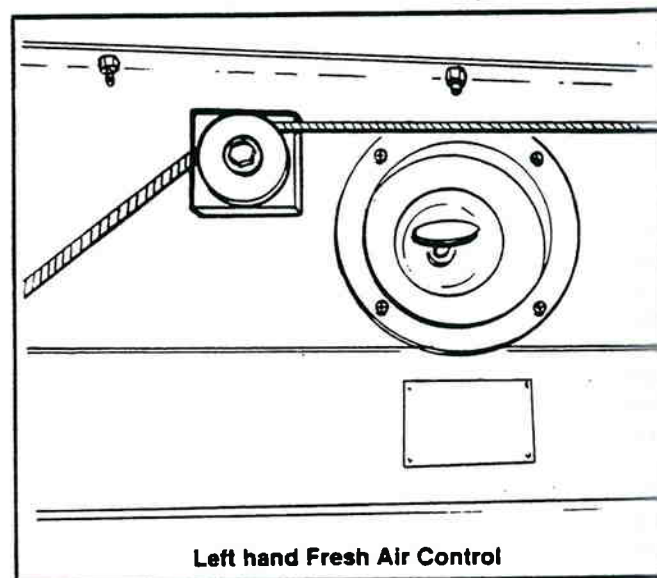
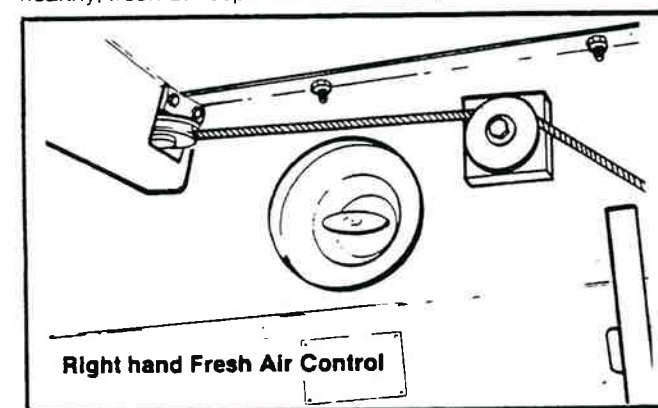
Fresh air intake above Tire Compartment

MC-9 MAINTENANCE MANUAL



FRESH AIR VENTILATION

Some MC-9 coaches are equipped with controls to regulate the percentage of outside air being drawn into the coach and mixed with recirculated air. The controls should normally be in the closed position. Even in this position approximately 20% of the conditioned air is fresh outside air. This provides a healthy, fresh atmosphere in the coach.



At intervals depending entirely on service conditions, the A/C air filter should be removed and washed. To reach the filter, open the battery compartment door, unlatch locks and pull out. The filter is provided with a grab handle for removal.

When the cooling system is drained and flushed (Refer to Section 6, Cooling), the heating water system should be similarly serviced.

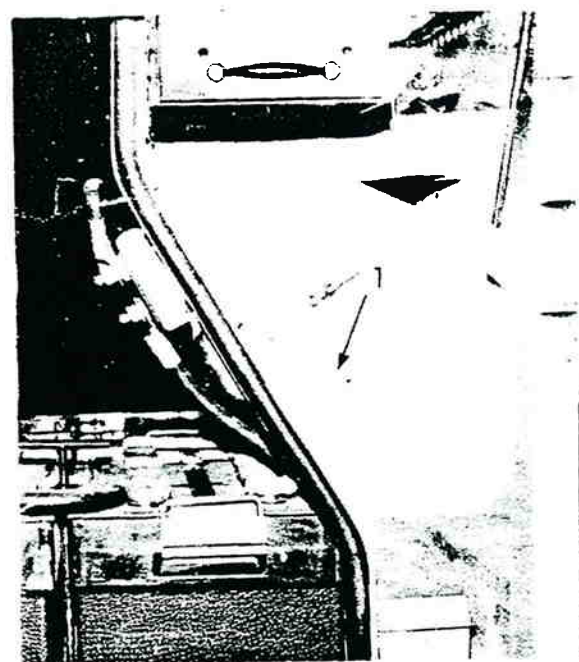


Figure 16-1. A/C Filter

DRAINING AND REFILLING

Refer to Section 6 (Cooling) for instructions on draining and refilling the engine cooling and coach heating system.

MC-9 MAINTENANCE MANUAL

If the heating system is to be drained without draining the engine cooling system, close gate valves in engine compartment and drain radiator cores. A manual vent plug is provided in the top of the main heater core and at the top of the driver's heater core for bleeding air while refilling. The vent plugs allow air to enter during draining.

OPERATION

Controls for coach heating system are located at the driver's switch panel. The temperature control selects the temperature range desired and the system automatically maintains the pre-set limits. Blower motors for coach heating, driver's heater and defroster are controlled by switches on the driver's switch panel.

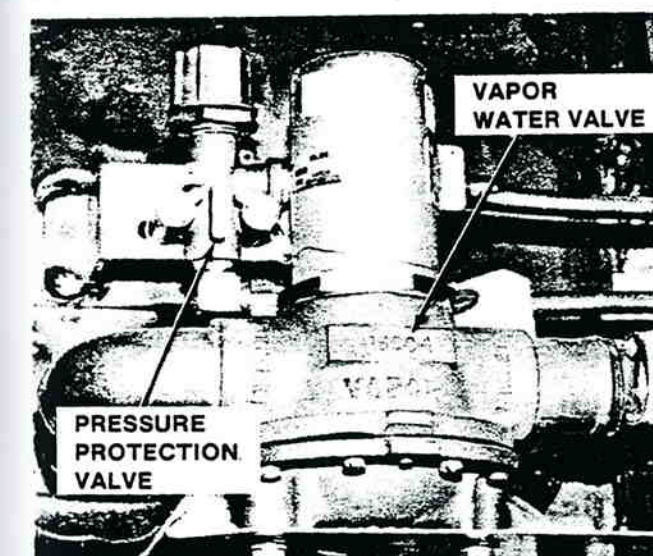
MAIN HEATER WATER VALVE
(ELECTRICALLY ACTUATED)

Figure 16-2A. Electrically Actuated Main Heater Water Valve Used Prior To Unit 39263.

Prior to unit 41089, the flow of hot water to the main heater core is controlled by an electric water valve mounted in the right front baggage compartment.

Valves from two different manufacturers are present on the coaches built prior to unit 41089. One make was used prior to unit 39263 and another was used from unit 39263 through unit 41088. These two valves are interchangeable as complete assemblies. Refer to TMC/MCI Service Bulletin No. 2224 for information on replacing the earlier valve with the later valve.

NOTE: The following information applies specifically to the earlier valve but is generally applicable to the later one.

The valve is designed so that the pilot valve within the assembly opens and closes a port which directs pressure to either the top or bottom of the valve diaphragm, thus opening or closing the valve.

A delay action is built into the water valve through the means of an orifice in the valve body and a modulating cup on the

diaphragm assembly. When the coach is operating with no current to the water valve solenoid, inlet water pressure is directed to the upper side of the diaphragm, thus forcing it open.

The pilot valve is normally open, relieving any build-up of pressure under the diaphragm. When the solenoid is energized the pilot valve closes, water pressure builds up through the orifice to the underside of the diaphragm and keeps the valve in closed position.

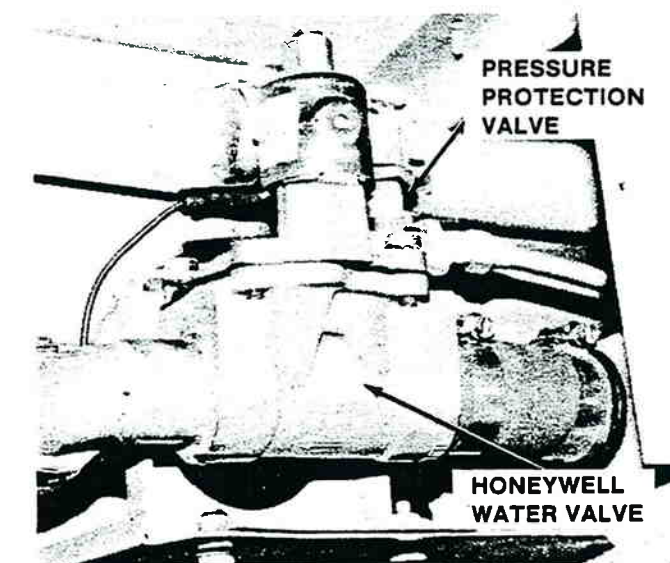


Figure 16-2B. Electrically Actuated Main Heater Water Valve Used On Units 39263 Through 41088.

MAINTENANCE

The main heater water valve requires a minimum amount of maintenance. The valve should be free of any sediment or dirt which might interfere with its operation. The diaphragm (8) (figure 16-2C) should be replaced every year before the heating season begins. No other maintenance is needed unless a malfunction occurs.

OVERHAUL

In the event of a malfunction, remove the water valve from the system.

CAUTION: Do not allow any liquid to reach the solenoid coil. After removing the valve from the system, carefully drain the remaining liquid from the inlet and outlet openings.

DISASSEMBLY

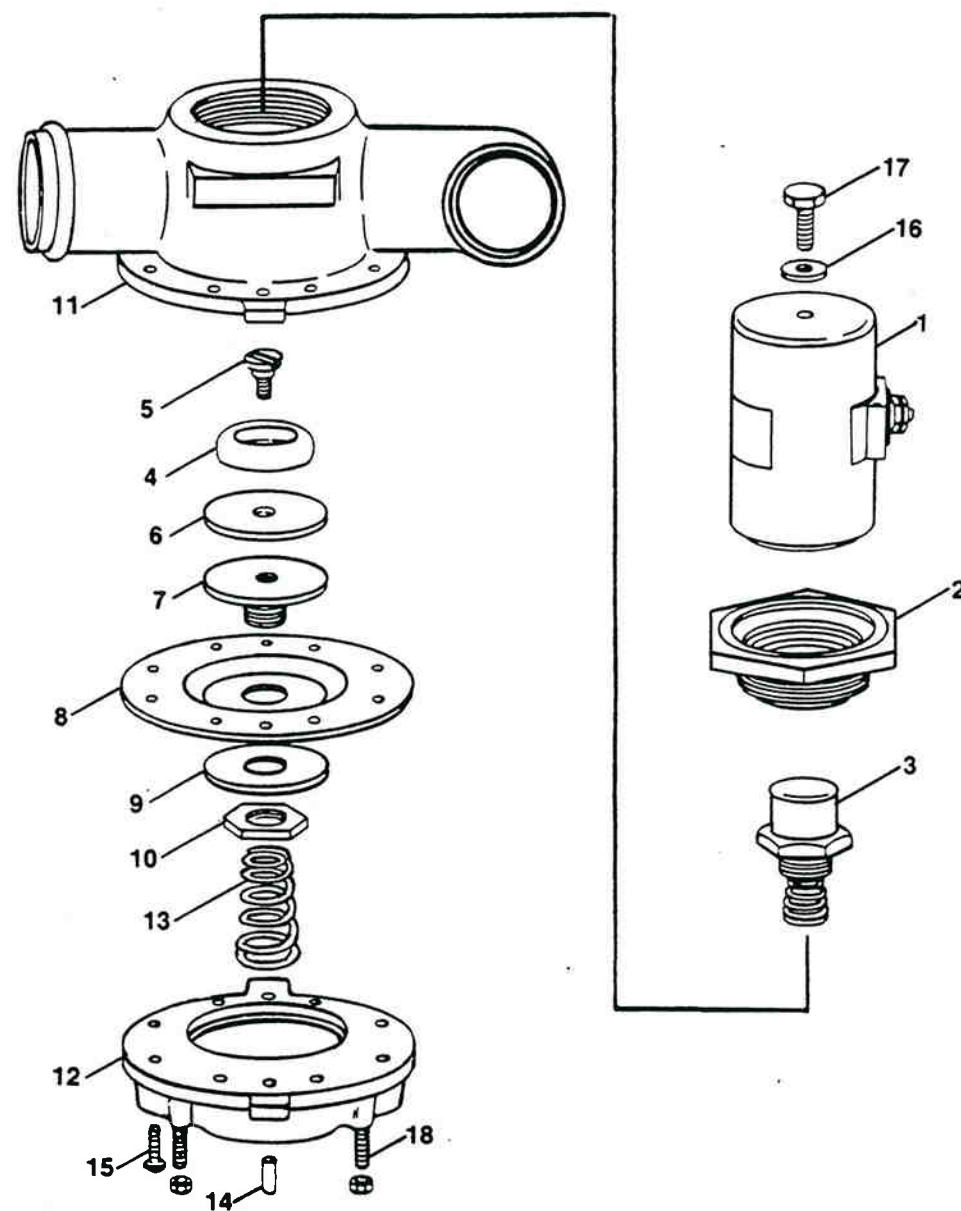
Refer to figure 16-2C.

Remove the terminal nuts, lockwashers, and washers from the valve.

Remove the screw (17) and lockwasher (16) from the coil and container assembly (1).

Remove the valve seat assembly (3) from the coil and container assembly (1) by turning it counterclockwise with a wrench.

MC-9 MAINTENANCE MANUAL



- | | | |
|---------------------------|--------------|------------------|
| 1. Coil & Container Assy. | 5. Screw | 9. Washer |
| 2. Ring Assy. | 6. Disc | 10. Lock Nut |
| 3. Valve Seat Assy. | 7. Retainer | 11. Body Assy. |
| 4. Modulator Flow | 8. Diaphragm | 12. Bottom Plate |

Figure 16-2C. Main Heater Water Valve Disassembled.

MC-9 MAINTENANCE MANUAL

NOTE: The valve should be held secure in a padded vise for disassembly.

The valve seat assembly (3) must be replaced in its entirety if it is damaged or worn.

Remove the eight No. 10-24 fillister head machine screws (15) used to secure the lower valve body (12) to the upper valve body (11). Carefully separate the two portions by using a screwdriver at the two pry-lugs on either side of the valve. The dowel pin (14) will remain in the upper valve body.

The diaphragm valve disc assembly is now removed and the diaphragm replaced. This is done by removing the locknut (10) and the diaphragm washer (9). If difficulty is experienced in removing the locknut, carefully hold the assembly in a vise between two strips of soft wood.

CAUTION: Do not tighten vise so as to damage or bend the disc assembly.

The locknut (10) should be torqued to 25-30 inch pounds (2.8-3.3 Nm) and the valve disc screw (15) is torqued to 12-15 inch pounds (1.3-1.6 Nm).

CLEANING AND INSPECTION

Before reassembling the valve, make sure that all parts are clean and in good condition. Thoroughly clean the serrations in the upper and lower valve bodies.

If the valve seat assembly is defective or leaks more than six drops per minute at 10 psi (69 kPa) when the coil is energized, it should be replaced.

REASSEMBLY

Position the diaphragm disc assembly on the upper valve body (11) so that the holes in the diaphragm align with the dowel pin (14) as well as with the pilot-channel hole and the valve body mounting holes. Set the conical spring (13) on the locknut (10). Carefully place the lower valve body (12) on the diaphragm disc assembly, engaging the dowel pin (14) with the hole opposite. Secure the eight No. 10-24 fillister head machine screws (15). Tighten the screws evenly around the valve body to 15 in. lbs. (1.6 Nm). Insert the valve seat assembly into the upper valve body (11) and tighten.

Screw the flux ring assembly (2) into the valve body.

Seat the cover assembly firmly on the flux ring assembly and tighten.

TESTING VALVE AFTER SERVICING

After servicing, the valve should be tested using water at approximately $170^{\circ}\text{F} \pm 10^{\circ}$ ($77^{\circ}\text{C} \pm 6^{\circ}$) and DC voltage at 24 VDC.

Apply water at 25 psi (172 kPa) to valve inlet and outlet; check for external leakage.

Reduce pressure to 10 psi (69 kPa) and open valve outlet. Check operation of valve by cycling valve several times.

Check internal leakage (through seat and needle valve) with 10 psi (69 kPa) at valve inlet and solenoid energized. Maximum allowable leakage is six drops per minute through the needle valve and zero leakage through the disc seat.

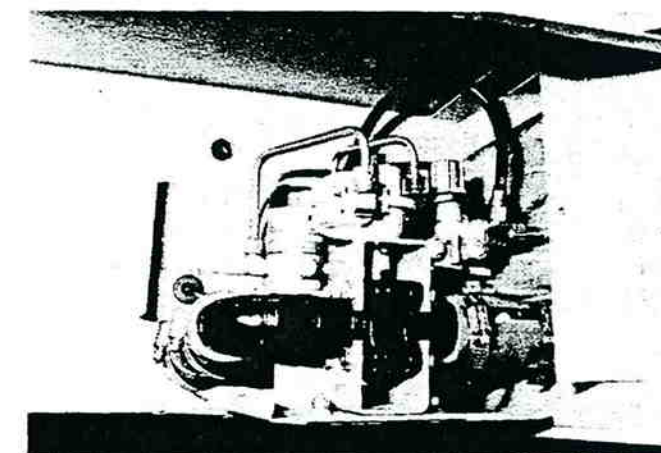


Figure 16-3. Air Operated Water Valve Installed (Effective With Unit 41089).

An air operated type of main heater water valve is used effective with unit 41089 (figure 16-3).

The bonnet of the valve contains a vane which is connected to a ball in the valve body. The valve is double acting; air is applied to both open and close the valve. The side of the vane to which air pressure is applied is controlled by a separate solenoid valve mounted on the same bracket as the water valve. The solenoid is activated by signals from the coach temperature control system which is described later in this section.

The air operated valve does not require any particular servicing; however, if for any reason the valve is disassembled, care must be taken in its reassembly so that the ball is oriented in the correct position in the valve body with respect to the direction of air flow against the vane. If this is not done, any signal to the solenoid valve from the temperature control system will result in the ball in the valve moving in the opposite direction to what is desired, with a consequent effect on the water flow.

DRIVER'S HEATER WATER VALVE**DESCRIPTION**

The driver's heater control valve is manually operated. It is located at the left-hand side of driver in heater duct panel at floor.

Note: Before removal of shut-off valve it is necessary to close valve in engine compartment. This prevents extensive water drainage from coolant system.

REMOVAL

1. Remove the valve control handle from the inside of the coach.
2. Open the exterior service door under the driver's window.
3. Disconnect the heater hose clamps at front and rear of valve assembly.

Slide hoses away from valve assembly. Remove the two hex nuts and screws which mount valve assembly. Remove complete valve assembly.

MC-9 MAINTENANCE MANUAL

DISASSEMBLY

1. Remove cotter pin from crank pin and slide yoke off.
2. Remove two hex nuts holding valve to mounting bracket.

REASSEMBLY

1. Mount new valve to bracket fastening with same screws and hex nuts removed during disassembly.
2. Install yoke to valve crank pin using new cotter pin. Valve assembly, complete with mounting bracket, is now ready for installation.
3. Mount the valve assembly with two hex nuts and screws.
4. Slide front and rear hoses over inlet and outlet of valve assembly and fasten clamps.
5. Install the valve control handle from the inside of the coach.

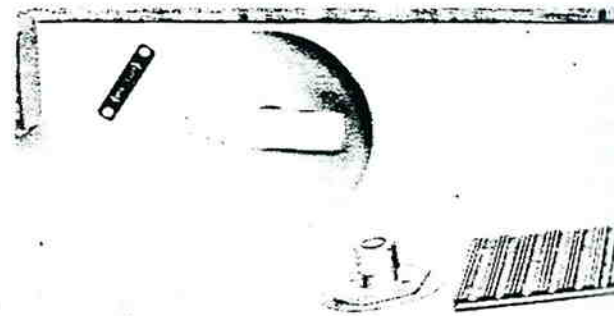
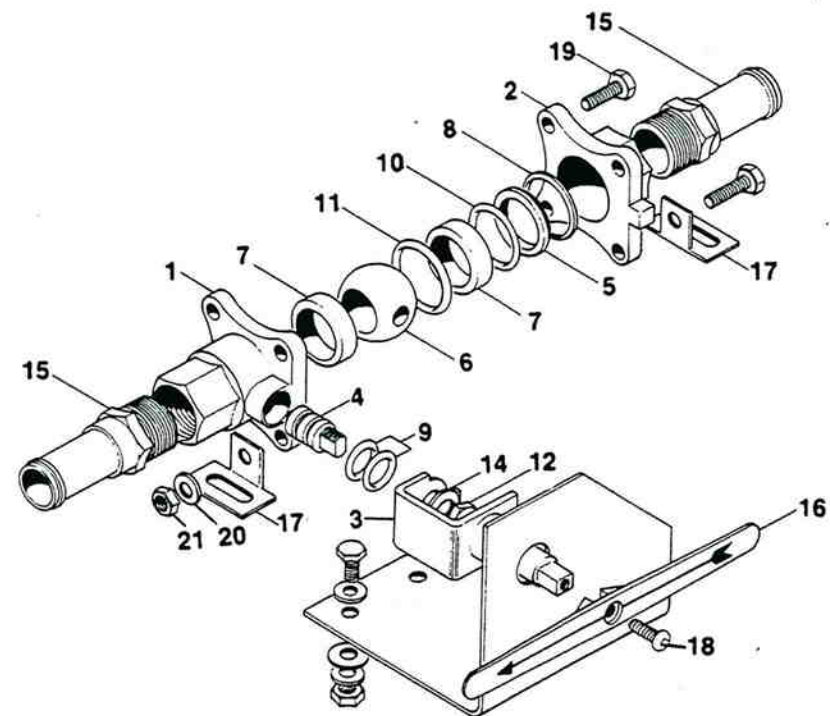


Figure 16-4. Driver's Heater Shut-of Valve.



- | | |
|-------------------------|-----------------------------------|
| 1. BODY | 12. JAM NUT |
| 2. CAP | 13. HEX. MACH. SCREW-1/4-20 x 5/8 |
| 3. STEM S/A | 14. INTERNAL TOOTH LOCKWASHER |
| 4. STEM | 15. EXTENSION S/A |
| 5. DISC | 16. HANDLE |
| 6. BALL | 17. VALVE MTG. ANGLE |
| 7. SEAT | 18. SCREW-#10-24 |
| 8. SPRING | 19. SCREW-1/4-20 x 1 |
| 9. 'O' RING-STEM SEAL | 20. LOCKWASHER-1/4" |
| 10. 'O' RING-SEAT SEAL | 21. HEX. HD. NUT-1/4" |
| 11. 'O' RING-JOINT SEAL | |

Figure 16-4A. Driver's Heater Shut-of Valve Disassembled.

MC-9 MAINTENANCE MANUAL

TEMPERATURE

The temperature control is a rheostat unit which increases the resistance in the thermostat sensing element, causing cycling at higher or lower temperatures (68°-78°F; 20°-26°C).

This unit is installed at the driver's switch panel and provides a means of selecting a temperature range which is then automatically maintained by the action of the thermostat and water valves.

Wiring connections to the heating system thermostat are shown in the wiring diagram included in Section 7 (Electrical) of this manual.

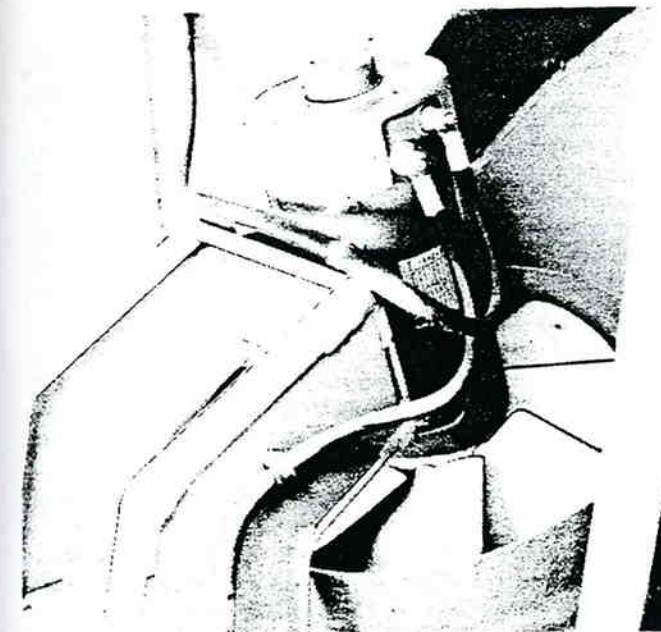


Figure 16-5: Axial Fan and Motor in Condenser Comp.

BLOWER MOTORS

All blower motors are 24 volt units of conventional design. Defective motors may be repaired according to standard procedures.

CAUTION: Do not use emery cloth or sandpaper for seating brushes or cleaning commutators. Motor brushes should be checked at regular intervals. New brushes should be seated using a bedding stone.

The blower motor for the central heat compartment is a 1½ h.p. unit (1.1 KW). The motor for the axial fan is a 2 h.p. unit (1.4 KW).

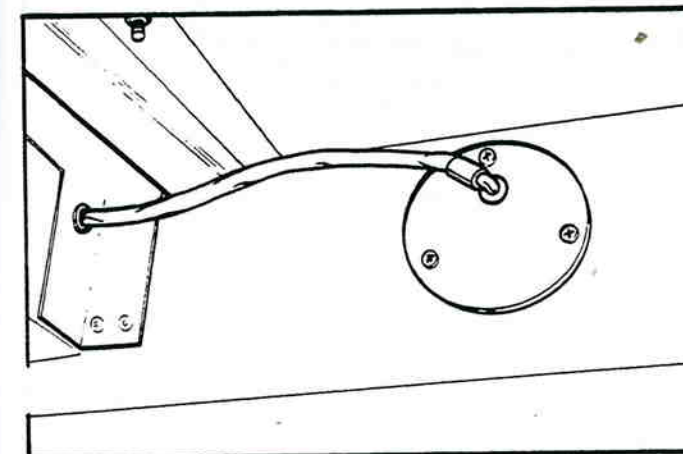


Figure 16-6: Sensing Unit installed at Center Control Duct

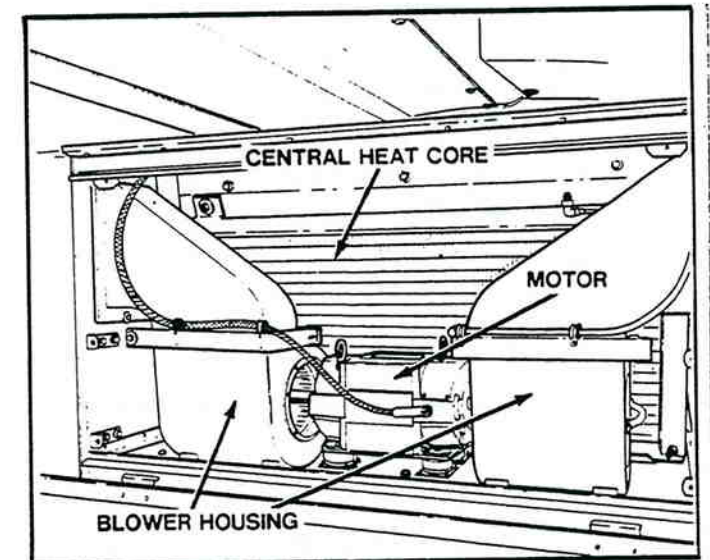


Figure 16-7: C/H Motor and Related Components

A/C & HEATER SWITCH

The A/C-Heating switch is fed from blower cut-in relay when generator is charging.

The selector switch in heat position "A" operates the central heating coach blower at low speed; in A/C position "B", it operates the following:

- 1) Coach blower operates at high speed.
- 2) Condenser motor is energized.
- 3) Compressor unloading solenoid and scavenge solenoid are energized.
- 4) Condenser blower operates.

AIR CONDITIONING SYSTEM

The air conditioning system is designed to provide a comfortable, healthful atmosphere within the coach. A schematic diagram of the air-conditioning system is illustrated in figure 16-8.

A mixture of cooled, filtered, dehumidified fresh and recirculated air is supplied through wall ducts located below the side windows. The combination of outside and recirculated air is continually filtered, resulting in a clean, fresh atmosphere.

MC-9 MAINTENANCE MANUAL

The air is drawn from the coach interior through center aisle ducts. It is filtered, cooled and dehumidified by an evaporator coil, then passed through a temperature-controlled heat core. Two blower fans send the air conditioned air up into the wall ducts.

The system is designed to provide a nominal 7½ tons main A/C and 1 ton driver's A/C of refrigeration or 90,000 Btu per hour (22,700 kcal/h) heat removal.

AIR CONDITIONING CYCLE

Refrigeration may be defined as "the transfer of heat from a place where it is not wanted to a place where it is unobjectionable." The air conditioning system in the coach is the "closed" type system using Freon 12 refrigerant. The major components required for a closed circuit refrigeration system are the compressor, evaporator, condenser, receiver tank and a liquid metering or expansion valve. The following is an explanation of the air conditioning cycle:

1. The refrigerant (Freon gas) flows to the compressor, is compressed to high pressure, and reaches a temperature

higher than the surrounding air. It is passed through the air-cooled fins and tubes of the condenser coil causing the hot, high pressure gas to be condensed into a liquid form.

2. The liquid refrigerant flows to the receiver tank, then through a filter-dryer where all moisture, acids and dirt are removed.

3. By its own pressure, the liquid refrigerant flows through a thermostat controlled expansion valve where reduced pressure causes it to become a low temperature, low pressure liquid.

4. The cold, low pressure refrigerant passes through the evaporator coil, absorbs heat from the air passing over the fins and tubes, and changes into gas. In this form, the refrigerant is drawn into the compressor to repeat the air conditioning cycle.

Proper operation of the air conditioning system depends on retaining the conditioned air within the coach. All windows and intake vents should be closed. An opening approximately eight inches square (203.2 mm) could easily neutralize the total capacity of the system.

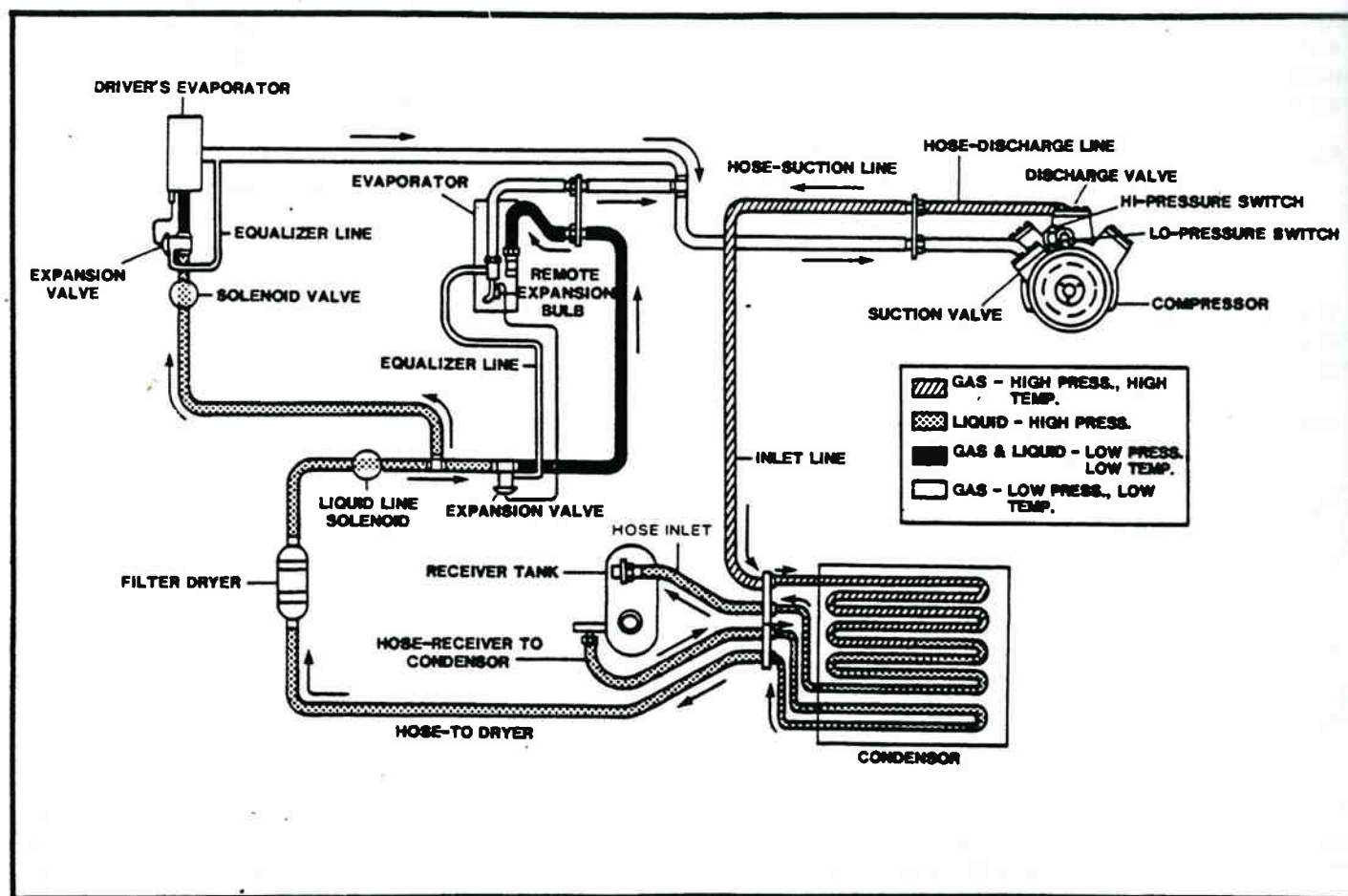


Figure 16-8: Air Conditioning System Diagram

MC-9 MAINTENANCE MANUAL

Another cause of inadequate cooling is a dirt-clogged evaporator coil or filter. Dirt acts as insulation and is also a restriction to air flow.

The refrigeration load is not constant and is affected by outside temperature, relative humidity, passenger load, the number of stops, etc. The compressor will load or unload depending on such operating conditions. The following information on the operating conditions is approximate and will vary:

Oil Level in compressor ½ of sight glass
 Freon Level in receiver ½ of lower glass
 Speed of engine - fast idle 900 rpm

MANUAL SWITCH CONTROLS

Temperature Rheostat - Located on panel to the left of the driver, it controls the air temperature in the coach during both heating and air conditioning.

Passenger A/C Coach Heat - Located on the switch panel to the left of the driver. In "A/C" position, the air conditioning system is energized and functions as required. In the "Off" position, the condenser and evaporator fans are shut off. In the "heating" position, the evaporator fans are at operating speed and the air conditioning compressor is unloaded.

FAST IDLE

The fast engine idle can only be used to power the air conditioning system when the coach is stationary and the emergency parking brakes are applied. The feature consists of a fast idle switch on the driver's switch panel, an air valve in the engine compartment and an air cylinder mounted on the engine governor.

Placing the Fast Idle switch ON energizes the air valve which lets air pressure to the air cylinder, causing the governor-operating lever to be moved to the fast idle position. To eliminate the possibility of engine damage, the accelerator cannot be operated when the fast idle switch is closed.

DAILY CHECKS

1. Check oil level in compressor.
CAUTION: It is essential that only the correct lubricant be used, such as Texaco WF 68, WFI 132, or equivalent.
2. Check Freon level in receiver.
3. Check and clean condenser coil. Do not use caustic soap.
4. Check and clean filter.
5. Check compressor and belts.

TEST EQUIPMENT

Specific air conditioning test equipment is recommended for routine servicing of the air conditioning system. It includes the following:

Qty.	Part No.	Description
1	16C-2-92	Air Conditioning Test Equipment Kit
1	16C-2-93	Halide Leak Detector (Bernz-o-Matic Model TX-12)
1	16C-2-94	Freon 12, 35 lb. tank (15.9 kg)

3	16C-2-95	Charging Hoses - (Yellow Jacket Hoses) (HCL-36)
1	16C-2-96	Pressure Gauge 0-400 lbs. with R 12 Temperature Scales
1	16C-2-97	Compound Gauge 0-30" Vac. 0-150 lbs. with R 12 Temperature Scales
1	16C-2-98	Gauge Manifold with handwheels
1	16C-2-99	Thermometer - (Mechanical) to check Superheat 10° to +100°F

The above parts are available from Universal Coach Parts Inc., Northlake, Illinois and in Canada from Motor Coach Industries, Service Parts Division.

A/C SYSTEM MAINTENANCE PROCEDURES

AIR CONDITIONING SYSTEM SOLENOID VALVE

When the Passenger A/C-Heat control is switched on, the system solenoid valve is actuated and allows refrigerant to circulate within the air conditioning system. Turning the switch off will close the valve. This valve is located in the condenser compartment.

The valve can be opened or closed manually in case the solenoid's electric operation of driver's switch operation is suspect. Removal of a seal cap on the valve will expose a 3/16" square stem. To manually open the valve, place a wrench on the stem and turn it 180 degrees (½ turn) counterclockwise.

CAUTION: Turn only 180° counterclockwise. Do not backseat.

To manually close the valve, turn the stem ½ turn clockwise until the stem is tight (seated).

NOTE: The manual stem must be in the closed position before automatic solenoid operation will take place.

PUMPING DOWN

Whenever it is necessary to "open" the refrigeration system for service or repairs, the refrigerant must be removed from that part of the system requiring service. Localizing refrigerant into one part of the system (usually the receiver) is known as "pumping down." The procedure is as follows:

1. Close the outlet valve on the receiver, backseat the suction valve, install a gauge and turn the valve forward ¼ turn, thus enabling visual check of the suction pressure.
2. Connect a jumper wire between horizontal studs 1 and 2 in remote control box

NOTE: This jumper will allow the compressor clutch to remain engaged after pressure drops below 15 psi (103.5 kPa).

3. Start the engine and operate the compressor until pressure reads 1-2 psi (6.9-13.8 kPa), then disconnect the jumper wire.

4. The pressure will probably rise. Install jumper wire again and lower the pressure until it remains at 1 or 2 psi (6.9-13.8 kPa). Close inlet valve to receiver tank. Stop compressor.

MC-9 MAINTENANCE MANUAL

5. Close the discharge valve at the compressor.
6. Close the suction valve at the compressor.

CAUTION: During this operation care must be taken not to fill the receiver tank over the top sight glass. It may be necessary to partially vent the tank. Always allow refrigerant piping and system components to warm up to the ambient air temperature before opening system or sweating will take place inside the lines with resultant system contamination.

ADDING REFRIGERANT

Always charge the system with the Freon cylinder upright and the valve on top to avoid drawing liquid out of the cylinder. When charging an empty system, weigh the amount of Freon put into the system. This will eliminate any possibility of overfilling. A full charge is exactly 24 pounds (10.8 kg).

To add Freon to the system:

1. Backseat the suction service valve on the compressor and loosely connect a charging line from the Freon cylinder to the valve.
2. Tighten the connection at Freon cylinder and open the tank end slightly to purge air from the charging line.
3. Tighten the charging line connection at the compressor.
4. Screw the stem of the suction valve in approximately two turns.
5. Start the engine (compressor) and run at fast idle. Add sufficient Freon to bring the level in lower sight glass in receiver tank to mid-point.

AIR IN SYSTEM

The presence of air in the air conditioning system may be determined by the following test procedure. To check for air, the system must be off and cooled to ambient temperature:

1. Connect test gauges to A/C compressor and record suction pressure and discharge pressure (head pressure).
2. Compare the readings. If the difference between the two readings is greater than 5 psi (34.5 kPa), air is present and the system should be purged.
3. If the difference between suction and discharge pressure is within 5 psi, connect a gauge to the test fitting on the main expansion valve and record the pressure. Compare this reading with the suction pressure.
4. Check the pressure on the discharge expansion valve in the same manner. Compare the reading with the suction pressure.
5. If there is more than a 5 psi (34.5 kPa) difference between suction pressure and either expansion valve pressure, air is present and the system should be evacuated.

EVACUATION OF AIR CONDITIONING SYSTEM

1. Connect service gauges and backseat both the suction and discharge valves on the compressor.
2. Remove protective caps from the service gauge pressure tap ports on the suction and discharge valves.

3. Connect the gauge hoses loosely to the compressor suction and discharge valves.

4. Connect the line from the gauge manifold to the vacuum pump. Connection should be tight.

5. Midseat the valves at the high and low sides of the service gauge manifold.

6. Open the suction and discharge service valves slightly to allow any Freon that might be remaining in the system to escape to the atmosphere.

7. When you can no longer detect Freon gas escaping, tighten the service hose connections.

8. Midseat the suction and discharge service valves.

9. Start vacuum pump and run until pressure in the system is from 29.5 to 29.7 In-Hg, then run 4 to 5 minutes longer.

To check the system, proceed as follows:

10. Close valve between manifold and pump.

11. Shut off pump and wait 15 minutes. If the pressure rises no more than 2 psi during that time period, the system is dry and free of leaks. If the pressure rises more than 2 psi and stops, it indicates there is moisture remaining in the system and further evacuation is required. (Repeat steps 9-11.) If the pressure rises more than 2 psi and continues to rise, it indicates a leak in the system.

12. If there are no leaks or moisture in the system, close the suction and discharge service valves on the compressor.

To remove gauges, proceed as follows:

13. Start engine and compressor.

14. Backseat compressor discharge service valve.

15. Backseat both high and low side hand valves of gauge manifold with discharge service valve backseated.

16. Backseat compressor suction valve.

17. Shut engine off.

18. Remove the hoses from the compressor.

NOTE: If hoses are attached to dummy fittings on back of manifold, there will be enough refrigerant left in the lines to give a slight positive reading to prevent dirt and moisture from entering the gauges.

CHARGING THE SYSTEM

When a system has been opened or if there is any question about the air or moisture in the system, evacuate the system. Charging of an evacuated system may be accomplished by forcing liquid Freon 12 directly into the receiver tank.

This may be accomplished by placing the refrigerant tank upside down on a scale (bathroom type) with valving at the bottom and liquid charging. This ensures that only liquid enters the reservoir.

1. Backseat the two compressor shut-off valves (out).
2. Install the test gauges at the shut-off valves noting that the 400 psi (2.758 kPa) gauge is connected to the discharge.
3. Turn in the two shut-off valves 3 to 4 turns.
4. Open the lower receiver valve by turning all the way out.
5. Backseat the upper receiver valve by turning all the way out.
6. Remove the cover cap from the service fitting in the top receiver valve.

MC-9 MAINTENANCE MANUAL

7. Attach a charging hose to the Freon tank. Open the tank valve slightly, permitting Freon to escape thus purging the hose of air.

8. Connect the charging hose to the service fitting.

9. Open the Freon tank valve.

10. Turn in the upper receiver valve several turns. The Freon will now enter the system.

11. The proper charge of Freon is 24 pounds (10.9 kg).

12. When the scale indicates this amount of charge, backseat the receiver valve and close the Freon tank valve.

13. Disconnect the charging hose. Replace the cover caps.

14. The system is now ready for operation.

LUBRICATION

Too much oil in the system is as harmful as too little. To ensure proper lubrication, the level should be maintained within certain limits.

Sight gauges are located on both sides of compressor crankcase. Oil level is correct when engine side sight gauge is full and curb side sight gauge is empty.

After standing idle for any length of time, the compressor will normally pump crankcase oil into the system and approximately 20 minutes of running time may be required to bring it back to the crankcase.

After the unit has run at least one-half hour, the crankcase temperature should be warm to touch. If cool, this indicates the expansion valve adjustment is passing too much liquid or there is excessive oil in the system. Oil level is always lower in a cool crankcase due to cooling evaporating refrigerant causing oil to foam and be carried out into the system.

BELT TENSION

AIR CYLINDER

An air-operated conditioning compressor belt tension air cylinder is installed to keep the correct tension of A/C compressor drive belts. Access to the air cylinder can be gained through rear engine compartment doors. See figure 16-9.

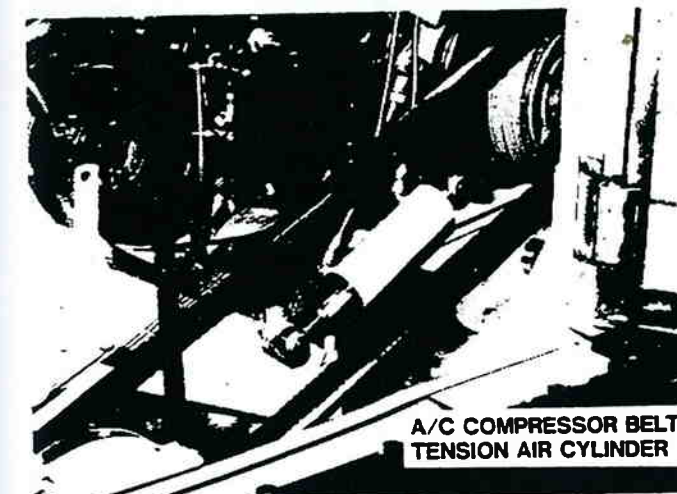


Figure 16-9: Belt Tension Cylinder

MAINTENANCE - The A/C compressor belt tension air cylinder should be lubricated at regular intervals, approximately every 30,000 miles (48,000 km).

The recommended procedure is as follows:

1. Remove air feed hose from cylinder and apply a few drops of SAE 30 or 40 engine oil into cylinder hose connector.

2. Reconnect the hose, then reverse the air supply to the cylinder to lubricate the other end of the cylinder.

3. Check the cylinder for air leaks and recondition if as required.

NOTE: Do not attempt to disassemble air cylinder in coach.

REMOVAL AND DISASSEMBLY - Proceed as follows:

1. Shut off air supply by turning control valve handle to compress the cylinder spring and relieve belt tension.

2. Remove drive belts.

3. Remove lock nuts and bolts securing rod ends to mounting bracket on the engine cradle, and bracket on compressor. Remove air cylinder from coach.

4. Disconnect feed and exhaust hoses at the air cylinder.

5. Remove the uniball ends from air cylinder assembly.

WARNING: Air cylinder end plate is under 50 to 60 lbs. (22.6-27.2 kg) spring pressure. Care must be exercised to avoid injury when disassembling the cylinder.

6. Using an arbor press, depress the piston rod into the cylinder approximately 1/2" (12.7 mm) before attempting to remove retaining ring.

CAUTION: Avoid depressing piston rod beyond 1/2" (12.7 mm) as spring pressure increases with more compression. Care should be taken not to damage any threaded surfaces.

7. Remove end plate retaining ring using a suitable pliers and screwdriver if necessary.

8. Slowly release pressure on piston rod and cylinder assembly thus allowing the end plate to come clear of cylinder.

9. Internal parts can now be removed for cleaning and inspection. See figure 16-10.

INSPECTION AND REPLACEMENT - Inspect all O-rings, cups, felts and seals; replace if damaged. Inspect cylinder bore and piston for scoring and replace if damaged. Refer to Specifications at end of this section for spring rate tension and replace if not within tolerances. Inspect retaining ring and replace if bent or damaged.

REASSEMBLY - follow this procedure:

1. Coat all new parts with SAE 30 or 40 engine oil prior to assembly.

2. Reassemble the cylinder in reverse order of disassembly.

3. Hold the cylinder in an upright position and install the spring and oil felt in position over the boss on the lower end.

MC-9 MAINTENANCE MANUAL

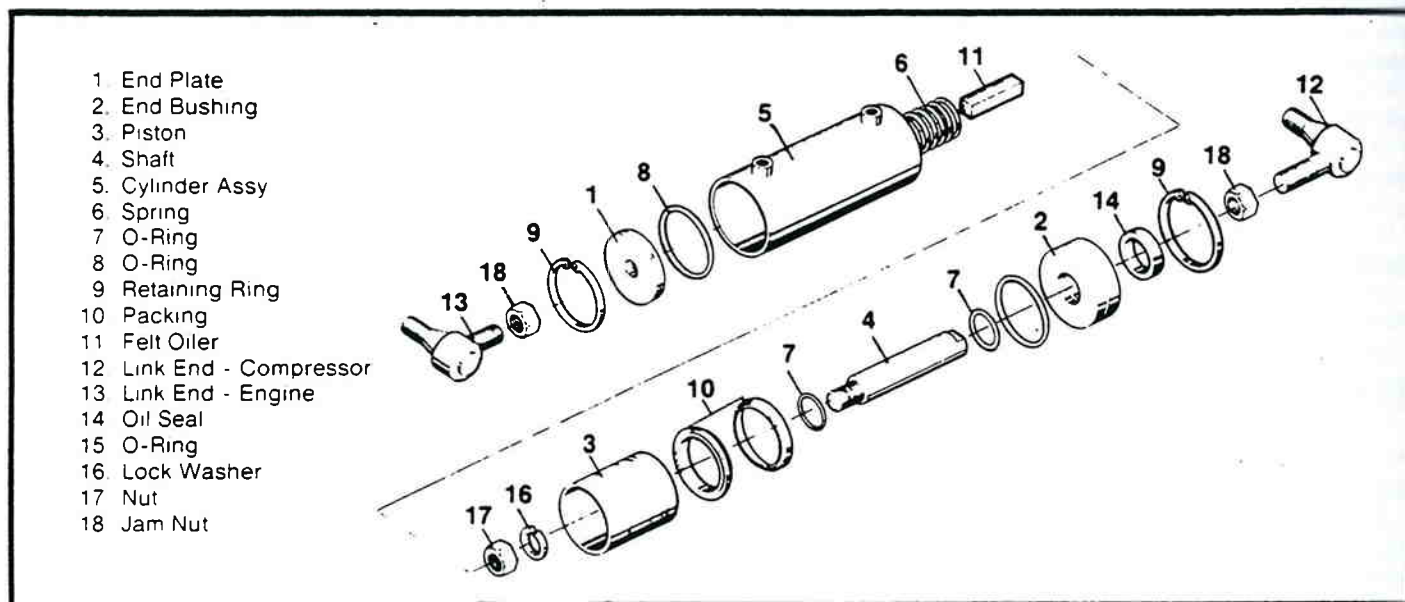


Figure 16-10: Belt Tension Cylinder Components

plate. The same applies when piston assembly and end plate are installed.

4. Place in vice or arbor press. Apply pressure against piston rod. Be careful not to damage seal.

5. Compress end plate approximately 1/16" (1.5 mm) beyond retaining ring groove and install retaining ring.

CAUTION: Care must be taken at assembly not to allow piston rod or air cylinder to slip out of vice or arbor press.

INSTALLATION AND ADJUSTMENT - Proceed with these steps:

1. Install A/C compressor air cylinder belts. Assemble lock nuts and bolts securing rod ends to mounting bracket on engine cradle and bracket on compressor.

2. Connect feed and exhaust hoses.

3. Turn control-valve handle to ON position.

4. Check the extension of the actuating shaft of the air cylinder. It should be $1\frac{1}{4} \pm \frac{1}{8}$ " (31.7 \pm under recommended air pressure from the air pressure regulating valve (discussed below).

NOTE: Shaft extension should be as specified in step 4 regardless of the length of the belts.

5. If shaft extension requirement is not as specified, loosen shaft jam nuts and adjust to achieve the specified extension. Tighten the jam nuts.

Follow the above procedure when new belts are installed. After 500 miles (800 km) check the shaft extension dimension and readjust as necessary. Refer to Belt Tension Pressure Regulating Valve (following) for air pressure adjustment.

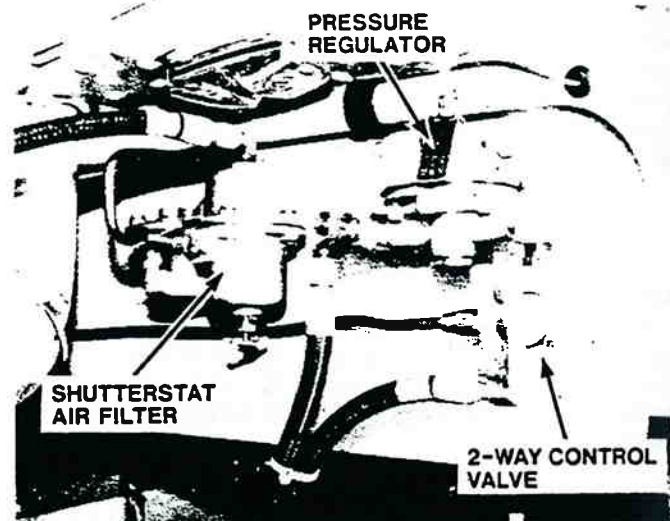


Figure 16-11: Pressure Regulator and Control Valve

BELT TENSION PRESSURE REGULATING VALVE

An air pressure regulating valve provides belt tension air pressure to prevent belt drive slippage. See figure 16-11. The required air pressure from the regulator is 95 psi (655 kPa). Perform this procedure to adjust the belt tension pressure regulator valve:

1. Install an air pressure gauge between the regulating valve and the belt tightener air cylinder.

2. Turn 2-way control valve to off and on positions several times and observe pressure reading on gauge.

3. If final pressure reading is not 95 psi, loosen lock nut at top of regulating valve.

4. If pressure is higher than 95 psi, turn regulator adjusting screen counterclockwise and turn 2-way valve to off and on several times. When reading is less than 95, proceed to step 5.

MC-9 MAINTENANCE MANUAL

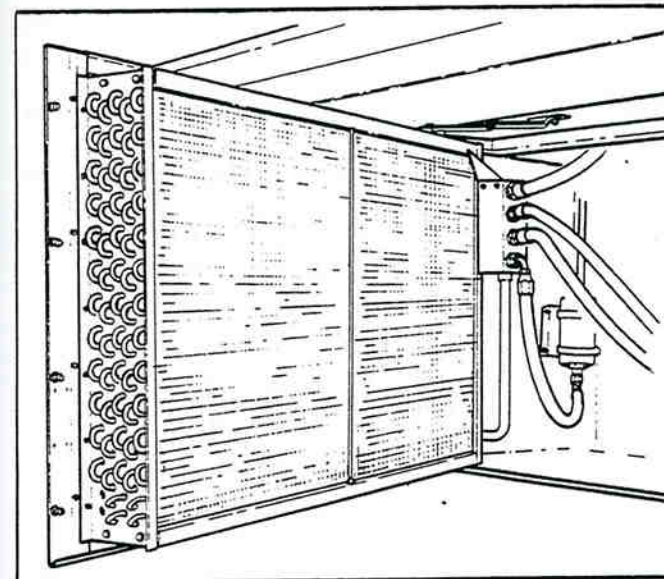


Figure 16-12: Air Conditioning Condenser Coil

5. While observing air pressure gauge, turn adjusting screw clockwise until the required 95 psi (655 kPa) reading is reached. Tighten the lock nut.

6. Remove air pressure gauge and reconnect lines.

CONDENSER

The condenser compartment is located on the left side of the coach, behind the front wheel housing and contains the coil, fan and housing blower motor, receiver tank and controls.

The condenser coil is mounted on the inner side of the compartment door. Since the condenser's purpose is to

dissipate the heat from the hot refrigerant, it is important to keep the cooling coils and fins clean. See figure 16-12.

Dirt and grease clogging the coil causes high head pressure and reduced system efficiency. It is important to clean the condenser coil regularly, preferably once a day, using water under pressure directed at the inside surface of the core.

Flush the condenser coil from inside out, using a water jet or water mixed with air pressure. Direct the pressure straight through the coil to prevent bending of fins.

For an extremely dirty coil, use Kelite 28 as a cleansing agent. Mix with cold water and wash the coil. Rinse with cold water.

CAUTION: Do not use a high pressure water jet, steam or harsh soaps.

EVAPORATOR

The evaporator is located in the heating/cooling compartment behind the heater core (when viewing from front baggage compartment). See figure 16-13. (The heater core and fan assembly can be checked by opening the center door in the front baggage compartment.)

The evaporator can be checked and cleaned by removing the access panel at the rear of the condenser compartment on the rear bulkhead. Periodic cleaning is required to ensure full efficiency. The evaporator should be cleaned with a cleansing agent not harmful to aluminum or copper. Also keep the compartment seals in weathertight condition to assure proper coach air circulation.

To remove the evaporator, it is necessary to remove the fans and ducts, the heater core and then the evaporator and frame as one assembly.

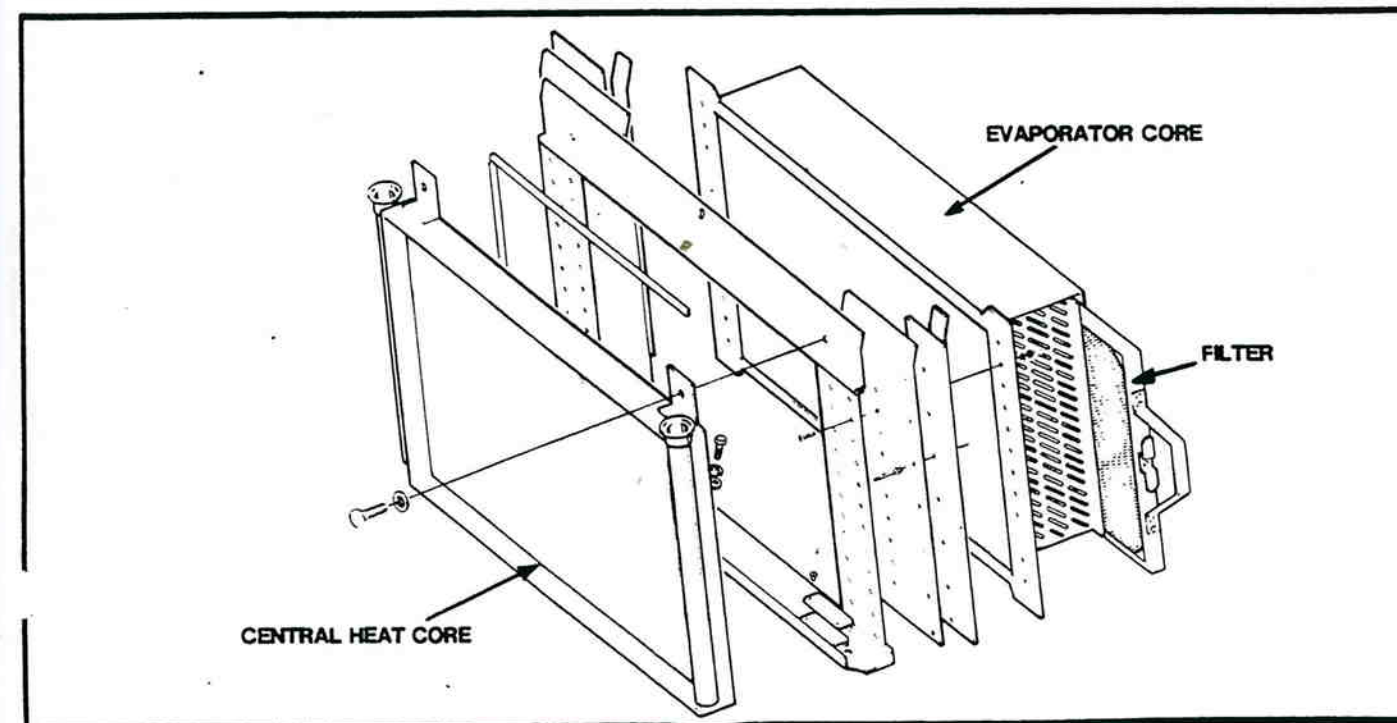


Figure 16-13: Evaporator and Heater Cores

MC-9 MAINTENANCE MANUAL

FANS AND MOTOR

Evaporator blowers are mounted on the shafts of a 1½ hp (1.1 kw) 24-volt motor. They should be cleaned periodically, the frequency depending on operating conditions. A dusty environment will mean more frequent cleaning. Use compressed air to clean the fans.

The motor (single speed) should be checked every 5,000 operating hours (more often in dusty environments). Lubrication is not necessary since the motor is a sealed, self-lubricated unit. However, the brushes should not be allowed to wear shorter than ¾" (19 mm).

To test the current draw of the motor, proceed as follows:

1. Connect an ammeter in series with the motor lead. The ammeter hook-up must allow the evaporator door to be fully closed during the check.
2. Start the engine and set at fast idle.
3. Place the A/C-Heat Switch in the A/C position.
4. Observe the ammeter reading. Current draw should be 48-52 amps at 27.2 VDC.
5. Check and replace the motor brushes if motor draws excessive current. Minimum brush length is ¾" (19 mm).

CAUTION: Do not use emery cloth or sandpaper for seating brushes or cleaning commutators. Seat new brushes with a bedding stone.

6. If the brushes are satisfactory, replace the motor.

NOTE: Fans and tapered lock bushings are dynamically balanced. Before removing the bushing, match-mark the fan and bushing to allow re-installation in the same position.

FILTER

At intervals depending on service conditions, the A/C air filter should be removed and the following procedure followed for cleaning:

1. Shake out excessive dirt and grit.
2. Wash in warm water and if excessively dirty, use a mild laundry detergent in warm water.
3. Rinse thoroughly and shake out excess water.
4. Let dry and replace in service.

To reach the filter, open the battery compartment door, unlatch locks and pull out filter. The filter is provided with a grab handle for removal. See figure 16-1.

CAUTION: The coach should never be operated without this filter because proper circulation would be impaired. All air would bypass from pressure to the suction side of the chamber.

RECEIVER TANK

The receiver tank is located in the condenser compartment. The sight glasses can be observed by opening the condenser compartment door (figure 16-14).

The function of the receiver tank is to store the liquid refrigerant. During normal operation, the level of the refrigerant should be approximately at the halfway mark on the lower glass.

erant should be approximately at the halfway mark on the lower glass.

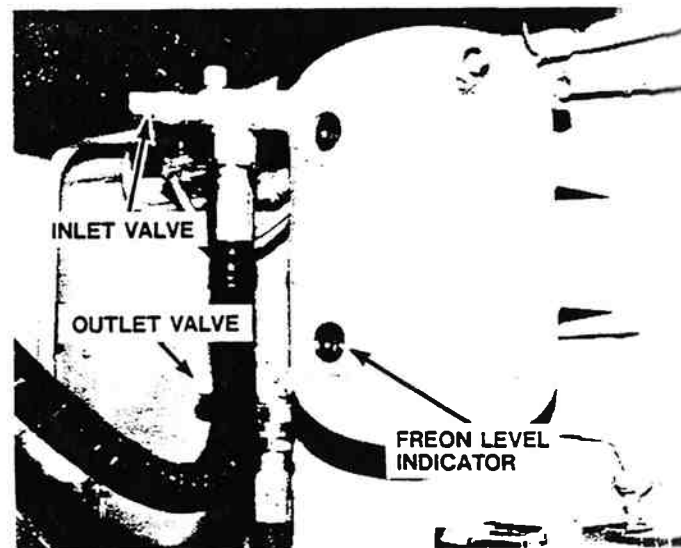


Figure 16-14: Receiver Tank

In case of extreme pressure rise in the liquid receiver tank, a pressure relief valve will break at 385 psi ± 10 psi (2,655 kPa ± 69 kPa), and relieve the receiver tank pressure.

The receiver tank incorporates an inlet valve at the inlet side which allows the tank to be isolated for service. An outlet valve at the outlet side permits complete isolation from the rest of the system.

PURGING SYSTEM AT RECEIVER TANK

Abnormal high head pressure sometimes indicates non-condensable gases in the receiver tank. In order to purge such gases that might accumulate in the system, use the test gauge fitting on the intake valve to purge the receiver tank.

The system requires 24 lbs. (10.8 kg) of Freon 12. The liquid should be approximately ½ in lower sight glass after 30 minutes of engine operation in fast idle with coach interior at approximately 70°F. (21°C.).

Refrigerant liquid should never be visible in upper sight glass and refrigerant should not be added unless the system has been operated as previously outlined.

FILTER-DRYER

A filter-dryer (figure 16-15) is installed between the receiver tank and expansion valve. It is used to absorb moisture from the refrigerant.

A plugged filter-dryer is indicated by differences in temperature on either side of it. If plugged, the filter-dryer must be replaced by following this procedure:

1. Pump down the system by isolating the refrigerant in the receiver and reducing pressure at the dryer.
2. Install a service gauge at the compressor.
3. Close off the outlet from the receiver tank.
4. Run the compressor until the low side of the system is evacuated.
5. Change the filter-dryer element.

MC-9 MAINTENANCE MANUAL

6. Admit a small quantity of Freon to the low side of the system. Check for leaks. Return the system to normal operation.

CAUTION: Use mineral spirits to clean parts. Do not use carbon tetrachloride or similar solvent. Do not use white gasoline or naphtha due to flammability hazard. Do not steam clean.

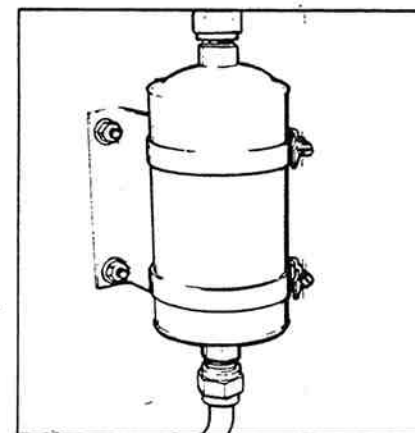


Figure 16-15: Filter/Dryer

LIQUID LINE SOLENOID VALVES

A solenoid valve is installed in the freon line going to the passenger A/C evaporator and in the line to the driver's A/C evaporator (figures 16-16 and 16-17). The valve is installed ahead of the expansion valve and is energized by the appropriate A/C switch on the driver's upper L.H. switch panel. When energized, the solenoid valve opens and allows freon to flow to the expansion valve.

Whenever the A/C system is being serviced, or when an insufficient cooling problem is being investigated, this valve should be checked to determine if it is opening so that freon is able to circulate through the system. If the valve is not functioning properly, check the electrical connections to it and check for damage to the wiring. Refer to the heating and air conditioning schematic which may be found in Section 7 of this manual.

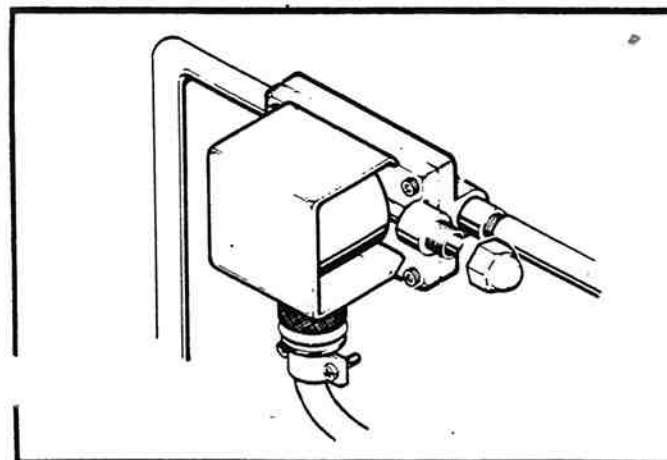


Figure 16-16: Liquid Line Solenoid Valve in Condenser Compartment

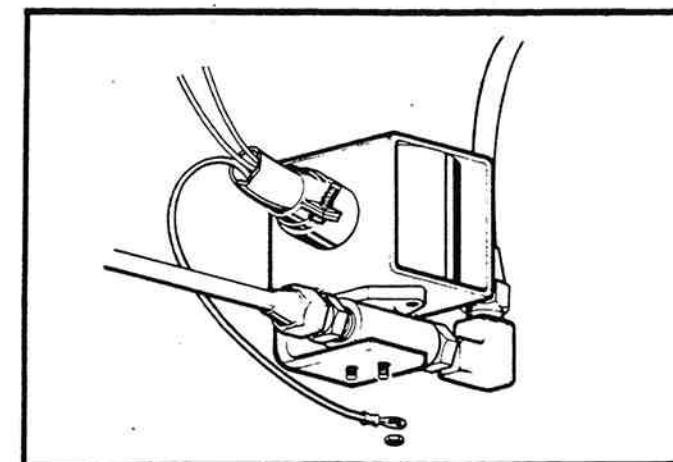


Figure 16-17: Liquid Line Solenoid Valve at Driver's Evaporator

EXPANSION VALVE

The expansion valve (figure 16-18) is a thermo-sensitive valve with a remote control bulb attached to the evaporator outlet line. The valve regulates the flow of liquid refrigerant into the evaporator coils depending on the suction gas temperature leaving the evaporator.

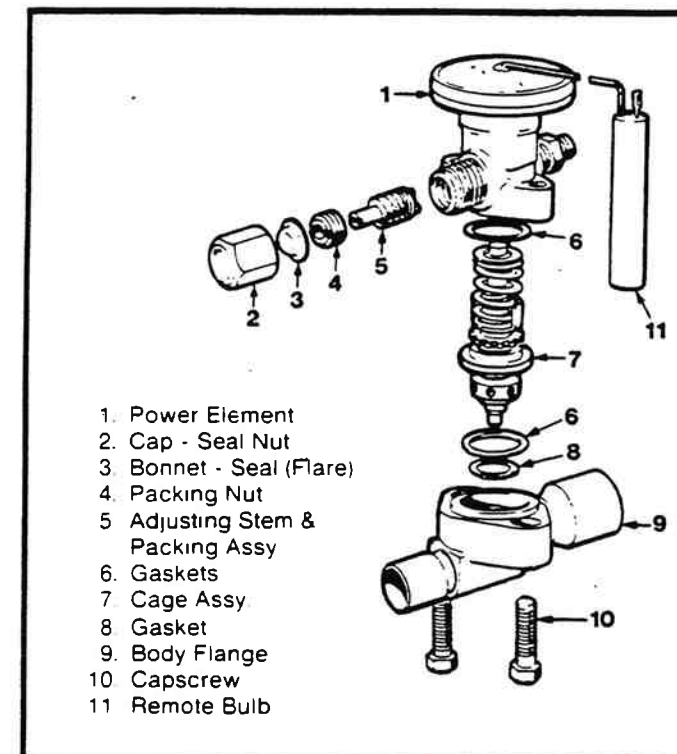


Figure 16-18: Expansion Valve

The remote bulb senses the gas refrigerant temperature as it leaves the evaporator. High temperature will cause expansion and pressure on the power head and spring. Such action causes the power assembly valve to open, allowing a flow of liquid refrigerant into the evaporator.

OPERATION - The remote bulb and power assembly is a closed system. The pressure within the remote bulb and

MC-9 MAINTENANCE MANUAL

power assembly corresponds to the saturation pressure of the refrigerant temperature leaving the evaporator and moves the valve pin in the opening direction. Opposed to this force on the underneath side of the diaphragm and acting in the closing direction, is the force exerted by the evaporator pressure, and the pressure exerted by the superheat spring. As the temperature of the refrigerant gas at the evaporator outlet increases above the saturation temperature corresponding to the evaporator pressure, it becomes superheated. The pressure thus generated in the bulb and power element increases above the combined pressures of the evaporator pressure and the superheat spring, causing the valve pin to move in the opening direction. Conversely, as the temperature of the refrigerant gas leaving the evaporator decreases, the pressure in the bulb and power element also decreases and the combined evaporator and spring pressures cause the valve pin to move in the closing position.

As the operating superheat is raised, the evaporator capacity decreases, since more of the evaporator surface is required to produce the superheat necessary to open the valve. It is most important to adjust the operating superheat correctly. A minimum change in superheat required to move the valve pin to full open position, is of vital importance because it provides savings in both initial evaporator costs and cost of operation. Accurate and sensitive control of the liquid refrigerant flow to the evaporator is necessary to provide maximum evaporator capacity under all load conditions.

The spring is adjusted to give 8°-12°F. (5°-7°C.) of superheat at the evaporator outlet. This ensures the refrigerant leaving the evaporator is in a completely gaseous state when drawn into the suction side of the compressor. Liquid would damage the compressor valves, pistons and heads if allowed to return in the suction line.

Vapor is superheated when its temperature is higher than the saturation temperature corresponding to its pressure. The amount of the superheat is, of course, the temperature increase above the saturation temperature at the existing pressure.

As the refrigerant moves along in the evaporator, the liquid boils off into a vapor and the amount of liquid decreases until all the liquid has evaporated due to the absorption of a quantity of heat from the surrounding atmosphere equal to the latent heat of vaporization of the refrigerant. The refrigerant gas continues along in the evaporator and remains at the same pressure; however, its temperature increases due to the continued absorption of heat from the surrounding atmosphere. The degree to which the refrigerant gas is superheated is a function of the amount of refrigerant being fed to the evaporator and the load to which the evaporator is exposed.

CAUTION: If the expansion valve is suspected of being out of adjustment, check the A/C system for a restricted suction line, plugged filter-dryer or a partially open valve before conducting this procedure.

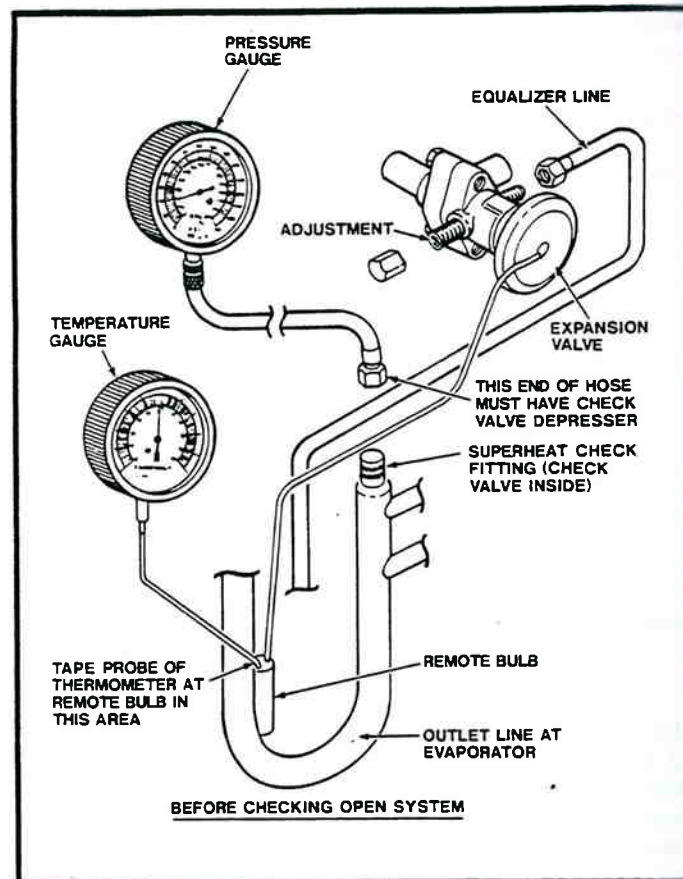


Figure 16-19: Gauges installed for Superheat Adjustment

SUPERHEAT ADJUSTMENT - Fittings are provided on both evaporators to adjust superheat temperature. Before checking the superheat in either the driver's or the main evaporator, turn the respective evaporator expansion valve adjustment control full counterclockwise and then 11 full turns clockwise. Perform the following procedure to adjust the superheat setting of the expansion valves:

1. Operate coach engine for at least one-half hour at fast idle with temperature controls set at 82°F. (28°C.).
2. Refer to figures 16-19 and 16-20. Install a pressure gauge at the fitting of the evaporator expansion valve. The hose end with the check valve depressor is connected to the fitting with the valve stem.
3. Install a remote reading thermometer to the evaporator outlet near the existing remote bulb. Refer to the illustrations. Thermostatic tape must be wrapped around the bulb, evaporator outlet line and gauge probe to get a true reading of the line temperature.
4. Over an 8-minute operating period, check and record the following gauge readings:
 - a. At 2-minute intervals record the pressure reading and the temperature reading (figure 16-21).
 - b. Record the highest temperature reading (during the 8 minutes) and the lowest temperature reading.
5. Refer to the Pressure-to-Temperature Chart. For each pressure reading recorded (a in step 4), record the equivalent temperature. Example:

MC-9 MAINTENANCE MANUAL

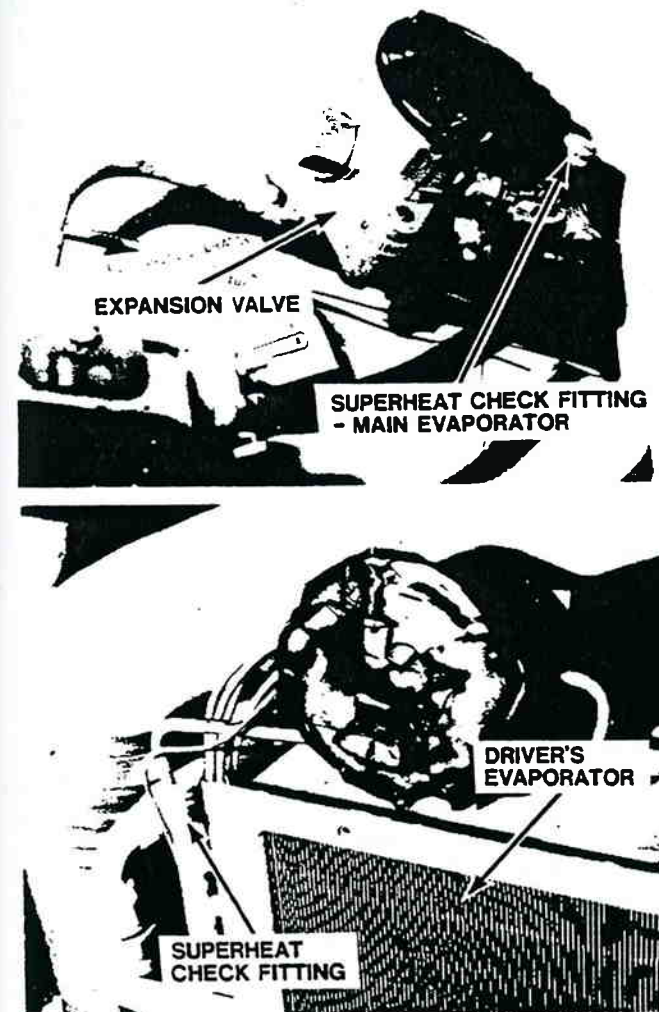


Figure 16-20: Superheat Check Fittings for Pressure Gauge Connection

Standard Units

- 36 psi = 39°F
- 37 psi = 40°F
- 41 psi = 44°F
- 39 psi = 42°F

Metric Units

- 247 kPa = 4°C
- 253 kPa = 4°C
- 281 kPa = 7°C
- 267 kPa = 6°C

6. Determine the average equivalent check fitting temperature by adding the four temperatures and dividing the sum by four. Example:

39°F	4°C
+40	+4°C
+44	+6°C
+42	+7°C
TOTAL: 165°F	21°C
165 ÷ 4 = 41°F Average	21 ÷ 4 = 5.25°C Average

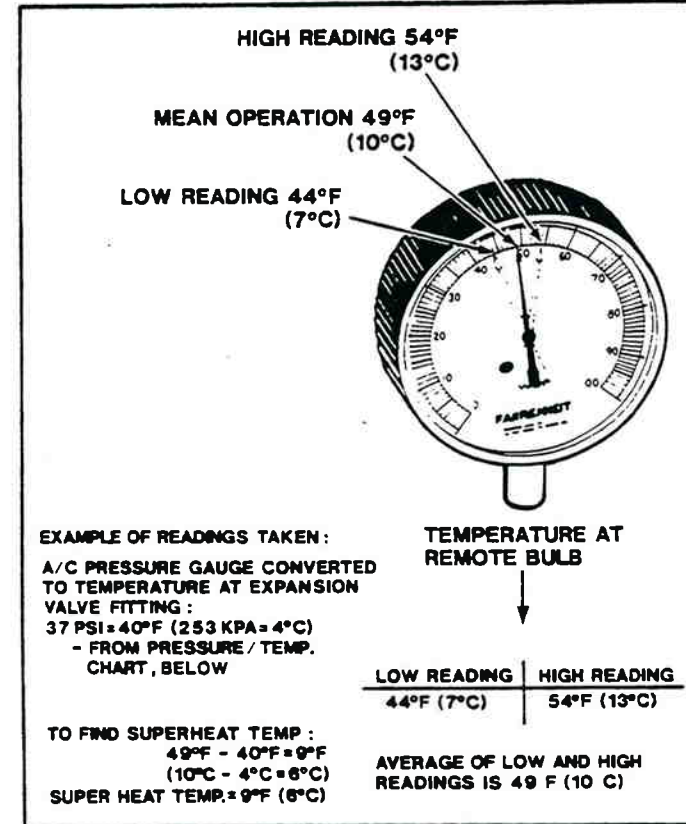


Figure 16-21: Temperature Gauge Readings

7. Determine the average remote bulb temperature from the high and low temperature readings recorded (b in step 4). Example:

High Reading: 54°F (12°C)
Plus Low Reading: +44 (8°C)
Total: 98°F (20°C)

Divide by 2: 98 ÷ 2 = 49°F (20 ÷ 2 = 10°C Average)

8. Subtract the lowest equivalent temperature recorded at the check fitting from the lowest temperature from the temperature gauge. The answer (difference) is the superheat temperature. Example:

Lowest Remote Bulb Temperature: 44°F (8°C)
Subtract Lowest Equivalent Temperature: -39°F (4°C)
Superheat Temperature: 5°F (4°C)

The superheat temperature should be a minimum of 4°F (2°C). If less than 4°F (2°C), the expansion valve should be adjusted (see step 10) and the entire procedure repeated.

NOTE: If the expansion valve needs adjustment at this point, proceed to step 10.

MC-9 MAINTENANCE MANUAL

9. Subtract the average equivalent temperature (from step 6) from the average remote bulb temperature (from step 7). Example:

Avg Temp. at Bulb: 49°F (10°C)
 Subtract Avg Equiv. Temp. at Fitting: -41°F (5.25°C)
 Difference: 8°F (4.75°C)

The difference in the average temperatures should be from 10-12°F (5-6°C). If more than 12°F (6°C) or less than 10°F (5°C), as in the example, the expansion valve requires adjustment (see step 10) and the entire procedure should be repeated.

CAUTION: Before adjusting the expansion valve, check for a restricted suction line, plugged filter dryer or for a partially opened valve.

To verify the need for expansion valve adjustment perform steps 10-17.

10. Remove the gauges from the expansion valve and install them at the compressor gauge connections; pressure gauge in suction line and temperature gauge installed to indicate suction line temperature.

11. Run the system for 10 minutes, set at 82°F (28°C).

12. Measure and record the line pressure and temperature.

13. Determine equivalent temperature from the chart. Example: 30 psi (206 kPa) equals 32°F (0°C).

PRESSURES AND EQUIVALENT TEMPERATURES (FREON 12)

STANDARD UNITS		METRIC UNITS		STANDARD UNITS		METRIC UNITS	
PSI	°F	KPA	°C	PSI	°F	KPA	°C
25	28	171	-2	48	51	329	11
26	29	178	-2	49	52	336	11
27	30	185	-1	50	53	343	12
28	31	192	-1	51	54	349	12
29	32	199	0	52	55	356	12
30	33	206	1	53	56	363	13
31	34	212	1	54	57	370	13
32	35	219	2	55	58	377	14
33	36	226	2	56	59	384	14
34	37	233	3	57	60	390	15
35	38	240	3	58	60	397	16
36	39	247	4	59	61	404	16
37	40	253	4	60	62	411	16
38	41	266	5	61	63	418	17
39	42	267	6	62	64	425	17
40	43	275	6	63	64	432	18
41	44	281	7	64	65	438	18
42	45	288	7	65	66	445	18
43	46	295	8	66	67	452	19
44	47	301	8	67	68	459	19
45	48	308	9	68	68	466	20
46	49	315	9	69	69	473	21
47	50	322	10	70	70	480	21

14. Subtract the equivalent temperature from the line temperature indicated on the temperature gauge. Example:

Temperature Gauge Reading: 40°F (4°C)
 Subtract Equivalent Temperature: -32°F (0°C)
 Answer: 8°F (4°C)

15. The answer represents the indicated superheat. If this temperature is approximately equal to the superheat temperature determined in step 8, above, there is no apparent restriction in the suction line or filter dryer, nor an open valve. Proceed to step 17.

16. If the answer (step 14) is not approximately equal to the superheat temperature determined in step 8, determine the cause of the different readings (e.g. suction line restriction, clogged filter dryer or malfunctioning valve) and repair the defective part. Repeat steps 1-16 to determine need for expansion valve adjustment.

17. To adjust the superheat setting on the expansion valve, turn the adjustment screw clockwise to increase superheat temperature, counterclockwise to lower superheat temperature.

18. Repeat steps 2 thru 9 to verify correct valve setting.

MAINTENANCE -

1. Pump down the system as directed earlier in this section.

2. See figures 16-19 and 16-20. At the expansion valve, disconnect the external equalizer line from the underside of the power head and unclamp the remote control bulb from the evaporator coil outlet line.

MC-9 MAINTENANCE MANUAL

3. Remove the two capscrews holding the power assembly to the valve body flange. Lift off the power assembly and remove the cage assembly.

4. Thoroughly clean all parts with mineral spirits and stiff bristle (not steel) brush. Dry thoroughly with compressed air.

CAUTION: Do not use gasoline, naphtha, carbon tetrachloride or similar solvent to clean parts. Do not use steam or caustic materials for cleaning.

5. Inspect all parts for wear, pitting, scoring, cracks or distortion. Remote bulb and connecting tube must be free of cracks, holes, kinks and cuts.

When reassembling, replace with new gaskets in proper place. Be sure the two lugs on the cage assembly fit into

grooves provided in the power assembly. Do not force the valve together. The cage must fit properly before tightening the body flange. Tighten bolts evenly.

CAUTION: If necessary to make a soldered connection, first remove the power and cage assemblies and all gasket. Keep heat away from all parts except the body flange, particularly the remote control bulb and tube.

SOLDERING -Before soldering any part of the system, make sure the area is well ventilated. Use (Stay-Clean) flux sparingly and apply solder (95-5 round wire ¼" (3.1 mm)). After completing repairs, test for leaks.

When using heat at or near a valve, wrap with a water-saturated rag to prevent overheating of vital parts.

EXPANSION VALVE TROUBLESHOOTING

TROUBLE
 LOW SUCTION PRESSURE, HIGH SUPERHEAT
 Expansion valve limiting flow or adjustment too low.

Inlet pressure too low from excessive vertical lift, undersize liquid line or excessive low condensing temperature. Resulting pressure difference across valve too small.

Gas in liquid line due to pressure drop in the line or insufficient refrigerant charge.

Inlet pressure too low from excessive vertical lift, undersize liquid line or excessive low condensing temperature. Resulting pressure difference across valve too small.

Gas in liquid line due to pressure drop in the line or insufficient refrigerant charge.

Valve orifice too small.

Superheat adjustment too high.

Power assembly failure or partial loss of charge.

Air filter screen clogged.

King valve at liquid receiver too small or not fully opened. Hand valve stem failure or valve too small or not fully opened.

Plugged lines.

Liquid line too small.

CAUSE
 Adjust and/or test expansion valve.

1. Increase head pressure.
 2. If liquid line is too small, replace with proper size.

Locate cause of liquid line flash and correct by use of the following methods: (1) Add charge (2) Replace or clean filter dryer.

1. Increase head pressure.
 2. If liquid line is too small, replace with proper size.

Locate cause of liquid line flash and correct by use of the following methods (1) Add charge (2) Replace or clean filter dryer (3) Check for proper line size.

Replace with proper valve.

Adjust superheat as outlined under Superheat Adjustment.

Replace power assembly or replace valve.

Clean or replace air filter screen.

1. Discharge or suction service valve on compressor restricted or not fully opened.
 2. Repair or replace faulty valve if it cannot be fully opened.
 3. Replace any underside valve with one of correct size.

Clean, repair or replace lines.

Install proper size liquid line.

MC-9 MAINTENANCE MANUAL

EXPANSION VALVE TROUBLESHOOTING (CONT'D)

Suction line too small.	Install proper size suction line.
LOW SUCTION PRESSURE, LOW SUPERHEAT Wrong compressor pulley size.	Install proper size pulley.
Uneven or inadequate evaporator loading due to poor air distribution or liquid flow.	Balance evaporator load distribution by providing correct air or liquid distribution.
HIGH SUCTION PRESSURE, HIGH SUPERHEAT Compressor discharge valve leaking.	Replace or repair valve.
HIGH SUCTION PRESSURE, LOW SUPERHEAT Valve superheat setting too low.	Adjust superheat as outlined under Superheat Adjustment.
Compressor discharge valves leaking.	Replace or repair discharge valve.
FLUCTUATING SUCTION PRESSURE Incorrect superheat adjustment.	Adjust superheat to 8-12°F (4-6°C).
FLUCTUATING DISCHARGE PRESSURE Insufficient charge.	Add charge to system.
HIGH DISCHARGE PRESSURE Air or non-condensable gases in condenser.	Purge and recharge system.
Overcharge of refrigerant.	Bleed to proper charge.
Condenser dirty.	Clean condenser.
Insufficient cooling air distribution over air cooled condenser.	Properly locate condenser to freely dispel hot discharge air.

LEAK TESTING LINES AND FITTINGS

All lines are copper tubing or Aeroquip No. 1540 hose. The copper lines have soldered joints and the large hose connections have a rubber O-ring seal.

LEAK TESTING - The most common method used is a halide torch consisting of an acetylene tank, a burner and a suction test hose.

WARNING: Do not inhale fumes from leak detector.

The flow of acetylene to the burner causes a suction in the test line. Any refrigerant gas present will be drawn through the hose and into the burner where it decomposes into free acids.

These acids come in contact with the hot copper reaction plate in the burner, causing color reaction in the flame. A small concentration is indicated by a green tint and a large concentration by an intense blue.

Do not confuse this change in color with the change caused by shutting off the air supply through the hose by holding the end too close to an object.

The procedure for testing is:

1. Adjust flame so the top of the cone is approximately level or within ½ inch (12.7 mm) above the plate.
2. Probe end of suction test tube around all joints, valves, etc. When a leak has been found at a soldered joint, that section of the system must be pumped down. Do not solder if pressure exists in the joint as pressure will force melted solder away from joint.

If the system is empty, it is more economical to put in just enough Freon to produce about 15 psi (103 kPa). The pressure can then be raised to about 150 psi (1,035 kPa) with dry nitrogen.

NOTE: This gas is put into the suction and discharge shut-off valves at the compressor. The receiver valves must also be opened. If no leaks are found, dump this mixture, evacuate the system and charge with refrigerant.

MC-9 MAINTENANCE MANUAL

A/C SYSTEM TROUBLESHOOTING

TROUBLE	REMEDY
LOW SUCTION PRESSURE AND FROSTING AT DRYER OUTLET Clogged filter-dryer element.	Clean filter element.
LOW OIL LEVEL	Check for oil leaks and for a leaking oil seal. Do not attempt to check oil level unless system has been stabilized at least 20 minutes.
EXCESSIVELY COLD SUCTION LINE Loss of contact between the expansion valve bulb and the suction line or sticking of the expansion valve.	Check for foreign matter and clean, repair or replace the valve.
EXCESSIVELY COLD SUCTION LINE AND NOISY COMPRESSOR	1. Check superheat adjustment. 2. Check remote bulb contact. 3. Check expansion valve for sticking.
COMPRESSOR SQUEAKS OR SQUEALS WHEN RUNNING	1. Check oil level. 2. Replace oil seal.
NOISY OR KNOCKING COMPRESSOR	1. Check for broken internal parts. 2. Overhaul if required.
COMPRESSOR VIBRATES	Check and tighten compressor mounting bolts.
EXCESSIVELY HOT CONDENSER AND HIGH DISCHARGE PRESSURE Air or non-condensable gas in system.	Purge system.
LOW REFRIGERANT LEVEL	Check for refrigerant leaks and add refrigerant if required.
SUCTION PRESSURE RISES FASTER THAN 5 POUNDS PER MINUTE AFTER SHUTDOWN	Check compressor valve for breakage or damage.
INSUFFICIENT COOLING	1. Check for refrigerant leaks. 2. Check condition of filter screens and motors.
INSUFFICIENT AIR FLOW Dirty or iced evaporator. Dirty air filter. Blowers inactive. Clogged ducts.	1. Check and clean evaporator, filters, ducts. 2. Recycle system.
FLOW OF REFRIGERANT THROUGH EXPANSION VALVE Dehydrator strainer is clogged. Remote bulb has lost charge. Expansion valve is defective.	1. Clean strainer. 2. Replace remote bulb and/or expansion valve.
EXPANSION VALVE HISSES BUBBLES IN MOISTURE AND LIQUID INDICATOR Gas in liquid line.	Add refrigerant.
LOSS OF CAPACITY Clogged dehydrator. Obstructed or defective expansion valve.	Check and clean as required.

MC-9 MAINTENANCE MANUAL

A/C SYSTEM TROUBLESHOOTING (CONTD)

SUPERHEAT TOO HIGH

1. Reset superheat adjustment.
2. Check for clogged external equalizer line, or dehydrator.

REDUCED AIR FLOW:

- (A) DIRTY OR CLOGGED AIR FILTER
 - (B) C/H BLOWER INOPERATIVE
 - (C) PLUGGED RETURN AIR DUCTS
- Dirty or iced evaporator coil.

1. Clean air filter screen.
2. Check return ducts for obstructions.
3. Check blower motor.

TOO FREQUENT STARTING AND STOPPING ON LOW PRESSURE CONTROL SWITCH

Lack of refrigerant.

1. Check for leaks.
2. Recharge.

COMPRESSOR INTERMITTENTLY STARTS AND STOPS

Intermittent contact in electrical control circuit.
Compressor valves not in operating position.

1. Check control circuit components.
2. Check compressor valve operation.

FREQUENT STARTING AND STOPPING

Low pressure switch controller differential set too close.

Check and adjust.

FREQUENT STARTING AND STOPPING

High pressure switch controls differential too close.

Replace switch assembly.

AIR CONDITIONING COMPRESSOR

The Model 05G compressor is of the open reciprocating type, that is, of positive displacement. Compressor wear is minimized by splash lubrication and force feed lubrication, which is accomplished by a low-speed oil pump driven directly from the end of the compressor crankshaft. A mechanical seal prevents refrigerant leakage where the rotating shaft passes through the crankcase.

The compressor is equipped with flanges for connecting suction and discharge service valves. Sight glasses, installed on both sides of the crankcase, provide a means for checking oil level in the compressor crankcase. A drain plug facilitates draining of oil from the crankcase and an oil fill plug enables addition of oil when necessary. A bottom plate provides access through the bottom of the crankcase for maintenance.

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

The pistons move in a straight line, but alternately in divergent directions. The downstroke of the piston admits refrigerant gas through the suction valve, and then compresses this gas on the upstroke, thereby raising its temperature and pressure. The compressed gas is prevented from re-entering the cylinder on its next downstroke by the compressor discharge valve.

The 05G compressor uses pressure-operated unloaders. These unloaders are of the snap-action, cylinder head bypass type, using a piston-type control valve to control discharge gas flow (figure 16-22).

The pressure-operated unloaders are controlled by suction pressure and actuated by discharge pressure. Each

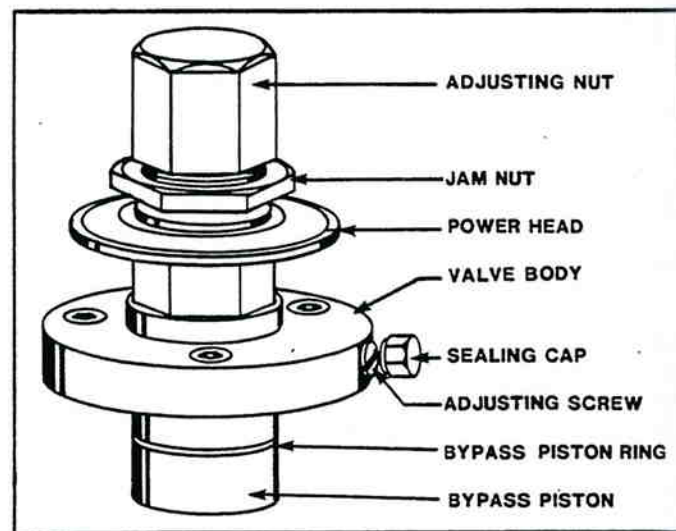


Figure 16-22: Compressor Capacity Control Loader

unloader valve controls two cylinders. On startup, controlled cylinders do not load up until differential between suction and discharge pressure is 10 psi (69 kPa).

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

During unloaded operation, when suction pressure drops below the valve control point, the poppet valve will open.

MC-9 MAINTENANCE MANUAL

Discharge gas bleeds from behind the bypass piston to the suction manifold. The bypass piston opens, discharge gas is recirculated back to the suction manifold and the cylinder bank is unloaded. Reduction in discharge pressure causes the check valve to close, isolating the cylinder bank from the discharge manifold.

COMPRESSOR LUBRICATION SYSTEM

Force-feed lubrication of the compressor is accomplished by a low-speed oil pump driven directly from the compressor crankshaft. Refrigeration oil is drawn from the compressor crankcase through the oil filter screen and pick-up tube to the oil pump located in the bearing head assembly. The crankshaft is drilled to enable the pump to supply oil to the main bearings, connecting rod bearings, and the shaft seal. The lubricating oil is pumped, under pressure, through the lube system by a lobed-rotor type oil pump.

The oil flows to the pump end main bearings, connecting rod bearings and seal end main bearings, where the oil path is divided into two directions. The largest quantity flows to the oil relief valve, which regulates oil pressure at 15 to 18 psi (103.5-120.5 kPa) above suction pressure. When the oil pressure reaches 15 to 18 psi (103.5-120.5 kPa) above suction pressure, the relief valve spring is moved forward allowing oil to return to the crankcase. The remaining oil flows through an orifice and into the shaft seal cavity to provide shaft seal lubrication and cooling. This oil is then returned to the crankcase through an overflow passage (figure 16-23).

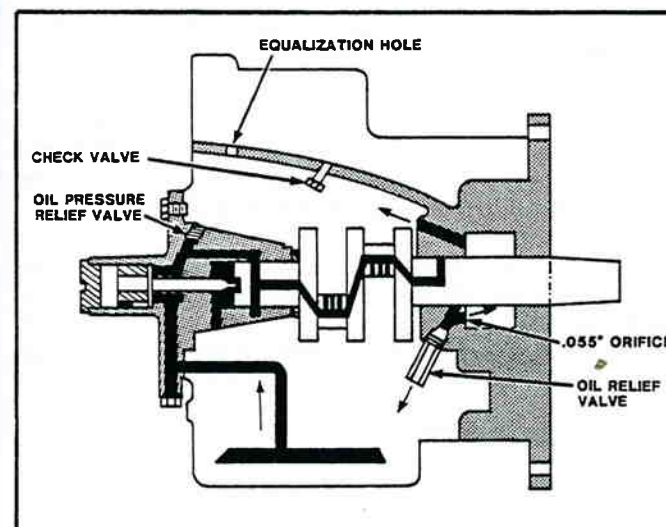


Figure 16-23: Compressor Lubrication Diagram

An additional oil pressure relief valve, built into the oil pump, is open at speeds above 400 rpm to relieve a portion of the oil pressure to the crankcase in order to maintain oil pressure below an acceptable maximum. At low speeds, the valve is closed to ensure adequate oil pressure at 400 rpm. At speeds above 1,900 rpm, the oil pressure will be 25 to 30 psi (172.5-207 kPa) above suction pressure.

The oil pressure equalization system consists of two oil return check valves and a 1/8-inch pressure equalization port between the suction manifold and crankcase. Under nor-

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

SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves on the compressor are equipped with mating flanges for connecting to flanges on the compressor. These valves are provided with a double seat and a gauge connection, which enables servicing of the compressor and refrigerant lines (figure 16-24).

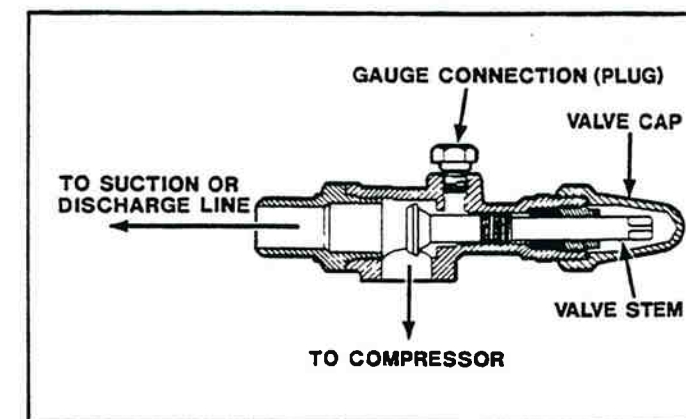


Figure 16-24: Suction/Discharge Valve

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

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

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

SETTING UNLOADERS (Engine Side) - Before setting unloaders, fully backseat the suction service valve and install the low pressure service gauge into the suction service valve.

1. Remove the cap from the differential adjustment screw and turn the screw out until it is approximately 2 turns from backstop.

2. Turn the unloader adjusting nut as far back as possible, without removing it.

3. With the engine running and A/C on, partially frontseat the suction service valve until the pressure gauge reads 30 psi (207 kPa).

MC-9 MAINTENANCE MANUAL

4. Turn the adjusting nut until the needle on the service gauge "jumps" to 36 psi (248 kPa).

5. If the unloader loads above or below 36 psi (248 kPa), adjust the differential screw until the desired setting is reached.

6. Once the adjustments have been made, tighten the jam nut against the adjusting nut, ensuring the adjusting nut does not move. Replace the differential adjustment screw cap.

The procedure for setting the curb side unloader is identical except for the following substitution for steps 3 and 4.

Partially frontseat the suction service valve until the pressure in the service gauge reads 24 psi (165.6 kPa). Turn in the adjusting nut until the needle on the service gauge "jumps" to 30 psi (207 kPa).

COMPRESSOR OIL LEVEL CHECK - Perform this procedure:

1. Operate coach engine at fast idle with A/C switch ON for at least 20 minutes. Shut engine off.

2. Open rear and right side engine compartment doors. Sight gauges are located on both sides of compressor crankcase. Oil level is correct when engine side sight gauge is full and curb side sight gauge is empty.

3. If below correct oil level, check freon level before adding oil.

4. If adding oil is required, proceed with the following.

ADDING OIL:

1. Backseat suction service valve and install low pressure service gauge hose into suction service valve fitting. Frontseat both sides of service gauge. Attach hose to middle port of service gauge manifold and completely submerge the other end in oil supply.

2. Disconnect liquid line solenoid wire, stud 11 in A/C junction box.

3. Connect jumper wire between horizontal studs 1 and 2 in remote control box.

NOTE: The preceding wiring changes will allow the clutch to remain engaged after pressure drops below 15 psi (103.5 kPa). It is necessary for the compressor to pump down into a vacuum to add oil in this manner.

4. Frontseat suction service valve and crack open the low pressure service gauge to purge the oil supply line. After purging line, frontseat service gauge.

5. Start engine and actuate air conditioning system.

6. When pressure in service gauge reads a vacuum, crack open the service gauge to allow oil to be drawn into compressor. When desired amount of oil is added, frontseat gauge.

7. Completely backseat suction service valve, disconnect jumper in remote control box and connect liquid line solenoid in A/C junction box.

8. Run A/C system 15-20 minutes and check oil level.

9. If more oil is needed, repeat procedure.

A pressurized oil pump that overcomes compressor pressure and forces oil into the crankcase may also be used. For further details, consult service department.

HI & LO PRESSURE SWITCH TESTS AND UNLOADER CHECK

HI PRESSURE SWITCH TEST:

1. Connect high pressure service gauge to discharge service valve test fitting; open or cover the condenser door.

2. With engine operating at fast idle, high pressure switch should open at 300 ± 10 psi ($2,070 \pm 69$ kPa) and cause compressor clutch to disengage.

NOTE: Observe front plate of clutch. When clutch is engaged, pulley and front plate rotate together. When clutch is disengaged pulley will rotate, but front plate will not.

3. Close, or uncover the condenser door. Observe pressure gauge and front plate of clutch at 190 ± 10 psi ($1,310 \pm 69$ kPa) pressure switch should close and clutch should engage.

LO PRESSURE SWITCH TEST:

1. Connect low pressure service gauge to suction service valve test fitting.

2. Partially frontseat service valve until suction pressure reads 5 ± 3 psi (34.5 ± 20.7 kPa). Low pressure switch should open, clutch should disengage.

3. Slowly backseat suction service valve. Observe service gauge and front plate of clutch. When pressure reads 20 ± 3 psi (137.9 ± 20.7 kPa) switch should close and clutch should engage.

CHECK UNLOADER OPERATION:

1. Operate engine at fast idle with A/C system ON, condenser door closed, and service gauges installed in suction and discharge service valves.

2. Partially frontseat suction service valve and observe the service gauges to determine pressure at which unloaders operate.

The engine side bank should load at 36 psi (248 kPa) and unload at 30 psi (207 kPa). The curb side bank should load at 30 psi (207 kPa) and unload at 24 psi (165.6 kPa). Load and unload pressures are adjusted at the cylinder head control set point adjust nuts (figure 16-22).

COMPRESSOR REMOVAL

1. If the compressor is inoperative, frontseat the suction and discharge service valves to trap the refrigerant in the system. If the compressor will operate, pump down the air conditioning system; then, frontseat the suction and discharge service valves.

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

3. Loosen the capscrews that mount the suction and discharge service valves, and tap the valves with a hammer to free them from the mounting flanges. Remove capscrews and service valves, but do not remove hoses from valves.

4. Disconnect electrical leads to compressor.

5. To remove the compressor drive belts, exhaust the air from the belt tensioning cylinder by opening the valve

MC-9 MAINTENANCE MANUAL

located above the compressor pulley. This will loosen the belts enough to facilitate removal.

6. Remove the four nuts that mount the compressor to the mounting bracket and remove the compressor from the coach.

CAUTION: The compressor weighs approximately 145 lbs. (65 kg). Exercise extreme caution during removal procedure. Use adequate sling and hoist.

REPLACEMENT AND INSTALLATION

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

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

1. Install compressor in coach; reverse removal procedure, above.

2. Install new locknuts on compressor mounting bolts and new gaskets on suction and discharge service valves.

3. Check oil level in oil level sight glass. Oil level should be between bottom $\frac{1}{4}$ and $\frac{1}{2}$ of sight glass. If necessary, add or remove oil.

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

5. Fully backseat suction and discharge service valves.

6. Operate the compressor and check for leaks and non-condensibles in the refrigerant system.

7. Check refrigerant level.

8. Recheck compressor oil level.

9. Check operation of capacity control unloaders.

DISASSEMBLY

Prior to disassembly of the compressor, oil must first be drained from the crankcase. Refer to figure 16-25.

1. Remove the oil fill plug to vent the crankcase. Loosen the drain plug in the bottom plate and allow the oil to drain completely.

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

NOTE: If a faulty part in the compressor is to be replaced, it may be necessary to remove other parts first. Therefore, the disassembly instructions that follow are arranged in the order for complete disassembly.

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

- Loosen cylinder head capscrews. If the head is stuck, tap it lightly with a wooden or lead mallet to free it.
- Remove cylinder head. Be careful not to drop the head or damage the gasket sealing surface (figure 16-26).



Figure 16-26: Removing Cylinder Head

- Remove cylinder head capscrews and gasket from the head.
- Remove the discharge valve capscrews, lock washers, stops, and valves (figure 16-27).

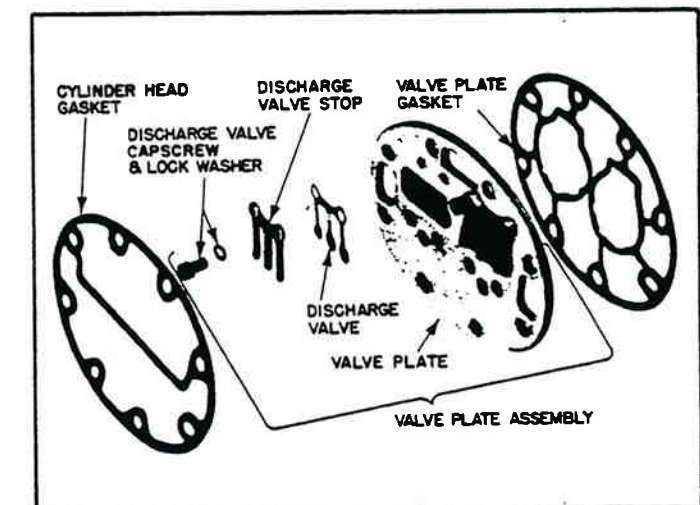
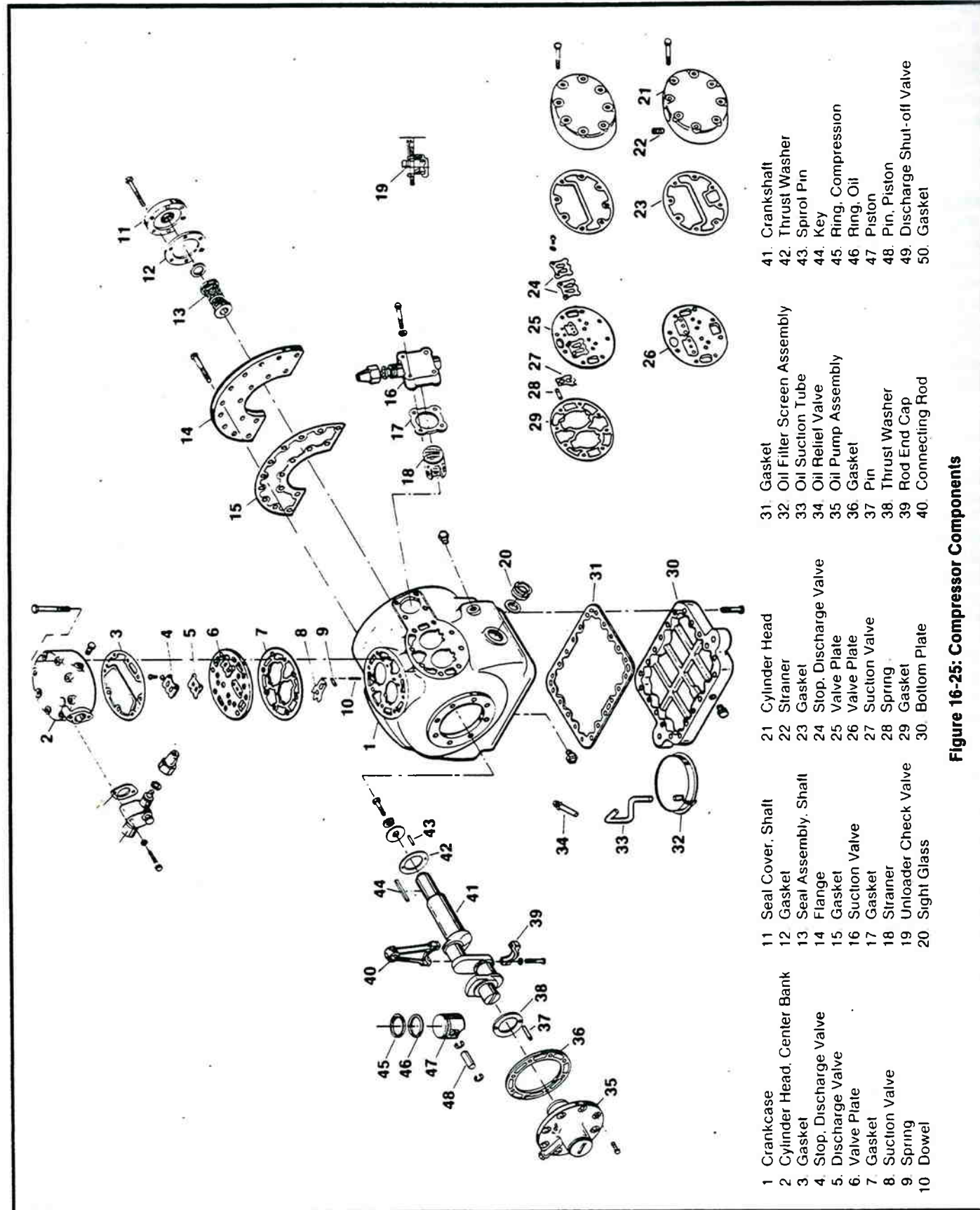


Figure 16-27: Discharge Valve Assembly

- Free the valve plates from the cylinder deck by using the discharge valve capscrews, without washers, as jackscrews through the outermost tapped holes in the valve

MC-9 MAINTENANCE MANUAL



MC-9 MAINTENANCE MANUAL

plate after the valve stops and valves have been removed. Remove the valve plate gasket (figure 16-28).



Figure 16-28: Valve Plate Removal

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

9. Turn the compressor over, bottom side up, and remove the bottom plate (figure 16-29). Scrape off all gasket material.

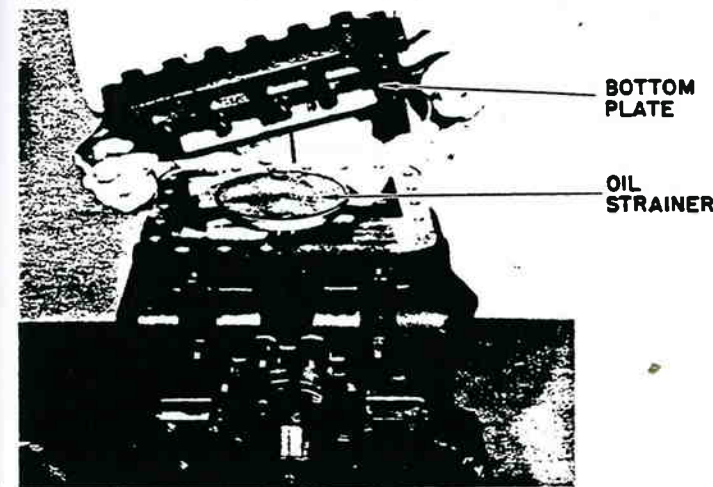


Figure 16-29: Bottom Plate Removal

10. Remove the oil strainer.
11. Matchmark each connecting rod cap and connecting rod for correct reassembly.
12. Remove the capscrews, flat washers and connecting rod caps (figure 16-30).

NOTE: The capscrews and flat washers should be discarded and new epoxy encapsulated capscrews and flat washers installed during compressor reassembly.

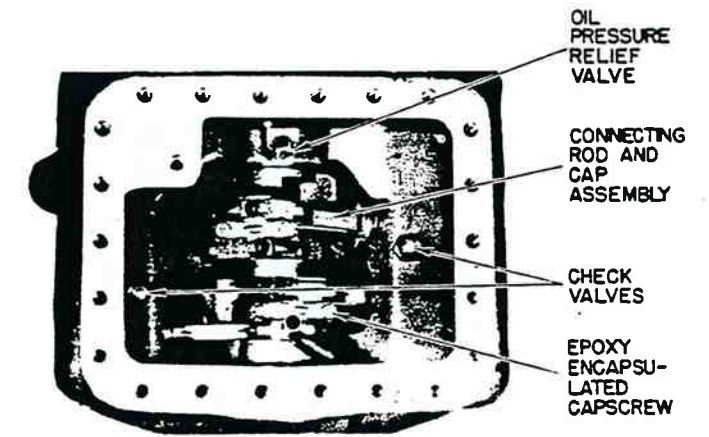


Figure 16-30: Compressor Crankcase Parts

13. Push the piston rods down so that the piston rings extend below the cylinders (figure 16-31). Remove and discard piston rings.

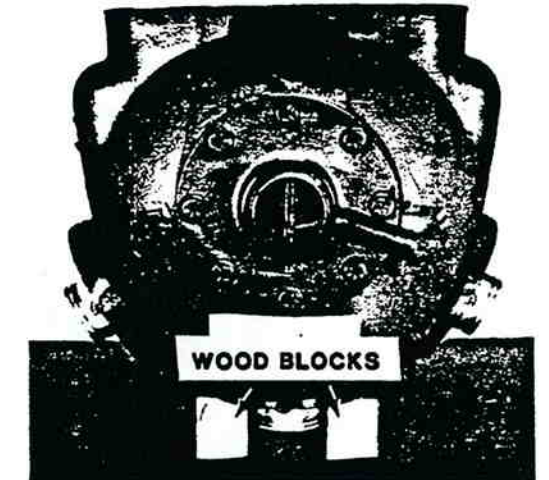


Figure 16-31: Piston Ring Removal

14. Remove eight capscrews and remove oil pump bearing head assembly, gasket and thrust washer (figure 16-32). Disassembly and cleaning of the pump and bearing head assembly will be accomplished during inspection and before reassembly.

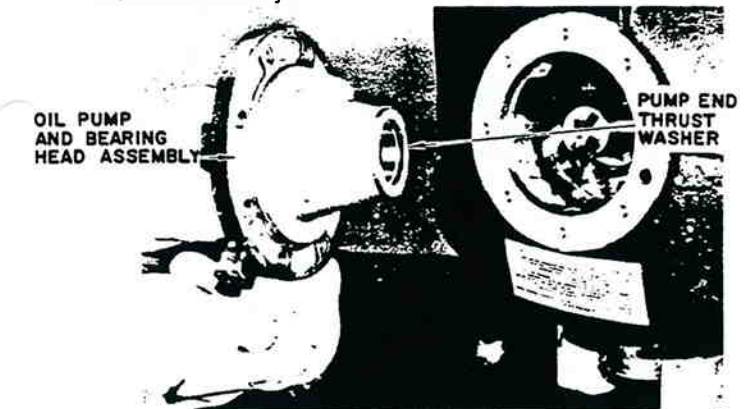


Figure 16-32: Removing Oil Pump Assembly

MC-9 MAINTENANCE MANUAL

15. Remove six capscrews and remove shaft seal cover and carbon washer (figure 16-33).

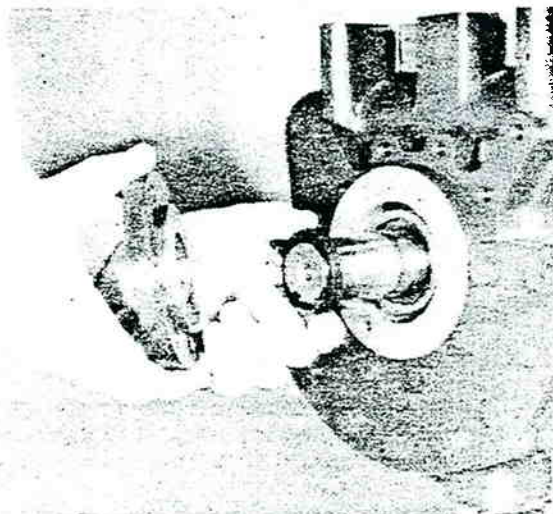


Figure 16-33: Removing Shaft Seal Cover and Carbon Washer

16. Tap seal end of crankshaft to loosen seal grip on shaft. Using two long screwdrivers, pry out the shaft seal (figure 16-34).

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

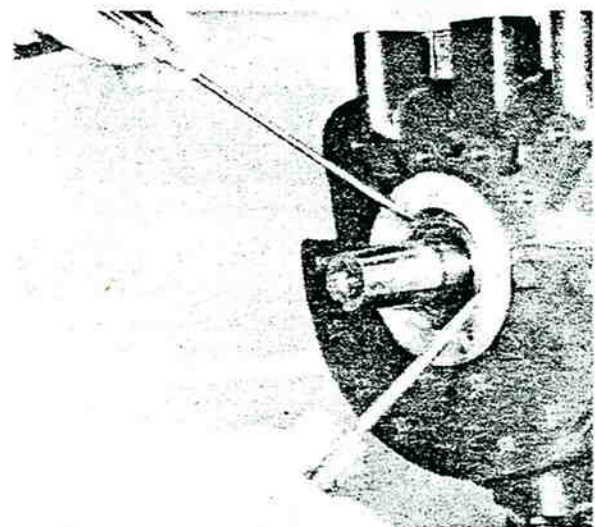


Figure 16-34: Carefully Pry Out Shaft Seal

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

18. Remove and check operation of the oil return check valves. The check valves are free-floating and can easily be checked visually.

19. Remove and check oil pressure relief valve. The oil pressure relief valve is a spring-loaded device which can be checked by using a small piece of stiff wire to ensure that the spring mechanism can be depressed.

20. Remove the piston rod assemblies.

21. Remove the suction strainer. Clean the strainer screen with solvent. Inspect the strainer; if damaged, replace it.

OIL PUMP AND BEARING HEAD - If it was determined that the oil pump was not operating properly, the entire oil pump and bearing head assembly must be replaced. Replacement parts for the pump are not available.

If the oil pump was operating properly, disassemble the pump, clean all parts, and reassemble the pump as follows (steps 22-32).

22. Remove pump cover and O-ring (figure 16-35).

23. Remove pin by holding eccentric in, tipping top of pin slightly outward, and turning pump bottom side up; pin should fall out.

24. The remainder of the pump components can now be removed by pushing out the drive segment from the crankshaft end of the bearing head.

25. Remove the relief valve assembly by removing the retainer pin.

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

27. Insert drive segment and five-lobed rotor, ensuring that the pins on the rotor are inserted into the appropriate holes in the drive segment drive wheel.

28. Reinstall the four-lobed rotor inside the five-lobed rotor, ensuring that the end with the counterbore is installed toward the drive segment.

29. Reinstall the eccentric.

30. Reinstall the pin in the shortest of the two grooves inside the bearing head.

31. Reinstall the O-ring and pump cover.

32. Reinstall the relief valve assembly.

PISTONS, PIN, AND CONNECTING RODS - Piston and pin, and connecting rod and rod cap are matched sets and must not be interchanged. If either the piston or piston pin is to be replaced, you must replace both of them. Likewise, if a connecting rod or rod cap must be replaced, both must be replaced.

33. Matchmark and disassemble pistons, pins, connecting rods, and caps.

34. Check wear dimensions of disassembled parts to determine if they are worn beyond limits. Refer to figure 16-25. If parts are worn beyond limits, replace them in matched sets as specified above.

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

INSPECTION

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

2. Inspect all parts for wear and overall condition. Replace any defective or excessively worn parts.

3. Inspect suction and discharge valve seats on both sides of valve plate.

4. Inspect operation of unloader bypass piston.

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

After cleaning, coat all moving parts with compressor oil before reassembly.

MC-9 MAINTENANCE MANUAL

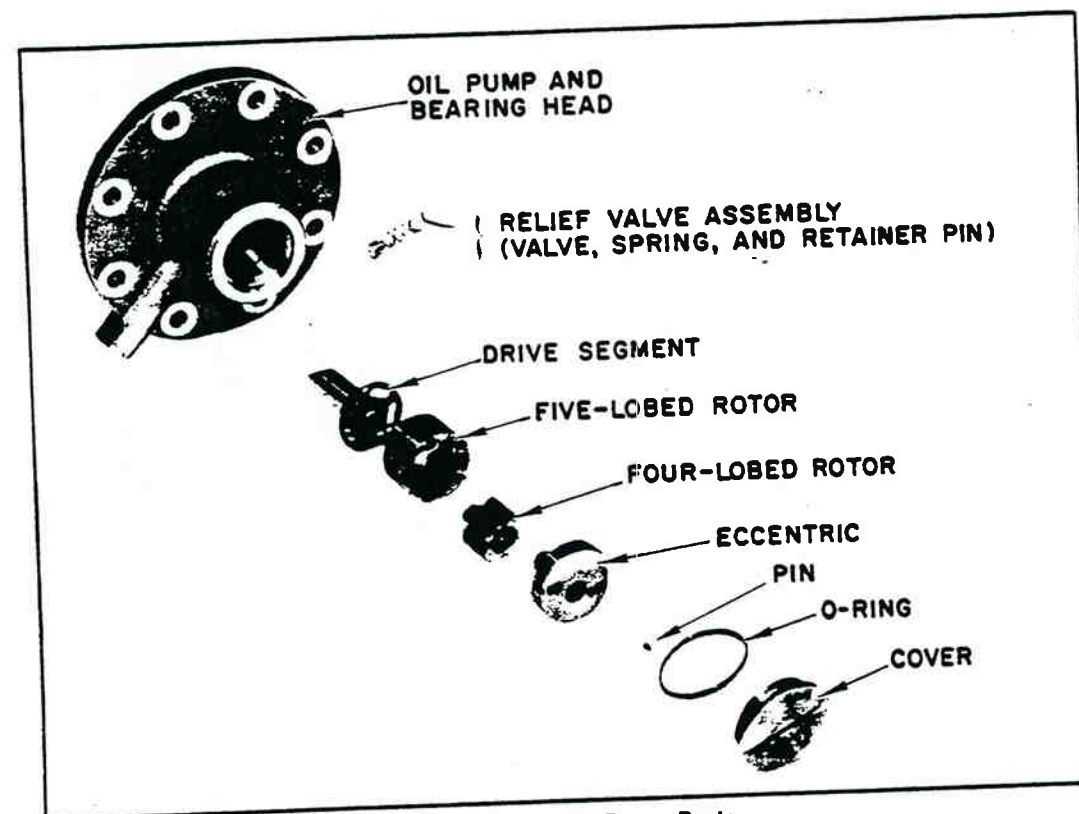


Figure 16-35: Oil Pump Parts

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

REASSEMBLY

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

2. The gap between the ends of the piston rings can be checked with a feeler gauge by inserting the ring into the piston bore about one inch below the top of the bore. Align the ring in the bore by pushing it slightly with a piston. The maximum and minimum allowable ring gaps are 0.013 and 0.005 inches (0.33 and 0.127 mm).

3. Install the piston and rod assemblies (figure 16-36) up through the bottom of the crankcase and into the cylinders. Allow pistons to extend beyond the top of the cylinder to enable installation of piston rings. Pistons should be installed so that the chamfer on the connecting rod faces toward the crankshaft journals. Center rods on each crankshaft throw may be installed in either direction (figure 16-37).

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

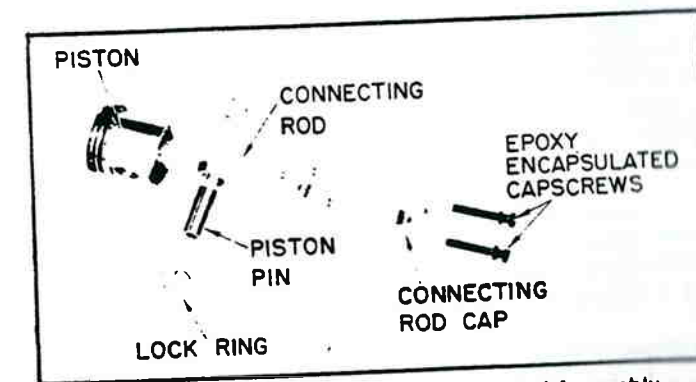
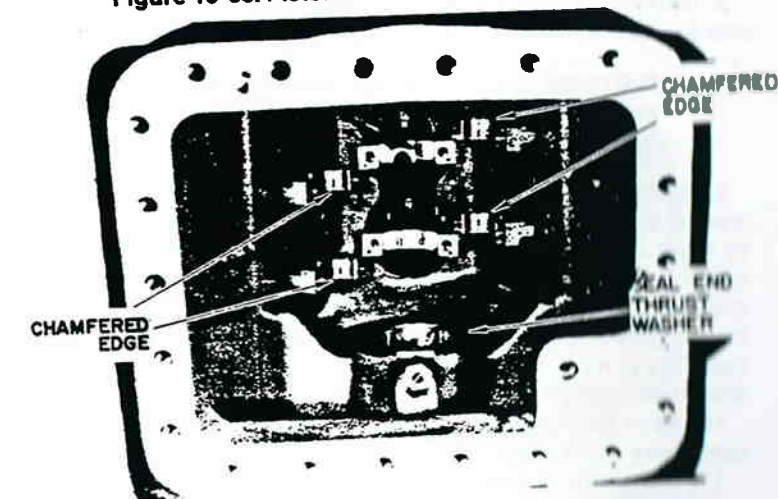


Figure 16-36: Piston and Connecting Rod Assembly



MC-9 MAINTENANCE MANUAL

4. On each piston, install the oil ring first, in the second groove, and the compression ring next, in the first groove nearest the piston top. The oil ring is notched and must be installed with the notch on the outside circumference and on the bottom. The compression ring is tapered on the inside circumference (figure 16-38). Install this ring with the taper on the top of the ring facing toward the valve plate.

NOTE: When installing the rings, stagger the ring ends so that the gaps are not aligned. The ring grooves must be smooth so that the ring will not bind when compressed. Ensure that side clearance is 0.001 to 0.002 inch (0.0254 to 0.0508 mm) between the ring and the piston.

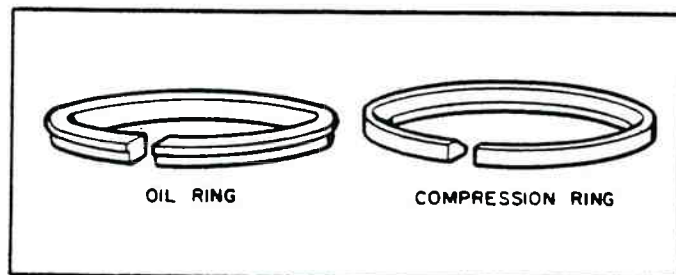


Figure 16-38: Piston Rings

5. Inspect the two brass thrust washers and replace if worn or scored.

6. Install the seal end thrust washer on the two dowel pins in place in the crankcase. See figure 16-25, Compressor Parts.

CAUTION: Exercise care to make sure the crankshaft does not drop down onto the connecting rods when installing the crankshaft in the crankcase.

7. Push the pistons out of the way and install the crankshaft.

8. Install the pump and thrust washer on the two dowel pins located on the bearing head (figure 16-39).

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

9. Install the bearing head assembly on the compressor crankshaft with a new gasket. Carefully push oil pump on by hand ensuring that the thrust washer remains on the dowel pins. The tang on the end of the drive segment engages the slot in the crankshaft, and the oil inlet port on the pump is aligned with the oil pickup tube in the crankcase. The pump should mount flush with the crankcase and should be oriented as shown in figure 16-39.

10. Align the new oil pump gasket and install the eight capscrews in the mounting flange.

11. Using a ring compressor, squeeze the rings sufficiently to allow piston to be pushed into the cylinder.

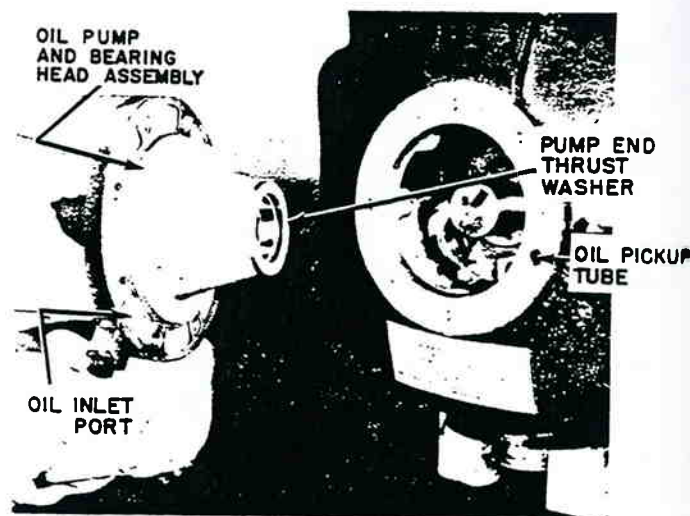


Figure 16-39: Installing Oil Pump

Ensure that ring ends are staggered so that gaps are not aligned, and lightly tap piston down into the cylinder (figure 16-40).

NOTE: The ring compressor can be easily fabricated from a piece of sheet metal.

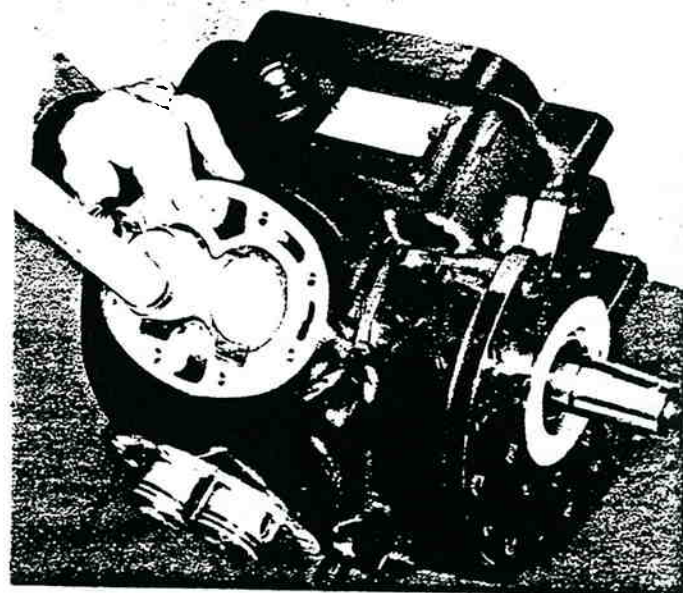


Figure 16-40: Tapping Piston into Cylinder

12. Check matchmarks and install connecting rod caps on connecting rods using new epoxy encapsulated capscrews and flat washers. Reuse of the old capscrews is not recommended. Ensure that the caps are installed on the dowel pins.

13. Tighten capscrews to 8-10 lbs.-ft. (10.8-13.5 Nm) torque. Ensure freedom of movement of crankshaft after capscrews are tightened on each rod cap.

14. Check operation and reinstall check valves and relief valve. The check valves are free-floating devices and can easily be checked visually. The relief valve is a spring-

MC-9 MAINTENANCE MANUAL

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

15. Clean and reinstall the oil strainer

16. Using a new gasket, install the bottom cover plate. Tighten cove capscrews, in a diagonal pattern, to 25-30 lb.-ft. (24-40.6 Nm) torque.

CAUTION: Never reinstall a used seal assembly or gasket. A new carbon washer should never be installed in a used cover plate. When installing the seal assembly, use care not to damage carbon washer or seal seat. If the new carbon washer is damaged during installation, replace it with a new one.

17. Remove new carbon washer from new seal assembly (figure 16-41). Lubricate shaft and neoprene seal bellows where it contacts the shaft.

CAUTION: Handle carbon washer by touching only the outside edge.

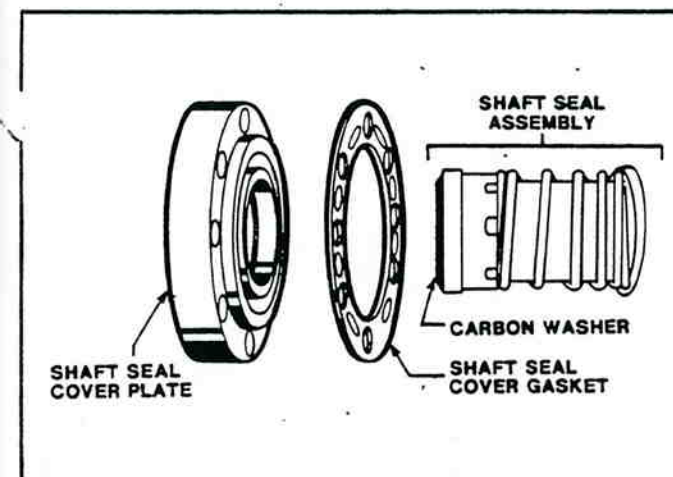


Figure 16-41: Shaft Seal Assembly

18. Slide seal assembly onto shaft until neoprene bellows starts to grip the shaft (figure 16-42).

19. Install the old carbon washer in the new seal seat. Install two capscrews in opposite sides of the old cover plate. Draw up capscrews evenly to properly position new seal assembly against shoulder on shaft.

20. Remove capscrews and old carbon washer and cover plate.

21. Lubricate new carbon washer and carbon washer seal seat with refrigerant oil. Install new carbon washer on the seat. Ensure that notches in carbon washer are aligned with two small knurls inside the seal seat.

22. Install the new cover plate and gasket. Draw capscrews down evenly to prevent damage to carbon washer.

CAUTION: Install only new valves and gaskets, and do not interchange valves.

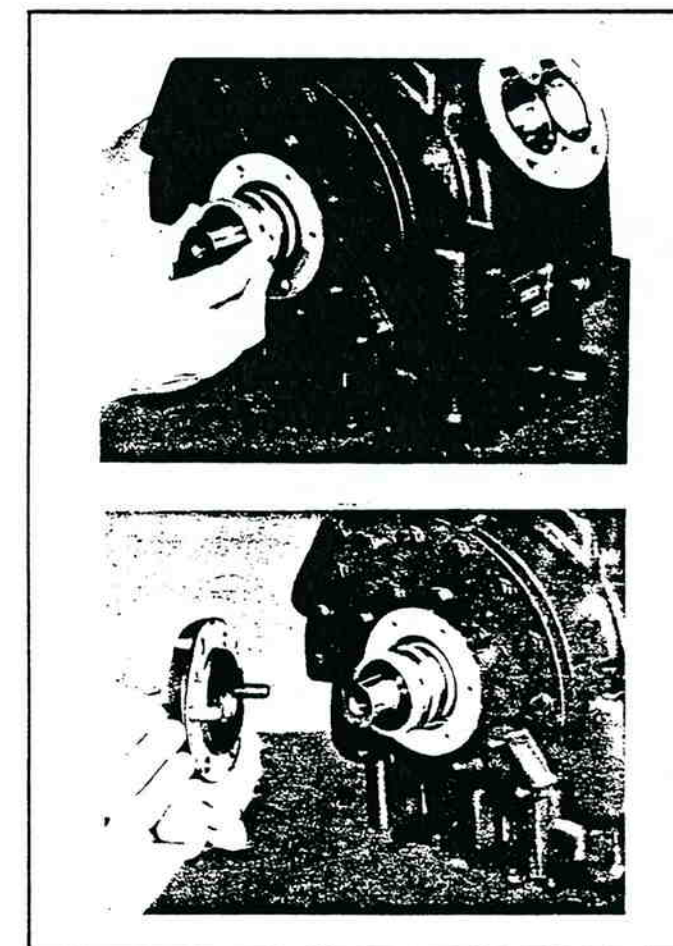


Figure 16-42: Installing Shaft Seal Assembly

23. Install suction valve, positioning springs on dowel pins. Assemble positioning springs with spring end bearing against cylinder deck. The spring will bow outward in the middle (figure 16-43).

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

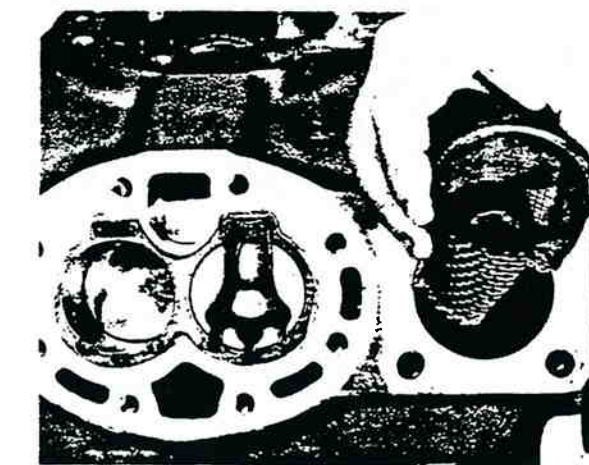


Figure 16-43: Suction Valve Installed Over Cylinders

MC-9 MAINTENANCE MANUAL

pressor crankshaft, the compressor begins operating when the pulley transmits its rotation to the armature.

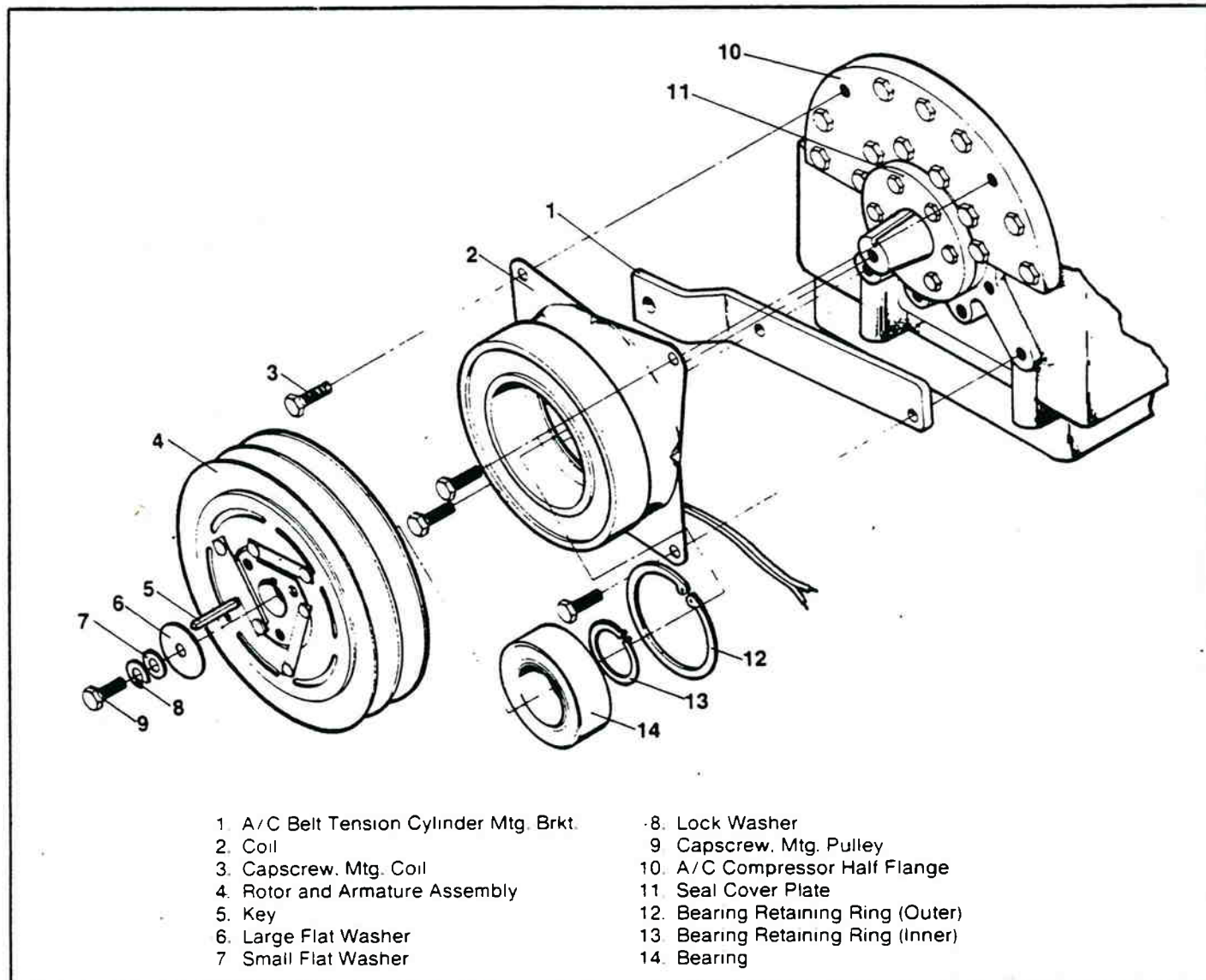
The compressor will operate as long as the clutch field coil remains energized - armature and rotor magnetically coupled. When the field coil is de-energized, the armature is pulled back, out of contact with the rotor (by spring tabs) and the armature (and compressor shaft) ceases rotation.

NOTE: A housing-mounted clutch has 6 mounting nuts on the armature; a shaft-mounted clutch does not have these 6 nuts.

MAINTENANCE - If the compressor clutch is mounted on the compressor shaft (figure 16-47), the clutch bearing has no provision for lubrication. Maintenance of this unit is limited to inspecting the clutch for wear, replacing the clutch as required, and checking the resistance of the coil winding. For shaft-mounted compressor clutch, perform the following procedure; if clutch is housing-mounted, skip this procedure and perform the subsequent maintenance procedure (Housing-Mounted Clutch Maintenance).

1. For the shaft-mounted clutch, clean all dirt and grease from the clutch armature plate. Take care not to allow the foreign material to be displaced into the armature slots and between clutch faces.

2. With compressed air, blow all dirt out from clutch facing area.



- | | |
|---|------------------------------------|
| 1. A/C Belt Tension Cylinder Mtg. Brkt. | 8. Lock Washer |
| 2. Coil | 9. Cap screw, Mtg. Pulley |
| 3. Cap screw, Mtg. Coil | 10. A/C Compressor Half Flange |
| 4. Rotor and Armature Assembly | 11. Seal Cover Plate |
| 5. Key | 12. Bearing Retaining Ring (Outer) |
| 6. Large Flat Washer | 13. Bearing Retaining Ring (Inner) |
| 7. Small Flat Washer | 14. Bearing |

Figure 16-47: Shaft-Mounted Compressor Clutch

MC-9 MAINTENANCE MANUAL

25. Place valve plate and new valve plate gasket on cylinder deck, ensuring that the valve plate is properly positioned on the four dowel pins (the top head has five dowel pins)(figure 16-44).

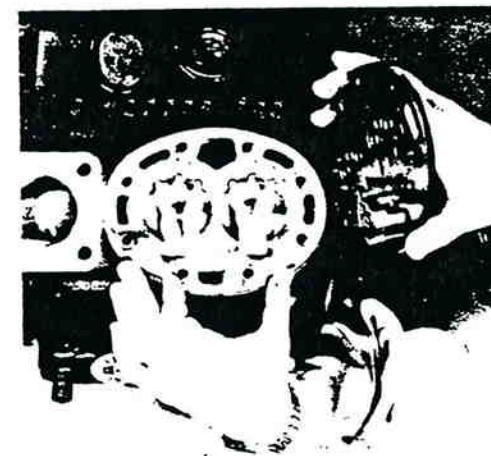


Figure 16-44: Installing Valve Plate and Gasket

26. Using a small screwdriver, flex the suction valves to ensure that the valve tips are not being held by the valve plate gasket (figure 16-45).

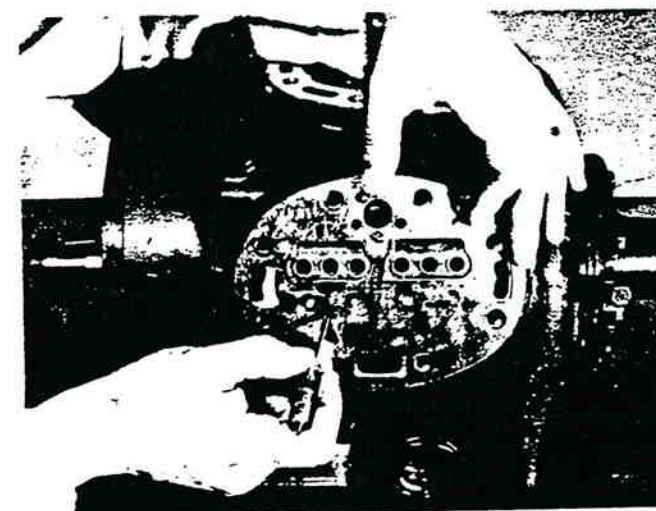


Figure 16-45: Flexing Suction Valve

27. Install discharge valve and discharge valve stop with cap screws and lock washers (figure 16-46). Tighten cap screws to 16-20 lb.-ft. (21.7-27 Nm) torque.

NOTE: Capacity control unloaders are in place in the right and left cylinder heads. Refer to Capacity Control Unloaders, in this section, for instructions on their removal and installation if they are to be serviced.

28. The center tank has a flange connection for the discharge service valve. Install center cylinder head and new cylinder headgasket with cap screws, ensuring that the

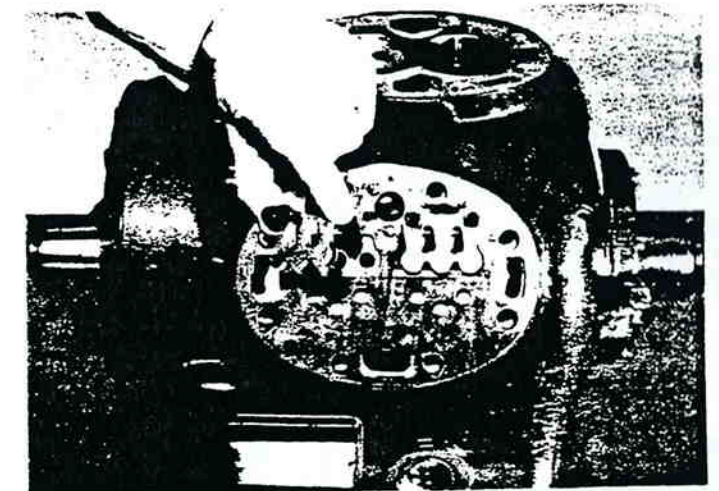


Figure 16-46: Installing Discharge Valve and Stop

gasket and cylinder head are properly positioned on the valve plate.

29. Tighten the cap screws, in a diagonal pattern, 30-35 lb.-ft. (40.6-47 Nm) torque. Repeat steps 23-29 for the other two cylinder banks.

NOTE: Suction strainer has been pre-formed to fit into suction cavity.

30. Remove and clean the suction strainer (figure 16-43). Check it for damage. If it is damaged, replace it. Reinstall the suction strainer and valve blank-off pad using a new gasket.

31. Install compressor according to previous instructions. Allow compressor to operate 4 to 5 hours before checking seal assembly for leakage.

CAPACITY CONTROL UNLOADERS

1. Remove the three socket-head cap screws holding the flange cover to the cylinder head.

2. Remove the unloader from the cylinder head.

3. Scrape all gasket material from cylinder head and flange cover.

4. Thoroughly clean unloaders in solvent (MEK) and inspect for evidence of wear, pitting, spring weakness, etc. Replace unloaders determined to be inoperative or defective.

5. Install new gasket and unloaders. Tighten unloader mounting nut to 12-16 lb.-ft. (16-22 Nm) torque.

6. Install the three socket-head cap screws into the unloader flange cover and cylinder head.

COMPRESSOR CLUTCH

The air conditioning compressor clutch is an electrically operated, friction-faced clutch. When the air conditioning system is off, the clutch rotor (pulley) is free-wheeling, being driven by the coach engine by way of the two drive belts. When the A/C system temperature sensor actuates the system, the compressor clutch field coil is energized. The magnetic field produced by the coil attracts the clutch armature, engaging its face with the rotating face of the rotor. Since the armature is coupled directly to the com-

MC-9 MAINTENANCE MANUAL

3. Using a depth micrometer, measure and record the distance from the back of the armature to the face of the rotor. See figure 16-48.

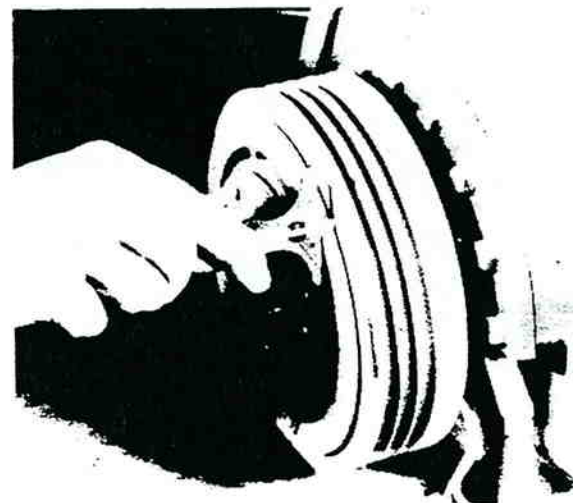


Figure 16-48: Armature-to-Rotor (Air Gap) Measurement

4. Disconnect the clutch coil electrical lead. Ground one connector terminal and connect 24 VDC to the other terminal to energize the coil.

5. Repeat step 3 for the measured distance when the armature and rotor faces are engaged.

6. De-energize the coil and determine the difference between the two measurements. If the difference exceeds .110" (2.794 mm), the clutch rotor and armature require replacement. Proceed to step 7. If the distance is .110" (2.794 mm) or less, clutch wear indicates replacement is not necessary.

7. To remove the shaft-mounted clutch, first open the two-way manual valve to vent air pressure from the drive belt tension air cylinder.

8. Remove the two compressor drive belts from the clutch rotor (pulley).

9. Disconnect the coil electrical lead.

10. Ensure that clutch rotor does not rotate, then remove the capscrew, lock washer, and two flat washers mounting clutch to compressor shaft.

CAUTION: Any bolts installed in the armature pulley holes must have stop nuts in place to prevent insertion into the armature more than 3/8" (9.5 mm). This will prevent damage to the bearing seal.

11. Remove the rotor and armature assembly, along with the locking key, from the compressor shaft.

12. Inspect the coil for damaged electrical leads, bent or cracked mounting plate, or cracked coil potting compound. Electrical resistance between connector terminals of the coil should be 5.15-5.69 ohms. Resistance from either terminal to the coil case (ground) should be infinite or open. Replace the coil if defective.

CAUTION: Before installing new clutch components, thoroughly clean compressor half flange and shaft seal cover plate of all dirt and grease. Use a clean cloth and suitable cleaning solvent. Dry cleaned surfaces thoroughly with compressed air.

Proceed as follows to install clutch:

13. To install the coil, place it over the shaft seal plate and align the mounting holes. Coil leads should be at the 4 o'clock position.

CAUTION: If the coil will not seat, do not draw it down flush by tightening the mounting capscrews. This will distort the coil mounting and cause misalignment between coil and clutch rotor.

14. When coil is capable of flush mounting, install belt tension cylinder mounting bracket and coil with the four capscrews. Tighten the capscrews to 25-30 lb.-ft. (34-40 Nm) torque.

15. Install the rotor and armature assembly on the compressor shaft. Align the keyways and install the locking key, large and small flat washers, lock washer and capscrew. Hand tighten capscrew.

16. Insert a .020" (.508 mm) feeler gauge between the O.D. of the coil and the coil cavity of the rotor. See figure 16-49. Holding the feeler in position, turn the rotor one revolution to check for proper coil-rotor clearance. If rotor turns freely, without binding, continue installation.

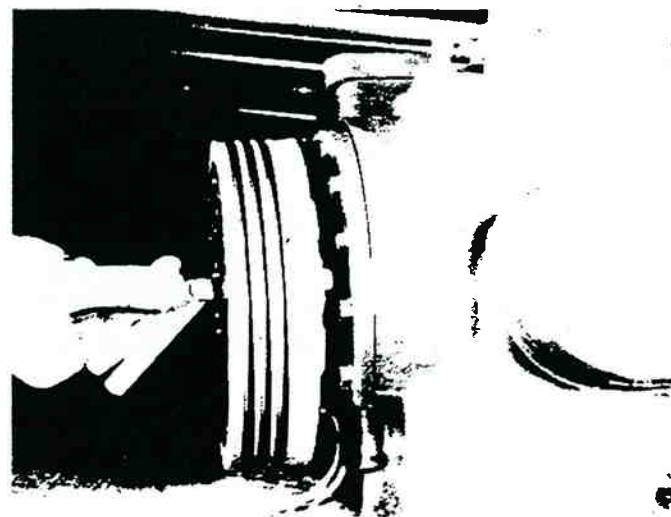


Figure 16-49: Checking Coil - Rotor Clearance

17. Taking appropriate measures to prevent the crankshaft from rotating, tighten the mounting capscrew to maximum 20 lb.-ft. (27 Nm) torque.

CAUTION: Any bolts installed in the armature pulley holes must have stop nuts in place to prevent insertion into the armature more than 3/8" (9.5 mm). This will pre-

MC-9 MAINTENANCE MANUAL

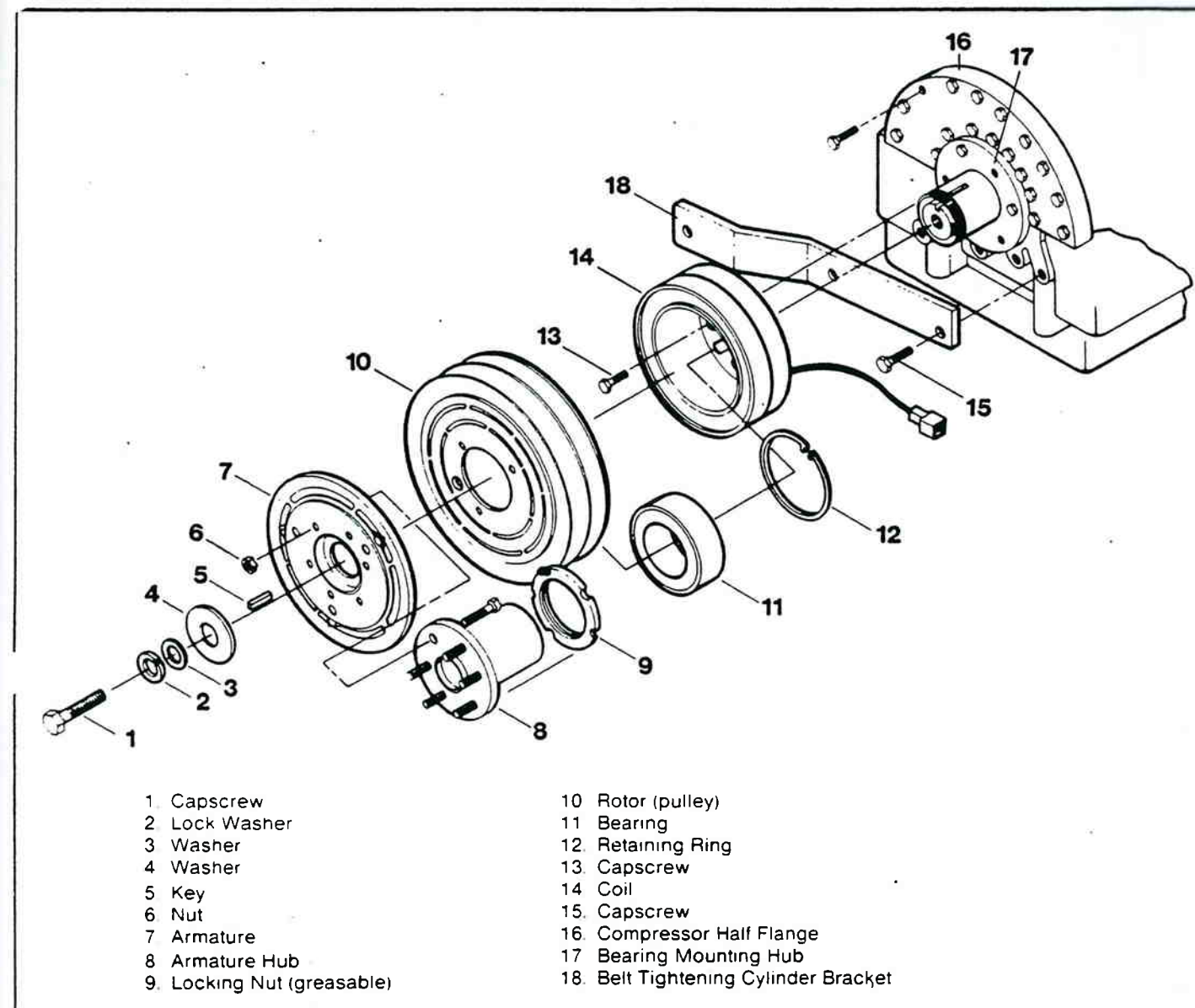


Figure 16-50: Housing-Mounted Compressor Clutch

vent damage to the bearing seal, loss of bearing grease and clutch burn-out.

18. Replace compressor drive belts and close the manual valve to charge the belt tensioning air cylinder.

HOUSING-MOUNTED CLUTCH MAINTENANCE - The housing-mounted compressor clutch on the coach (figure 3-50) requires bearing lubrication periodically after the initial 5,000 miles (8,000 km). The frequency of lubrication is once per year, in the spring when the air conditioning

system is being checked for operation. The point of lubrication is the grease fitting on the bearing retaining nut. Perform the following procedure to grease the bearing:

1. Open the two-way manual valve to vent air pressure from the drive belt tension air cylinder.

2. Remove the two A/C drive belts from the compressor clutch rotor.

3. Disconnect the coil electrical connector.

4. Insert tool 20-296 into two of the three threaded holes in the armature. See figure 16-51. This is to prevent the armature from rotating.

MC-9 MAINTENANCE MANUAL

CAUTION: Do not attempt to restore proper air gap by inserting or removing shims. Clutch failure and air conditioning compressor damage may result. After initial air gap adjustment when clutch is installed, shim pack should not be changed.

Bearing failure is usually associated with loss of lubricant from within the bearing. The lubricant may be deposited on the clutch faces and cause slippage. In cases where such slippage is suspected, the coach air conditioning system should not be used until the clutch is repaired, according to the following procedure.

REMOVAL AND DISASSEMBLY:

1. Open the two-way manual valve to vent air pressure from the drive belt tension air cylinder.
2. Remove the two A/C drive belts from the compressor clutch rotor (pulley).
3. Disconnect the coil electrical connector.

NOTE: To make sure armature does not rotate in the following step, use of special tool 20-296 is recommended.

4. Remove retaining capscrew, lock washer and flat washer from compressor crankshaft. See figure 16-41.
5. Install a $\frac{7}{8}$ -14 x 2" (51 mm) capscrew into the center hole of the armature. Use this capscrew as a jacking bolt to draw the armature from the compressor crankshaft. Secure armature with tool 20-296 as in step 4. See figure 16-52.

CAUTION: Do not use a puller or pry bar against the armature or the end plate. To do so will cause damage to the armature assembly.

6. Remove the armature (figure 16-53).
7. Using special tool number 20-294, remove the rotor retaining nut. See figure 16-54.

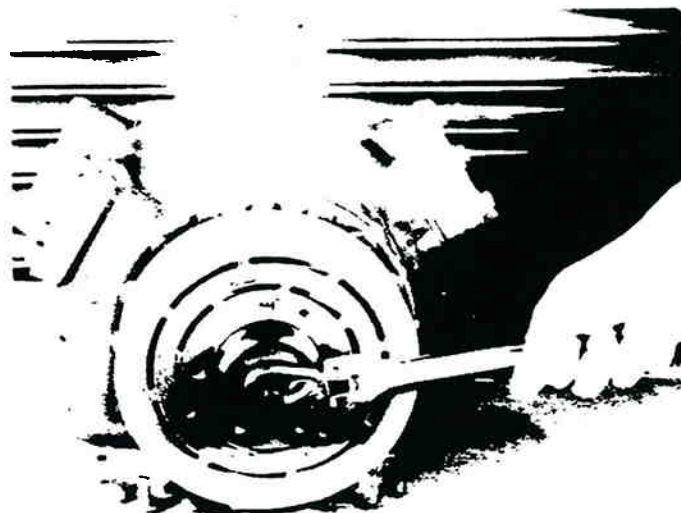


Figure 16-54: Removing Rotor Retaining Nut

8. Install the gear puller into the three threaded holes of the clutch rotor. Refer to figure 16-55.

CAUTION: Use a washer, bushing or spacer to protect the end of the compressor crankshaft from being damaged by the gear puller. Do not use a puller mounted in the belt grooves of the rotor.

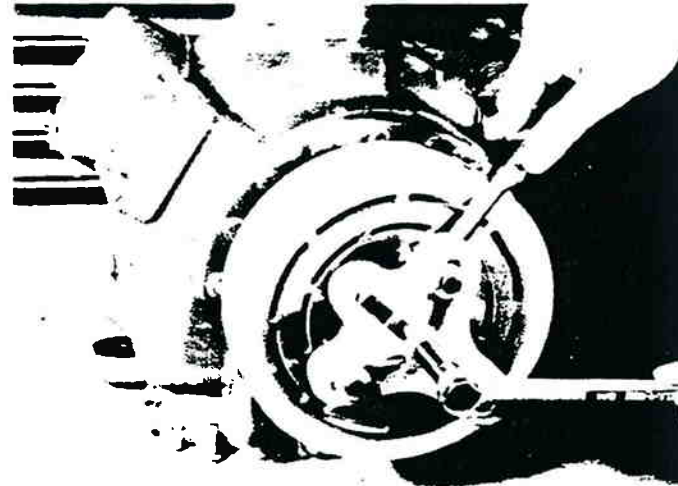


Figure 16-55: Removing Pulley

9. Rotate the puller bolt with a wrench and, while holding the rotor with a bar to prevent movement, draw the pulley from the bearing mounting hub. See figures 16-55 and 16-56.

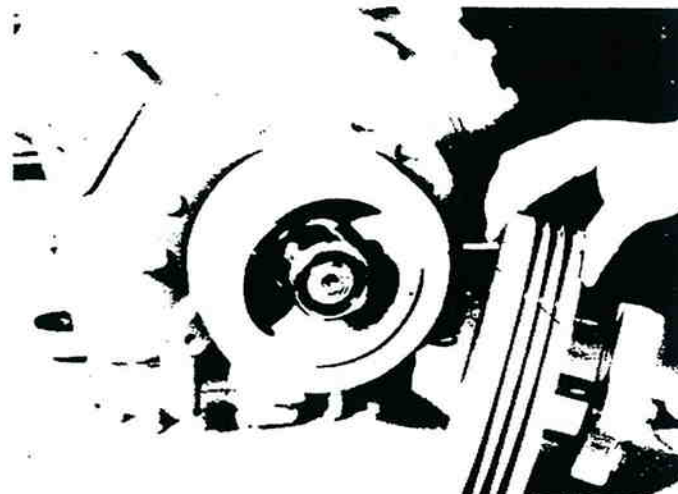


Figure 16-56: Pulley Removed

10. Remove the three capscrews mounting the coil to the flange of the clutch bearing mounting hub. Remove the coil by pulling straight back.

CAUTION: Do not pry coil from mounting flange. To do so may bend coil mounting plate and cause misalignment of coil and rotor cavity.

MC-9 MAINTENANCE MANUAL

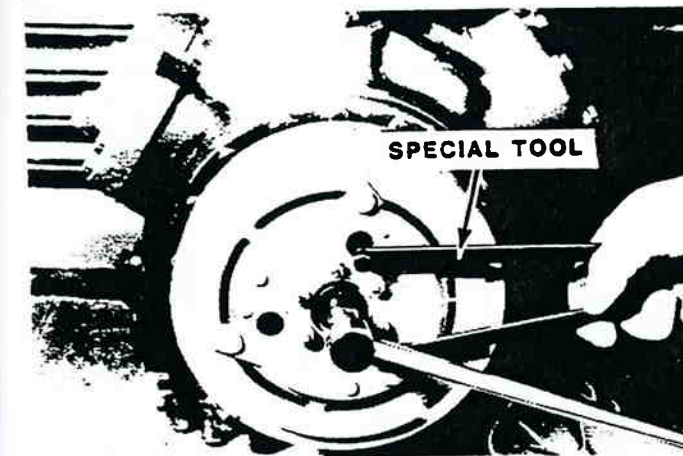


Figure 16-51: Capscrew Removal

5. Remove the retaining capscrew, lock washer and flat washer from compressor crankshaft.
6. Install a $\frac{7}{8}$ -14 x 2" (51 mm) capscrew into the center hole of the armature. Use this capscrew as a jacking bolt to draw the armature from the compressor crankshaft. Secure armature with tool 20-296, as in step 4. See figure 16-52.

CAUTION: Do not use a puller or pry bar against the armature or the end plate. To do so will cause damage to the armature assembly.

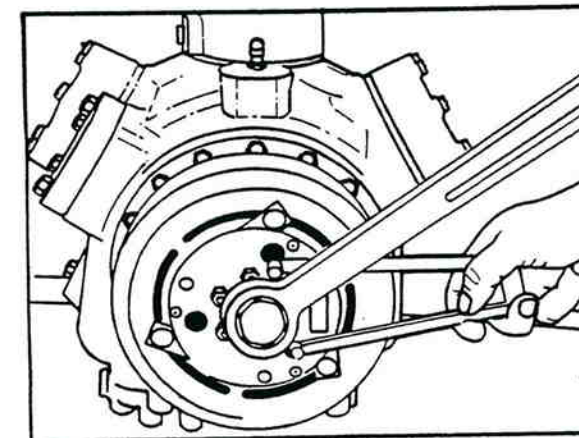


Figure 16-52: Armature Removal with Jacking Bolt

7. Remove the armature (figure 16-53).

CAUTION: The requirement to remove the armature in order to grease the clutch bearing is to provide a means to clean excess grease from the clutch faces. This reduces the potential for clutch slippage, damage, and reduced torque transmission to the compressor. Modification of the clutch or the procedure to grease the bearing is unauthorized and will void the warranty covering the clutch and compressor.

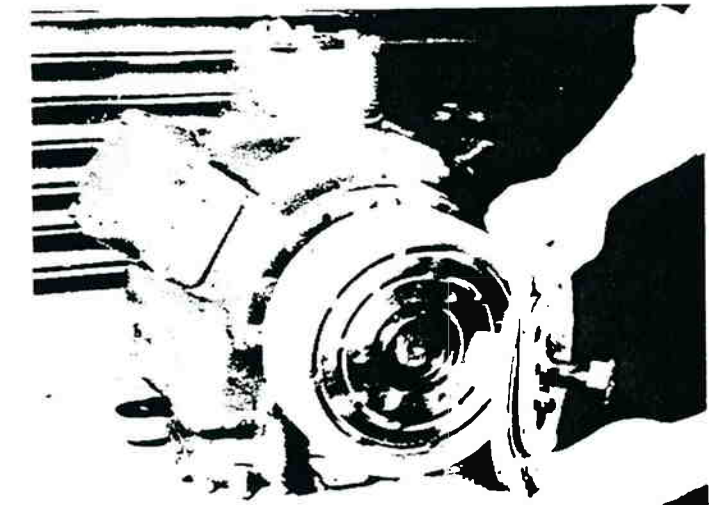


Figure 16-53: Armature Removal

8. Wipe the grease fitting clean of all dirt and foreign material.
9. Using a manual grease gun with an approximate 0.1 oz. (2.835 g) delivery per stroke, insert 1 ounce of grease into bearing. Grease must be **Chevron SR1-2**.

CAUTION: Do not give extra grease to the bearing "for good measure." Excess greasing will cause clutch slippage, overheated clutch parts and clutch failure.

10. Wipe all grease spills from clutch faces, retaining nut, hubs and washers. Use a clean cloth dampened in degreasing agent trichloroethane to clean clutch faces.
 11. Install armature, flat washer, lock washer and armature retaining capscrew on compressor crankshaft. Tighten capscrews to 16-20 lb.-ft. (22-27 Nm) torque.
 12. Connect coil electrical lead, install drive belts and close two-way manual air valve.
- Every 50,000 miles (80,000 km) clutch face wear should be measured according to the following procedure:

CAUTION: Clutch coil must be de-energized. If this procedure is done with the clutch mounted to the compressor while installed in the coach, ensure the engine starter cannot be engaged.

13. Using a depth micrometer, measure and record the distance from the back of the armature to the face of the rotor (air gap). See figure 16-48.
14. Disconnect the clutch coil electrical connector. Ground one connector terminal and connect 24 VDC to the other terminal to energize the clutch coil.
15. Repeat step 13 for the measured distance when the armature and rotor faces are engaged.
16. Determine the difference between the two measurements. If the difference exceeds .110" (2.794 mm), the clutch rotor and armature require replacement. Proceed to Removal and Disassembly, below.

MC-9 MAINTENANCE MANUAL

If it is necessary to remove the bearing from the rotor, follow these steps:

1. Remove the retaining ring from the rotor bore (figure 16-50).
2. Using the proper-sized arbor, press the bearing from the rotor.

INSPECTION:

1. Check the bearing for evidence of lubricant leakage, looseness or excessive free play from inner race to outer race. Check also for "roughness" in movement when inner and outer race are rotated in opposite directions. Replace the bearing if worn or defective.

NOTE: Bearing replacement is recommended any time the compressor clutch is serviced after 150,000 miles (240,000 km), regardless of its apparent condition.

2. Inspect the faces of both the rotor and armature assemblies. Surfaces should be clean and free of discoloration from grease or excessive heat. Check for presence of raised ribs on faces of rotor and armature. Replace both rotor and armature if raised ribs have been flattened or if the faces are contaminated or burned.

CAUTION: Both assemblies must be replaced as a pair. Do not intermix a used component with a new one. Premature clutch failure will result.

3. Inspect the coil for damaged electrical leads, bent or cracked mounting plate, or cracked coil potting compound. Electrical resistance between connector terminals of the coil should be 5.15-5.69 ohms. Resistance from either terminal to coil case (ground) should be infinite or open. Replace the coil if defective.

INSTALLATION

1. Position coil on clutch mounting hub with electrical leads at 4 o'clock position. Align the mounting holes.
2. Install the coil-mount capscrews and tighten to 25-30 ft.-lb. (34-41 Nm) torque.

CAUTION: Do not draw coil onto flange with the capscrews. Distortion of the coil and misalignment will result.

3. If clutch bearing is not installed in rotor, do so using arbor and press. Install retaining ring.
4. To ease installation of the rotor onto the clutch bearing mounting hub (on compressor), preheat inner race of rotor bearing. A 75-100 watt outdoor post lamp-style bulb, placed in the bearing for 15-30 minutes, will heat the race.

CAUTION: Do not heat the bearing with open flame. Bearing must not be heated more than 175°F (79°C).

5. When bearing is heated, slide rotor assembly onto clutch bearing mounting hub. Use rotor installation tool

20-296 seated against the bearing inner race and tap lightly until bearing bottoms against flange. See figure 16-57.

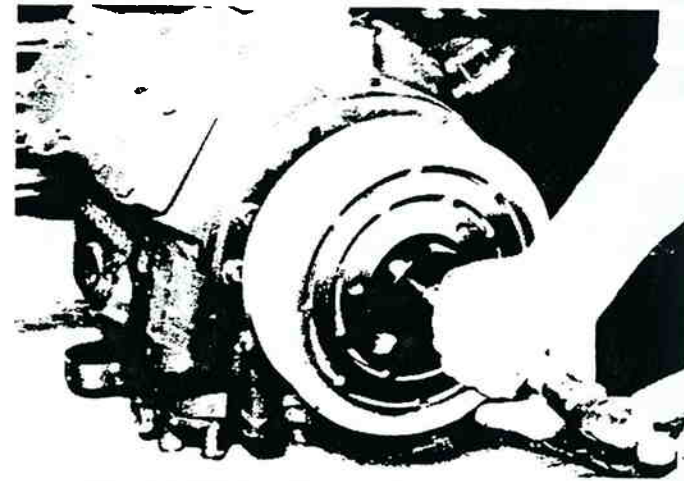


Figure 16-57: Installing Rotor/Bearing Assembly

6. Install bearing retaining nut, using tool 20-294 and a torque wrench. See figure 16-58. Due to the self-locking feature of the nut, observe the torque required to seat the bearing against the hub. After the bearing seats, tighten the nut 50 lb.-ft. (68 Nm) greater than the bearing-seating torque.

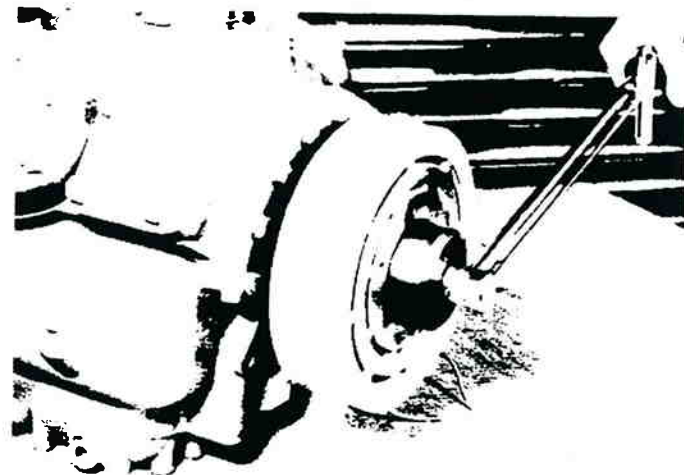


Figure 16-58: Tightening Bearing Retaining Nut

7. Check coil-to-rotor clearance with feeler gauge .020" (.508 mm) thick by .156" (.842 mm) wide (max.). Insert the feeler gauge through a slot in the rotor face (figure 16-59) so it extends beyond the rear of the rotor. Slowly rotate the rotor one full revolution. The feeler should not rub or bind against the coil shell. Make the test through several evenly spaced slots around the rotor circumference.

NOTE: If the feeler gauge check shows misalignment between the rotor and field shell, determine the cause. The field mounting bracket must be flat and not distorted.

MC-9 MAINTENANCE MANUAL

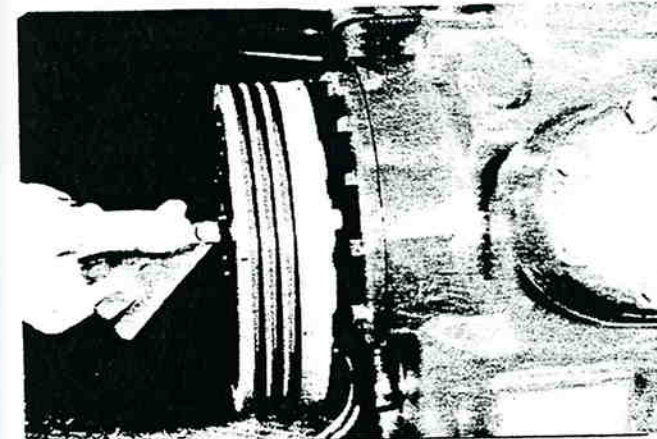


Figure 16-59: Checking Coil-to-Rotor Clearance

8. Place the armature and hub assembly onto the compressor crankshaft. Align the keyway slots in the crankshaft and armature hub.
9. Install the key into the keyways. Make sure the outer end of the key is flush with the hub counterbore.
10. Install the flat washer, lock washer and capscrew to secure the armature to the shaft. Tighten the capscrew to 16-20 lb.-ft. (22-27 Nm) while using tool 20-296 to prevent armature rotation.

NOTE: The remainder of this procedure applies to new clutch installations only.

11. Using a feeler gauge, measure and record the air gap between the rotor face and the armature face. See figure 16-60.

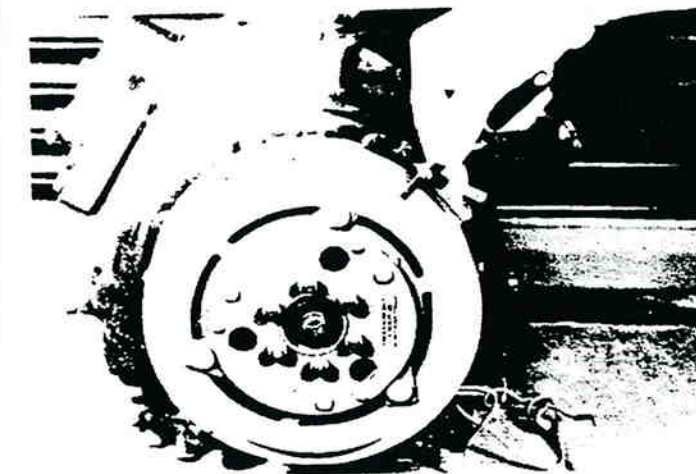


Figure 16-60: Measuring Rotor-to-Armature Air Gap

12. Determine if the air gap as measured meets the required air gap of .045 ± .015" (1.143 ± 0.381 mm).

NOTE: Shims have been factory installed between the armature and the armature hub. There are six .020 shims and one .010 shim; one or more of them may require removal in order to achieve the proper air gap for new clutch installations.

13. Determine which shims should be removed, if any, for the .045 ± .015" (1.524 ± 0.381 mm) air gap.

NOTE: The remainder of this procedure is necessary only if air gap is not within .030"- .060" (.762-1.524 mm).

14. Install tool 20-296 to prevent armature rotation and remove the six armature-to-hub retaining nuts and washers (figure 16-61).

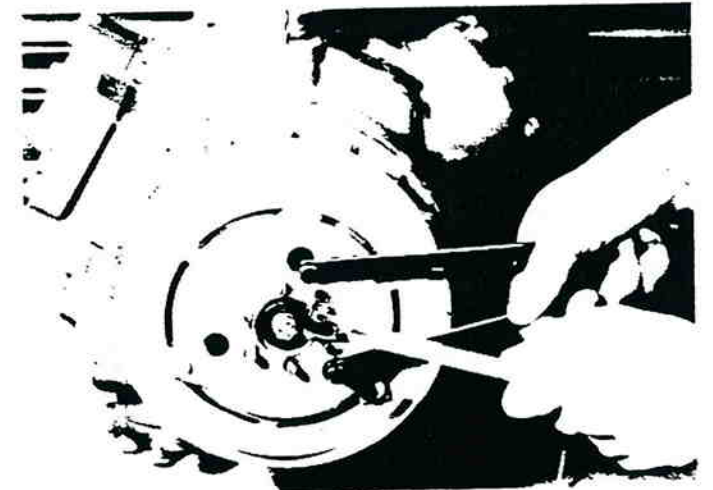


Figure 16-61: Removal of Armature Retaining Nuts

15. Remove the armature plate and the required shims for the correct air gap.
16. Insert a .020" (.508 mm) feeler gauge between the outside edge of the clutch bearing mounting hub and the inside edge of the armature mounting hub. See figure 16-62. If the clearance is less than .020" (.508 mm), clutch installation to this point is not correct. Determine the reason for the clearance discrepancy and correct before proceeding.



Figure 16-62: Checking Bearing Hub and Armature Hub Clearance

17. Reinstall the armature plate, washers and nuts. Tighten nuts to 7 lb.-ft. (9.5 Nm) torque.
18. Check for the proper air gap between clutch faces. If satisfactory, procedure is complete.

MC-9 MAINTENANCE MANUAL

SPECIFICATIONS

COMPRESSOR

Manufacturer Carrier Transicold
 Model 05GE037110
 No. of Cylinders 6
 Bore 2" (50.8 mm)
 Stroke 1-15/16" (49.2 mm)
 Operating Speed 400 to 2200 rpm (1750 rpm nominal)
 Minimum Speed (for lubrication) 400 rpm
 Horsepower 25, nominal
 Oil Pressure at 1750 rpm 15 to 30 psi (103.5-207 kPa)
 above suction pressure
 Oil Change 9 pints (4.03 liters)
 Weight 142 lb. (64.5 kg)
 Recommend Oil Texaco WF 68 WF1 132

APPROVED COMPRESSOR OILS

Dupont Zephron 150
 Sun Oil Company Sunisco 3GS
 Texas Oil Company WF1 132 WF68

The above oils are suitable for use with reciprocating compressors using Freon 12 with evaporator temperature above -40°F (-40°C).

APPROVED CLUTCH GREASE Chevron SR1-2

REFRIGERANT

Type Freon 12
 (Dichlorodifluormethane)
 Quantity 24 lbs. (10.8 kg)

RECEIVER TANK

Manufacturer Standard Refrigeration Co.
 TMC/MCI Part No. 16R-5-2

CONDENSER COIL

Manufacturer Carrier
 TMC/MCI Part No. 16B-4-1

FILTER DRYER

Manufacturer Henry Valve
 TMC/MCI Part No. 16F-10-13

CONDENSER FAN AND MOTOR

Manufacturer Ohio Electric
 Type 24 Volt, 2 hp continuous duty
 RPM 2200
 Amperage Draw Rated 71 Amp
 Average 52 Amp
 TMC/MCI Part No. 16G-9-20

EVAPORATOR COIL

Manufacturer Carrier
 TMC/MCI Part No. 16R-6-1

EVAPORATOR FANS AND MOTOR

Manufacturer Reliance Electric
 Model C-3087
 Type Single speed continuous duty
 Horsepower (kw) 1½ hp (1.1 kw)
 Volt 24-28 Volts
 Rotation CW-Commutator End
 Amperage Draw Start-Up 70 amps
 Running 53 amps
 RPM 2900
 TMC/MCI Part No. 16G-8-33

TORQUE SPECIFICATIONS

SIZE DIA. (IN.)	THREADS PER IN.	TORQUE RANGE		LOCATION
		FT.-LB.	Nm	
1/16	27 (pipe)	8-12	10-16	Pipe Plug - Crankshaft
1/4	20 (pipe)	20-25	27-34	Oil Return Check Valve - Crankcase
	20 (pipe)	20-25	27-34	Pipe Plug - Pressure Gauge Connection
	20	8-10	10-13	Connecting Rod Cap Screw
	28	12-16	16-32	Unloader Valve
No. 10	32	4-6	5-8	Oil Pump Drive Segment
				Oil Pump Drive Segment
5/16	18	16-20	22-27	Cover Plate - Pump End Bearing Head
				Suction Valve
				Discharge Valve
				Suction Valve Adapter - Crankcase
3/8	16	25-30	34-41	Pump End Bearing Head
				Bottom Plate - Crankcase
				Compressor Foot
7/16	14	55-60	75-81	Seal Cover
				Cylinder Head
1/4	18 NEF	35-45	47-61	End Cover - Crankcase
				Oil Level Sight Glass

MC-9 MAINTENANCE MANUAL

SIX CYLINDER COMPRESSOR

COMPRESSOR WEAR LIMITS

PART NAME	FACTORY MAXIMUM		FACTORY MINIMUM		MAXIMUM WEAR BEFORE REPAIR	
	INCHES	mm	INCHES	mm	INCHES	mm
SEAL END						
Main Bearing Diameter	1.8760	47.6504			.002	0.051
Main Bearing Journal Diameter			1.8725	47.5615	.002	0.051
PUMP END						
Main Bearing Diameter	1.3755	34.9377			.002	0.051
Main Bearing Journal Diameter			1.3735	34.8869	.002	0.051
CONNECTING ROD DIAMETER	1.3755	34.9377			.002	0.051
Piston Pin Bearing			.6878	17.4701	.001	0.0254
CRANKPIN DIAMETER			1.9356	49.16	.0025	0.0635
Throw	1.9396	49.27				
THRUST WASHER (THICKNESS)						
Pump End	.145	3.683	.144	3.658	.040*	1.016
Seal End	.157	3.987	.155	3.937	.040*	1.016
CYLINDERS AND PISTONS	2.0005	50.8127			.002	0.051
Bore			1.996	50.0698	.002	0.051
Piston			.6873	17.4574	.001	0.025
Piston Pin Bearing			Thumbfit			
Piston Ring Gap	.013	0.33	.005	0.127	.025	0.635
Piston Ring Side Clearance	.002	0.051	.001	0.0254	.002	0.051
SUCTION VALVE RECESS (Depth)	.082	2.08	.078	1.98	.090	2.286

* MAXIMUM END CLEARANCE BETWEEN THRUST WASHER AND SHAFT

