AIR CONDITIONING 3E

SECTION INDEX

CJ AIR CONDITIONING

GENERAL

When driving at normal highway speeds the CJ air conditioning system (fig. 3E-1) will provide maximum efficiency. However, when operating under stop-and-go city driving conditions, a slight reduction in cooling efficiency generally will be experienced.

It is recommended that intermediate temperature and high fan setting be used for average city driving and intermediate temperature and medium fan setting for highway driving.

When driving at relatively high speed for an extended period of time, the cooling coil may possibly frost over, resulting in a temporary loss of cooling. Should this occur, simply turn the TEMP knob to OFF and allow the blower to operate for a few minutes to allow the cooling coil to defrost. Then turn the TEMP knob to a setting which is not as cold as the setting at which frosting occurred.

To maintain maximum cooling efficiency, periodically remove bugs and foreign matter from the condenser and radiator fins. DO NOT install a bug screen or other screen material in front of the condenser and radiator.

Water forming under a vehicle, at a point below the cooling case, is condensation water draining from the system and is considered normal.

The engine temperature gauge pointer will indicate a slightly higher than normal temperature when the air conditioning system is operating. However, should excessive overheating occur, check the condition of all water hoses, check the radiator for rust or scaling conditions, and make sure that the condenser is free of bugs or other foreign matter.

The air conditioner also can be used for fast, efficient defogging of windows during cool, damp weather.

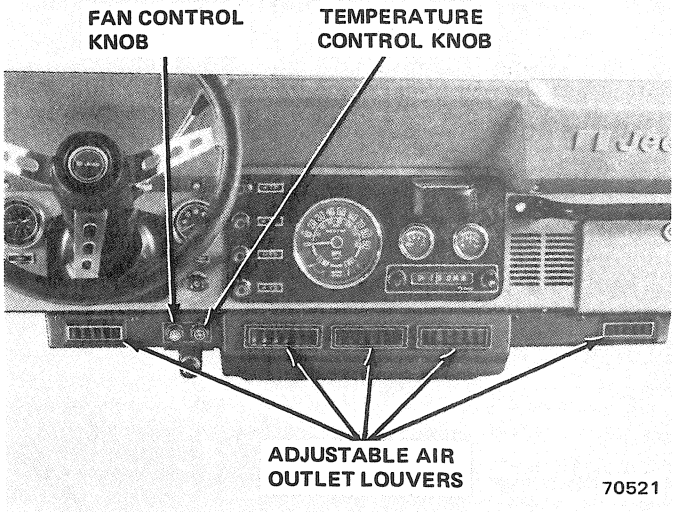


Fig. 3E-1 Air Conditioner—CJ

The condenser is mounted ahead of the radiator and the remaining components are in the engine compartment.

The compressor is a two-cylinder, belt-driven pump. An electromagnetic clutch couples the compressor to the drive pulley. The drive pulley freewheels when the air conditioner is not in use.

The start position on the ignition switch automatically disconnects all accessories, including the air conditioner, to reduce battery load and provide easier starting.

CONTROL OPERATION

For fast, maximum efficiency, purge the vehicle of hot air by driving the equivalent of two or three city blocks with at least one window open. During this time, place the TEMP control in the MAX position and the FAN control in the HI position. This permits the evaporator to precool in hot weather.

Adjust the air outlets to obtain desired airflow distribution by moving the louver levers left, right, up, or down. Airflow can be adjusted for quick delivery to a specific spot or for gentle diffusion of air throughout the vehicle.

When the interior of the vehicle has cooled to the desired temperature, the FAN knob may be set to obtain the desired volume of air from the air outlets. The TEMP knob may be rotated to vary the temperature. It may be necessary to experiment with the TEMP knob to determine the settings best suited to various driving conditions. Generally, an intermediate temperature and high fan setting is comfortable for city driving, and a lesser fan setting comfortable for open road driving.

Run the engine well above idle speed for more efficient cooling under conditions in which the system is operated with the vehicle standing.

CONTROL PANEL

Fan Switch

The fan switch may be serviced by removing the access plate located on the lower evaporator core housing below the control panel.

Temperature Control Thermostat

To service the temperature control thermostat, the evaporator core housing must be disassembled.

When installing a replacement temperature control thermostat, insert the capillary tube into the evaporator coil a minimum of two inches (fig. 3E-2).

CAUTION: *Handle the tube with care to avoid bends or kinks which could cause the thermostat to malfunction.*

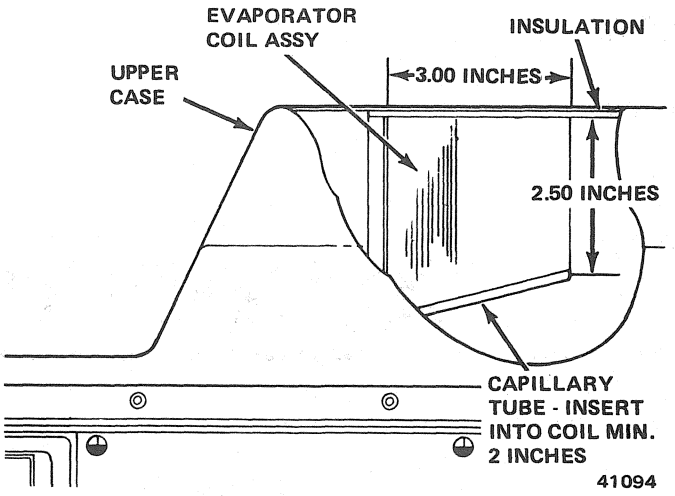


Fig. 3E-2 Capillary Tube Position

CONDENSER AND RECEIVER/DRYER ASSEMBLY

Removal

(1) Discharge refrigerant from system as described in General Information section of this chapter.

NOTE: *Discharge system slowly to prevent loss of compressor oil.*

(2) Drain radiator.
(3) Remove fan shroud and radiator.
(4) Disconnect pressure line at condenser.
(5) Remove condenser attaching screws and tilt bottom of condenser toward engine.

NOTE: *Plug all open connections to prevent entry of dirt and moisture.*

(6) From underside of vehicle, disconnect receiver/dryer-to-evaporator hose at receiver/dryer.
(7) Remove condenser and receiver/dryer assembly.
(8) Remove receiver/dryer from condenser, if necessary.

Installation

(1) If removed, install receiver/dryer to condenser.
(2) Place condenser in position and connect receiver/dryer-to-evaporator hose at receiver/dryer.
(3) Install condenser attaching screws.
(4) Connect pressure line at condenser.
(5) Install radiator and fan shroud.
(6) Fill radiator.
(7) Evacuate, leak test, and charge system as described in General Information section of this chapter.

RECEIVER/DRYER

Removal

(1) Discharge refrigerant from system as described in General Information section of this chapter.

NOTE: *Discharge system slowly to prevent loss of compressor oil.*

(2) Disconnect evaporator and condenser lines from receiver/dryer.

(3) Remove attaching screws from receiver/dryer bracket and remove receiver/dryer.

Installation

(1) Install receiver/dryer to support bracket.

(2) Install evaporator and condenser line to receiver/dryer.

(3) Evacuate, charge system and leak test as described in General Information section of this chapter.

EVAPORATOR HOUSING ASSEMBLY

Removal

(1) Discharge system as described in General Information section of this chapter.

(2) Disconnect inlet (suction) line at compressor.

(3) Disconnect receiver/dryer-to-evaporator hose.

(4) Remove hose clamps and dash grommet retaining screws.

(5) Remove evaporator housing-to-instrument panel attaching screws and the evaporator housing-to-mounting bracket screw (fig. 3E-3).

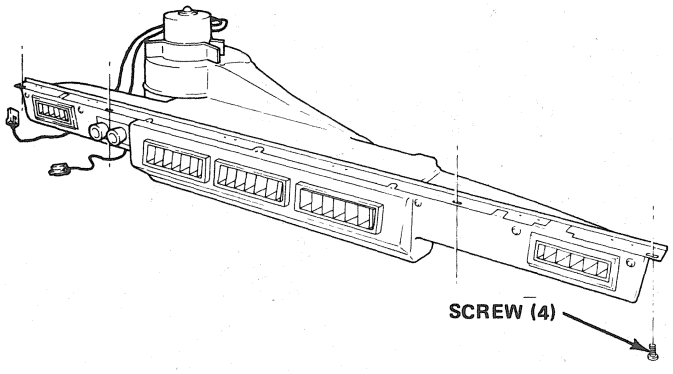


Fig. 3E-3 Evaporator Housing Mounting—CJ

(6) Lower evaporator housing and pull hoses and grommet through opening.

The blower motor, blower motor housing, and evaporator core may be serviced after the evaporator housing is removed (fig. 3E-4).

NOTE: *It is not necessary to discharge the system to service the blower motor. The evaporator housing may be lowered from the instrument panel to gain access to the blower motor attaching screws.*

Installation

(1) Push hoses through grommet opening, and install grommet by pushing toward engine compartment of vehicle and fasten to dash panel with two attaching screws.

(2) Raise evaporator and install evaporator housing-to-instrument-panel attaching screws and the evaporator-to-mounting bracket screw.

(3) Install hose clamps and grommet attaching screws.

(4) Connect receiver/dryer-to-evaporator hose.

(5) Connect inlet (suction) line to compressor.

(6) Evacuate, leak test, and charge system as described in General Information section of this chapter.

EXPANSION VALVE SERVICE

The valve is preset and should not be adjusted. A defective valve requires replacement.

(1) Discharge system as described in General Information section of this chapter.

(2) Remove evaporator housing assembly.

(3) Remove insulation wrapped around suction line and expansion valve. Mark capillary tube location on suction line.

(4) Disconnect inlet and outlet connections, capillary tube clamp, and equalizer tube.

(5) Remove expansion valve.

(6) Clean suction line to provide a positive contact with replacement expansion valve capillary tube.

(7) Connect inlet and outlet hoses. Clamp capillary tube at marked position and connect equalizer tube.

NOTE: *Clamp capillary tube securely so that a firm contact with the suction line is formed.*

(8) Wrap expansion valve and line with insulation.

(9) Install evaporator housing assembly.

(10) Evacuate, leak test, and charge system as described in General Information section of this chapter.

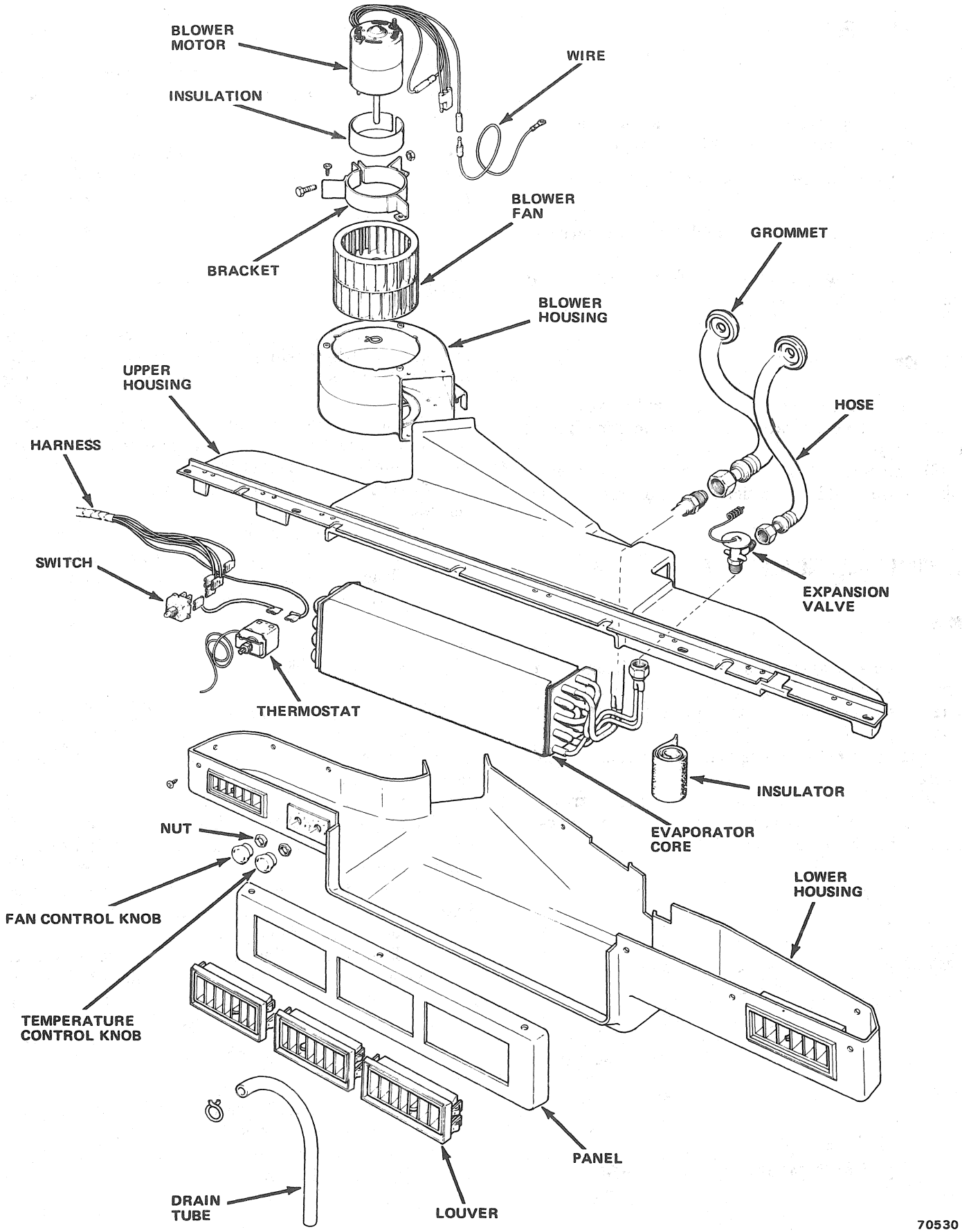


Fig. 3E-4 Evaporator Housing Assembly—CJ

CHEROKEE - WAGONEER - TRUCK AIR CONDITIONING

GENERAL

When driving at normal highway speeds the Jeep air conditioning system will provide maximum efficiency. However, when operating under stop-and-go city driving conditions a slight reduction in cooling efficiency generally will be experienced.

It is recommended that intermediate temperature and high fan setting be used for average city driving and intermediate temperature and medium fan setting for highway driving.

The air conditioning system, as shown for the Wagoneer in figure 3E-5, is applicable to Cherokee and Truck models.

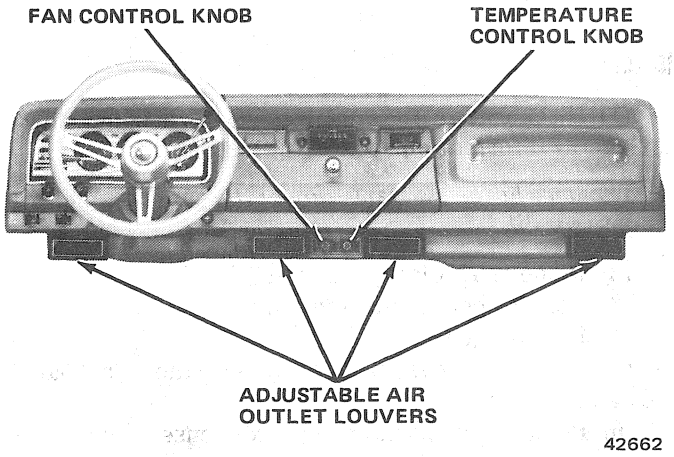


Fig. 3E-5 Air Conditioner—Cherokee-Wagoneer-Truck Models

When driving at relatively high speed for an extended period of time, the cooling coil may possibly frost over, resulting in a temporary loss of cooling. Should this occur, simply turn the TEMP knob to OFF and allow the blower to operate for a few minutes to allow the cooling coil to defrost. Then turn the TEMP knob to a setting which is not as cold as the setting at which frosting occurred.

To maintain maximum cooling efficiency, periodically remove bugs and foreign matter from the condenser and radiator fins. DO NOT install a bug screen or other screen material in front of the condenser and radiator.

Water forming under a vehicle, at a point below the cooling case, is condensation water draining from the system and is considered normal.

The engine temperature gauge pointer will indicate a slightly higher than normal temperature when the air conditioning system is operating. However, should excessive overheating occur, check the condition of all water hoses, check the radiator for rust or scaling conditions, and make sure that the condenser is free of bugs or other foreign matter.

The air conditioner also can be used for fast, efficient defogging of windows during cool, damp weather.

The condenser is mounted ahead of the radiator and the remaining components are in the engine compartment.

The compressor is a two-cylinder, belt-driven pump. An electromagnetic clutch couples the compressor to the drive pulley. The drive pulley freewheels when the air conditioner is not in use.

The start position on the ignition switch automatically disconnects all accessories, including the air conditioner, to reduce battery load and provide easier starting.

CONTROL OPERATION

For fast, maximum efficiency, purge the vehicle of hot air by driving the equivalent of two or three city blocks with at least one window open. During this time, place the TEMP control in the MAX position and the FAN control in the HI or PC position. This permits the evaporator to precool in hot weather.

CAUTION: *Do not leave fan control on PC for longer than 30 seconds. Move the fan control to HI position and raise all windows.*

Adjust the air outlets to obtain desired airflow distribution by moving the louver levers left, right, up, or down. Airflow can be adjusted for quick delivery to a specific spot or for gentle diffusion of air throughout the vehicle.

When the interior of the vehicle has cooled to the desired temperature, the FAN knob may be set to obtain the desired volume of air from the air outlets. The TEMP knob may be rotated to vary the temperature. It may be necessary to experiment with the TEMP knob to determine the settings best suited to various driving

conditions. Generally, an intermediate temperature and high fan setting is comfortable for city driving, and a lesser fan setting comfortable for open road driving.

Run the engine well above idle speed for more efficient cooling under conditions in which the system is operated with the vehicle standing.

CONTROL PANEL

Fan Switch

The fan switch may be serviced by removing the access plate located on the lower evaporator core housing below the control panel.

Temperature Control Thermostat

To service the temperature control thermostat, the evaporator core housing must be disassembled.

When installing a new temperature control thermostat, insert the capillary tube into the evaporator coil a minimum of two inches (fig. 3E-6).

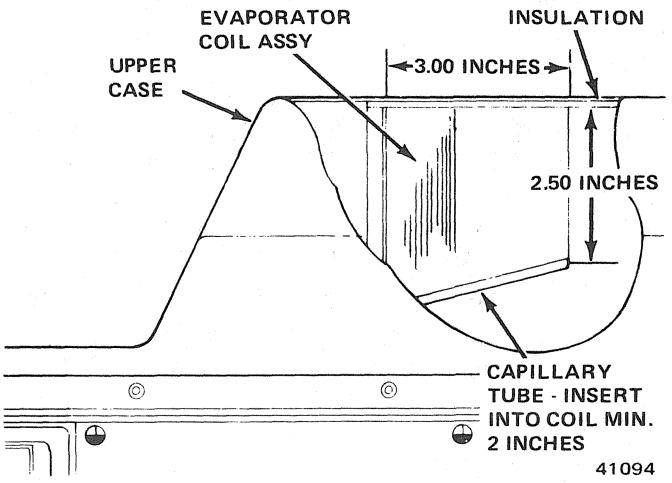


Fig. 3E-6 Capillary Tube Position

CAUTION: *Handle the tube with care to avoid bends or kinks which could cause the thermostat to malfunction.*

CONDENSER AND RECEIVER/DRYER ASSEMBLY

Removal

(1) Discharge refrigerant from system as described in General Information section of this chapter.

NOTE: *Discharge system slowly to prevent loss of compressor oil.*

(2) Drain radiator.
(3) Remove fan shroud and radiator.
(4) Disconnect pressure line at condenser.
(5) Remove condenser attaching screws and tilt bottom of condenser toward engine.

NOTE: *Plug all open connections to prevent entry of dirt and moisture.*

(6) From underside of vehicle, disconnect receiver/dryer-to-evaporator hose at receiver/dryer.
(7) Remove condenser and receiver/dryer assembly.
(8) Remove receiver/dryer from condenser, if necessary.

Installation

(1) If removed, install receiver/dryer to condenser.
(2) Place condenser in position and connect receiver/dryer-to-evaporator hose at receiver/dryer.
(3) Install condenser attaching screws.
(4) Connect pressure line at condenser.
(5) Install radiator and fan shroud.
(6) Fill radiator.
(7) Evacuate, leak test, and charge system as described in General Information section of this chapter.

RECEIVER/DRYER

Removal

(1) Discharge refrigerant from system as described in General Information section of this chapter.

NOTE: *Discharge system slowly to prevent loss of compressor oil.*

(2) Remove headlamp trim ring.
(3) Remove headlamp assembly.
(4) Remove grille.
(5) Remove bolt from top of inner panel. Pull panel back and block.
(6) Remove evaporator and condenser line from receiver/dryer.
(7) Remove screws from receiver/dryer bracket and remove receiver/dryer.

Installation

(1) Install receiver/dryer to radiator support bracket.
(2) Install evaporator and condenser lines to receiver/dryer.
(3) Remove block and install inner panel bolt.
(4) Install grille.
(5) Install headlamp assembly.
(6) Install headlamp trim ring.
(7) Evacuate, charge system and leak test as described in General Information section of this chapter.

EVAPORATOR HOUSING ASSEMBLY

Removal

(1) Discharge system as described in General Information section of this chapter.

(2) Disconnect inlet (suction) line at compressor.

(3) Disconnect receiver/dryer-to-evaporator hose at quick-disconnect coupling (fig. 3E-7).

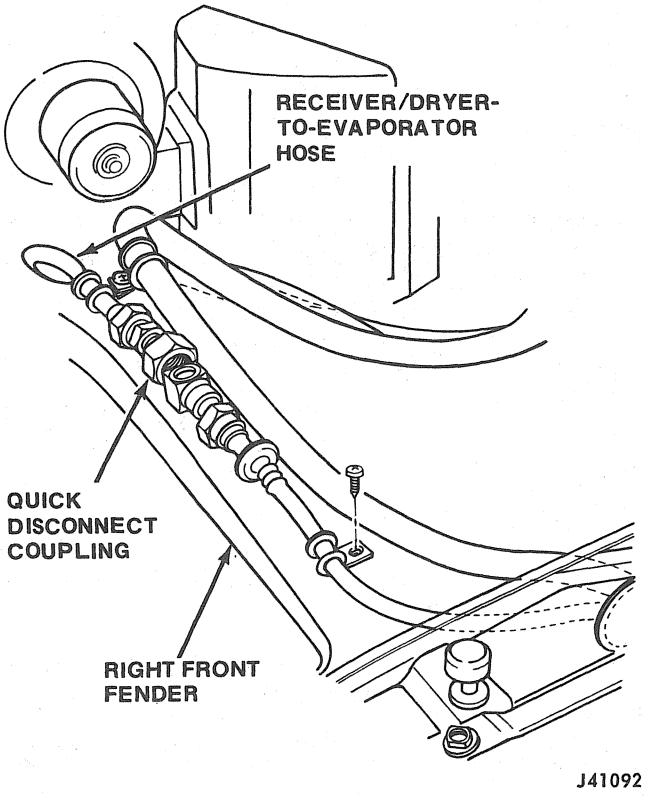


Fig. 3E-7 Quick-Disconnect Coupling

(4) Remove hose clamps and dash grommet retaining screws.

(5) Remove evaporator housing-to-instrument panel attaching screws and evaporator housing-to-mounting bracket screw (fig. 3E-8).

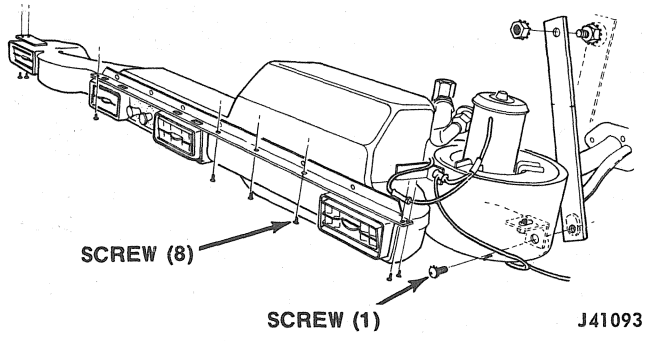


Fig. 3E-8 Evaporator Housing Mounting—Cherokee-Wagoneer-Truck Models

(6) Lower evaporator housing and pull hoses and grommet through opening.

The blower motor, blower motor housing, and evaporator core may be serviced after the evaporator housing is removed (fig. 3E-9).

NOTE: *It is not necessary to discharge the system to service the blower motor. The evaporator housing may be lowered from the instrument panel to gain access to the blower motor attaching screws.*

Installation

(1) Push hoses through grommet opening, and install grommet by pushing toward engine compartment of vehicle and fasten to dash panel with two attaching screws.

(2) Raise evaporator and install evaporator housing-to-instrument-panel attaching screws and evaporator-to-mounting bracket screw.

(3) Install hose clamps and grommet attaching screws.

(4) Connect receiver-to-evaporator hose at quick-disconnect coupling.

(5) Connect inlet (suction) line to compressor.

(6) Evacuate, leak test, and charge system as described in General Information section of this chapter.

EXPANSION VALVE SERVICE

The valve is preset and should not be adjusted. A defective valve requires replacement.

(1) Discharge system as described in General Information section of this chapter.

(2) Remove evaporator housing assembly.

(3) Remove insulation wrapped around suction line and expansion valve. Mark capillary tube location on suction line.

(4) Disconnect inlet and outlet connections, capillary tube clamp, and equalizer tube.

(5) Remove expansion valve.

(6) Clean suction line to provide a positive contact with replacement expansion valve capillary tube.

(7) Connect inlet and outlet hoses. Clamp capillary-tube at marked position and connect equalizer tube.

NOTE: *Clamp capillary tube securely so that a firm contact with suction line is formed.*

(8) Wrap expansion valve and line with insulation.

(9) Install evaporator housing assembly.

(10) Evacuate, leak test, and charge system as described in General Information section of this chapter.

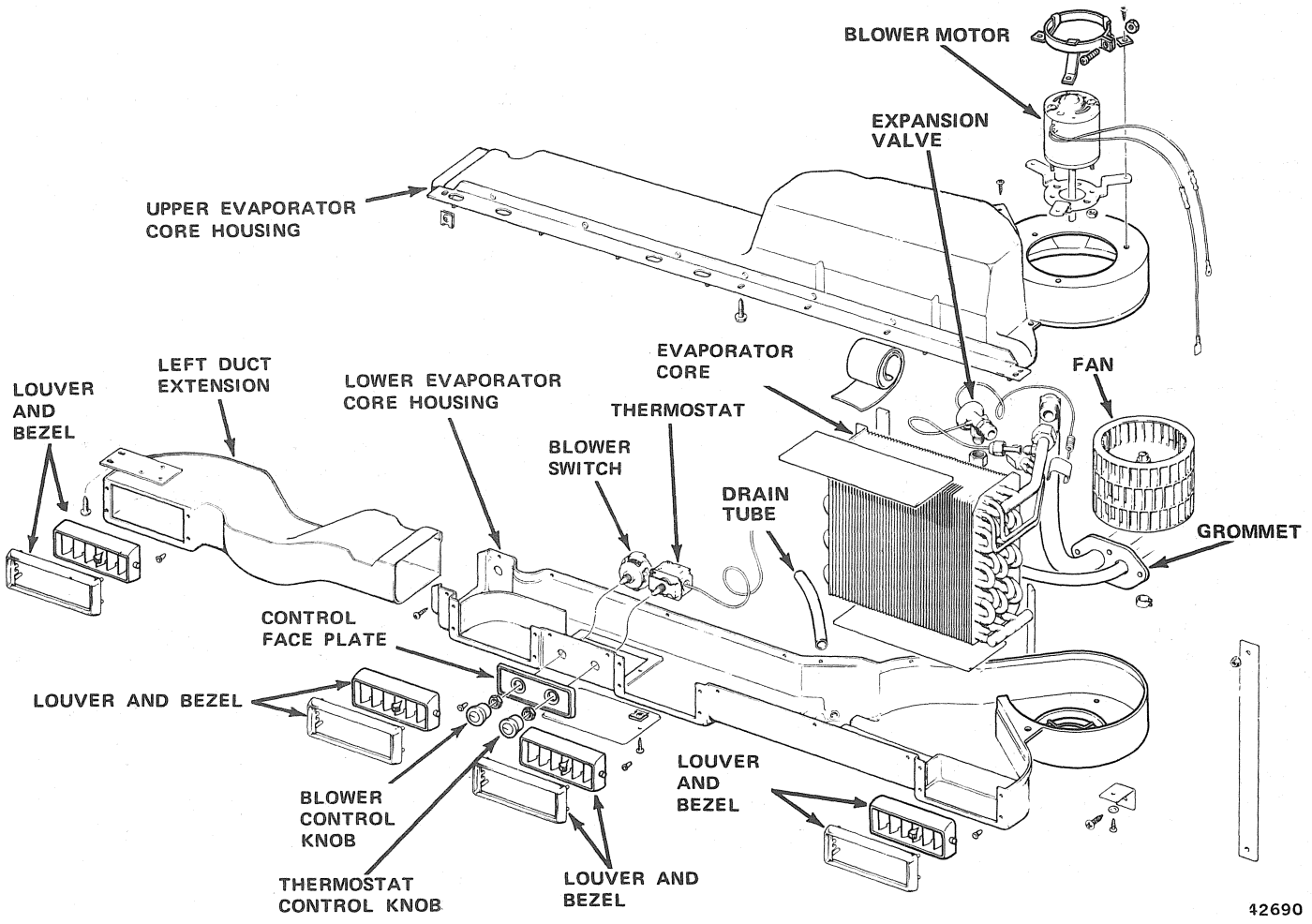


Fig. 3E-9 Evaporator Housing Assembly—Cherokee-Wagoneer-Truck Models

GENERAL INFORMATION

GENERAL

The following service procedures apply to all factory installed air conditioning systems unless otherwise specified.

REFRIGERANT SAFETY PRECAUTIONS

The refrigerant used in automotive air conditioning systems is dichlorodifluoromethane, commonly known as Refrigerant-12 or R-12. It is transparent and colorless in both the liquid and vapor state. Since it has a boiling point of **21.7°F below zero** at atmospheric pressure, it vaporizes at all normal temperatures and pressures. The vapor is heavier than air, nonflammable and nonexplosive. It is nonpoisonous except when in direct contact with open flame, and is noncorrosive except when combined with water. Observe the following precautions when handling R-12.

R-12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes.

WARNING: *Always wear safety goggles when servicing the refrigeration part of the air conditioning system. Keep a bottle of sterile mineral oil and a weak solution of boric acid handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out (R-12 is rapidly absorbed by oil). Next, wash the eyes with the weak solution of boric acid. Call a doctor immediately, even though irritation has ceased after the first aid treatment.*

WARNING: *Do not heat R-12 above 125°F.*

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant. A bucket or large pan of hot water not over 125°F is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld, steam clean or heat the system components or refrigerant lines.

CAUTION: *Keep R-12 containers upright when charging the system, so as to utilize the vapor instead of the liquid.*

When metering R-12 into the refrigeration system, **keep the supply tank or cans in an upright position.** If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

WARNING: *Always work in a well-ventilated area.*

Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation.

Although R-12 vapor is normally nonpoisonous, it can be changed into a very poisonous gas if allowed to come in contact with an open flame. Do not discharge large quantities of refrigerant in an area having an open flame. A poisonous gas is produced when using the halide torch leak detector. Avoid inhaling the fumes from the leak detector.

CAUTION: *Do not allow liquid refrigerant to touch bright metal.*

Refrigerant will tarnish bright metal and chrome surfaces. Avoid splashing refrigerant on any surface. Refrigerant in combination with moisture is very corrosive and can cause extensive damage to all metal surfaces.

SERVICE VALVES

The discharge and suction service valves are mounted directly to the compressor head. The valves are used for diagnosis, charging, discharging, evacuating, and component removal.

The service valves are three-position valves (fig. 3E-10). The normal operating position, shown in figure 3E-10, View B, has the valve stem turned **counterclockwise** to the **back-seated** (full-out) position.

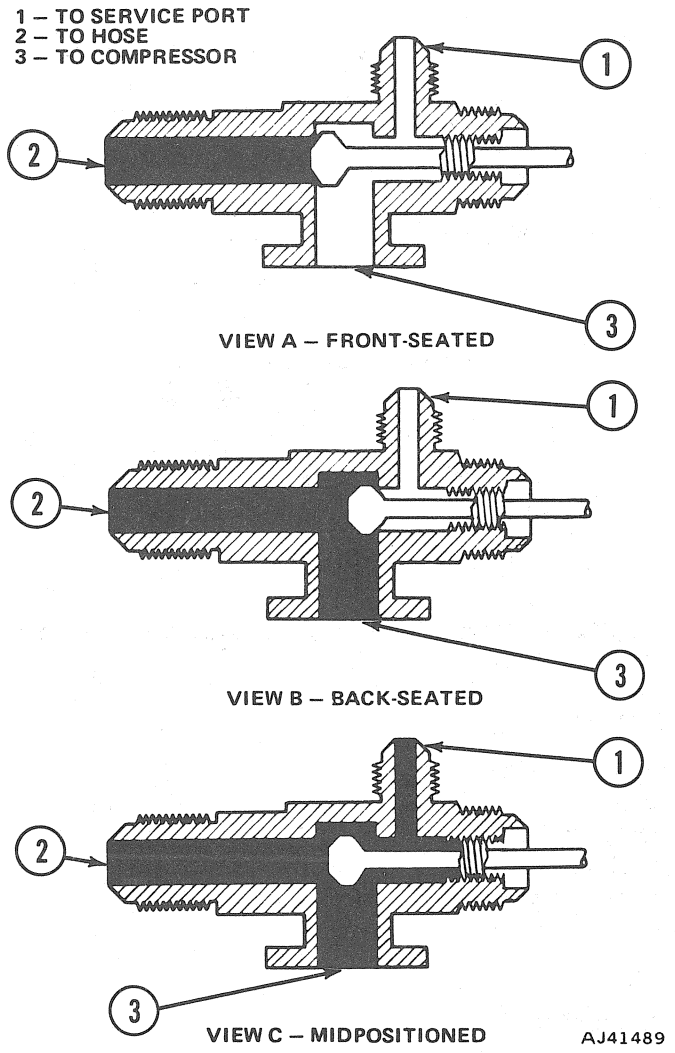


Fig. 3E-10 Service Valve Operating Positions—Typical

When the valve stem is turned **clockwise** to the **front-seated** (full-in) position (fig. 3E-10, View A), the compressor is isolated from the system. This position is used when removing the compressor or when checking compressor oil level.

When the valve is **mid-positioned** (cracked) (fig. 3E-10, View C), the gauge port is **open**. This position is used when charging, discharging, evacuating, and checking system pressure.

PRESSURE GAUGE AND MANIFOLD ASSEMBLY

The pressure gauge and Manifold Assembly Tool J-23575 (fig. 3E-11) is the most important tool used to service the air conditioning system. The gauge assembly is used to determine system high and low side gauge pressures, the correct refrigerant charge, and for system

diagnosis. It is designed to provide simultaneous high and low side pressure indications, because these pressures must be compared to determine correct system operation.

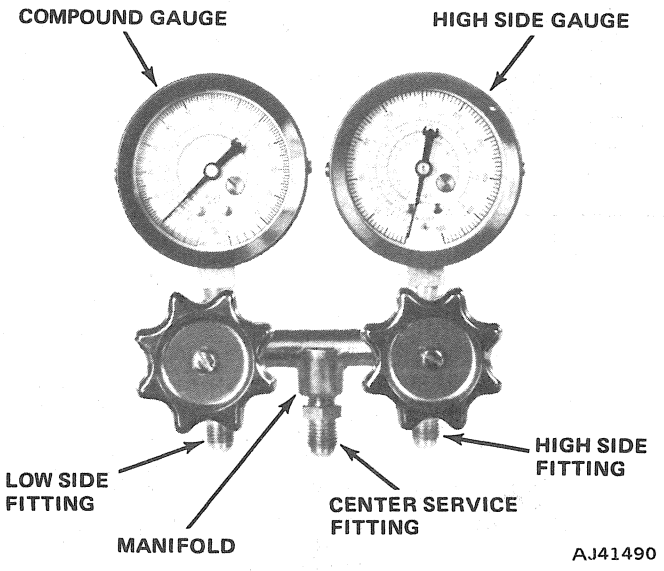


Fig. 3E-11 Pressure Gauge and Manifold Assembly Tool J-23575

Low Side Gauge

The low side gauge is a compound gauge, which means that it will register both pressure and vacuum. The compound gauge is calibrated 0 to 150 psi pressure and 0 to 30 inches of mercury vacuum. It is connected to the suction service valve to check low side pressure or vacuum.

High Side Gauge

The high side gauge is used to check pressure in the discharge side of the air conditioning system.

Manifold

The gauges are connected into the air conditioning system through a manifold (fig. 3E-11). The manifold has three connections. The low side hose and fitting is connected directly below the low side gauge. The high side hose and fitting is connected below the high side gauge.

The center connection of the manifold is used for charging, discharging, evacuating, and any other necessary service. Both the high and low sides of the manifold have hand shutoff valves. The hand shutoff valves open or close the respective gauge connections to the center service connection or to each other. The manifold is constructed so that pressure will be indicated on the gauges regardless of hand valve position.

Connecting the Pressure Gauge and Manifold Assembly

(1) Remove protective caps from service valve gauge ports and valve stems.

(2) Close both hand valves on gauge manifold set.

(3) Connect compound gauge hose to compressor suction service valve gauge port (low-side).

(4) Connect high pressure gauge hose to discharge service valve gauge port (high-side).

NOTE: *If necessary, to facilitate installation of the gauge set, loosen the service valve-to-compressor fitting and* ***rotate the service valve slightly****. Do not allow line to contact engine or body components. Tighten the service valve-to-compressor fitting to 25 foot-pounds (34 N•m) torque or 15 foot-pounds (20 N•m) torque for flange-type service valve screws.*

(5) Set both service valve stems to mid- or cracked-position. The gauges will indicate high and low side pressure respectively.

(6) Purge any air from high side test hose by opening high side hand valve on manifold for three to five seconds (center connection on manifold must be open).

(7) Purge any air from low side test hose by opening low side hand valve on manifold for three to five seconds (center connection on manifold must be open).

(8) Air conditioning system may be operated with gauge manifold assembly connected in this manner. Gauges will indicate respective operative pressures.

CHECKING SYSTEM PRESSURES

The pressure developed on the high side and low side of the compressor indicate whether the system is operating properly.

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(1) Attach pressure gauge and manifold assembly.

(2) Close both hand valves on gauge and manifold assembly.

(3) Set both service hand valve stems to mid-position.

(4) Operate air conditioning system with engine running at 1500 rpm and controls set for full cooling but not into the MAX or COLD detent.

(5) Insert thermometer into discharge air outlet and observe air temperature.

(6) Observe high and low side pressures and compare with those shown in the Normal Operating Temperatures and Pressures Chart. If pressures are abnormal, refer to Pressure Diagnosis Chart.

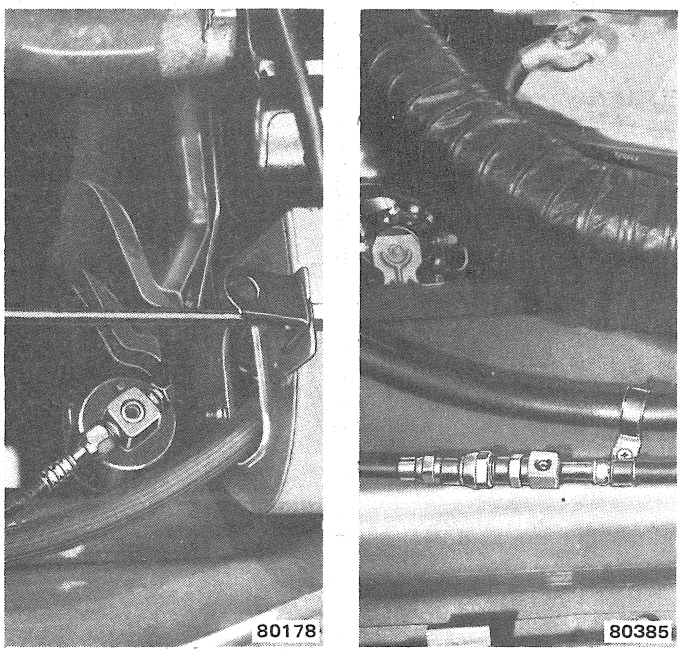
Normal Operating Temperatures and Pressures *

Relative Humidity (percent)	Surrounding Air Temperature (° F)	Engine Speed (RPM)	Maximum Desirable Center Register Discharge Air Temp. (° F)	Suction Pressure PSI (REF)	Head Pressure PSI (+25 PSI)
	70		40	11	177
20	80	1500	41	15	208
	90		42	20	226
	100		43	23	255
	70		40	12	181
30	80	1500	41	16	214
	90		42	22	234
	100		44	26	267
	70		40	13	185
40	80	1500	42	18	220
	90		43	23	243
	100		44	26	278
	70		40	14	189
50	80	1500	42	19	226
	90		44	25	251
	100		46	27	289
	70		41	15	193
60	80	1500	43	21	233
	90		45	25	259
	100		46	28	300
	70		41	16	198
70	80	1500	43	22	238
	90		45	26	267
	100		46	29	312
	70		42	18	202
80	80	1500	44	23	244
	90		47	27	277
	100		—	—	—
	70		42	19	206
90	80	1500	47	24	250
	90		48	28	284
	100		—	—	—

*Operate engine with transmission in neutral. Keep vehicle out of direct sunlight.

SIGHT GLASS

A sight glass is incorporated in the receiver-to-evaporator hose at the receiver end (fig. 3E-12). The sight glass provides a visual check of the system refrigerant level. A continuous stream of bubbles will appear in the sight glass of a system which is not properly charged. Properly charged and completely discharged systems will appear similar through the sight glass because of a lack of bubbles. To distinguish between the two situations, cycle the magnetic clutch Off and On with the engine running at 1500 rpm. During the time the clutch is off, bubbles will appear if the refrigerant is in the system and will disappear when the clutch is on. If no bubbles appear when cycling the magnetic clutch, there is no refrigerant in the system since some bubbles would appear in a fully charged system. If the system is discharged, it will be necessary to leak test, repair as required, evacuate, and charge the system.



CJ CHEROKEE-WAGONEER-TRUCK

Fig. 3E-12 Sight Glass

DISCHARGING SYSTEM

Refrigerant should be discharged from the system before replacing any part in the system except the compressor.

(1) Connect pressure gauge and manifold assembly to proper service valves.

(2) Turn both manifold hand valves to maximum counterclockwise (open) position.

(3) Open both service valves a slight amount (from back-seated position) and allow refrigerant to discharge **slowly** from system (fig. 3E-13).

CAUTION: *Do not allow the refrigerant to rush out, as the oil in the compressor or system will be forced out along with it.*

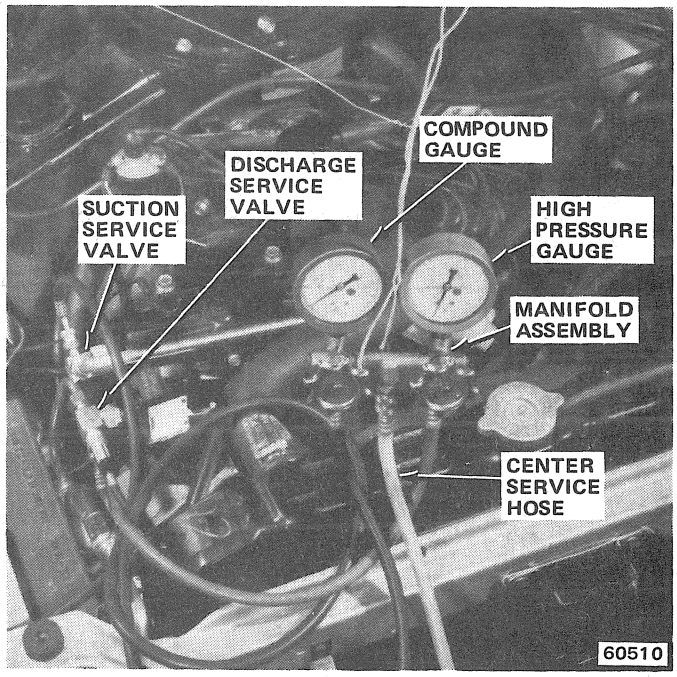


Fig. 3E-13 Typical Pressure Gauge and Manifold Assembly Connections for Discharging System

EVACUATING SYSTEM

A system with the refrigerant removed during repair, or one that is excessively low on refrigerant must be evacuated with a vacuum pump before new refrigerant is installed. The reason for evacuating a system is to remove any air and moisture that may have entered the system.

Moisture in any quantity is extremely harmful to the air conditioning system. Moisture may collect and freeze in the thermostatic expansion valve orifice, blocking refrigerant flow and preventing system cooling. Moisture will also react with R-12 to form hydrochloric acid which will corrode metal parts of the system. Corrosion particles may become detached and block the small passages and orifices in the system.

Unwanted air and moisture are removed from the system by proper evacuation of the system. A vacuum pump is used to lower the pressure sufficiently so that moisture boiling temperature is reduced to a point where the water will vaporize and can be evacuated from the system.

Water boils at 212°F at 14.7 psi (sea level). As the vacuum pump lowers the pressure of the closed air conditioning system, the boiling point of the moisture in the system will also be lowered. In evacuating the system, it is necessary to lower the boiling point of any moisture in the system to a point lower than the ambient (surrounding) temperature to ensure that all moisture is boiled

off. At an ambient temperature of 75°F, when the desired vacuum of 29.5 in. Hg is reached, water will boil at approximately 54°F and a complete boiling off of all moisture in the system is assured when this vacuum reading has been reached.

At altitudes higher than sea level, it will not be possible to obtain a vacuum reading of 29.5 in. Hg on the low side compound gauge. For each 1,000 feet of altitude, the vacuum gauge must be corrected by one in. Hg to compensate for a change in atmospheric pressure. For example, at altitudes of 1,000 feet, a gauge reading of 28.5 in. Hg will be the same as a gauge reading of 29.5 in. Hg at sea level. When this vacuum is reached, a minimum of 30 minutes should be allowed in evacuating the system to ensure complete moisture removal.

Evacuating Procedure with J-26695 Vacuum Pump

The J-26695 Vacuum Pump and motor is a self-contained unit equipped with a carrying handle and stand. The unit must be kept upright at all times to prevent oil from spilling.

(1) Connect pressure gauge and Manifold Assembly Tool J-23575.

(2) Discharge system.

(3) Connect center service hose to inlet fitting of vacuum pump (fig. 3E-14).

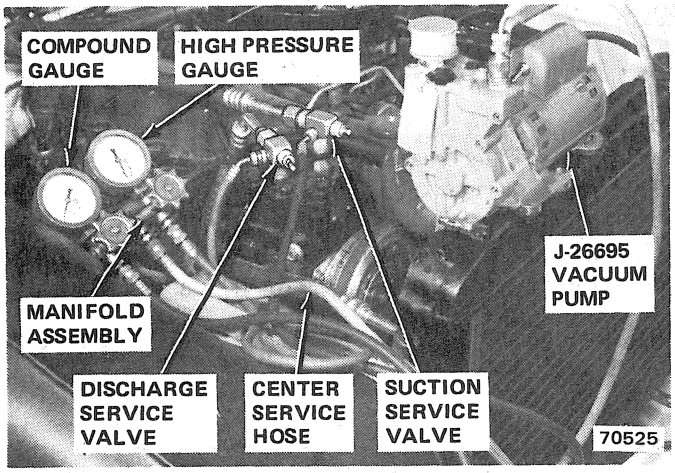


Fig. 3E-14 Typical Connections for Evacuating System with J-26695 Vacuum Pump

(4) Open both manifold hand valves wide open.

(5) Start vacuum pump; note compound gauge reading.

(6) Operate pump a MINIMUM of 30 minutes after reaching lowest vacuum.

(7) Test system for leaks. Close both manifold hand valves, turn off vacuum pump, and note compound gauge reading. Gauge needle should remain stationary at point at which pump was turned off.

(8) If gauge needle returns to zero rapidly, install a partial charge in system and locate leak with leak detector. Repair leak and repeat evacuation procedure.

(9) If gauge needle remains stationary and vacuum is maintained for three to five minutes, resume evacuation for minimum of 30 minutes.

(10) Close both manifold hand valves and stop vacuum pump.

(11) Disconnect center service hose from vacuum pump. System is now ready for charging.

Evacuation Procedure with J-23500-01 Portable Air Conditioning Service Station

The J-23500-01 Portable Air Conditioning Service Station (fig. 3E-15) is a completely portable station equipped with vacuum pump, metering-charging cylinder, refrigerant supply, gauges, hoses and hand control valves.

The control switch for the vacuum pump is mounted on the front of the charging station. It should be in the Off position before inserting plug into the power source.

NOTE: *Be certain system is completely depressurized before evacuating. With the system under pressure, refrigerant may enter vacuum pump and damage the pump.*

(1) Close all hand valves.

(2) Connect red charging hose to discharge service valve port on compressor.

(3) Connect blue charging hose to suction service valve port on compressor.

(4) Discharge system, leaving suction and discharge service valves in the mid- or cracked-position.

(5) Connect vacuum pump hose to vacuum pump inlet.

(6) Open low pressure hand control valve and high pressure hand control valve on charging station.

(7) Start vacuum pump and open vacuum control valve; note compound gauge reading.

(8) Operate pump **minimum of 30 minutes** after reaching lowest vacuum.

(9) Fill charging cylinder, as described below, while system is evacuating.

(10) Close vacuum control valve and stop vacuum pump. Observe blue compound gauge to determine if leak exists. System is now ready for charging.

CHECKING FOR LEAKS

Whenever a system requires more than 1/2 pound of refrigerant after a season's operation, a serious leak is indicated which must be located and repaired.

Most leaks will be located at points of connection and are caused by automobile vibration. Correction of this type of leak may only require retightening of the connection. However, some leaks may occur only at periods

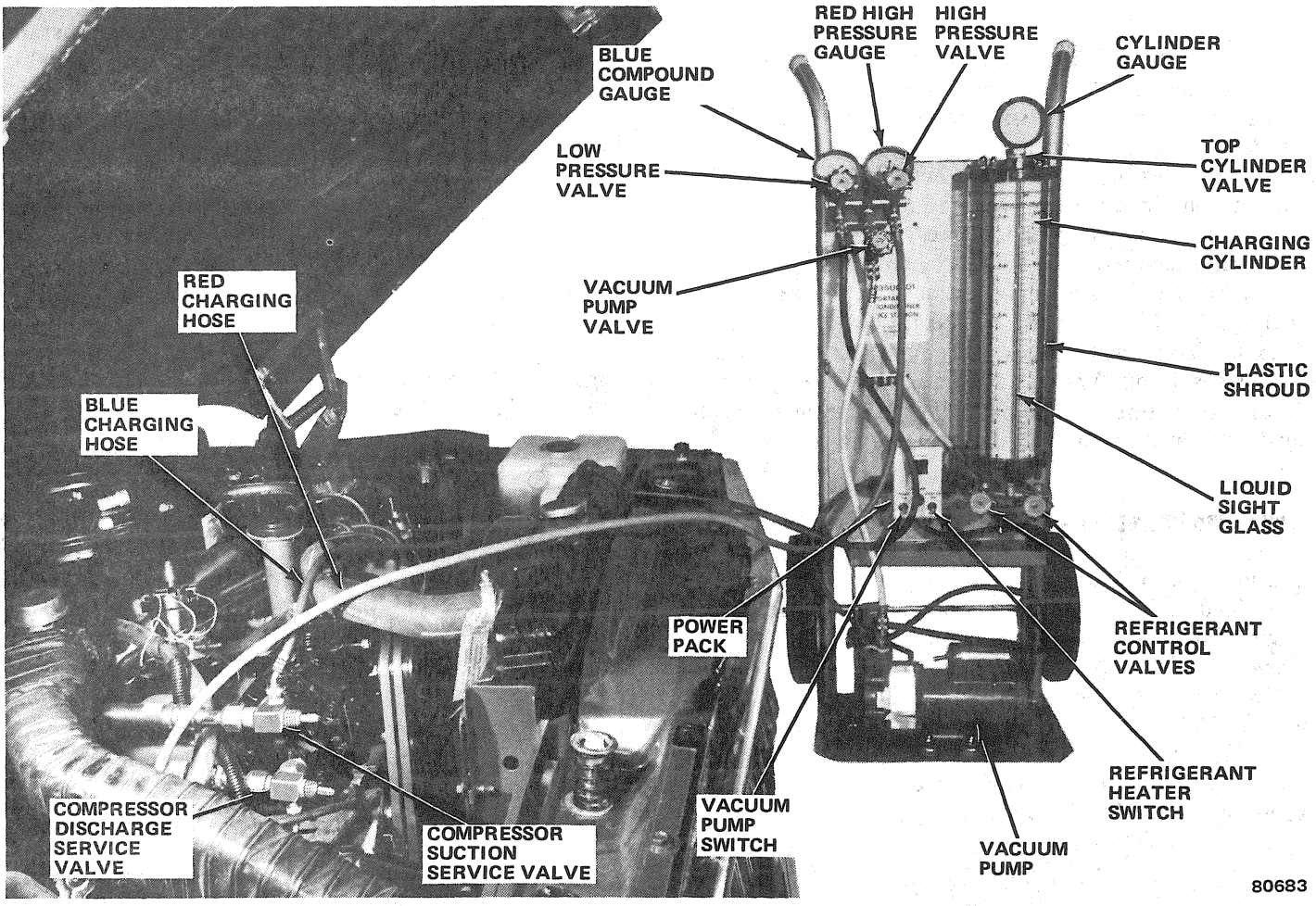


Fig. 3E-15 Typical Connections for Portable Air Conditioning Service Station J-23500-01

of high traffic on a very warm day. This type of leak most often occurs through the compressor shaft seal or service valve gasket.

A system must contain an adequate quantity of refrigerant to be properly leak tested. If a system is completely discharged, evacuate and install 1/2 pound of refrigerant.

Halide Torch Leak Detection

External leaks are detected and located with a Halide Torch Tool J-6084 (fig. 3E-16). The torch burns propane fuel and is equipped with a search hose. When air is drawn into the hose by the torch, it contacts a heated copper reactor ring in the torch. If refrigerant gas is present in the air, the normally light blue flame will change color. A small refrigerant leak will change the flame color to yellow. A large refrigerant leak will change it to green or purplish-blue.

Leak Test Procedure Using Halide Torch

(1) Open torch valve and light torch, adjusting flame just high enough to heat copper reactor ring to a cherry red.

(2) Lower flame until it is about 1/4 inch above or even with copper reactor ring. Smaller flame is more sensitive to refrigerant.

(3) Move search hose slowly **under** all connections, joints and seals. Because refrigerant is heavier than air, leaks may be more readily detected on lower side of areas being checked.

(4) Watch for color change of flame indicating area of leak.

WARNING: *When R-12 refrigerant comes into contact with an open flame, phosgene gas is formed. NEVER INHALE THE VAPORS OR FUMES FROM THE HALIDE TORCH; they are poisonous.*

(5) Repair leaks as required.

(6) Evacuate and leak-test system after all leaks are corrected.

(7) Charge system.

Electronic Leak Detection

External leaks are detected and located with the Electronic Leak Detector Tool J-26933. The leak detector is

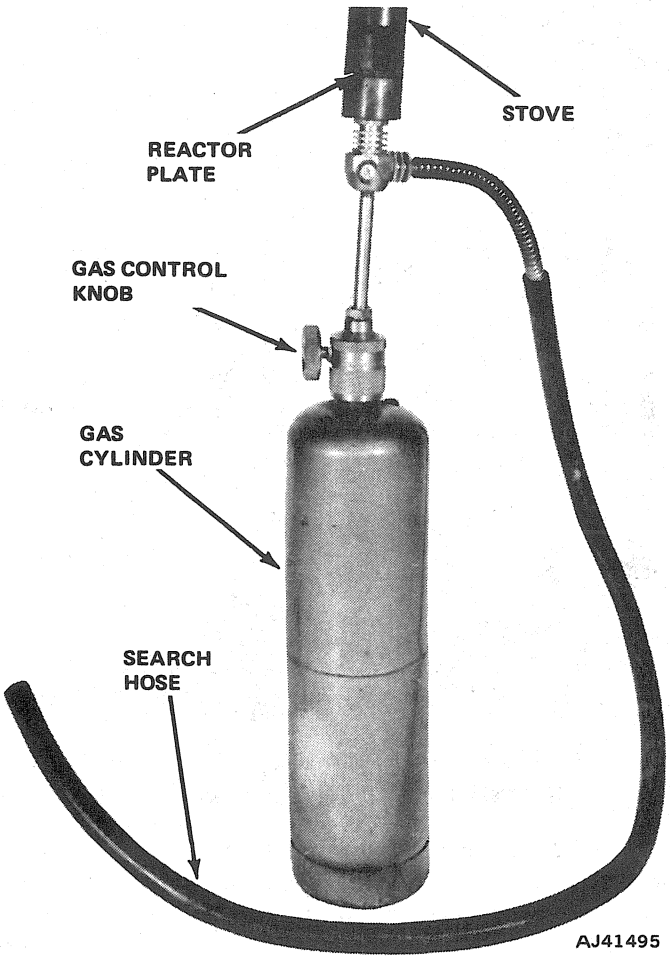


Fig. 3E-16 Halide Torch Tool J-6084

an electronic instrument designed to detect R-12 refrigerant leaks as small as one-half ounce per year. The 18-inch flexible probe gets at inaccessible places. Follow the manufacturer's calibration instructions, included with the unit, to set up the electronic leak detector for proper operation.

NOTE: *Using the Electronic Leak Detector Tool J-26933, will NOT expose the user to phosgene gas vapors or fumes.*

Leak Test Procedure Using Electronic Detector

(1) Unwind flexible probe from case.

(2) Activate Off/On switch, place flexible probe tip near leak port and adjust BAT thumbwheel a few teeth until light goes on and goes out when tip is removed from leak port.

(3) Move flexible probe slowly **under** suspected connections, joints, and seals. R-12 refrigerant is heavier than air, leaks may be detected more readily on lower side of areas being checked.

(4) When a leak is found, its presence will be indicated by white signal light.

NOTE: *If probe tip is held too long on the leak, the white signal light will go out.*

(5) Repair leaks, as required.

(6) Evacuate system after all leaks are corrected.

(7) Charge system.

FLUSHING SYSTEM

Anytime a failure of the compressor causes foreign material to be passed into the system, the condenser must be flushed and the receiver/drier replaced. Filter screens in the compressor at the suction side and in the receiver/drier will confine foreign material to the compressor, condenser, receiver/drier and connecting hoses.

Flushing Procedure

(1) Install replacement compressor and connect service valves and hoses.

NOTE: *System must be in a discharged state.*

(2) Using Portable Air Conditioning Service Station J-23500-01, close all control valves, and connect red high pressure to compressor discharge service valve.

WARNING: *Wear goggles to protect eyes.*

(3) Open refrigerant drum valve. Bleed charging cylinder through valve located on back of control panel directly above cylinder. When two pounds of refrigerant is in charging cylinder, close bleed valve.

(4) Close refrigerant drum valve.

(5) Disconnect receiver/drier from condenser. Place a shop towel on condenser outlet to catch oil that will be forced from system.

(6) Center compressor discharge valve.

(7) Fully open high pressure valve on control panel and allow liquid refrigerant to flow through condenser.

WARNING: *Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation.*

(8) When charging cylinder is empty, close high pressure valve on control panel.

(9) Check compressor oil level.

(10) A replacement receiver/drier should be installed, and system evacuated before charging.

FILLING CHARGING CYLINDER

(1) Be certain refrigerant drum is inverted and valve is open.

(2) Open right hand valve at base of charging cylinder and fill with required amount of refrigerant to charge system (refer to Charge Capacity). Liquid refrigerant will be observed rising in charging cylinder sight glass.

(3) Crack open valve at top of cylinder when pressure in charging cylinder equals pressure in supply tank. This relieves head pressure and allows refrigerant to continue filling cylinder.

(4) Observe pressure gauge at top of cylinder and rotate plastic shroud until pressure heading column corresponds with gauge pressure in line with sight glass.

NOTE: *If pressure gauge at top of cylinder reads, for example, 70 psi, find the column with the pressure heading of "70" and rotate shroud so the "70" column aligns with the sight glass.*

(5) When refrigerant reaches desired level in sight glass, close both the right hand valve at base of cylinder and refrigerant drum valve. Be certain top cylinder valve is fully closed.

NOTE: *If bubbling occurs in sight glass, tilt charging station back momentarily.*

(6) Connect heating element cord to heating element receptacle of power pack and turn heater switch On. Allow refrigerant to heat (building up pressure proportionately) for about ten minutes while vacuum pump is running.

CHARGING SYSTEM

Before making a complete charge, check the compressor oil level, leak test if necessary, and evacuate the system.

Charge Capacity

The recommended charge for the respective systems is as follows: CJ—2-1/2 pounds R-12; Cherokee, Wagoneer and Truck—2-1/4 pounds R-12. Capacities are also indicated on a decal attached to compressor.

NOTE: *Replacement of a hose, receiver/dryer, condenser, expansion valve or evaporator requires the addition of one ounce of AMC Oil 8132400, or equivalent.*

Charging Procedure with Multi-Refrigerant Can Opener Tool J-6272-02

The following charging procedure is based on the use of pressure gauge and Manifold Assembly J-23575, and Multi-Refrigerant Can Opener J-6272-02. Refer to figure 3E-17.

WARNING: *Wear goggles to protect eyes.*

(1) Connect pressure gauge and Manifold Assembly J-23575 and evacuate system. Keep both service valves in mid- or cracked-position.

(2) Close both gauge hand valves.

(3) Disconnect service hose from vacuum pump and connect it to center of Multi-Refrigerant Can Opener J-6272-02. Close four petcock valves on dispenser.

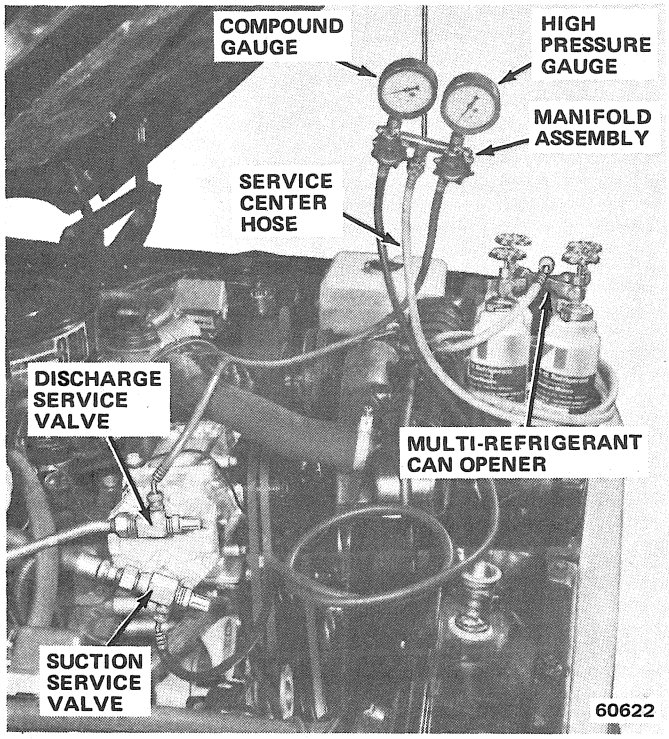


Fig. 3E-17 Typical Connections for Charging System with Multi-Refrigerant Can Opener Tool J-6272-02

(4) Attach necessary number of refrigerant cans to opener. Refer to Charge Capacity for proper weight of refrigerant necessary to charge automobile being serviced.

(5) Open one petcock valve. Loosen center service hose at pressure gauge and manifold assembly allowing refrigerant to purge air from line. Tighten service hose connection and close petcock valve.

(6) Open suction (compound) gauge hand valve and one petcock valve. Do not open discharge (high pressure) gauge hand valve.

WARNING: *Use extreme caution when engine is operating. Do not stand in direct line with fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.*

(7) Start engine and place air conditioning controls in maximum cooling position. The compressor will operate and help pull refrigerant gas into suction side of system.

NOTE: *The refrigerant cans may be placed upright in warm water NO HOTTER THAN 125°F to speed up the charging process.*

(8) When first refrigerant can is empty, open another petcock valve to continue charging system.

(9) Continue charging until specified amount of refrigerant is in system. The frost line on refrigerant can will indicate what portion of refrigerant in can has entered system. This may be used as a guide when a system requires a fraction of a full can.

NOTE: *If an accurate scale is available, weigh the refrigerant cans before and during the charging procedure to assure that the correct amount of refrigerant is being used.*

(10) When system is fully charged, close suction (compound) gauge hand valve and all petcock valves.

(11) Operate system five to ten minutes to allow it to normalize and to determine if system will cycle properly. Refer to Checking System Pressures.

(12) Upon completion of operational check, back-seat suction and discharge service valves to their normal operating position by turning them fully counterclockwise.

(13) Loosen pressure gauge and manifold assembly service hoses to allow refrigerant trapped in hoses to discharge.

(14) Remove pressure gauge and manifold assembly and install dust caps on fittings.

Charging Procedure with Portable Air Conditioner Service Station J-23500-01

NOTE: *Fill charging cylinder as described above.*

WARNING: *Wear goggles to protect eyes.*

(1) Discharge and evacuate system as described above.

(2) Close low pressure valve on charging station, fully open left hand refrigerant control valve at base of cylinder and high pressure valve on charging station, and allow required charge of refrigerant to enter high side of system. When full charge has entered system, close refrigerant control valve and high pressure valve on charging station.

CAUTION: *Do not permit liquid level to drop below zero on cylinder sight glass.*

(3) Close manifold gauges after completion of charging, and check high and low pressures and system operation.

CAUTION: *Read gauges with high and low pressure valves on charging station closed. The low pressure gauge could be damaged if both high and low pressure valves of manifold are opened. The high pressure developed in discharge side (high side) of compressor would peg indicator needle of low pressure gauge and damage the gauge.*

(4) Close all valves on charging station and close refrigerant drum valve when all operations are completed.

(5) Upon completion of operational check, back-seat suction and discharge service valves to their normal operating position by turning them fully counterclockwise.

(6) Disconnect high and low pressure charging hoses from compressor with care. (A small amount of refrigerant remaining in hoses will escape.) Replace charging hoses on hose holder on charging station to keep air and dirt out of hoses.

(7) Open valve at top of cylinder to remove remaining refrigerant.

NOTE: *The charging cylinder is not designed to store refrigerant.*

(8) Replace quick seal caps on compressor service valves when service is completed.

SERVICE PROCEDURES — 49-STATE SIX AND EIGHT-CYLINDER MODELS

GENERAL

This section consists of a general description of each component and the system operation of all components used with the 49-State six- and eight-cylinder engines. Service information for the compressor and magnetic clutch is also contained within this section. All other service information can be found in the CJ Air Conditioning and Cherokee-Wagoneer-Truck Air Conditioning sections or the General Information section of this chapter.

The 49-State six- and eight-cylinder engine components are as follows.

Compressor—The compressor used on the 49-State six- and eight-cylinder engines is a two-cylinder in-line unit that is driven by a single V-belt. It is used to circulate and increase the pressure of the refrigerant in the system. It is mounted to the engine as shown in figures 3E-18 and 3E-19.

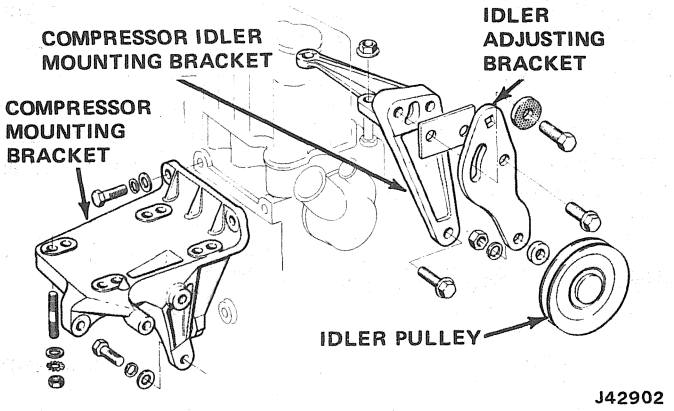


Fig. 3E-18 Compressor Mounting—49-State Six-Cylinder Engine

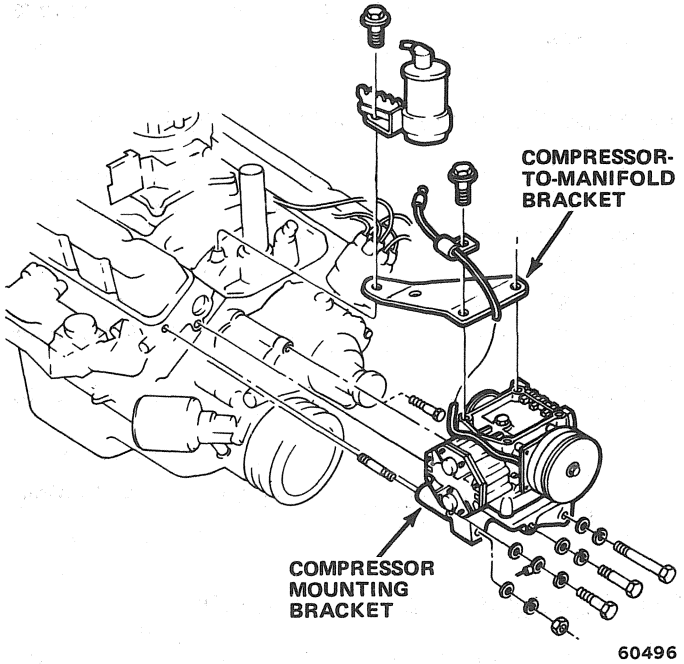


Fig. 3E-19 Compressor Mounting—49-State Eight-Cylinder Engine

Condenser—The condenser is mounted in front of the radiator to allow air to flow over the cooling fins and remove heat from the refrigerant. As the refrigerant passes through the condenser, it liquifies (condenses).

Receiver/Drier—The receiver/drier is a reservoir used to store the precise amount of refrigerant required by the system. The refrigerant level in the receiver/drier must be adequate to provide a steady flow of refrigerant to the expansion valve. The receiver/drier contains a desiccant to remove moisture from the system. The receiver/drier must be replaced anytime the system has been open to atmosphere due to a system component failure. If during servicing the receiver/drier is removed from the system, it must be tightly capped immediately.

Expansion Valve—The thermostatic expansion valve is located at the inlet of the evaporator. It meters the refrigerant to the evaporator, so as to maintain the proper flow for the various evaporator heat load requirements encountered during operation. The metering action of the expansion valve is controlled by the temperature sensing bulb mounted on the outlet (suction) line of the evaporator.

Evaporator—The evaporator is an air cooler and dehumidifier. As the refrigerant enters the evaporator core, it begins to boil. The heat in the air passing over the evaporator transfers or gives up its heat to the boiling refrigerant. As the air cools, the moisture in the air condenses on the evaporator core and is drained off as water.

SYSTEM OPERATION

The compressor increases the pressure and temperature of the system refrigerant. The heated refrigerant vapor is then pumped into the condenser where it cools by giving off heat to air passing over the condenser fins. As the refrigerant cools in the condenser, it condenses into a liquid. Still under high pressure, the liquid refrigerant passes into the receiver. The receiver acts as a reservoir to furnish refrigerant to the expansion valve at all times. From the receiver, the high pressure liquid refrigerant passes to the expansion valve. The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the suction side of the compressor. As it enters the evaporator, the refrigerant immediately begins to boil by absorbing heat from the air passing over the evaporator core. Having given up its heat to boil the refrigerant, the air is cooled and passes into the passenger compartment of the vehicle. From the evaporator the vaporized refrigerant is drawn back to the compressor to repeat the cycle.

COMPRESSOR VALVE LEAK DIAGNOSIS

The compressor should be at operating temperature to perform an accurate test.

(1) Install pressure gauge and Manifold Assembly J-23575.

(2) Front-seat the suction and discharge service valve by turning them clockwise.

(3) Discharge refrigerant remaining in compressor by opening suction gauge hand valve **slowly**.

(4) Open suction gauge hand valve and close the high pressure gauge hand valve.

(5) Start engine and operate compressor. Pressure will build up rapidly. Stop engine/compressor at 150 to 200 pounds pressure.

NOTE: *Pressure should hold if the discharge valve is operating properly. Loss of pressure indicates leaking compressor discharge valve or head gasket.*

COMPRESSOR BELT TENSION

Belt tensions are important and should be inspected at time of new vehicle predelivery and at subsequent scheduled maintenance intervals.

Belt Tension Gauge, Tool J-23600, will provide accurate belt tension adjustments. Install the gauge on the longest accessible belt span. Belt tension for new vehicle predelivery and all belts with previous service should be 90 to 115 pounds (400 to 512 newtons).

Belt tension is adjusted by moving the idler mounting bracket.

When a replacement belt is installed, it should be adjusted to 125 to 155 pounds (556 to 689 newtons), 155 pounds (689 newtons) preferred, tension to compensate for the initial run-in loss that occurs within the first several minutes of operation.

NOTE: *New belt tension specifications apply only to service replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used-belt specifications.*

A characteristic of the **Dacron type belt(s)** used to drive the A/C compressor is that **it tends to increase in tension, rather than stretch, when subjected to heat.** The loss in belt tension which can be observed after the initial run-in is the result of wear-in which allows the belt to ride deeper in the V-groove of the pulleys.

If a belt is run with less than the specified tension, slippage can occur and cause the belt contact surfaces to become glazed. A glazed belt looses some of its load carrying capabilities and may slip even when adjusted to specified belt tension.

Belt **vibration**, particularly on six-cylinder engine models, is usually the result of improper belt tension. When excessive belt vibration or flutter is encountered, adjust the belt tension to specifications. Adjusting to higher tensions will not stop vibration but will increase stress on the idler assembly.

ISOLATING THE COMPRESSOR

It is not necessary to discharge the system for compressor removal. The compressor can be isolated from the remainder of the system, eliminating the need for recharging when performing compressor service.

(1) Connect pressure gauge and Manifold Assembly J-23575.

(2) Close both gauge hand valves and mid-position (crack) both service valves.

(3) Start engine and operate air conditioning.

(4) Turn the suction service valve slowly clockwise toward front-seated position. When suction pressure is reduced to zero or less, stop engine and compressor and quickly finish front-seating the suction service valve.

(5) Front-seat discharge service valve.

(6) Loosen oil check plug slowly to release any internal pressure in compressor. The compressor is now isolated from the remainder of the system. Service valves can be removed from compressor.

COMPRESSOR REMOVAL— SIX-CYLINDER

(1) Isolate compressor.

(2) Remove both service valves and cap compressor and valves.

(3) Loosen compressor belt and move aside.

(4) Remove alternator belt and adjusting bolt.

(5) Remove upper alternator mounting bolt.

(6) Loosen lower alternator mounting nut.

(7) Remove back idler.

(8) Remove compressor mounting nuts and remove compressor.

COMPRESSOR INSTALLATION—SIX-CYLINDER

(1) Position compressor and install mounting nuts.

(2) Install back idler.

(3) Install alternator upper mounting bolt.

(4) Tighten lower mounting nut.

(5) Install alternator adjusting bolt.

(6) Install alternator drive belt and adjust to proper tension.

(7) Install compressor drive belt and adjust to proper tension.

(8) Attach compressor service valves and lines.

(9) Purge compressor of air and open service valves.

(10) Connect clutch wire.

COMPRESSOR REMOVAL—EIGHT-CYLINDER

(1) Isolate compressor.

(2) Remove both service valves and place protective caps over compressor head fittings and service valve openings.

(3) Loosen and remove compressor belt(s).

(4) Disconnect clutch wire.

NOTE: *Remove alternator mounting bracket to obtain working clearance for removing compressor mounting bracket attaching bolts and nuts.*

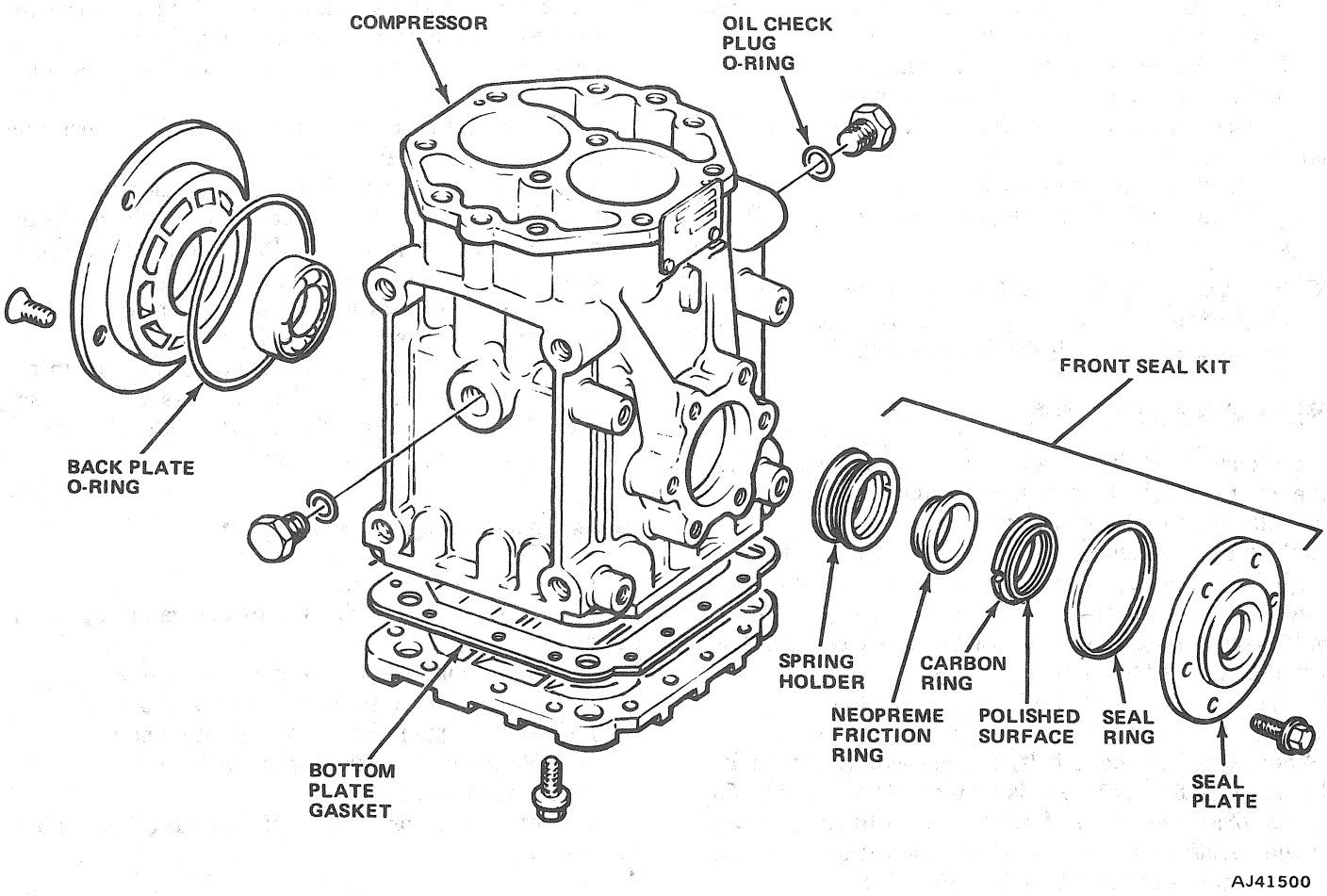


Fig. 3E-20 Compressor Seal Components and Gaskets

(5) Remove compressor and mounting bracket as an assembly and place on work bench.

(6) Remove bracket and bracket attaching nuts and studs.

COMPRESSOR INSTALLATION—EIGHT-CYLINDER

(1) Install mounting bracket to compressor.

(2) Install compressor and bracket assembly to engine.

(3) Install alternator mounting bracket, if removed.

(4) Install compressor drive belt(s) and adjust to proper tension.

(5) Attach compressor service valves and lines.

(6) Purge compressor of air and open service valves.

(7) Connect clutch wire.

COMPRESSOR FRONT SEAL REPLACEMENT

The compressor front seal is serviced in kit form. Kit components are shown in figure 3E-20. All seal parts must be replaced if a leak has been detected at the seal.

NOTE: *A small amount of oil around the shaft seal is normal and does not indicate a seal leak. All seal parts were dipped in oil at the time of assembly and operation may force out surplus oil.*

(1) Isolate compressor.

(2) Remove belt.

(3) Remove clutch and woodruff key from compressor shaft.

(4) Remove seal plate capscrews. Pry seal plate loose and remove.

(5) Carefully pry behind spring holder (that part of the seal assembly farthest back on the shaft) and remove seal assembly.

(6) Lubricate new seal assembly with clean refrigeration oil.

NOTE: *Cleanliness, careful handling, and clean refrigeration oil are important for successful seal replacement.*

(7) Push neoprene friction ring and spring holder over compressor shaft.

(8) Move assembly in and out on compressor shaft to seat neoprene friction ring.

(9) Push assembly in until spring holder contacts bearing race. Position carbon ring in spring holder with polished side facing out.

NOTE: *The carbon ring must seat in the retainer. Engage notches in carbon ring with drive tangs in spring holder.*

(10) Coat mating surfaces of compressor and seal plate with film of refrigeration oil. Position seal ring in groove on compressor.

(11) Install seal plate with polished face toward carbon ring.

(12) Install seal plate capscrews and tighten evenly. Center seal plate on shaft by lightly tapping plate. Tighten the capscrews in a diagonal pattern to 6 foot-pounds (8 N•m) torque.

(13) Turn compressor shaft by hand, using clutch mounting bolt, to seat seal.

(14) Install clutch and woodruff key.

(15) Install belt.

(16) Purge compressor of air.

(17) Leak test system. Evacuate and charge, if necessary.

BACK PLATE O-RING SEAL REPLACEMENT

NOTE: *It is not necessary to remove the compressor for seal replacement on six-cylinder engines.*

(1) Isolate and remove compressor.

(2) Remove four back plate attaching screws using Torx Bit Tool J-25359-C.

(3) Remove back plate by gently prying it loose from crankcase. Pry in such a manner to pull parallel to bearing surface.

(4) Remove O-ring seal from back plate.

(5) Clean back plate and apply light film of refrigeration oil to O-ring sealing area.

(6) Position O-ring seal on back plate and install back plate over rear bearing and into crankcase.

(7) Install four back plate attaching screws and tighten in diagonal pattern to 13 foot-pounds (18 N•m) torque.

(8) Install and purge compressor of air.

(9) Leak test system. Evacuate and charge, if necessary.

HEAD, VALVE PLATE AND GASKET REPLACEMENT

(1) Isolate compressor.

(2) Remove service valves from compressor. The compressor head service valve ports are identified as **D** for discharge and **S** for suction.

(3) Remove compressor head attaching screws.

(4) Tap under valve plate ears (short, half-round projections on the valve plate) to remove head and valve plate.

(5) Tap valve plate ears while holding the compressor head to separate head from valve plate.

(6) Clean all gasket material from head, valve plate, and compressor using care not to scratch or nick sealing surfaces.

(7) Coat all machined sealing surfaces with light film of refrigeration oil.

(8) Install new valve plate cylinder gasket on compressor body, locating gasket on dowel pins.

(9) Install valve plate on compressor, locating it on dowel pins so that discharge valve is at top. Figure 3E-21 shows correct assembly sequence.

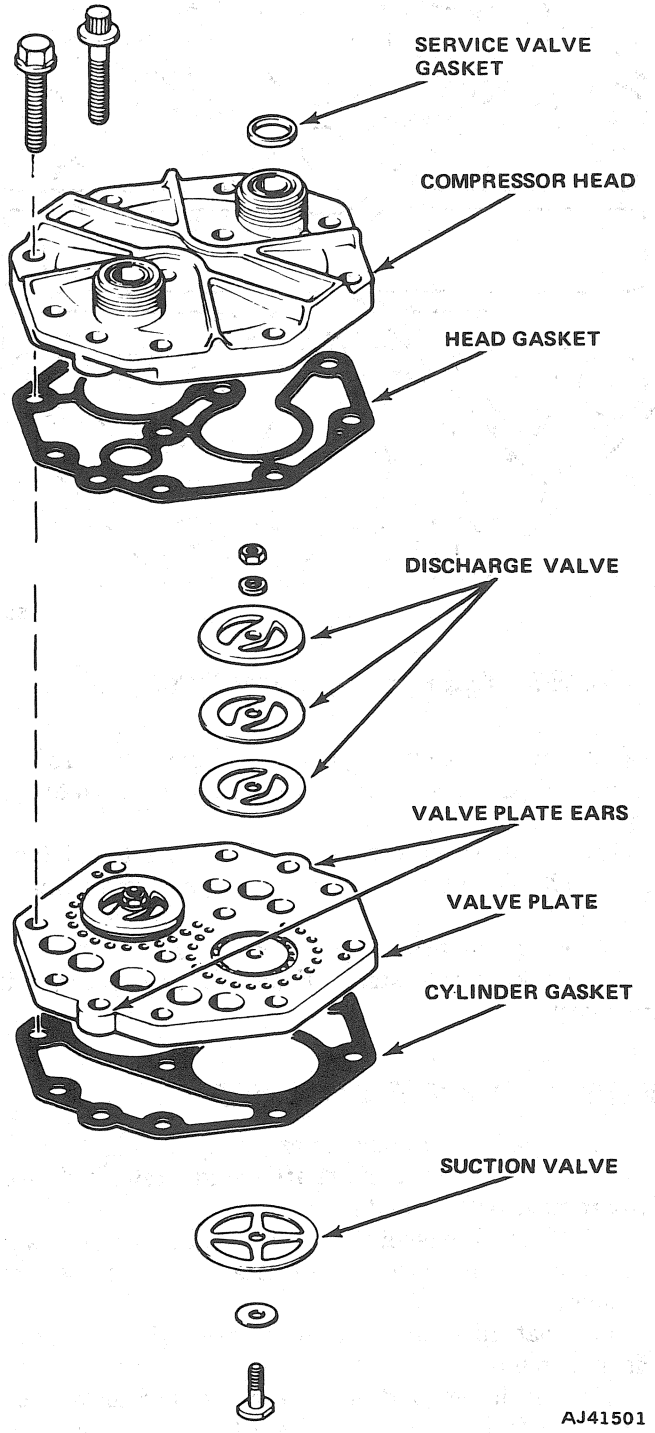


Fig. 3E-21 Head and Valve Plate Assembly Sequence

(10) Install replacement head gasket, locating it on dowel pins.

(11) Install head. Tighten compressor head capscrews to 15 foot-pounds (20 N•m) torque, following sequence outlined in figure 3E-22.

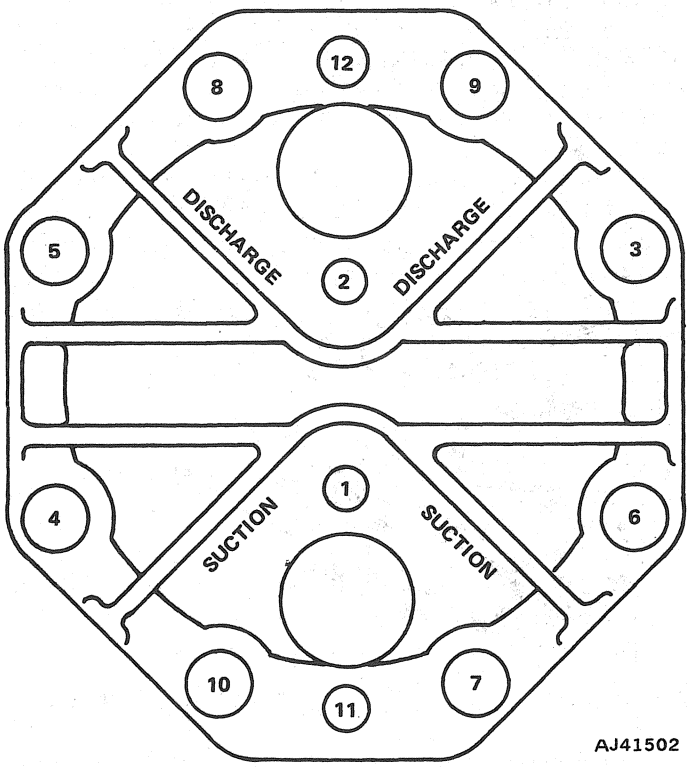


Fig. 3E-22 Compressor Head Capscrew Tightening Sequence

(12) Coat service valve ports with light film of refrigeration oil and install new service valve gaskets, as required.

(13) Install service valves and tighten to 15 foot-pounds (20 N•m) torque for attaching screws of flange type valve.

(14) Purge compressor of air.

(15) Leak test system. Evacuate and charge, if necessary.

BOTTOM PLATE GASKET REPLACEMENT

(1) Isolate and remove compressor.

(2) Remove bottom plate attaching screws and carefully remove bottom plate.

(3) Clean all gasket material from bottom plate and compressor using care not to scratch or nick sealing surfaces.

(4) Coat all sealing surfaces with light film of refrigeration oil.

(5) Install new bottom plate gasket and install bottom plate. Tighten bottom plate attaching screws to 15 foot-pounds (20 N•m) torque.

(6) Install and purge compressor of air.

(7) Leak test system. Evacuate and charge, if necessary.

CHECKING COMPRESSOR OIL LEVEL

Initially, the compressor has 7 ounces of refrigeration oil in the crankcase (Approved oil: Sun Oil Suniso 5, Texaco Capella E, or equivalent). In normal operation, a small amount of oil is always circulating with the refrigerant in the system. Unless the system has developed a leak, the oil level will remain the same in the system.

CAUTION: *The oil level should be checked whenever the system is discharged for a service part replacement, and especially after a rapid loss of refrigerant has occurred.*

NOTE: *Check compressor oil level with compressor in operating position, and only after the vehicle interior air has been cooled to the desired temperature. Operating the system stabilizes the oil entrained in the system, and provides an accurate oil level reading. The oil check plugs are located on either side of the compressor crankcase.*

Before installing a replacement compressor, check the oil level in the compressor to be replaced prior to removing it. The oil level in the replacement compressor must be adjusted to correspond with that of the replaced compressor.

(1) Isolate compressor.

(2) Loosen crankcase oil check plug slowly to release any internal pressure in compressor. Remove check plug when all pressure is relieved.

(3) Fabricate dipstick rod as shown in figure 3E-23.

(4) Hold dipstick as vertical as possible and insert in check plug opening. The oil level should be within specified levels indicated.

(5) Add clean refrigerant oil, if necessary.

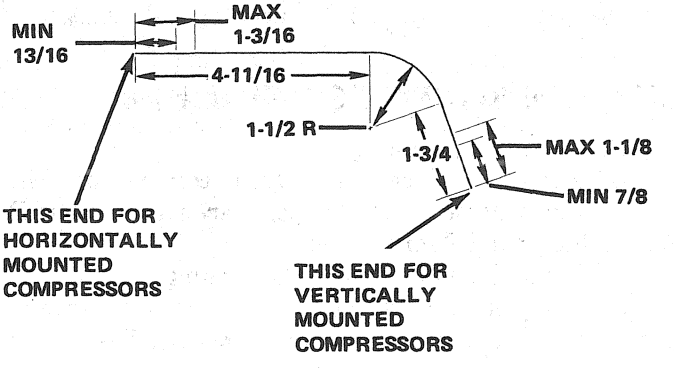


Fig. 3E-23 Oil Dipstick Fabrication Dimensions (Inches)

NOTE: *Refrigeration oil readily absorbs moisture. Keep the container capped until ready to use, and recap immediately after use.*

(6) Install oil check plug O-ring seal. Be sure O-ring is not twisted.

NOTE: *Oil filler plug leaks are usually due to a damaged O-ring or dirt on the seat.*

(7) Install plug and tighten to 4 foot-pounds (5 N•m) torque.

(8) Purge compressor of air.

PURGING COMPRESSOR OF AIR

The compressor must be purged of air whenever it has been isolated for oil level check or other service procedures without discharging the entire system.

(1) Cap service gauge ports on both service valves.

(2) Back-seat the suction service valve to allow system refrigerant to enter compressor.

(3) Place discharge service valve in mid- or cracked-position.

(4) Loosen discharge service valve gauge port cap to permit refrigerant to force any air out of the compressor.

(5) Back-seat the discharge service valve and tighten the gauge port cap.

The compressor is now ready for service.

MAGNETIC CLUTCH

The magnetic clutch consists of a stationary electromagnetic coil and a rotating pulley and plate assembly.

The electromagnetic coil is mounted on four bosses on the compressor. The pulley and plate assembly is mounted on the compressor shaft. When the air conditioner is off, the pulley is free to turn on the clutch hub bearing. When the clutch is energized, the plate is magnetically attracted to the pulley and turns the compressor crankshaft.

Do not attempt to replace the bearing, pulley or clutch plate separately. These components are serviced only as a complete assembly. The coil is serviced as a separate unit.

Electrical Diagnosis

Refer to the Magnetic Clutch Troubleshooting Guide when diagnosing magnetic clutch malfunctions.

Diagnosis for Noisy Clutch

Spin the pulley by hand. There must be no interference between the field and the rotor assembly. The clutch coil must be mounted properly using the special capscrews which position the field coil to the compressor.

A worn pulley bearing can be detected by the roughness felt when spinning the pulley. Do not attempt to replace the bearing. Replace the clutch as an assembly.

A replacement clutch may emit a short squeal when initially engaged. After a few cycles of operation, the noise will disappear.

Clutch Removal

(1) Remove compressor belt(s).

(2) Energize the clutch or use a spanner wrench to hold clutch plate while removing the clutch-to-shaft attaching bolt and washer.

(3) Install a 5/8-inch by 11 standard thread bolt in the threaded center of the clutch plate.

(4) Tighten bolt and pull clutch from shaft.

CAUTION: *Do not pry on clutch to remove.*

(5) Remove four capscrews which retain the magnetic coil and disconnect coil wire. Remove coil.

Clutch Installation

(1) Install magnetic coil with the four special capscrews provided with the replacement unit. These capscrews are used to ensure coil is positioned properly on the compressor.

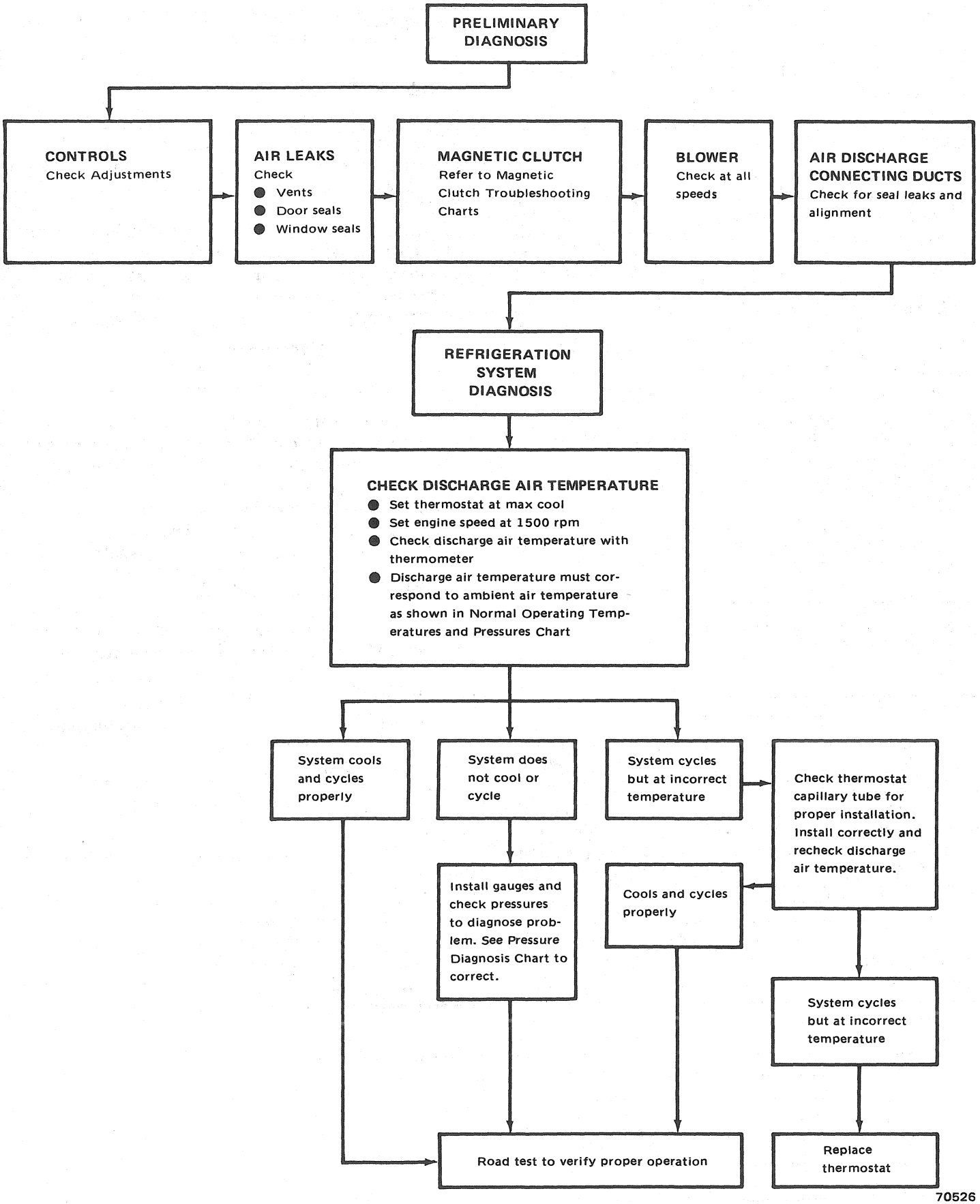
(2) Tighten capscrews to 7 foot-pounds (10 N•m) torque.

(3) Align clutch assembly with key and install clutch on shaft.

(4) Install clutch-to-shaft attaching washer and bolt and tighten to 20 foot-pounds (27 N•m) torque. Connect clutch coil wire and energize clutch to hold unit when tightening.

(5) Install compressor belt and adjust belt tension to specifications.

System Troubleshooting



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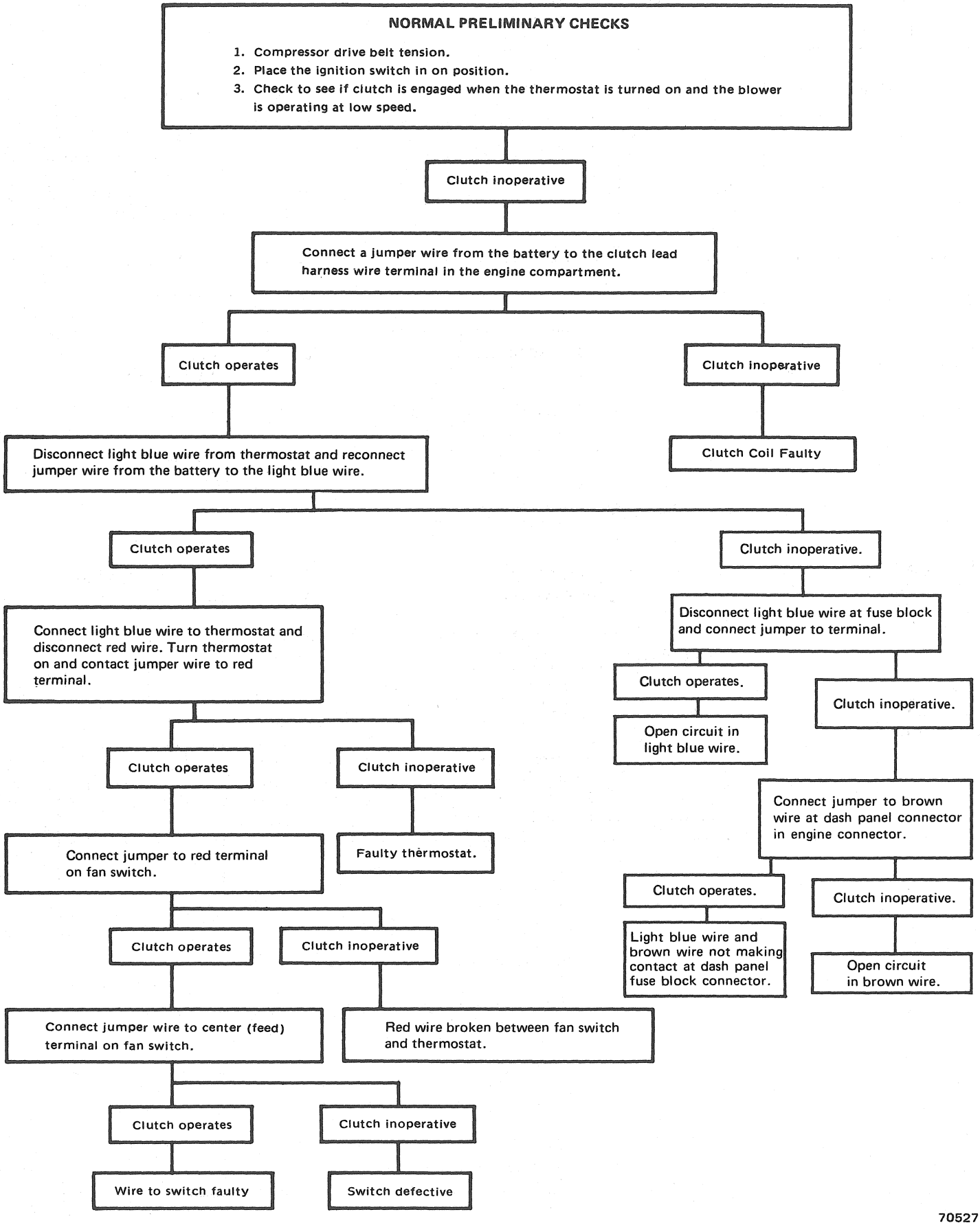
Magnetic Clutch Troubleshooting



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Performance Diagnosis—All Models

Condition	Possible Cause	Correction
COMPRESSOR NOISE	(1) Broken valves.	(1) Replace valve plate.
	(2) Overcharged.	(2) Discharge, evacuate, and install correct charge.
	(3) Incorrect oil level.	(3) Isolate compressor and check oil level. Correct as necessary.
	(4) Piston slap.	(4) Replace compressor.
	(5) Broken rings.	(5) Replace compressor.
EXCESSIVE VIBRATION	(1) Incorrect belt tension.	(1) Set belt tension. Refer to Compressor Belt Tension
	(2) Clutch loose.	(2) Tighten clutch.
	(3) Overcharged.	(3) Discharge, evacuate, and install correct charge.
	(4) Pulley misaligned.	(4) Align pulley.
CONDENSATION DRIPPING IN PASSENGER COMPARTMENT	(1) Drain hose plugged or improperly positioned.	(1) Clean drain hose and check for proper installation.
	(2) Insulation removed or improperly installed.	(2) Replace insulation on expansion valve and hoses.
FROZEN EVAPORATOR COIL	(1) Faulty thermostat.	(1) Replace thermostat.
	(2) Thermostat capillary tube improperly installed.	(2) Install capillary tube correctly.

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Pressure Diagnosis—All Models

Condition	Possible Cause	Correction
LOW SIDE LOW—HIGH SIDE LOW	(1) System refrigerant low.	(1) Evacuate, leak test, and charge system.
LOW SIDE HIGH—HIGH SIDE LOW	(1) Internal leak in compressor — worn.	(1) Remove compressor cylinder head and inspect compressor. Replace valve plate assembly if necessary. If compressor pistons, rings, or cylinders are excessively worn or scored, replace compressor.
	(2) Head gasket leaking.	(2) Install new cylinder head gasket.
	(3) Expansion valve.	(3) Replace expansion valve.
	(4) Drive belt slipping.	(4) Set belt tension.
LOW SIDE HIGH—HIGH SIDE HIGH	(1) Clogged condenser fins.	(1) Clean out condenser fins.
	(2) Air in system.	(2) Evacuate, leak test, and charge system.
	(3) Expansion valve.	(3) Replace expansion valve.
	(4) Loose or worn fan belts.	(4) Adjust or replace belts as necessary.
LOW SIDE LOW—HIGH SIDE HIGH	(1) Expansion valve.	(1) Replace expansion valve.
	(2) Restriction in liquid line.	(2) Check line for kinks — replace if necessary.
	(3) Restriction in receiver.	(3) Replace receiver.
	(4) Restriction in condenser.	(4) Replace condenser.
LOW SIDE AND HIGH SIDE NORMAL (INADEQUATE COOLING)	(1) Air in system.	(1) Evacuate, leak test, and charge system.
	(2) Moisture in system.	(2) Evacuate, leak test, and charge system.

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SERVICE PROCEDURES—CALIFORNIA SIX-CYLINDER MODELS

GENERAL

This section consists of a general description of each component and the system operation of all components used with the California six-cylinder engine. Service information for the rotary compressor and magnetic clutch, which are unique to vehicles equipped with the California six-cylinder engine, is also contained within this section. All other service information can be found in the CJ Air Conditioning and Cherokee-Wagoneer-Truck Air Conditioning sections or the General Information section of this chapter.

The air conditioning system components used with the California six-cylinder engine are as follows.

Compressor—The compressor on the California six-cylinder engine, is a five-cylinder rotary unit driven by a serpentine drive single belt system (fig. 3E-24). The compressor is used to circulate and increase the pressure

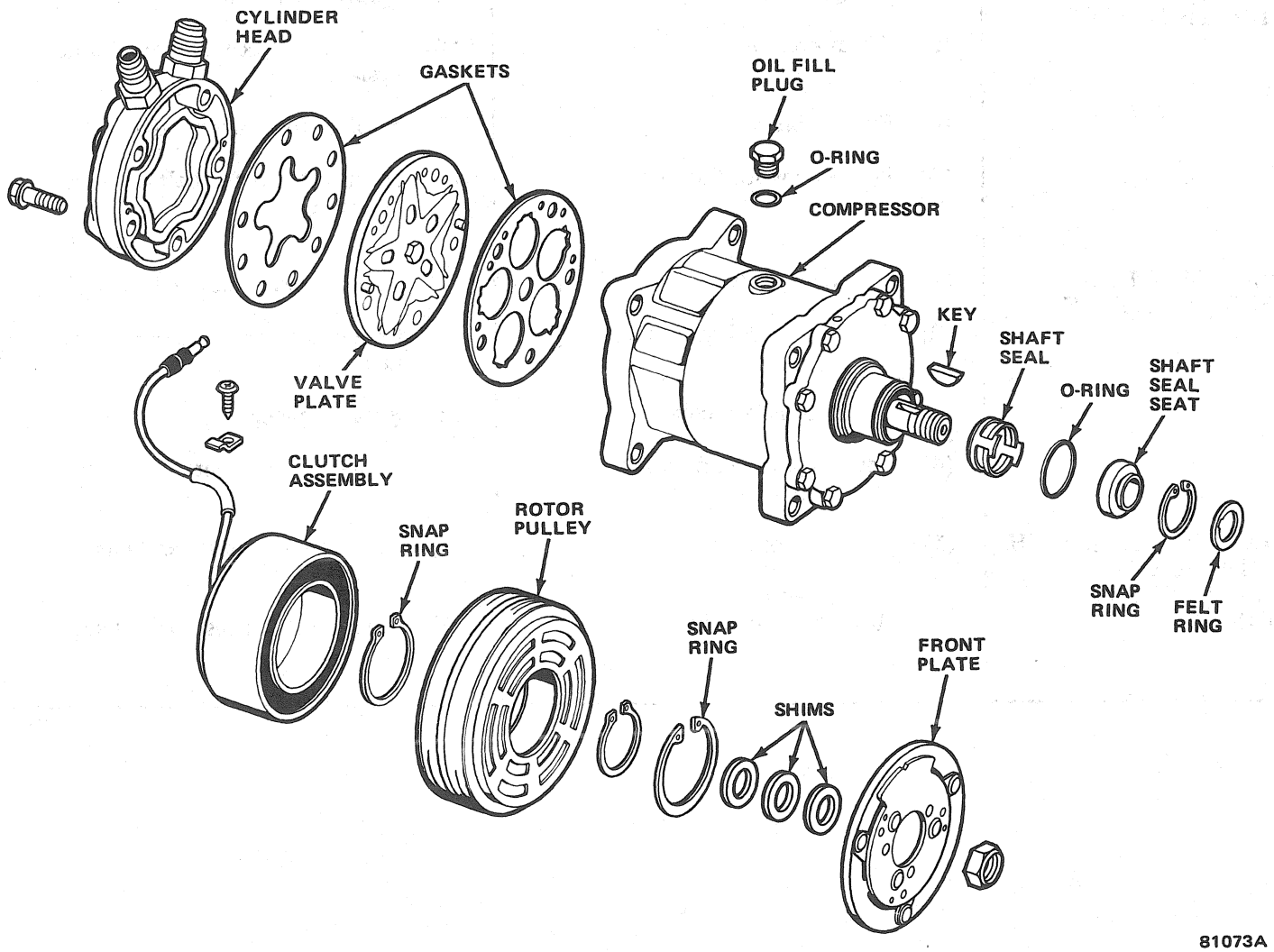

Fig. 3E-24 Compressor Components—California Six-Cylinder Engine

of the refrigerant in the system. Refer to the Troubleshooting chart at the end of this section for Diagnosis Procedures. The compressor is mounted to the engine as shown in figure 3E-25.

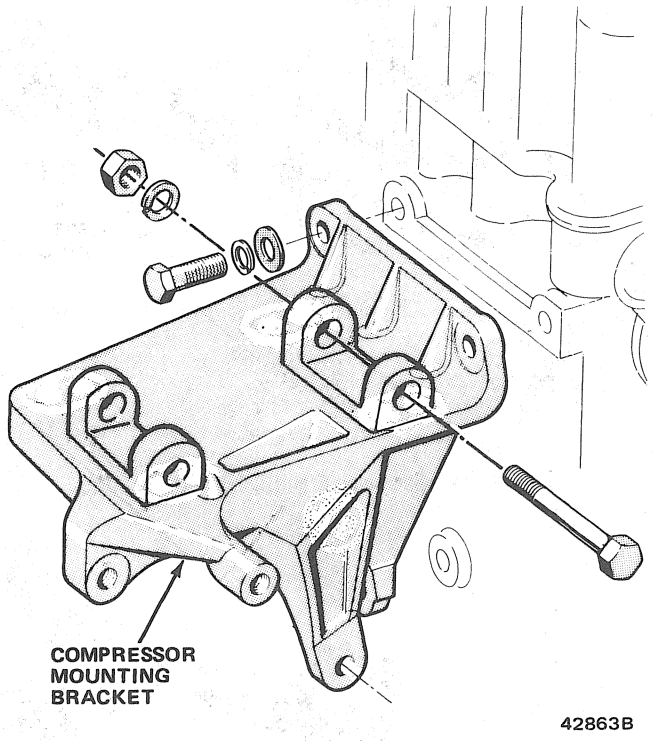

Fig. 3E-25 Compressor Mounting—California Six-Cylinder Engine

Condenser—The condenser is mounted in front of the radiator to allow air to flow over the cooling fins and remove heat from the refrigerant. As the refrigerant passes through the condenser, it liquifies (condenses).

Receiver/Drier—The receiver/drier is a reservoir used to store the precise amount of refrigerant required by the system. The refrigerant level in the receiver/drier must be adequate to provide a steady flow of refrigerant to the expansion valve. The receiver/drier contains a desiccant to remove moisture from the system. The receiver/drier must be replaced anytime the system has been open to atmosphere due to a system component failure. If during servicing the receiver/drier is removed from the system, it must be tightly capped immediately.

Expansion Valve—The thermostatic expansion valve is located at the inlet of the evaporator. It meters the refrigerant to the evaporator, so as to maintain the proper flow for the various evaporator heat load requirements encountered during operation. The metering action of the expansion valve is controlled by the temperature sensing bulb mounted on the outlet (suction) line of the evaporator.

Evaporator—The evaporator is an air cooler and dehumidifier. As the refrigerant enters the evaporator core, it begins to boil. The heat in the air passing over the evaporator transfers or gives up its heat to the boiling refrigerant. As the air cools, the moisture in the air condenses on the evaporator core and is drained off as water.

SYSTEM OPERATION

The compressor increases the pressure and temperature of the system refrigerant. The heated refrigerant vapor is then pumped into the condenser where it cools by giving off heat to air passing over the condenser fins. As the refrigerant cools in the condenser, it condenses into a liquid. Still under high pressure, the liquid refrigerant passes into the receiver. The receiver acts as a reservoir to furnish refrigerant to the expansion valve at all times. From the receiver, the high pressure liquid refrigerant passes to the expansion valve. The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the suction side of the compressor. As it enters the evaporator, the refrigerant immediately begins to boil by absorbing heat from the air passing over the evaporator core. Having given up its heat to boil the refrigerant, the air is cooled and passes into the passenger compartment of the vehicle. From the evaporator the vaporized refrigerant is drawn back to the compressor to repeat the cycle.

COMPRESSOR VALVE LEAK DIAGNOSIS

The compressor should be at operating temperature to perform an accurate test.

(1) Install pressure gauge and Manifold Assembly J-23575.

(2) Front-seat suction and discharge service valve by turning them clockwise.

(3) Discharge refrigerant remaining in compressor by opening suction service valve **slowly**.

(4) Open suction gauge hand valve and close high pressure gauge hand valve.

(5) Start engine and operate compressor. Pressure will build up rapidly. Stop engine/compressor at 150 to 200 pounds pressure.

NOTE: *Pressure should hold if the discharge valve is operating properly. Loss of pressure indicates leaking compressor discharge valve or head gasket.*

COMPRESSOR BELT TENSION

For the serpentine drive belt tension procedure refer to Section 1C.

ISOLATING THE COMPRESSOR

It is not necessary to discharge the system for compressor removal. The compressor can be isolated from the remainder of the system eliminating the need for recharging when performing compressor service.

(1) Connect pressure gauge and Manifold Assembly J-23575.

(2) Close both gauge hand valves and mid-position (crack) both service valves.

(3) Start engine and operate air conditioning.

(4) Turn suction service valve slowly clockwise toward front-seated position. When suction pressure is reduced to zero or less, stop engine and compressor and quickly finish front-seating suction service valve.

(5) Front-seat discharge service valve.

(6) Loosen oil check plug slowly to release any internal pressure in compressor. The compressor is now isolated from remainder of system. Service valves can be removed from compressor.

COMPRESSOR REPLACEMENT

Removal

(1) Disconnect battery negative cable.

(2) Isolate the compressor (see previous procedure).

(3) Remove discharge and suction hoses from compressor, then cover all openings with tape or plastic plugs.

(4) Remove drive belts by loosening alternator.

(5) Remove alternator from mounting bracket and lay aside.

(6) Remove compressor from engine mounting bracket.

Installation

(1) Install compressor to engine mounting bracket.

(2) Install alternator to alternator mounting bracket.

(3) Install drive belt and tighten as specified in Section 1C.

(4) Remove tape or plastic plugs from all suction and discharge openings and install hoses on compressor.

(5) Evacuate and charge system as described under General Information.

(6) Connect battery negative cable.

COMPRESSOR FRONT SEAL REPLACEMENT

(1) Remove compressor.

(2) Insert two pins of Front Plate Spanner J-29635 into any two bolt holes in clutch front plate (fig. 3E-26). Hold clutch plate stationary and remove nut.

(3) Remove clutch plate using Clutch Plate Puller J-29636, and remove key from shaft (fig. 3E-27).

(4) Using snap ring pliers, insert pliers into two holes in felt ring metal retainer and lift out felt ring.

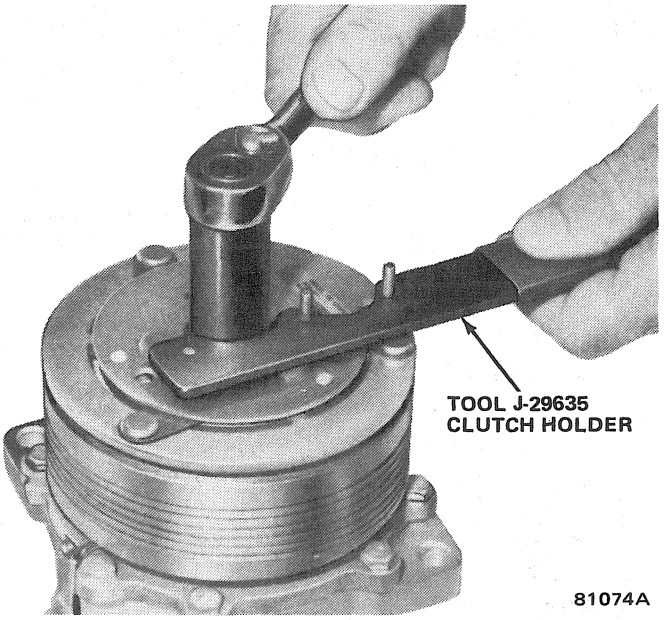

Fig. 3E-26 Removing Front Clutch Plate Hex Nut

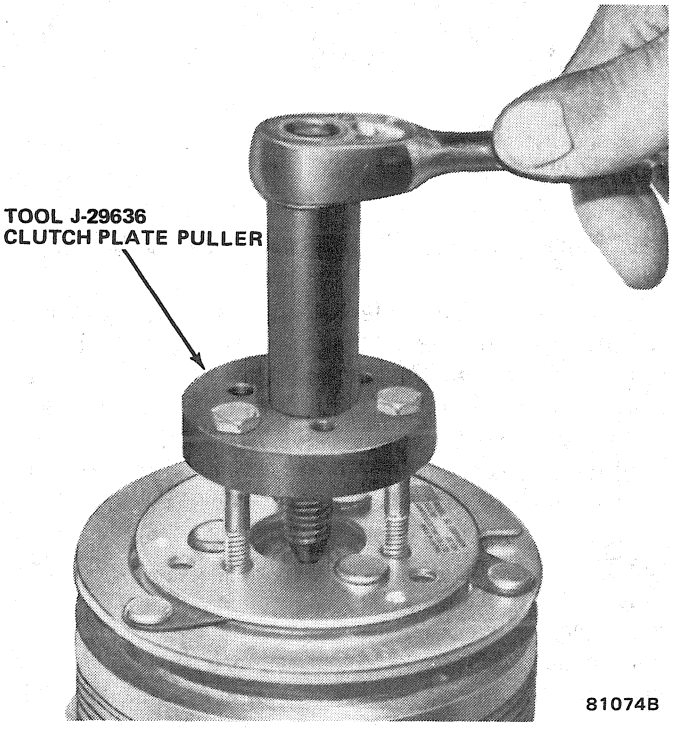

Fig. 3E-27 Removing Front Clutch Plate with Puller

(5) Remove clutch shims. Use O-ring hook and small screwdriver to prevent shim from binding on shaft.

(6) Remove shaft seal seat retaining snap ring with pliers.

(7) Remove shaft seal seat using Seal Retainer Tongs J-9393-2 (fig. 3E-28).

CAUTION: *When removing shaft seal O-ring, do not scratch the O-ring groove with O-ring hook.*

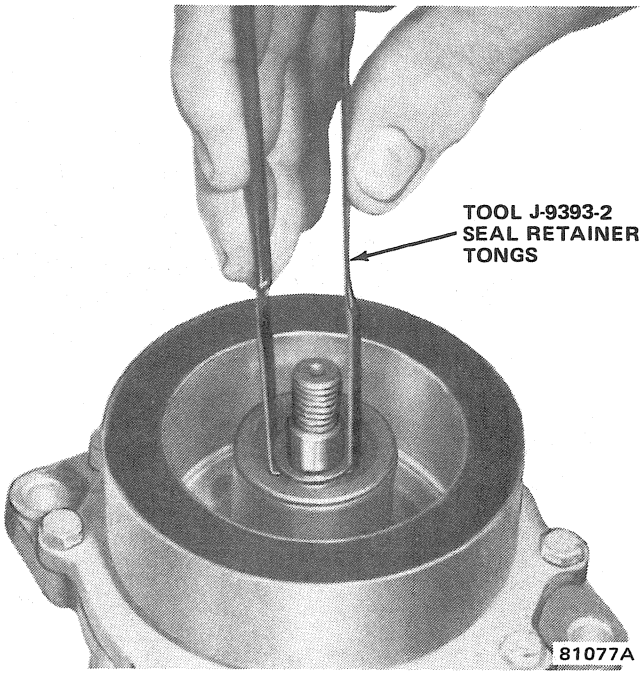

Fig. 3E-28 Removing Shaft Seal Seat Using Tongs

(8) Use O-ring Hook J-9553-01 to remove shaft seal O-ring (fig. 3E-29).

(9) Insert Seal Installer and Remover J-29639 into seal bore, press down against seal spring and twist tool until it engages in slots in seal cage and lift seal out (fig. 3E-30).

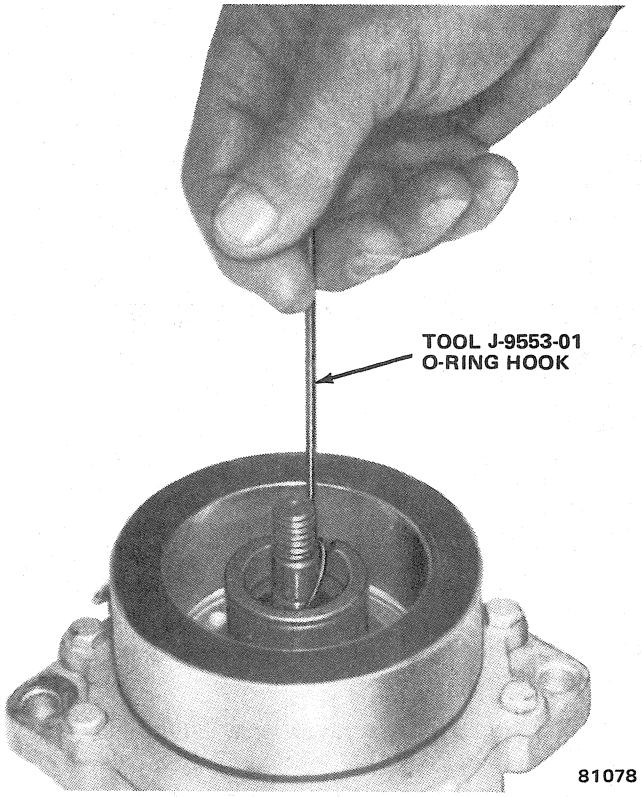

Fig. 3E-29 Removing O-Ring

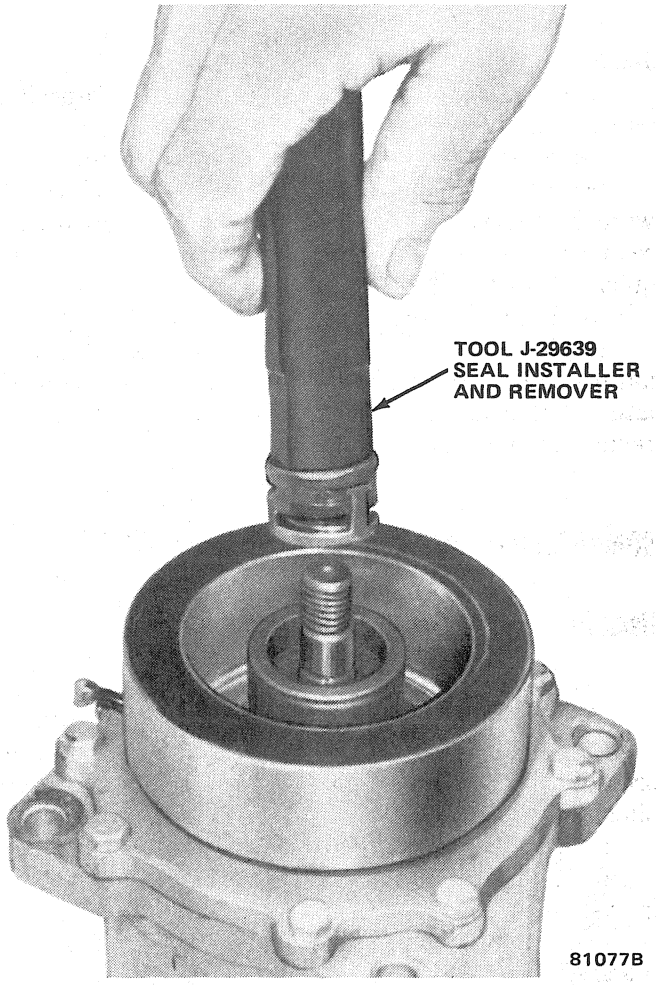

Fig. 3E-30 Removing Shaft Seal

(10) Clean seal cavity thoroughly with "lint-free" or synthetic cloth and clean refrigerant oil and then blow out with clean dry air.

NOTE: *Be sure all foreign materials are removed from the seal bore prior to seal installation.*

(11) Insert Seal Sleeve Protector J-29640 over compressor shaft (fig. 3E-31).

CAUTION: *Do not touch the new seal lapping surfaces.*

(12) Dip mating surfaces of seal lapping surfaces in clean refrigerant oil.

(13) Engage slots of Seal Remover and Installer J-29639 in slots in seal cage and insert seal assembly firmly into place in compressor seal cavity. Twist tool in opposite direction to disengage tool from seal cage (fig. 3E-30).

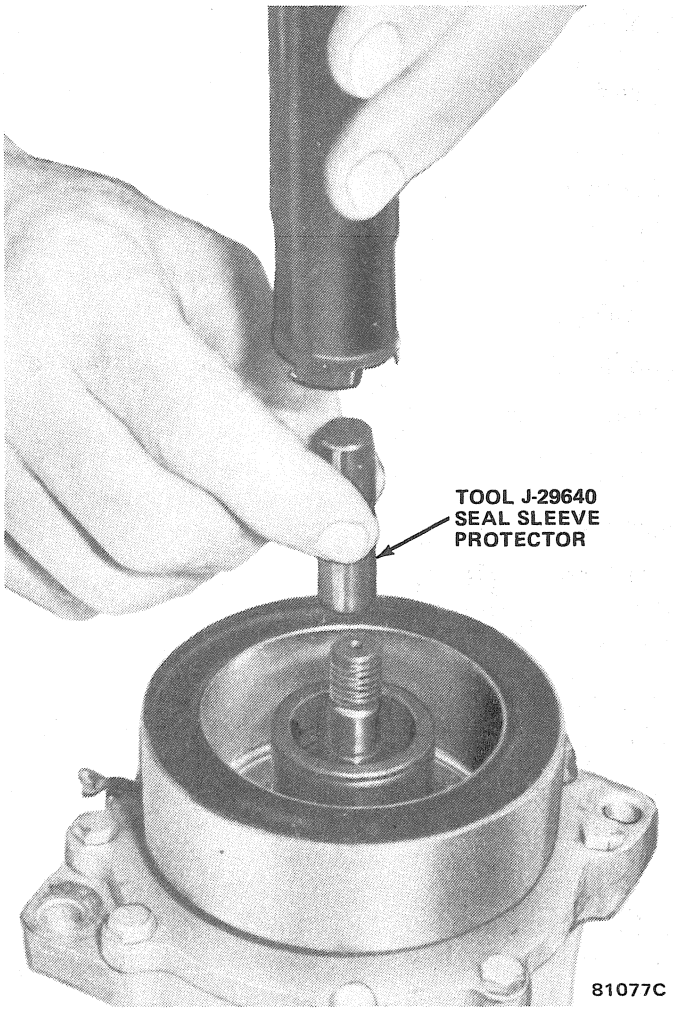

Fig. 3E-31 Shaft Seal Replacement

CAUTION: *When installing shaft seal O-ring, do not scratch the O-ring groove with O-ring hook.*

(14) Coat O-ring with clean refrigerant oil and carefully place in seal groove with O-ring Hook J-9553-01.

(15) Coat seal retainer with clean refrigerant oil and install with Seal Retainer Tongs J-9393-2. Press retainer lightly against seal.

(16) Install snap ring with beveled edge outward (away) from compressor.

NOTE: *It may be necessary to lightly tap the snap ring to seat it in its groove.*

(17) Install clutch spacer shims.

(18) Tap new felt ring into place and install compressor shaft key.

(19) Align front plate keyway to compressor shaft key.

(20) Using Clutch Face Installer J-29641 (fig. 3E-32), tap front plate to shaft until it has bottomed on clutch shims.

NOTE: *When the front plate bottoms on the shims a distinct sound change will take place.*

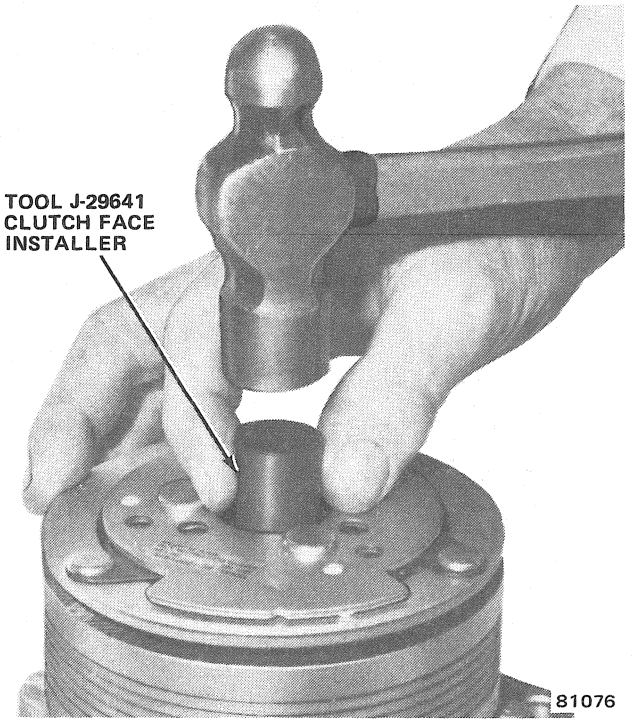

Fig. 3E-32 Front Plate Installation

(21) Install shaft nut and torque to 25 to 30 foot-pounds (34 to 41 N•m).

(22) Check air gap with feeler gauge which must be between .016 and .031 inch. If air gap is not consistent pry up lightly at minimum variations and tap down lightly at points of maximum variation.

If the air gap is not between .016 and .031 inch add or subtract shims as necessary.

NOTE: *The air gap is controlled by the spacer shims. When installing a new or previously installed clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use .040, .020 and .005-inch shims.*

COMPRESSOR HEAD, VALVE PLATE AND GASKET REPLACEMENT

Removal

(1) Remove all cylinder head capscrews from cylinder head.

(2) Using small hammer and gasket scraper to tap outer edge of cylinder head until separated from valve plate. Inspect for damage.

NOTE: *The cylinder head gasket normally sticks to the valve plate.*

(3) Position gasket scraper between outside edge of valve plate and cylinder block and lightly tap valve plate loose. Inspect reed valves and discharge retainer. Replace any damaged portion.

CAUTION: *When cleaning gasket material from cylinder head or valve plate of cylinder head be careful not to damage machined surfaces.*

(4) If valve plate and/or cylinder head are to be reinstalled, carefully remove gasket materials with gasket scraper.

(5) Inspect cylinder head for fitting or thread damage. Replace cylinder head if damaged.

(6) Inspect service ports on back of cylinder head. Remove valve core with valve core tool to inspect.

(7) Remove service port to inspect O-ring; if damaged replace O-ring.

Installation

(1) Coat valve plate gasket with clean refrigerant oil.

(2) Install valve plate gasket.

NOTE: *Align valve plate gasket to locating pin holes and oil orifice in cylinder block.*

(3) Install cylinder head with fittings pointing up or in line with oil filler plug.

(4) Insert cylinder head capscrews finger-tight. Torque cylinder head bolts to 22 to 25 foot-pounds (30 to 25 N•m) torque following torque sequence (fig. 3E-33).

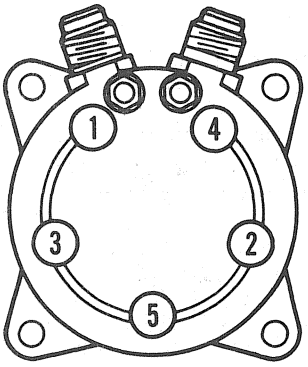

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Fig. 3E-33 Cylinder Head Bolt Tightening Sequence

Checking Compressor Oil Level

When replacing a compressor that contains uncontaminated oil, use the following oil level check.

(1) Drain oil from new compressor.

(2) Drain and measure oil from old compressor.

(3) Measure new oil equal to amount drained from old compressor and add one ounce of additional oil. Fill new compressor with this oil.

NOTE: *This compressor is a high-speed compressor. Satisfactory operation depends on sufficient lubrication, however too much oil decreases cooling efficiency.*

MAGNETIC CLUTCH

The magnetic clutch consists of a stationary electromagnetic coil and a rotating pulley and plate assembly.

The electromagnetic coil is retained on the compressor with a snap ring and is slotted to maintain its position.

The pulley and plate assembly are mounted on the compressor shaft. When the compressor is not pumping, the pulley freewheels on the clutch hub bearing. When the coil is energized the plate is magnetically engaged with the pulley and turns the compressor shaft.

Magnetic Clutch Noise Diagnosis

When a magnetic clutch assembly is suspected of being the source of unusual noises, follow the sequence given on the Troubleshooting Chart.

Magnetic Clutch Removal

(1) Insert two pins of front plate spanner J-29635 into any two bolt holes in front clutch plate. Hold clutch plate stationary and remove nut as shown in figure 3E-26.

(2) Remove clutch plate using Clutch Plate Puller J-29636 and remove key from shaft as shown in figure 3E-27.

(3) Remove internal bearing snap ring.

(4) Remove external front snap ring.

(5) Remove rotor pulley assembly using Shaft Protector and Jaws J-29637 as shown in figure 3E-34. Insert lip of jaws into internal bearing snap ring groove. Place rotor puller shaft protector over exposed compressor shaft. Align thumb head bolts to puller jaws and finger-tighten. Turn puller center bolt clockwise to remove rotor pulley.

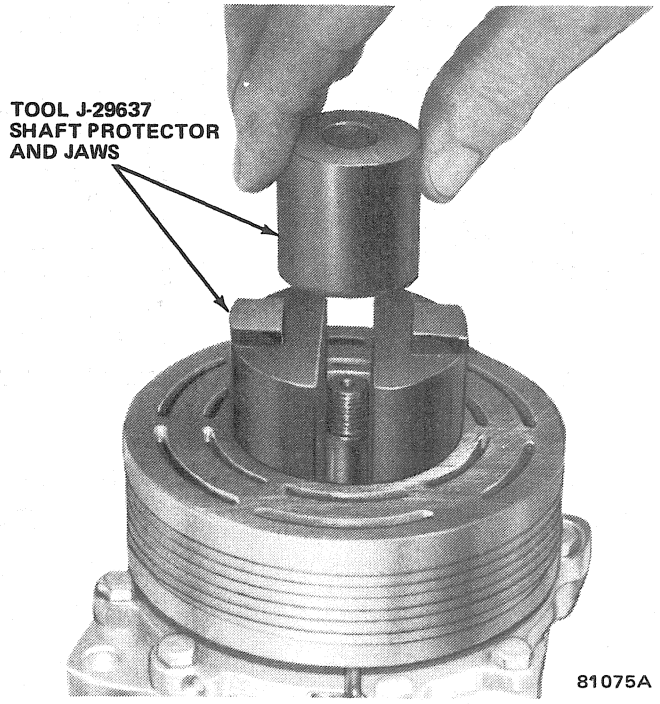

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Fig. 3E-34 Removing Rotor Pulley with Jaws Installed

(6) Remove field coil lead wire from clip on top of compressor front housing.

(7) Using snap ring pliers remove snap ring and then remove field coil.

Magnetic Clutch Installation

(1) Install field coil.

NOTE: *Coil flange protrusion must align with hole in front housing to prevent coil movement and correctly locate lead wire.*

(2) Support compressor by four mounting ears on rear of compressor. Do not clamp compressor in vise with jaws on compressor body.

(3) Align rotor assembly squarely on front housing hub. Use suitable driver to drive rotor assembly onto shaft.

(4) Install internal bearing snap ring and then external bearing snap ring.

NOTE: *All snap rings have a straight edge and a beveled edge on the circumference. Position the snap rings so that the flat edge is toward the compressor and the beveled edge is outward.*

(5) Install front plate assembly using original clutch shims on compressor shaft.

(6) Install compressor shaft key.

(7) Align front plate keyway to compressor shaft key and using Clutch Face Installer J-29641 tap front plate onto shaft until it bottoms on clutch shims as shown in figure 3E-32.

NOTE: *When installing the front plate a distinct change in the sound will be heard when the front plate bottoms.*

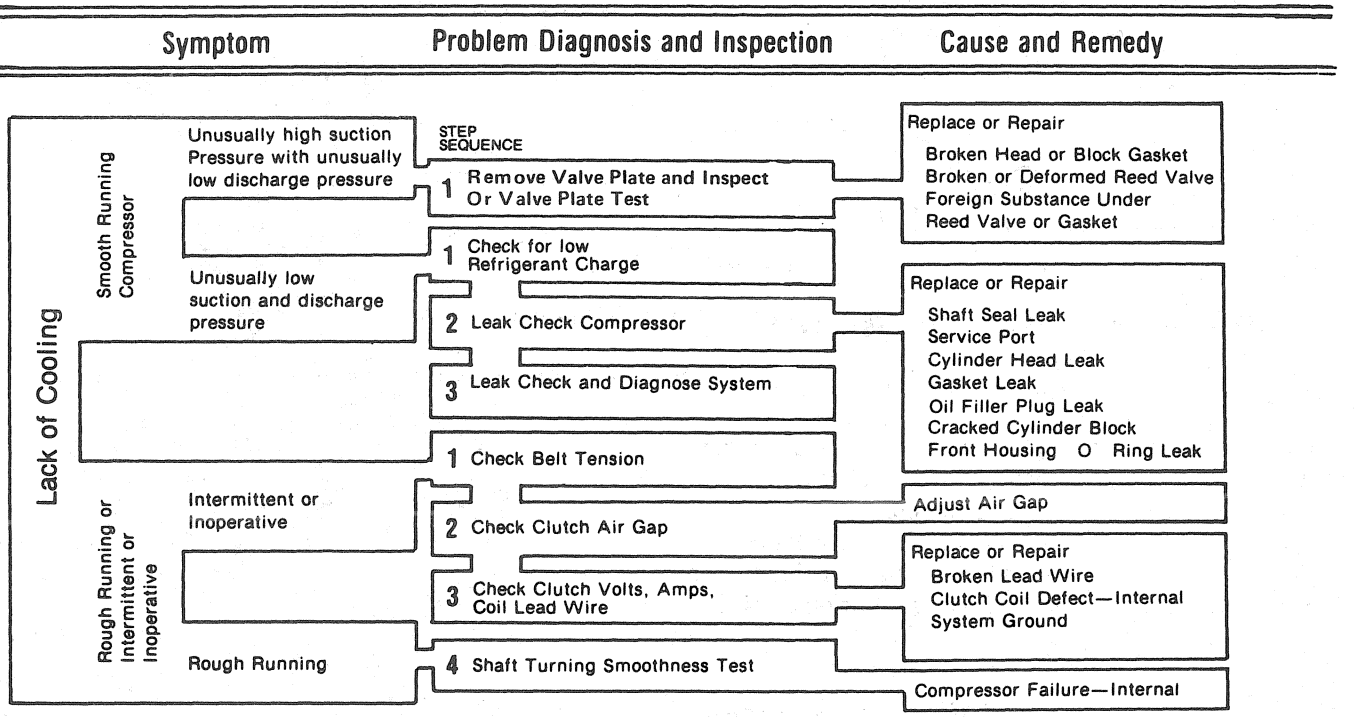
(8) Install hex nut and torque to 25 to 30 foot-pounds (34 to 41 N•m) torque.

(9) Check air gap with feeler gauge. Air gap should consistently be .016-.031 inch around circumference of magnetic clutch. If air gap varies, pry up lightly at minimum variations and tap down at maximum variations. If air gap does not meet specifications remove hex nut and front plate.

NOTE: *The air gap is determined by the spacer shims. When assembling existing or new clutch components try the original shims first. When installing a new clutch onto a compressor that previously had no clutch use a .040-.020 and .005-inch shim.*

TROUBLE SHOOTING CHART

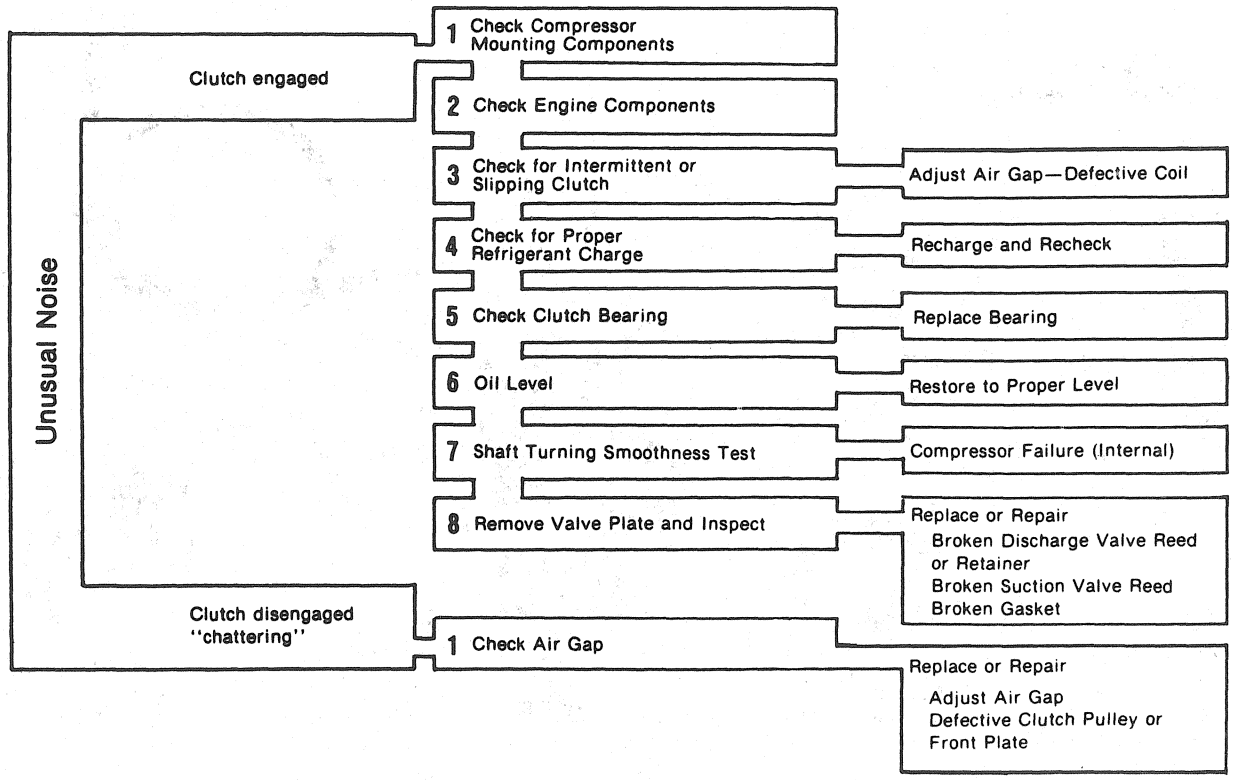
During diagnosis follow the inspection procedures in the sequence shown until a defect is found. Then perform the repair in the Cause and Remedy Section. If this repair does not fully solve the problem, proceed to the next Inspection Step.



81152

TROUBLE SHOOTING CHART (Continued)

During diagnosis follow the inspection procedures in the sequence shown until a defect is found. Then perform the repair in the Cause and Remedy Section. If this repair does not fully solve the problem, proceed to the next Inspection Step.



81152

SPECIFICATIONS

Torque Specifications

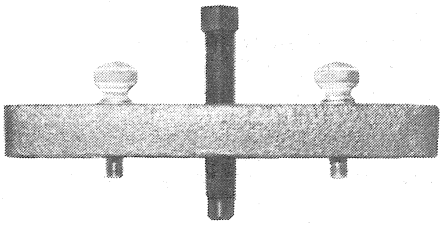
Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
A/C Service Valve (Flange Type)	15	13-17	20	17-24
A/C Service Valve (Rototype)	Wet Torque			
Clutch Retaining Nut	27	25-30	37	34-39
Cylinder Head Cap Screws	24	22-25	33	30-34
Discharge Hose Fitting	20	18-22	27	24-30
Oil Filler Plug	24	22-25	33	30-34
Suction Hose Fitting 5/8 inch Flange				

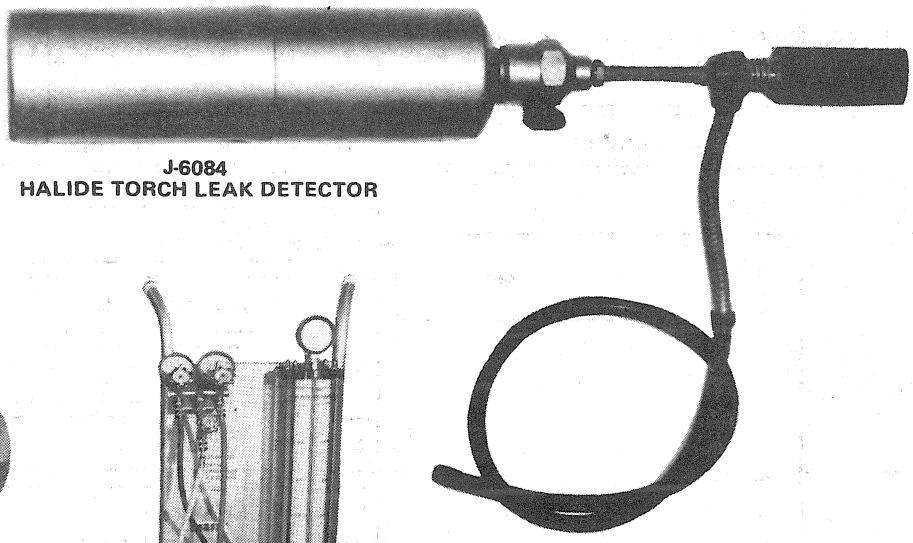
All Torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.

81145

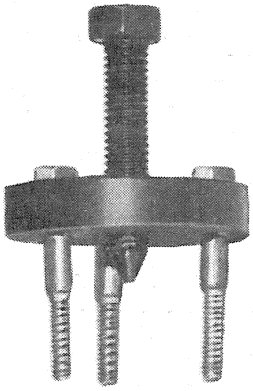
TOOLS



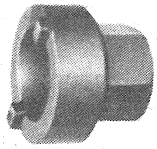
J-29637
CLUTCH ROTOR
REMOVER ADAPTER



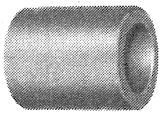
J-6084
HALIDE TORCH LEAK DETECTOR



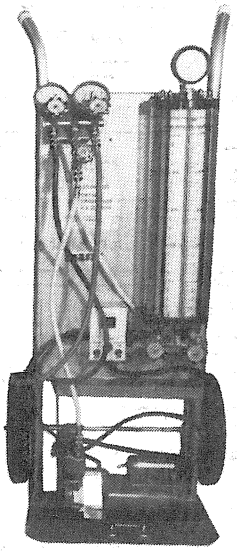
J-29636
CLUTCH PLATE
REMOVER PULLER



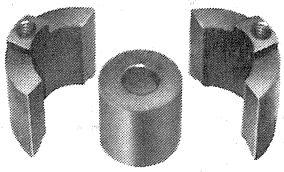
J-29636
CLUTCH PLATE
REMOVER PULLER



J-29641
CLUTCH FACE
INSTALLER

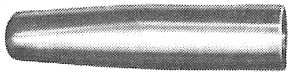


J-23500-01
PORTABLE
SERVICE STATION



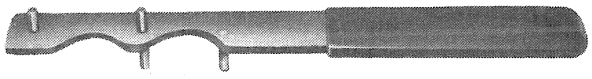
J-29637
SHAFT PROTECTOR
AND JAWS

J-6105
1/4-INCH RATCHET

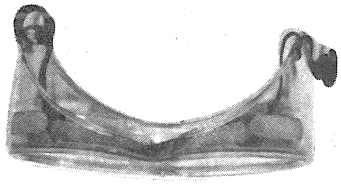


J-22974
SHAFT SEAL
PROTECTOR

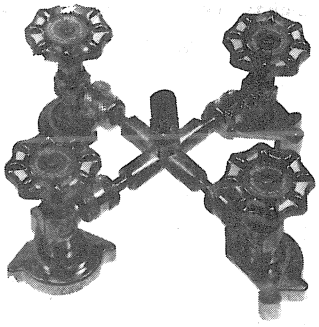
J-9392
SEAL REMOVER



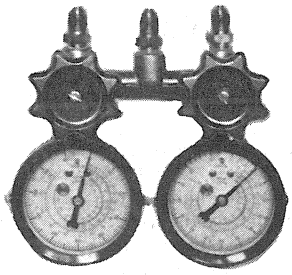
J-29635
CLUTCH HOLDER



J-5453
GOGGLES



J-6272-02
NO. 4 MULTI-REFRIGERANT
CAN OPENER



B W R

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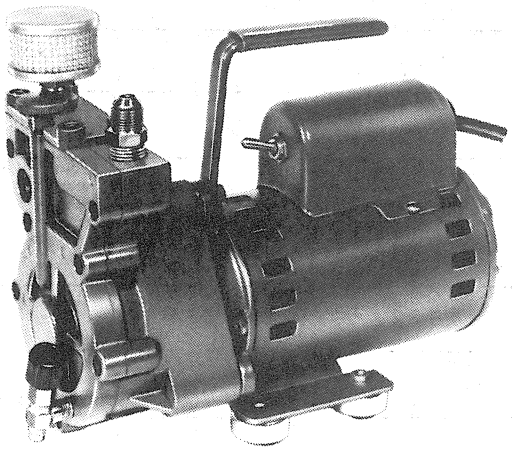
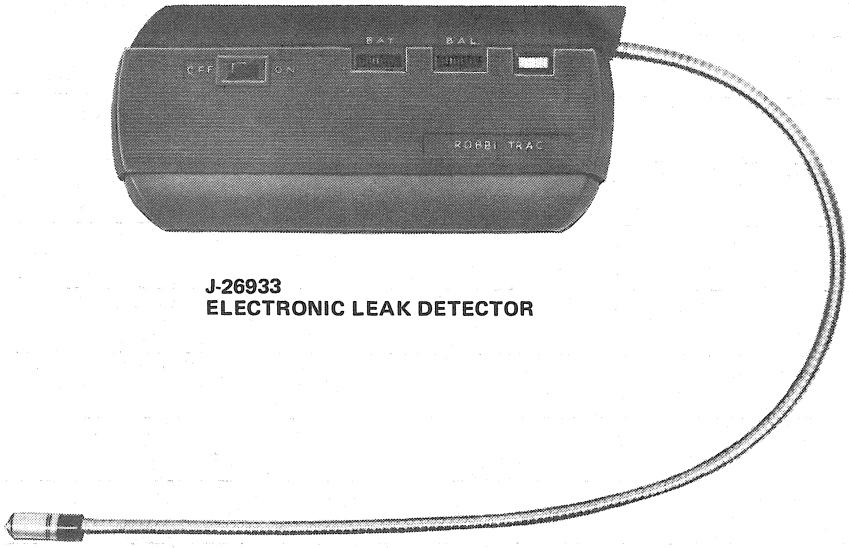
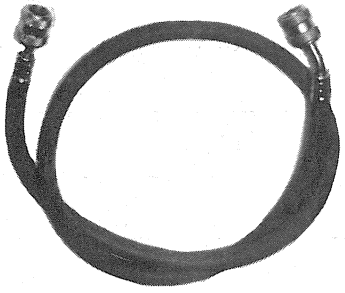
Tools



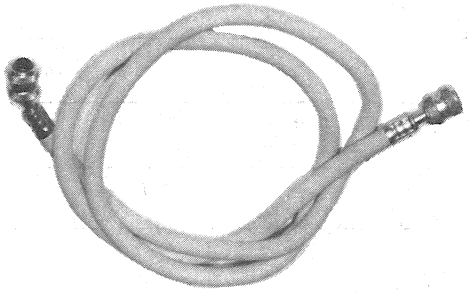
J-26695
VACUUM PUMP



J-26933
ELECTRONIC LEAK DETECTOR



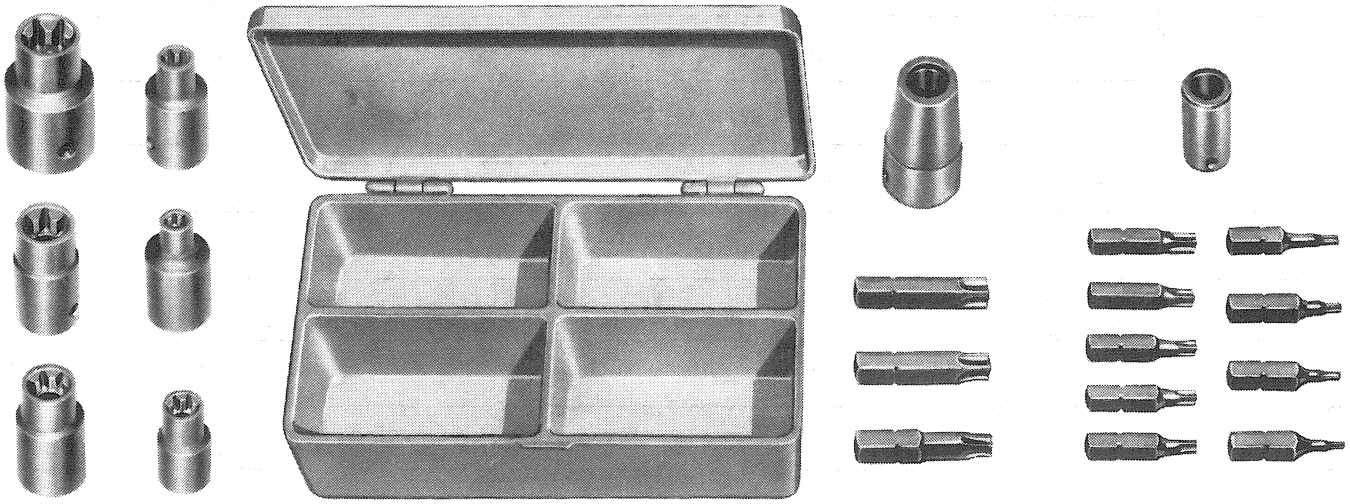
BLUE



WHITE

RED

J-23575 PRESSURE GAUGE AND MANIFOLD ASSEMBLY



J-25359-02
TORX BIT AND SOCKET SET

42866