HEATING AND AIR CONDITIONING

CONTENTS

GENERAL INFORMATION

HEATER AND AIR CONDITIONER

All vehicles are equipped with a common heater-A/C housing assembly (Fig. 1). The system combines air conditioning, heating, and ventilating capabilities in a single unit housing mounted under the instrument panel. On heater-only systems, the evaporator coil is omitted from the housing and replaced with an air restrictor plate.

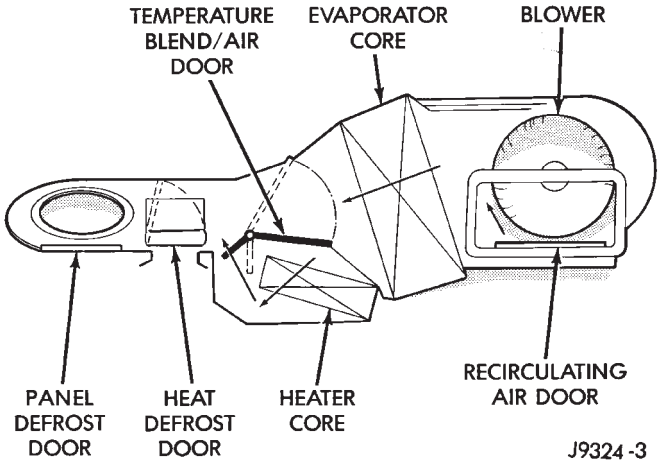

Fig. 1 Common Blend-Air Heater-Air Conditioner System

Outside fresh air enters the vehicle through the cowl top opening at the base of the windshield, and passes through a plenum chamber to the heater-A/C system blower housing (Fig. 2). Air flow velocity can then be adjusted with the blower motor speed selector switch on the heater-A/C control panel. The air intake openings must be kept free of snow, ice, leaves, and other obstructions for the heater-A/C system to receive a sufficient volume of outside air.

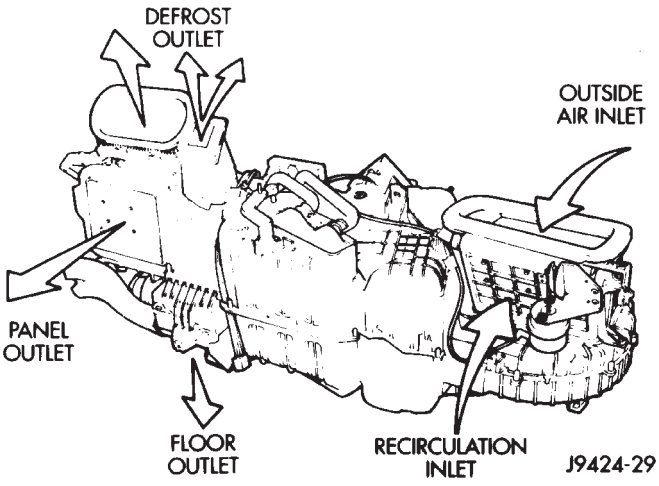

Fig. 2 Heater-A/C System Air Flow (Front View)

It is also important to keep the air intake openings clear of debris because leaf particles and other debris that is small enough to pass through the cowl plenum screen can accumulate within the heater-A/C housing. The closed, warm, damp and dark environment created within the heater-A/C housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C system operation.

The heater and optional air conditioner are blend-air type systems. In a blend-air system, a blend-air door controls the amount of unconditioned air (or cooled air from the evaporator on models with air conditioning) that is allowed to flow through, or around, the heater core. A temperature control knob on the heater-A/C control panel determines the discharge air temperature by moving a cable, which operates the blend-air door. This allows an almost immediate manual control of the output air temperature of the system.

The mode control knob on the heater-only or heater-A/C control panel is used to direct the conditioned air to the selected system outlets. Both mode control switches use engine vacuum to control the mode doors, which are operated by vacuum actuator motors.

On air conditioned vehicles, the outside air intake can be shut off by selecting the recirculation mode (Max A/C) with the mode control knob. This will operate a vacuum actuated recirculating air door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The optional air conditioner for all models is designed for the use of non-CFC, R-134a refrigerant. The air conditioning system has an evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. This air conditioning system uses a fixed orifice tube in the liquid line between the condenser and the evaporator coil to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, a fixed pressure setting switch on the accumulator cycles the compressor clutch.

HEATER AND AIR CONDITIONER CONTROL

Both the heater-only and heater-A/C systems use a combination of mechanical, electrical, and vacuum controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more

GENERAL INFORMATION (Continued)

information on the features, use, and suggested operation of these controls.

The heater-only or heater-A/C control panel is located to the right of the instrument cluster on the instrument panel. The control panel contains a rotary-type temperature control knob, a rotary-type mode control switch knob, and a rotary-type blower motor speed switch knob. On models with the optional heated mirror system, a momentary push button switch and indicator lamp are located near the bottom of the heater-A/C control panel. Refer to Heated Mirror System in Group 8N - Electrically Heated Systems for more information on this feature.

The heater-only or heater-A/C control panel cannot be repaired. If faulty or damaged, the entire unit must be replaced. The control knobs and the illumination lamps are available for service replacement.

SERVICE WARNINGS AND PRECAUTIONS

WARNING:

• THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT UNDER HIGH PRESSURE. SEVERE PERSONAL INJURY MAY RESULT FROM IMPROPER SERVICE PROCEDURES. REPAIRS SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

• AVOID BREATHING THE REFRIGERANT AND REFRIGERANT OIL VAPOR OR MIST. EXPOSURE MAY IRRITATE THE EYES, NOSE, AND/OR THROAT. WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM DIRECT CONTACT WITH THE REFRIGERANT. IF EYE CONTACT OCCURS, SEEK MEDICAL ATTENTION IMMEDIATELY.

• DO NOT EXPOSE THE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.

• IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE THE WORK AREA BEFORE RESUMING SERVICE. LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

• THE EVAPORATION RATE OF R-134a REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT THE SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH THE REFRIGERANT.

• THE R-134a SERVICE EQUIPMENT OR THE VEHICLE REFRIGERANT SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR AND R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS, AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

CAUTION:

• Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.

• Never add R-12 to a refrigerant system designed to use R-134a. Damage to the system will result.

• R-12 refrigerant oil must not be mixed with R-134a refrigerant oil. They are not compatible.

• Do not use R-12 equipment or parts on the R-134a system. Damage to the system will result.

• Do not overcharge the refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.

• Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

• Do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

• The refrigerant system must always be evacuated before charging.

• Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system.

• Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system.

• Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.

• Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting.

GENERAL INFORMATION (Continued)

- **Do not remove the sealing caps from a replacement component until it is to be installed.**
- **When installing a refrigerant line, avoid sharp bends that may restrict refrigerant flow. Position the refrigerant lines away from exhaust system components or any sharp edges, which may damage the line.**
- **Tighten refrigerant fittings only to the specified torque. The aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a refrigerant fitting, use a wrench on both halves of the fitting. This will prevent twisting of the refrigerant lines or tubes.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.**
- **Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.**

COOLING SYSTEM REQUIREMENTS

To maintain the performance level of the heating-air conditioning system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the heater core and the heater hoses. Refer to Group 7 - Cooling System for more information before the opening of, or attempting any service to the engine cooling system.

REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS

Kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all refrigerant system connections are pressure tight.

A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. Sharp bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold. It is a good practice to inspect all flexible refrigerant system hose lines at least once a year to make sure they are in good condition and properly routed.

There are two types of refrigerant fittings:

- All fittings with O-rings need to be coated with refrigerant oil before installation. Use only O-rings that are the correct size and approved for use with R-134a refrigerant. Failure to do so may result in a leak.
- Unified plumbing connections with gaskets cannot be serviced with O-rings. The gaskets are not reusable and new gaskets do not require lubrication before installing.

Using the proper tools when making a refrigerant plumbing connection is very important. Improper tools or improper use of the tools can damage the refrigerant fittings. Always use two wrenches when loosening or tightening tube fittings. Use one wrench to hold one side of the connection stationary, while loosening or tightening the other side of the connection with a second wrench.

The refrigerant must be recovered completely from the system before opening any fitting or connection. Open the fittings with caution, even after the refrigerant has been recovered. If any pressure is noticed as a fitting is loosened, tighten the fitting and recover the refrigerant from the system again.

Do not discharge refrigerant into the atmosphere. Use an R-134a refrigerant recovery/recycling device that meets SAE Standard J2210.

The refrigerant system will remain chemically stable as long as pure, moisture-free R-134a refrigerant and refrigerant oil is used. Dirt, moisture, or air can upset this chemical stability. Operational troubles or serious damage can occur if foreign material is present in the refrigerant system.

When it is necessary to open the refrigerant system, have everything needed to service the system ready. The refrigerant system should not be left open to the atmosphere any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are to be installed.

All tools, including the refrigerant recycling equipment, the manifold gauge set, and test hoses should be kept clean and dry. All tools and equipment must be designed for R-134a refrigerant.

DESCRIPTION AND OPERATION

ACCUMULATOR

The accumulator is mounted in the engine compartment between the evaporator coil outlet tube and the compressor inlet. Refrigerant enters the accumulator canister as a low pressure vapor through the inlet tube.

Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag is mounted inside the accumulator canister to absorb any moisture which may have entered and

DESCRIPTION AND OPERATION (Continued)

become trapped within the refrigerant system (Fig. 3)

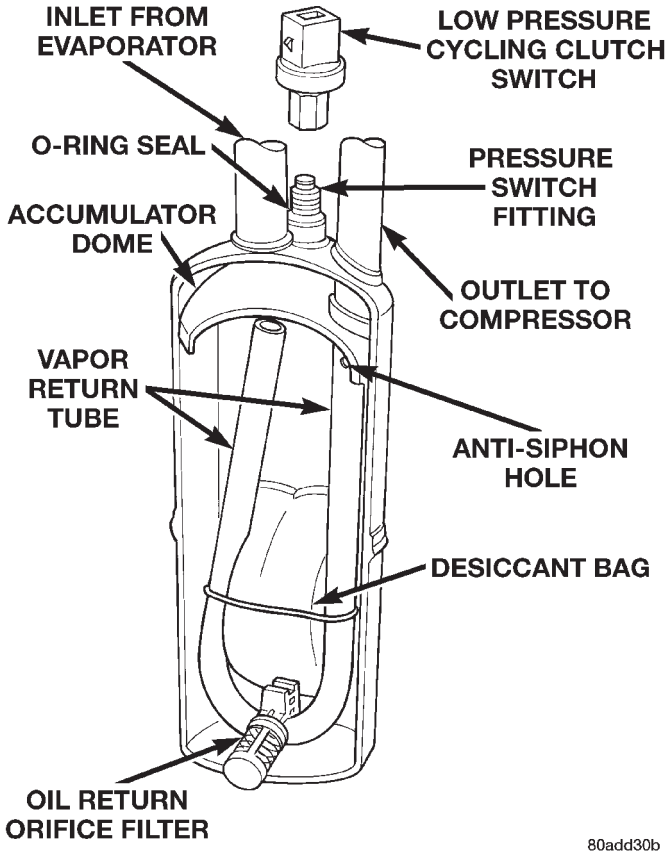

Fig. 3 Accumulator - Typical

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BLOWER MOTOR

The blower motor and blower wheel are located in the passenger side end of the heater-A/C housing, below the glove box. The blower motor controls the velocity of the air flowing through the heater-A/C housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and blower wheel can be serviced from the passenger compartment side of the housing.

The blower motor will only operate when the ignition switch is in the On position, and the heater-A/C mode control switch knob is in any position, except Off. The blower motor receives a fused battery feed through the blower motor relay whenever the ignition switch is in the On position.

The blower motor battery feed circuit is protected by a fuse in the Power Distribution Center (PDC). The blower motor relay control circuit is protected by a fuse in the junction block. Blower motor speed is controlled by regulating the ground path through the heater-A/C mode control switch, the blower motor switch, and the blower motor resistor.

The blower motor and blower wheel cannot be repaired and, if faulty or damaged, they must be replaced. The blower motor and blower wheel are each serviced separately.

BLOWER MOTOR RELAY

The blower motor relay is a International Standards Organization (ISO)-type relay. The relay is a electromechanical device that switches battery current from a fuse in the Power Distribution Center (PDC) directly to the blower motor. The relay is energized when the relay coil is provided a voltage signal by the ignition switch. This arrangement reduces the amount of battery current that must flow through the ignition switch.

The blower motor relay control circuit is protected by a fuse located in the junction block. When the relay is de-energized, the blower motor receives no battery current. See Blower Motor Relay in the Diagnosis and Testing section of this group for more information.

The blower motor relay is located in the PDC in the engine compartment. Refer to the PDC label for blower motor relay identification and location.

The blower motor relay cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR RESISTOR

The blower motor resistor is mounted to the bottom of the heater-A/C housing, under the instrument panel and just inboard of the blower motor. It can be accessed without removing any other components.

The resistor has multiple resistor wires, each of which will change the resistance in the blower motor ground path to change the blower motor speed. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected blower motor speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR SWITCH

The heater-only or heater-A/C blower motor is controlled by a four position rotary-type blower motor switch, mounted in the heater-A/C control panel. The switch allows the selection of one of four blower motor speeds, but can only be turned off by selecting the Off position with the heater-A/C mode control switch knob.

DESCRIPTION AND OPERATION (Continued)

The blower motor switch directs the blower motor ground path through the mode control switch to the blower motor resistor, or directly to ground, as required to achieve the selected blower motor speed.

The blower motor switch cannot be repaired and, if faulty or damaged, the entire heater-only or heater-A/C control unit must be replaced. The blower motor switch knob is serviced separately.

COMPRESSOR

The air conditioning system uses a Sanden SD7H15 seven cylinder, reciprocating wobble plate-type compressor on all models. This compressor has a fixed displacement of 150 cubic centimeters (9.375 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the compressor.

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley and clutch coil are available for service.

COMPRESSOR CLUTCH

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 4). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is mounted to the compressor shaft and secured with a nut.

These components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

The compressor clutch engagement is controlled by several components: the heater-A/C mode control switch, the low pressure cycling clutch switch, the high pressure cut-off switch, the compressor clutch relay, and the Powertrain Control Module (PCM). The PCM may delay compressor clutch engagement for up to thirty seconds. Refer to Group 14 - Fuel System for more information on the PCM controls.

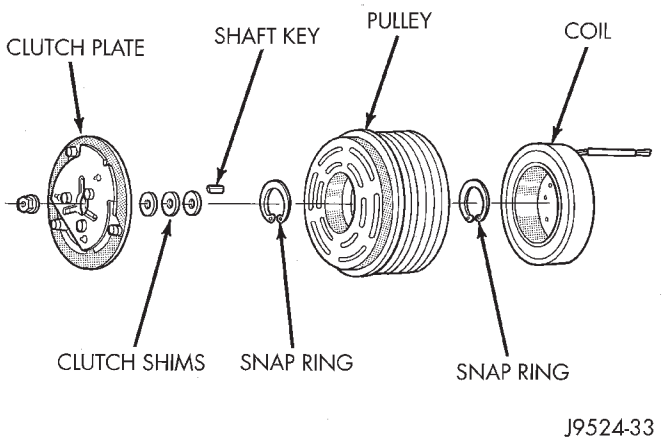

Fig. 4 Compressor Clutch - Typical

COMPRESSOR CLUTCH RELAY

The compressor clutch relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (footprint) is different, the current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The compressor clutch relay is a electromechanical device that switches battery current to the compressor clutch coil when the Powertrain Control Module (PCM) grounds the coil side of the relay. The PCM responds to inputs from the heater-A/C mode control switch, the low pressure cycling clutch switch, and the high pressure cut-off switch. See Compressor Clutch Relay in the Diagnosis and Testing section of this group for more information.

The compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

The compressor clutch relay cannot be repaired and, if faulty or damaged, it must be replaced.

CONDENSER

The condenser is located in the air flow in front of the engine cooling radiator. The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins. When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant.

The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air

DESCRIPTION AND OPERATION (Continued)

conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

EVAPORATOR COIL

The evaporator coil is located in the heater-A/C housing, under the instrument panel. The evaporator coil is positioned in the heater-A/C housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

Refrigerant enters the evaporator from the fixed orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas before it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

FIXED ORIFICE TUBE

The fixed orifice tube is installed in the liquid line between the outlet of the condenser and the inlet of the evaporator. The fixed orifice tube is only serviced as an integral part of the liquid line.

The inlet end of the fixed orifice tube has a nylon mesh filter screen, which filters the refrigerant and helps to reduce the potential for blockage of the metering orifice by refrigerant system contaminants (Fig. 5). The outlet end of the tube has a nylon mesh diffuser screen. The O-rings on the plastic body of the fixed orifice tube seal the tube to the inside of the liquid line and prevent the refrigerant from bypassing the fixed metering orifice.

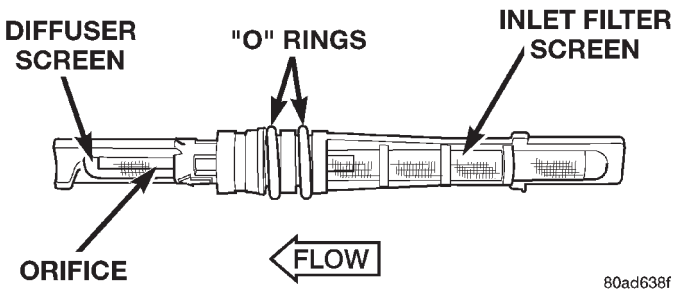

Fig. 5 Fixed Orifice Tube - Typical

The fixed orifice tube is used to meter the flow of liquid refrigerant into the evaporator coil. The high-pressure liquid refrigerant from the condenser expands into a low-pressure liquid as it passes through the metering orifice and diffuser screen of the fixed orifice tube.

The fixed orifice tube cannot be repaired and, if faulty or plugged, the liquid line assembly must be replaced.

HEATER CORE

The heater core is located in the heater-A/C housing, under the instrument panel. It is a heat exchanger made of rows of tubes and fins. Engine coolant is circulated through heater hoses to the heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes.

Air directed through the heater core picks up the heat from the heater core fins. The blend air door allows control of the heater output air temperature by controlling how much of the air flowing through the heater-A/C housing is directed through the heater core. The blower motor speed controls the volume of air flowing through the heater-A/C housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Group 7 - Cooling System for more information on the engine cooling system, the engine coolant and the heater hoses.

HIGH PRESSURE CUT-OFF SWITCH

The high pressure cut-off switch is located on the discharge line near the compressor. The switch is screwed onto a fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The discharge line fitting is equipped with an O-ring to seal the switch connection.

The high pressure cut-off switch is connected in series electrically with the low pressure cycling clutch switch between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This prevents compressor operation when the discharge line pressure approaches high levels.

The high pressure cut-off switch contacts are open when the discharge line pressure rises above about 3100 to 3375 kPa (450 to 490 psi). The switch contacts will close when the discharge line pressure drops to about 1860 to 2275 kPa (270 to 330 psi). When checking refrigerant system pressures with a manifold gauge set, keep in mind that the indicated pressures will be about 172 kpa (25 psi) below the actual switch pressure values due to the pressure

DESCRIPTION AND OPERATION (Continued)

drop that occurs in the refrigerant system between the switch and the high pressure service port.

The high pressure cut-off switch is a factory-calibrated unit. The switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor cylinder head, which is at the rear of the compressor. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes with a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean the valve is faulty.

The high pressure relief valve is a factory-calibrated unit. The valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the compressor assembly.

LOW PRESSURE CYCLING CLUTCH SWITCH

The low pressure cycling clutch switch is located on the top of the accumulator. The switch is screwed onto an accumulator fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The accumulator fitting is equipped with an O-ring to seal the switch connection.

The low pressure cycling clutch switch is connected in series electrically with the high pressure cut-off switch and the heater-A/C controls, between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This regulates the refrigerant system pressure and controls evaporator temperature. Controlling evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing air conditioning system air flow.

The low pressure cycling clutch switch contacts are open when the suction pressure is about 172 kPa (25 psi) or lower. The switch contacts will close when the suction pressure rises to about 296 kPa (43 psi) or above. Lower ambient temperatures, below about -1° C (30° F), will also cause the switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

The low pressure cycling clutch switch is a factory-calibrated unit. It cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REFRIGERANT

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

REFRIGERANT LINE

The refrigerant lines and hoses are used to carry the refrigerant between the various air conditioning system components. A barrier hose design with a nylon tube inner hose liner is used for the R-134a air conditioning system on this vehicle. This nylon liner helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum, and use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

DESCRIPTION AND OPERATION (Continued)

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

REFRIGERANT LINE COUPLER

Spring-lock type refrigerant line couplers are used to connect many of the refrigerant lines and other components to the refrigerant system. These couplers require a special tool for disengaging the two coupler halves.

The spring-lock coupler is held together by a garter spring inside a circular cage on the male half of the fitting (Fig. 6). When the two coupler halves are connected, the flared end of the female fitting slips behind the garter spring inside the cage on the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage

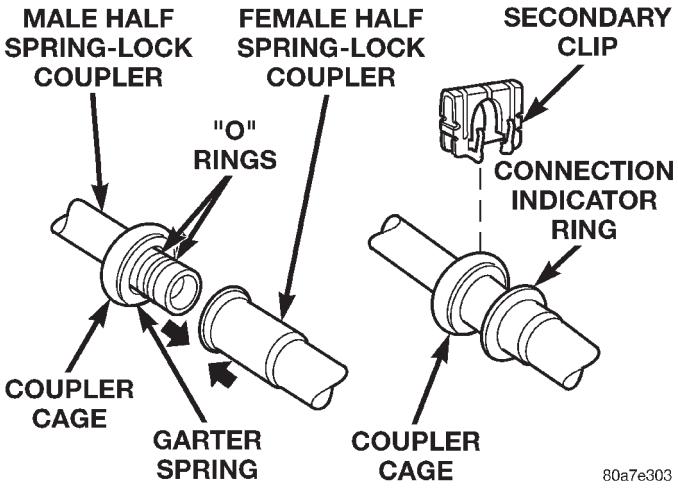

Fig. 6 Spring-Lock Coupler - Typical

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Two O-rings on the male half of the fitting are used to seal the connection. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material.

Secondary clips are installed over the two connected coupler halves at the factory for added blowoff protection. In addition, a plastic ring is used at the factory as a visual indicator to confirm that these couplers are connected. After the coupler is connected, the plastic indicator ring is no longer needed; however, it will remain on the refrigerant line near the coupler cage.

REFRIGERANT OIL

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The SD7H15 compressor used in this vehicle is designed to use an SP-20 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED, BEFORE CONNECTING TO OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used. Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 7). The service hoses on the gauge set being used should have manual (turn wheel), or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

DESCRIPTION AND OPERATION (Continued)

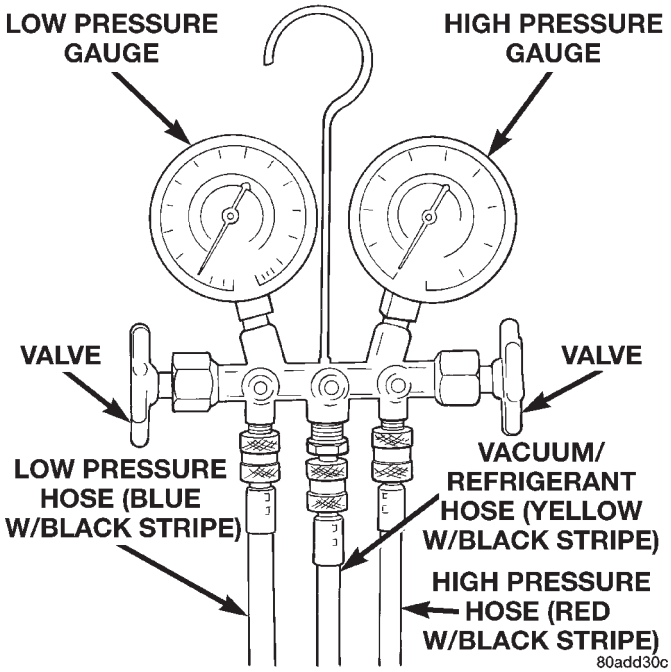


Fig. 7 Manifold Gauge Set - Typical

LOW PRESSURE GAUGE HOSE

The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the suction line, near the accumulator outlet.

HIGH PRESSURE GAUGE HOSE

The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the liquid line between the condenser and the evaporator, near the front of the engine compartment.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE

The center manifold hose (Yellow, or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

REFRIGERANT SYSTEM SERVICE PORT

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system, to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

The high pressure service port is located on the liquid line between the condenser and the evaporator, near the front of the engine compartment. The low pressure service port is located on the suction line, near the accumulator outlet.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

VACUUM CHECK VALVE

On models with a gasoline engine, a vacuum check valve is installed in the accessory vacuum supply line near the vacuum tap on the right side of the engine intake manifold. On models with a diesel engine, a vacuum check valve is installed on the engine vacuum pump. The vacuum check valve is designed to allow vacuum to flow in only one direction through the accessory vacuum supply circuits.

The use of a vacuum check valve helps to maintain the system vacuum needed to retain the selected heater-A/C mode and vehicle speed control settings. On gasoline engine models, it prevents the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation. On diesel engine models, it prevents oil from contaminating the vacuum supply system by maintaining vacuum in the pump after engine shut-off.

On gasoline engine models, a second vacuum check valve is installed in the accessory vacuum supply line at the tee fitting near the dash panel in the engine compartment. This check valve also helps to maintain the system vacuum needed to retain the selected heater-A/C mode settings, but isolates the heater-A/C vacuum circuit from the vehicle speed control vacuum circuit. It prevents the vehicle speed control servo from bleeding down the heater-A/C system vacuum during extended heavy engine load operation.

The vacuum check valve cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM RESERVOIR

Models equipped with a gasoline engine have a vacuum reservoir. The vacuum reservoir is mounted in the passenger side cowl plenum area, under the cowl plenum cover/grille panel. The cowl plenum cover/grille panel must be removed from the vehicle to access the vacuum reservoir for service.

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

A/C PERFORMANCE

The air conditioning system is designed to provide the passenger compartment with low temperature and low humidity air. The evaporator, located in the heater-A/C housing on the dash panel below the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes through the cooled evaporator, the air transfers its heat to the refrigerant in the evaporator tubes and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an air conditioning system will be more effective in the recirculation mode (Max-A/C). With the system in the recirculation mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, the air conditioning system performance levels improve.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

Review the Service Warnings and Precautions in the General Information section near the front of this group before performing this procedure. The air temperature in the test room and in the vehicle must be a minimum of 21° C (70° F) for this test.

(1) Connect a tachometer and a manifold gauge set.

(2) Set the heater-A/C mode control switch knob in the recirculation mode (Max-A/C) position, the temperature control knob in the full cool position, and the blower motor switch in the highest speed position.

(3) Start the engine and hold the idle speed at 1,000 rpm with the compressor clutch engaged. If the compressor clutch does not engage, see the A/C Diagnosis chart in the Diagnosis and Testing section of this group.

(4) The engine should be at operating temperature. The doors and windows must be open and the hood must be mostly closed.

(5) Insert a thermometer in the driver side center A/C (panel) outlet. Operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, unplug the low pressure cycling clutch switch wire harness connector from the switch located on the accumulator (Fig. 8). Place a jumper wire between the two cavities of the low pressure cycling clutch switch wire harness connector.

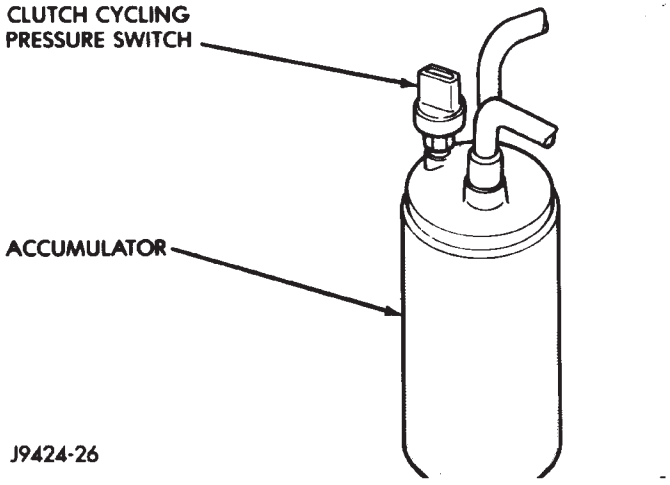


Fig. 8 Low Pressure Cycling Clutch Switch - Typical

(7) With the compressor clutch engaged, record the panel outlet discharge air temperature, the discharge pressure (high side), and the suction pressure (low side).

(8) Compare the panel outlet discharge air temperature reading to the Performance Temperature and Pressure chart. If the temperature reading is high, clamp off both heater hoses (inlet and outlet), wait five minutes and record the temperature again. Compare the second reading to the Performance Temperature and Pressure chart. If the temperature reading is now OK, see Temperature Control Cable in the Removal and Installation section and in the Adjustments section of this group. If the temperature reading is still too high, see Refrigerant System Leaks in the Diagnosis and Testing section of this group, and Refrigerant System Charge in the Service Procedures section of this group .

(9) Compare the discharge (high side) and suction (low side) pressure readings to the Performance Temperature and Pressure chart. If the pressures are abnormal, see the A/C Diagnosis chart in the Diagnosis and Testing section of this group.

DIAGNOSIS AND TESTING (Continued)

Performance Temperature and Pressure						
Ambient Temperature	**21° C (70° F)**	**27° C (80° F)**	**32° C (90° F)**	**38° C (100° F)**	**43° C (110° F)**	**49° C (120° F)**
Center Panel OutletDischarge Air Temperature	5 to 7° C (40 to 45° F)	13 to 16° C (55 to 60° F)	16 to 21° C (60 to 70° F)	21 to 24° C (70 to 75° F)	27 to 29° C (80 to 85° F)	29 to 32° C (85 to 90° F)
*Suction Pressure (Low Side)	241 to 276 kPa (35 to 40 psi)	276 to 345 kPa (40 to 50 psi)	345 to 414 kPa (50 to 60 psi)	414 to 483 kPa (60 to 70 psi)	483 to 552 kPa (70 to 80 psi)	552 to 586 kPa (85 to 90 psi)
*Discharge Pressure (High Side)	931 to 1000 kPa (135 to 145 psi)	1207 to 1482 kPa (175 to 215 psi)	1482 to 1862 kPa (215 to 270 psi)	1862 to 2275 kPa (270 to 330 psi)	2344 to 2551 kPa (340 to 370 psi)	2758 to 2965 kPa (400 to 430 psi)
*Note: If pressures are lower than shown, but center panel outlet discharge air temperatures are OK, then the A/C system is OK.						

A/C Diagnosis		
Condition	**Possible Causes**	**Correction**
RAPID COMPRESSOR CLUTCH CYCLING (TEN OR MORE CYCLES PER MINUTE).	1. Low refrigerant system charge. 2. Faulty low pressure cycling clutch switch. 3. Faulty Powertrain Control Module (PCM).	1. See Refrigerant System Leaks in the Diagnosis and Testing section of this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. See Low Pressure Cycling Clutch Switch in the Diagnosis and Testing section of this group. Test the low pressure cycling clutch switch and replace, if required. 3. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.
EQUAL PRESSURES, BUT THE COMPRESSOR CLUTCH DOES NOT ENGAGE.	1. No refrigerant in the refrigerant system. 2. Faulty fuse. 3. Faulty compressor clutch coil. 4. Faulty compressor clutch relay. 5. Improperly installed or faulty low pressure cycling clutch switch. 6. Faulty high pressure cut-off switch. 7. Faulty Powertrain Control Module (PCM). 8. Faulty heater-A/C control.	1. See Refrigerant System Leaks in the Diagnosis and Testing section of this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. Check the fuses in the Power Distribution Center and the junction block. Repair the shorted circuit or component and replace the fuses, if required. 3. See Compressor Clutch Coil in the Diagnosis and Testing section of this group. Test the compressor clutch coil and replace, if required. 4. See Compressor Clutch Relay in the Diagnosis and Testing section of this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required. 5. See Low Pressure Cycling Clutch Switch in the Diagnosis and Testing section of this group. Test the low pressure cycling clutch switch and tighten or replace, if required. 6. See High Pressure Cut-Off Switch in the Diagnosis and Testing section of this group. Test the high pressure cut-off switch and replace, if required. 7. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required. 8. See Heater-A/C Control in the Diagnosis and Testing section of this group. Test the heater-A/C control and replace, if required.

DIAGNOSIS AND TESTING (Continued)

A/C Diagnosis		
Condition	**Possible Causes**	**Correction**
NORMAL PRESSURES, BUT A/C PERFORMANCE TEST AIR TEMPERATURES AT CENTER PANEL OUTLET ARE TOO HIGH.	1. Excessive refrigerant oil in system. 2. Temperature control cable improperly installed or faulty. 3. Blend-air door inoperative, obstructed or sealing improperly.	1. See Refrigerant Oil Level in the Service Procedures section of this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required. 2. See Temperature Control Cable in the Removal and Installation and Adjustments sections of this group. Inspect the temperature control cable for proper routing, operation and adjustment. Repair as required. 3. See Heater-A/C Housing Door in the Removal and Installation section of this group. Inspect the blend-air door for proper operation and sealing and correct, if required.
LOW SIDE PRESSURE IS NORMAL OR SLIGHTLY LOW, AND HIGH SIDE PRESSURE IS TOO LOW.	1. Low refrigerant system charge. 2. Refrigerant flow through the accumulator is restricted. 3. Refrigerant flow through the evaporator coil is restricted. 4. Faulty compressor.	1. See Refrigerant System Leaks in the Diagnosis and Testing section of this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. See Accumulator in the Removal and Installation section of this group. Replace the restricted accumulator, if required. 3. See Evaporator Coil in the Removal and Installation section of this group. Replace the restricted evaporator coil, if required. 4. See Compressor in the Diagnosis and Testing section of this group. Replace the compressor, if required.
LOW SIDE PRESSURE IS NORMAL OR SLIGHTLY HIGH, AND HIGH SIDE PRESSURE IS TOO HIGH.	1. Condenser air flow restricted. 2. Inoperative cooling fan. 3. Refrigerant system overcharged. 4. Air in the refrigerant system. 5. Engine overheating.	1. Check the condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Refer to Group 7 - Cooling System for more information on air seals. Clean, repair, or replace components as required. 2. Refer to Group 7 - Cooling System for more information. Test the cooling fan and replace, if required. 3. See Refrigerant System Charge in the Service Procedures section of this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required. 4. See Refrigerant System Leaks in the Diagnosis and Testing section of this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 5. Refer to Group 7 - Cooling System for more information. Test the cooling system and repair, if required.
LOW SIDE PRESSURE IS TOO HIGH, AND HIGH SIDE PRESSURE IS TOO LOW.	1. Accessory drive belt slipping. 2. Fixed orifice tube not installed. 3. Faulty compressor.	1. Refer to Group 7 - Cooling System for more information. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. 2. See Fixed Orifice Tube in the Diagnosis and Testing section of this group. Install the missing fixed orifice tube, if required. 3. See Compressor in the Diagnosis and Testing section of this group. Replace the compressor, if required.

DIAGNOSIS AND TESTING (Continued)

A/C Diagnosis		
Condition	**Possible Causes**	**Correction**
LOW SIDE PRESSURE IS TOO LOW, AND HIGH SIDE PRESSURE IS TOO HIGH.	1. Restricted refrigerant flow through the refrigerant lines. 2. Restricted refrigerant flow through the fixed orifice tube. 3. Restricted refrigerant flow through the condenser.	1. See Liquid Line and Suction and Discharge Line in the Removal and Installation section of this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required. 2. See Fixed Orifice Tube in the Diagnosis and Testing section of this group. Replace the restricted fixed orifice tube, if required. 3. See Condenser in the Removal and Installation section of this group. Replace the restricted condenser, if required.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling System for the procedures to check the engine coolant level and flow, engine coolant reserve/recovery system operation, accessory drive belt condition and tension, radiator air flow and the fan drive operation. Also be certain that the accessory vacuum supply line is connected at the engine vacuum source.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control knob in the full hot position, the mode control switch knob in the floor position, and the blower motor switch knob in the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the heater-A/C housing floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

If the floor outlet air temperature is too low, refer to Group 7 - Cooling System to check the engine coolant temperature specifications. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling System for the procedures.

An alternate method of checking heater performance is to use a DRB scan tool to monitor the engine coolant temperature. The floor outlet air temperature reading should be no more than 4.5° C (40° F) lower than the engine coolant temperature reading.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow:

- Faulty water pump.
- Faulty thermostat.
- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- A faulty, obstructed or improperly installed blend-air door.
- The temperature control cable is not connected, or is not routed or adjusted properly.
- A faulty blower system.
- A faulty heater-A/C control.

Temperature Reference				
Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

DIAGNOSIS AND TESTING (Continued)

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob on the heater-A/C control panel, the following could require service:

- A faulty heater-A/C control.
- The temperature control cable is not connected, or is not routed or adjusted properly.
- A faulty, obstructed or improperly installed blend-air door.
- An obstructed cowl air intake.
- The engine cooling system.

HEATER-A/C CONTROL

Satisfactory heater and air conditioner performance depends upon proper operation and adjustment of all operating controls and refrigeration system components. For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. These inspections, tests, and adjustments should be used to locate the cause of a malfunction.

Operation must be tested as described in the following sequence:

(1) Move the temperature control knob quickly to the full hot and the full cold positions. There should be a distinct sound of the blend-air door hitting its stops within the heater-A/C housing at the end of knob travel in each direction, with no spring-back of the knob. If not OK, inspect the condition, routing, installation and adjustment of the temperature control cable. See Temperature Control Cable in the Removal and Installation section and in the Adjustments section of this group for more information.

(2) Inspect and adjust the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(3) Start the engine and hold the idle speed at 1,300 rpm.

(4) On vehicles with air conditioning, turn the temperature control knob to the extreme counterclockwise (Cool) position, and set the mode control switch knob in the Bi-Level (A/C) position. The outside (recirculation) air door should be open to outside air. If not OK, see Vacuum System in the Diagnosis and Testing section of this group.

(5) Open the vehicle windows. Test the blower motor operation in all speeds. If not OK, see Blower Motor in the Diagnosis and Testing section of this group. Leave the blower motor switch knob in the highest speed position.

(6) On vehicles with air conditioning, the compressor should be running and the air conditioning system in operation unless the ambient air temperature is below about -1° C (30° F). If not OK, see A/C Performance in the Diagnosis and Testing section of this group.

(7) Check the mode control switch operation. The heater and air conditioner systems should respond as

Heater Diagnosis

Condition	Possible Cause	Correction
INSUFFICIENT HEATER OUTPUT.	1. Incorrect engine coolant level. 2. Air trapped in engine cooling system. 3. Incorrect engine coolant temperature. 4. Temperature control cable improperly installed or not adjusted. 5. Blend-air door not operating properly. 6. Insufficient air flow through heater housing. 7. Improper blower motor operation.	1. Check the engine coolant level. Refer to Group 7 - Cooling System for the procedures. 2. Check the operation of the coolant reserve/recovery system. Refer to Group 7 - Cooling System for the procedures. 3. Check the performance and operation of the engine cooling system including: thermostat, water pump, fan drive, accessory drive belt, coolant flow (plugged radiator or heater core, plugged or kinked coolant hoses), air flow (missing or improperly installed radiator air seals or fan shroud). Refer to Group 7 - Cooling System for the procedures. 4. See Temperature Control Cable in the Removal and Installation and in the Adjustments sections of this group. 5. Check for a damaged, obstructed or improperly installed blend-air door or seals. See Heater-A/C Housing Door in the Removal and Installation section of this group. 6. Remove foreign material or obstructions from cowl air intake. 7. See Blower Motor in the Diagnosis and Testing section of this group.

DIAGNOSIS AND TESTING (Continued)

described in the owner's manual in the vehicle glove box to each mode selected. Reduce the engine speed to normal idle. The vacuum will be high at low idle and the vacuum actuators should respond quickly. If not OK, see Vacuum System in the Diagnosis and Testing section of this group.

(8) If the vacuum tests, and the electrical component and circuit tests reveal no problems, disassemble the heater-A/C housing to inspect for mechanical misalignment or binding of the mode doors.

VACUUM SYSTEM

Vacuum control is used to operate the mode doors in the heater-only and heater-A/C housings. Testing of the heater-only and heater-A/C mode control switch operation will determine if the vacuum, electrical, and mechanical controls are functioning. However, it is possible that a vacuum control system that operates perfectly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be caused by leaks in the vacuum system, or by a faulty or improperly installed vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem is not a disconnected vacuum supply tube at the engine vacuum source or the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 9), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.). Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

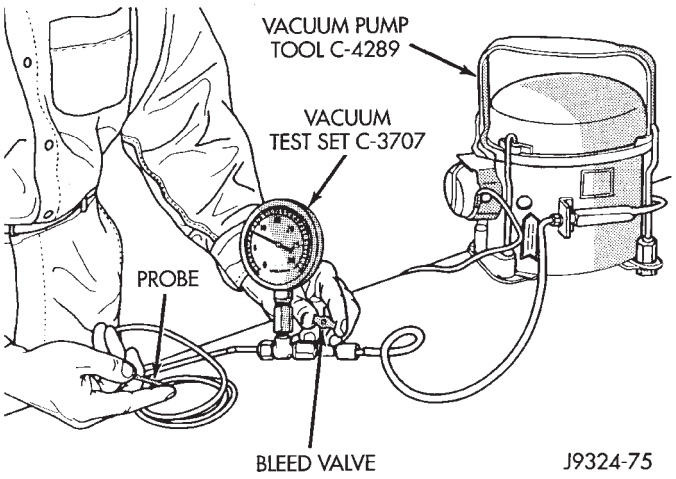


Fig. 9 Adjust Vacuum Test Bleed Valve

VACUUM CHECK VALVE

(1) Remove the vacuum check valve. On gasoline engines, one valve is located in the vacuum supply tube (black) at the intake manifold tap on the right side of the engine. A second check valve is located next to the tee fitting in the vacuum supply tube (black) near the dash panel in the engine compartment. On diesel engines, the vacuum check valve is integral to the engine vacuum pump nipple and is threaded into the vacuum pump. The vacuum check valve must be removed in order to perform the following tests. See Vacuum Check Valve in the Removal and Installation section of this group for the procedures.

(2) Connect the test set vacuum supply hose to the heater-A/C control side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to step Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

HEATER-A/C CONTROLS

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (black) tube in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the heater-A/C mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See Locating Vacuum Leaks in the Diagnosis and Testing section of this group.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

DIAGNOSIS AND TESTING (Continued)

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum harness connector located between the heater-A/C control and the heater-A/C housing under the instrument panel.

(2) Connect the test set vacuum hose probe to each port in the heater-A/C housing half of the vacuum harness connector, one port at a time, and pause after each connection (Fig. 10). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty heater-A/C control. If not OK, go to step Step 3.

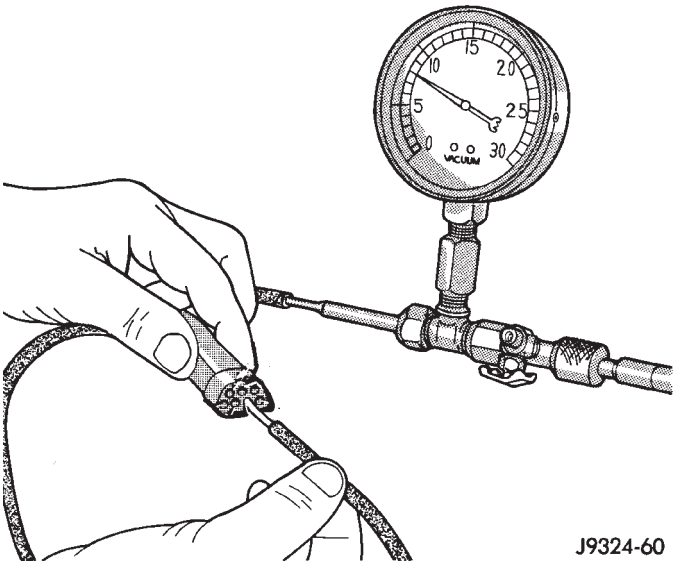


Fig. 10 Vacuum Circuit Test

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, see the Vacuum Circuits chart (Fig. 11).

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components. See the Removal and Installation section of this group for more information.

(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end of the line. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (0.125 inch) inside diameter rubber hose.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor circuit wiring or wire harness connectors
- Faulty blower motor resistor
- Faulty blower motor relay
- Faulty blower motor switch
- Faulty heater-A/C mode control switch
- Faulty blower motor.

Possible causes of the blower motor not operating in all speeds include:

- Faulty fuse
- Faulty blower motor switch
- Faulty blower motor resistor
- Faulty blower motor relay
- Faulty blower motor circuit wiring or wire harness connectors.

VIBRATION

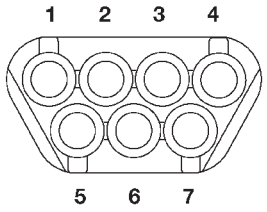
Possible causes of blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Blower wheel out of balance or deformed
- Blower motor faulty.

NOISE

To verify that the blower is the source of the noise, unplug the blower motor wire harness connector and

DIAGNOSIS AND TESTING (Continued)



HEATER-A/C VACUUM HARNESS CONNECTOR – HOUSING HALF (VIEWED FROM ENGAGEMENT END)

VACUUM CIRCUIT LEGEND		
ID	FUNCTION	COLOR
1	RECIRCULATION ACTUATOR	GREEN
2	DEFROST/FLOOR ACTUATOR	RED
3	VACUUM RESERVOIR	BLACK
4	NOT USED	N/A
5	DEFROST/FLOOR ACTUATOR	BROWN
6	PANEL/DEFROST ACTUATOR	YELLOW
7	NOT USED	N/A

HEATER ONLY

MODE KNOB POSITION	PORTS/TUBE COLOR						
	DK GRN	RED	BLK	LT BLU	BRN	YEL	LT GRN
	1	2	3	4	5	6	7
OFF	●	❍	●	N	❍	●	N
				O			O
				T			T
BI-LEVEL	❍	●	●	/	❍	●	/
PANEL	❍	❍	●	U	❍	●	U
FLOOR	❍	●	●	S	●	❍	S
FLOOR/DEFROST	❍	●	●	E	❍	❍	E
DEFROST	❍	❍	●	D	❍	❍	D

● = VACUUM
❍ = VENTED

HEATER – A/C

MODE KNOB POSITION	PORTS/TUBE COLOR							CLUTCH RELAY
	DK GRN	RED	BLK	LT BLU	BRN	YEL	LT GRN	
	1	2	3	4	5	6	7	
OFF	●	❍	●	N	❍	●	N	OFF
MAX A/C	●	❍	●	O	❍	●	O	ON
PANEL A/C	❍	❍	●	T	❍	●	T	ON
BI-LEVEL A/C	❍	●	●	/	❍	●	/	ON
PANEL	❍	❍	●	U	❍	●	U	OFF
FLOOR	❍	●	●	S	●	❍	S	OFF
FLOOR/DEFROST	❍	●	●	E	❍	❍	E	ON
DEFROST	❍	❍	●	D	❍	❍	D	ON

80ae83c7

Fig. 11 Vacuum Circuits

DIAGNOSIS AND TESTING (Continued)

operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the heater-A/C housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower motor faulty.

BLOWER MOTOR RELAY

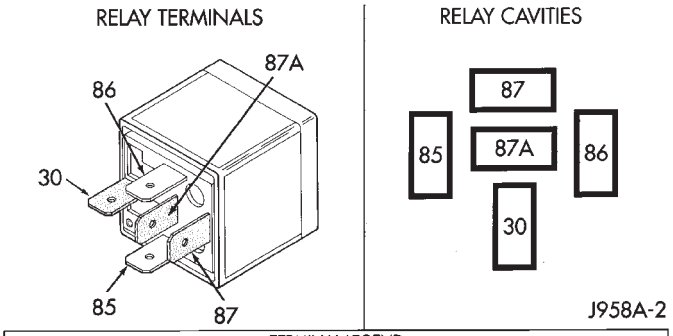
RELAY TEST

The blower motor relay (Fig. 12) is located in the Power Distribution Center (PDC). Remove the blower motor relay from the PDC as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see Relay Circuit Test in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 12 Blower Motor Relay

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed directly from a fuse in the Power Distribution Center (PDC), and should be hot at all times. Check for battery voltage at the PDC cavity for relay terminal 30. If OK, go to Step 2. If not OK, repair the open circuit to the PDC fuse as required.

(2) The relay normally closed terminal cavity (87A) is not used for this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the blower motor. When the relay is energized, terminal 87 is connected to terminal 30 and provides full battery current to the blower motor feed circuit. There should be continuity between the PDC cavity for terminal 87 and the blower motor relay output circuit cavity of the blower motor wire harness connector at all times. If OK, go to Step 4. If not OK, repair the open circuit to the blower motor as required.

(4) The coil battery terminal cavity (86) is connected to the ignition switch. When the ignition switch is placed in the On position, fused ignition switch output is directed from a fuse in the junction block to the relay electromagnetic coil to energize the relay. There should be battery voltage at the PDC cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the junction block fuse as required.

(5) The coil ground terminal cavity (85) is connected to ground. This terminal supplies the ground for the relay electromagnetic coil. There should be continuity between the PDC cavity for relay terminal 85 and a good ground at all times. If not OK, repair the open circuit as required.

BLOWER MOTOR RESISTOR

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the blower motor resistor.

(3) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

DIAGNOSIS AND TESTING (Continued)

BLOWER MOTOR SWITCH

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the heater-A/C control from the instrument panel. Check for continuity between the ground circuit cavity of the heater-A/C control wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) With the heater-A/C control wire harness connector unplugged, place the heater-A/C mode control switch knob in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the heater-A/C control as you move the blower motor switch knob to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the heater-A/C control connector and the blower motor resistor as required. If not OK, replace the faulty heater-A/C control unit.

COMPRESSOR

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension as described in Group 7 - Cooling System before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap. See Compressor and Compressor Clutch in the Removal and Installation section of this group for the procedures.

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises. See Suction and Discharge Line in the Removal and Installation section of this group for more information.

(5) If the noise is from opening and closing of the high pressure relief valve, evacuate and recharge the refrigerant system. See Refrigerant System Evacuate and Refrigerant System Charge in the Service Procedures section of this group. If the high pressure relief valve still does not seat properly, replace the compressor.

(6) If the noise is from liquid slugging on the suction line, replace the accumulator. See Accumulator in the Removal and Installation section of this group for the procedures. Check the refrigerant oil level and the refrigerant system charge. See Refrigerant Oil Level and Refrigerant System Charge in the Service Procedures section of this group. If the liquid slugging condition continues following accumulator replacement, replace the compressor.

(7) If the noise continues, replace the compressor and repeat Step 1.

COMPRESSOR CLUTCH COIL

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. The battery must be fully-charged

DIAGNOSIS AND TESTING (Continued)

before performing the following tests. Refer to Group 8A - Battery for more information.

(1) Connect an ammeter (0 to 10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0 to 20 volt scale) with clip-type leads for measuring the voltage across the battery and the compressor clutch coil.

(2) With the heater-A/C mode control switch in any A/C mode, and the blower motor switch in the lowest speed position, start the engine and run it at normal idle.

(3) The compressor clutch coil voltage should read within two volts of the battery voltage. If there is voltage at the clutch coil, but the reading is not within two volts of the battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as required. If there is no voltage reading at the clutch coil, use a DRB scan tool and the proper Diagnostic Procedures manual for testing of the compressor clutch circuit. The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the junction block and the Power Distribution Center (PDC)
- Heater-A/C mode control switch
- Compressor clutch relay
- High pressure cut-off switch
- Low pressure cycling clutch switch
- Powertrain Control Module (PCM).

(4) The compressor clutch coil is acceptable if the current draw measured at the clutch coil is 2.0 to 3.9 amperes with the electrical system voltage at 11.5 to 12.5 volts. This should only be checked with the work area temperature at 21° C (70° F). If system voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the system voltage drops below 12.5 volts.

(a) If the clutch coil current reading is four amperes or more, the coil is shorted and should be replaced.

(b) If the clutch coil current reading is zero, the coil is open and should be replaced.

COMPRESSOR CLUTCH RELAY

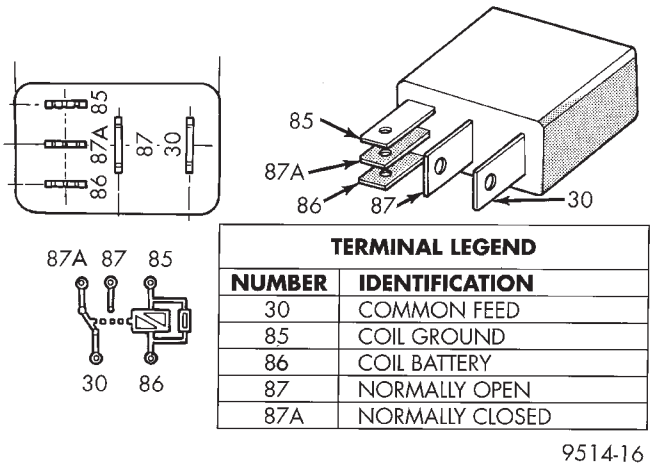
RELAY TEST

The compressor clutch relay (Fig. 13) is located in the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location. Remove the relay from the PDC to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see Relay Circuit Test in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

9514-16

Fig. 13 Compressor Clutch Relay

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed. There should be battery voltage at the cavity for relay terminal 30 at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is not used in this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the compressor clutch coil. There should be continuity between this cavity and the A/C compressor clutch relay output circuit cavity of the compressor clutch coil wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) The relay coil battery terminal (86) is connected to the fused ignition switch output (run/start) circuit. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the junction block as required.

(5) The coil ground terminal cavity (85) is switched to ground through the Powertrain Control Module (PCM). There should be continuity between this cavity and the A/C compressor clutch relay control circuit cavity of the PCM wire harness connector C

DIAGNOSIS AND TESTING (Continued)

(gray) at all times. If not OK, repair the open circuit as required.

FIXED ORIFICE TUBE

The fixed orifice tube can be checked for proper operation using the following procedure. However, the fixed orifice tube is only serviced as a part of the liquid line unit. If the results of this test indicate that the fixed orifice tube is obstructed or missing, the entire liquid line unit must be replaced.

WARNING: THE LIQUID LINE BETWEEN THE CONDENSER OUTLET AND THE FIXED ORIFICE TUBE CAN BECOME HOT ENOUGH TO BURN THE SKIN. USE EXTREME CAUTION WHEN PERFORMING THE FOLLOWING TEST.

(1) Confirm that the refrigerant system is properly charged. See Refrigerant System Charge in the Service Procedures section of this group.

(2) Start the engine. Turn on the air conditioning system and confirm that the compressor clutch is engaged.

(3) Allow the air conditioning system to operate for five minutes.

(4) Lightly and cautiously touch the liquid line near the condenser outlet at the front of the engine compartment. The liquid line should be hot to the touch.

(5) Touch the liquid line near the evaporator inlet at the rear of the engine compartment. The liquid line should be cold to the touch.

(6) If there is a distinct temperature differential between the two ends of the liquid line, the orifice tube is in good condition. If there is little or no detectable temperature differential between the two ends of the liquid line, the orifice tube is obstructed or missing and the liquid line must be replaced.

HIGH PRESSURE CUT-OFF SWITCH

Before performing diagnosis of the high pressure cut-off switch, verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the high pressure cut-off switch wire harness connector from the switch on the refrigerant system fitting.

(3) Check for continuity between the two terminals of the high pressure cut-off switch. There should be continuity. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

LOW PRESSURE CYCLING CLUTCH SWITCH

Before performing diagnosis of the low pressure cycling clutch switch, be certain that the switch is properly installed on the accumulator fitting. If the switch is too loose it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure. Also verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

Remember that lower ambient temperatures, below about -1° C (30° F), during cold weather will open the switch contacts and prevent compressor operation due to the pressure/temperature relationship of the refrigerant. For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the low pressure cycling clutch switch wire harness connector from the switch on the accumulator fitting.

(3) Install a jumper wire between the two cavities of the low pressure cycling clutch switch wire harness connector.

(4) Connect a manifold gauge set to the refrigerant system service ports. See Refrigerant System Service Equipment and Refrigerant System Service Ports in the Description and Operation section of this group for more information.

(5) Connect the battery negative cable.

(6) Place the heater-A/C mode control switch knob in any A/C position and start the engine.

(7) Check for continuity between the two terminals of the low pressure cycling clutch switch. There should be continuity with a suction pressure reading of 296 kPa (43 psi) or above, and no continuity with a suction pressure reading of 172 kPa (25 psi) or below. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE LEAK TESTING THE SYSTEM.

If the air conditioning system does not cool properly, the A/C system performance should be tested. See A/C Performance in the Diagnosis and Testing section of this group for the procedures. If the A/C system refrigerant fill is found to be low or if the sys-

DIAGNOSIS AND TESTING (Continued)

tem is empty; a leak at a refrigerant line, connector fitting, component, or component seal is likely.

An electronic leak detector designed for R-134a refrigerant, or a fluorescent R-134a leak detection dye and a black light are recommended for locating and confirming refrigerant system leaks. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

An oily residue on or near refrigerant system lines, connector fittings, components, or component seals can indicate the general location of a possible refrigerant leak. However, the exact leak location should be confirmed with an electronic leak detector prior to component repair or replacement.

To detect a leak in the refrigerant system with an electronic leak detector, perform one of the following procedures:

SYSTEM EMPTY

(1) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

(3) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(4) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(5) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet and the floor duct outlet. Set the blower motor switch to the lowest speed position, and the mode control switch in the recirculation mode (Max-A/C).

SYSTEM LOW

(1) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(2) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run with the air conditioning system turned on for five minutes.

(3) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(4) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet and the floor duct outlet. Set the blower motor switch to the lowest speed position, and the mode control switch in the recirculation mode (Max-A/C).

SERVICE PROCEDURES

REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE RECOVERING REFRIGERANT.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE EVACUATING THE SYSTEM.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be charged. If moisture and air enters the system and becomes mixed with the refrigerant, the compressor head pressure will rise above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating the refrigerant system will remove the air and boil the moisture out of the system at near room temperature. To evacuate the refrigerant system, use the following procedure:

(1) Connect a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 and a manifold gauge set to the refrigerant system of the vehicle.

(2) Open the low and high side valves and start the charging station vacuum pump. When the suction gauge reads 88 kPa (26 in. Hg.) vacuum or greater, close all of the valves and turn off the vacuum pump.

(a) If the refrigerant system fails to reach the specified vacuum, the system has a leak that must be corrected. See Refrigerant System Leaks in the Diagnosis and Testing section of this group for the procedures.

SERVICE PROCEDURES (Continued)

(b) If the refrigerant system maintains the specified vacuum for five minutes, restart the vacuum pump, open the suction and discharge valves and evacuate the system for an additional ten minutes.

(3) Close all of the valves, and turn off the charging station vacuum pump.

(4) The refrigerant system is now ready to be charged with R-134a refrigerant. See Refrigerant System Charge in the Service Procedures section of this group.

REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. See Refrigerant Charge Capacity in the Service Procedures section of this group for the proper amount of the refrigerant charge.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT CHARGE CAPACITY

The R-134a refrigerant system charge capacity for this vehicle is 0.907 kilograms (32 ounces).

REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the air conditioning system.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

Refrigerant Oil Capacities		
Component	**ml**	**fl oz**
A/C System	240	8.1
Accumulator	60	2
Condenser	30	1
Evaporator	60	2
Compressor	drain and measure the oil from the old compressor - see text.	

REMOVAL AND INSTALLATION

REFRIGERANT LINE COUPLER

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(2) Remove the secondary clip from the spring-lock coupler.

(3) Fit the proper size A/C line disconnect tool (Special Tool Kit 7193) over the spring-lock coupler cage (Fig. 14).

(4) Close the two halves of the A/C line disconnect tool around the spring-lock coupler.

(5) Push the A/C line disconnect tool into the open side of the coupler cage to expand the garter spring. Once the garter spring is expanded and while still pushing the disconnect tool into the open side of the coupler cage, pull on the refrigerant line attached to the female half of the coupler fitting until the flange on the female fitting is separated from the garter spring and cage on the male fitting within the disconnect tool.

NOTE: The garter spring may not release if the A/C line disconnect tool is cocked while pushing it into the coupler cage opening.

REMOVAL AND INSTALLATION (Continued)

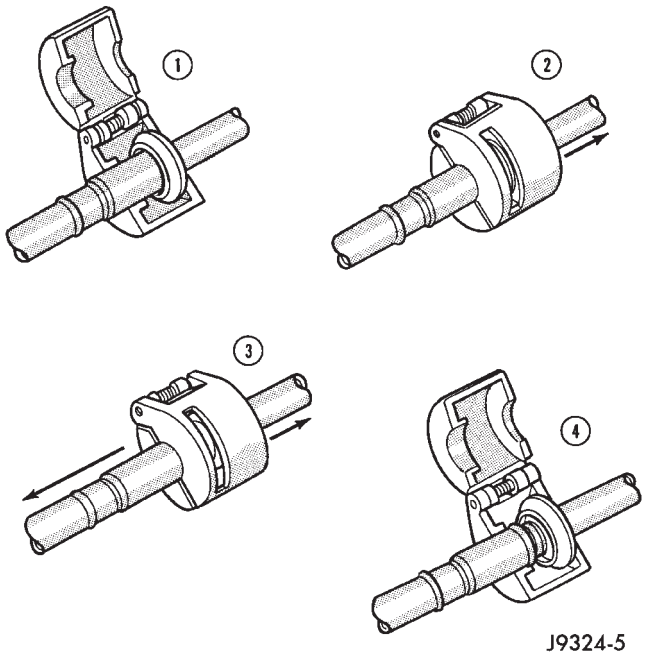


Fig. 14 Refrigerant Line Spring-Lock Coupler Disconnect

(6) Open and remove the A/C line disconnect tool from the disconnected spring-lock coupler.

(7) Complete the separation of the two halves of the coupler fitting.

INSTALLATION

(1) Check to ensure that the garter spring is located within the cage of the male coupler fitting, and that the garter spring is not damaged.

(a) If the garter spring is missing, install a new spring by pushing it into the coupler cage opening.

(b) If the garter spring is damaged, remove it from the coupler cage with a small wire hook (DO NOT use a screwdriver) and install a new garter spring.

(2) Clean any dirt or foreign material from both halves of the coupler fitting.

(3) Install new O-rings on the male half of the coupler fitting.

CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any other O-rings may allow the connection to leak intermittently during vehicle operation.

(4) Lubricate the male fitting and O-rings, and the inside of the female fitting with clean R-134a refrigerant oil. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(5) Fit the female half of the coupler fitting over the male half of the fitting.

(6) Push together firmly on the two halves of the coupler fitting until the garter spring in the cage on the male half of the fitting snaps over the flanged end on the female half of the fitting.

(7) Ensure that the spring-lock coupler is fully engaged by trying to separate the two coupler halves. This is done by pulling the refrigerant lines on either side of the coupler away from each other.

(8) Reinstall the secondary clip over the spring-lock coupler cage.

HIGH PRESSURE CUT-OFF SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure cut-off switch, which is mounted to a fitting on the discharge line between the compressor and the condenser inlet (Fig. 15).

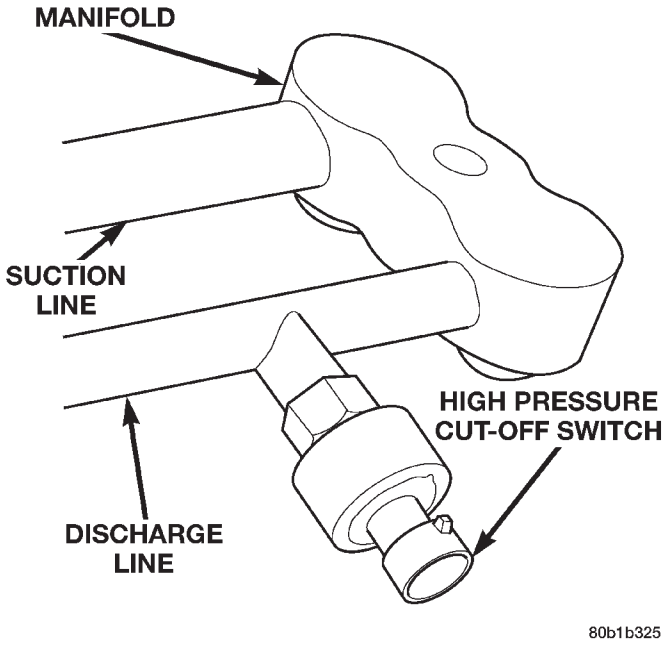


Fig. 15 High Pressure Cut-Off Switch Remove/Install

(3) Unscrew the high pressure cut-off switch from the discharge line fitting.

(4) Remove the high pressure cut-off switch from the vehicle.

(5) Remove the O-ring seal from the discharge line fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only

REMOVAL AND INSTALLATION (Continued)

refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the high pressure cut-off switch on the discharge line fitting.

(3) Plug the wire harness connector into the high pressure cut-off switch.

(4) Connect the battery negative cable.

SUCTION AND DISCHARGE LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Unplug the wire harness connector from the high pressure cut-off switch.

(4) Disconnect the suction line refrigerant line coupler at the accumulator. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the nut that secures the block fitting to the stud on the condenser inlet and disconnect the discharge line from the condenser. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) On models with a gasoline engine, remove the nut that secures the refrigerant line support bracket to the stud on the compressor mounting bracket.

(7) Remove the screw that secures the refrigerant line manifold to the compressor (Fig. 16) or (Fig. 17). Install plugs in, or tape over all of the opened refrigerant line fittings.

(8) Remove the suction and discharge line assembly from the vehicle.

INSTALLATION

(1) Remove the tape or plugs from all of the refrigerant line fittings. Connect the suction line refrigerant line coupler to the accumulator. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

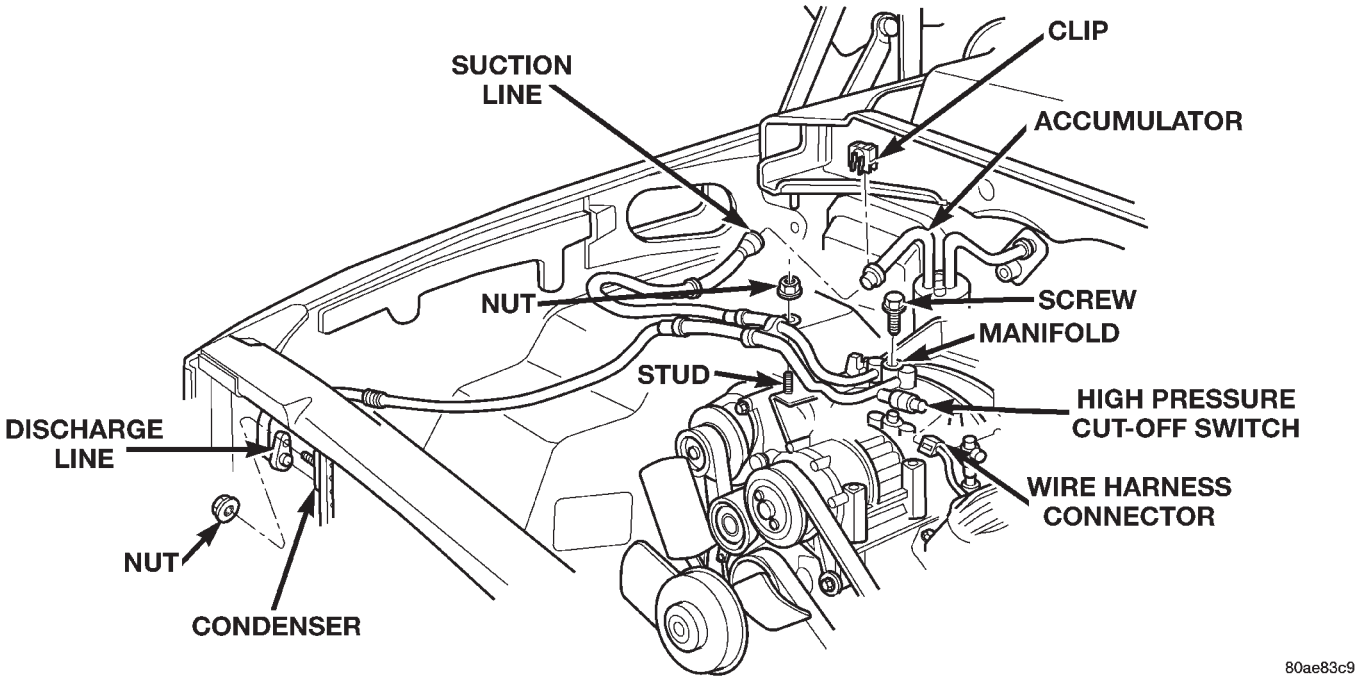


Fig. 16 Suction and Discharge Line Remove/Install - Gasoline Engine

REMOVAL AND INSTALLATION (Continued)

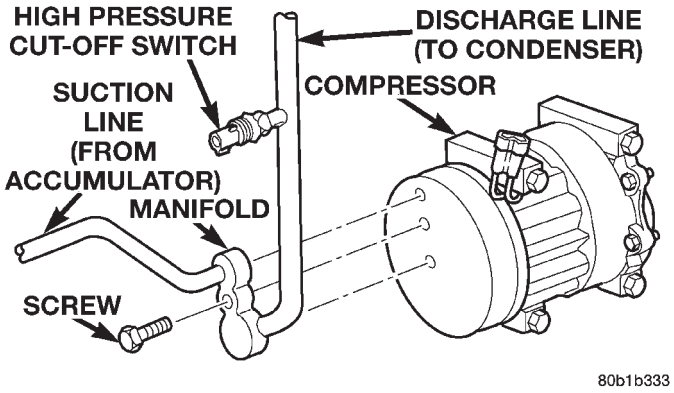


Fig. 17 Suction and Discharge Line Remove/Install - Diesel Engine

(2) Install a new gasket and the discharge line block fitting over the stud on the condenser inlet. Tighten the mounting nut to 20 N·m (180 in. lbs.).

(3) Install the refrigerant line manifold to the compressor. Tighten the mounting screw to 22 N·m (200 in. lbs.).

(4) On models with a gasoline engine, install the nut that secures the refrigerant line support bracket to the stud on the compressor mounting bracket. Tighten the mounting nut to 22 N·m (200 in. lbs.).

(5) Plug in the wire harness connector to the high pressure cut-off switch.

(6) Connect the battery negative cable.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(8) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

COMPRESSOR

The compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch or clutch coil, the engine, the cylinder head, or the generator.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(2) Disconnect and isolate the battery negative cable.

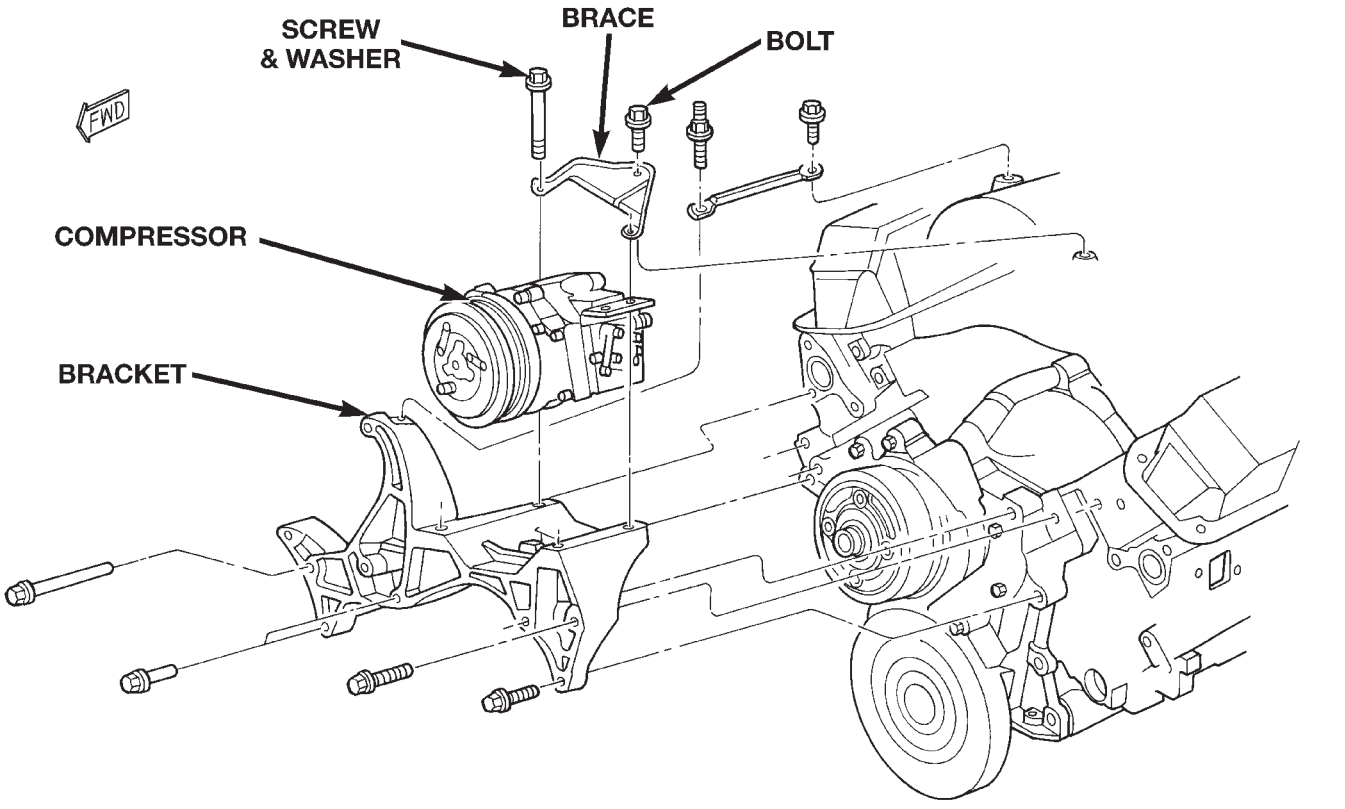


Fig. 18 Compressor Remove/Install - Gasoline Engine

REMOVAL AND INSTALLATION (Continued)

(3) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Unplug the compressor clutch coil wire harness connector.

(5) Remove the suction and discharge refrigerant line manifold from the compressor. See Suction and Discharge Line in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Remove the four screws that secure the compressor to the mounting bracket (Fig. 18) or (Fig. 19) .

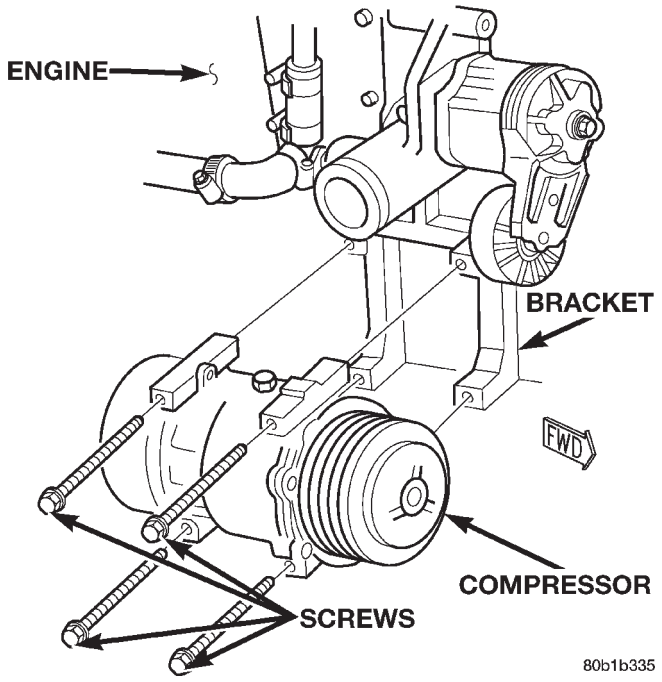


Fig. 19 Compressor Remove/Install - Diesel Engine

(7) Remove the compressor from the mounting bracket.

INSTALLATION

NOTE: If a replacement compressor is being installed, be certain to check the refrigerant oil level. See Refrigerant Oil Level in the Service Procedures section of this group. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(1) Install the compressor to the mounting bracket. Tighten the four mounting screws to 24 N·m (210 in. lbs.).

(2) Remove the tape or plugs from all of the opened refrigerant line fittings. Install the suction and discharge line manifold to the compressor. See Suction and Discharge Line in the Removal and Installation section of this group for the procedures.

(3) Install the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Plug in the compressor clutch coil wire harness connector.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(7) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

COMPRESSOR CLUTCH

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) On models with the diesel engine option, remove the compressor from the engine. Do not remove the refrigerant lines or fittings. See Compressor in the Removal and Installation section of this group for the procedures.

(3) Unplug the compressor clutch coil wire harness connector.

(4) Insert the two pins of the spanner wrench (Special Tool 6462 in Kit 6460) into the holes of the clutch plate. Hold the clutch plate stationary and remove the hex nut (Fig. 20).

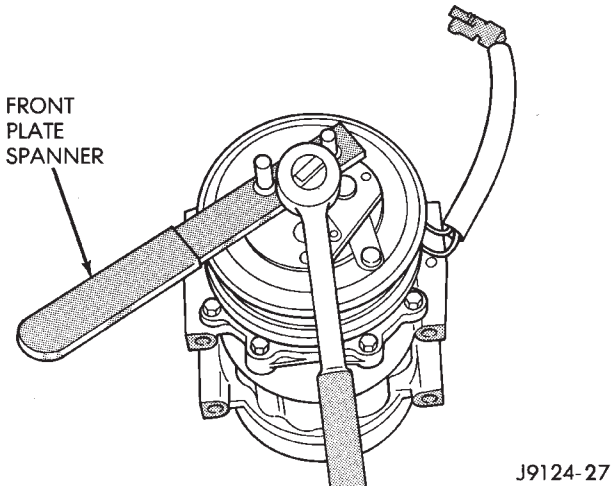


Fig. 20 Clutch Nut Remove

REMOVAL AND INSTALLATION (Continued)

(5) Remove the clutch plate and clutch shims. On models with the diesel engine option, a puller (Special Tool 6461 in Kit 6460) is used to remove the clutch plate (Fig. 21). This compressor also uses a shaft key, which must be removed.

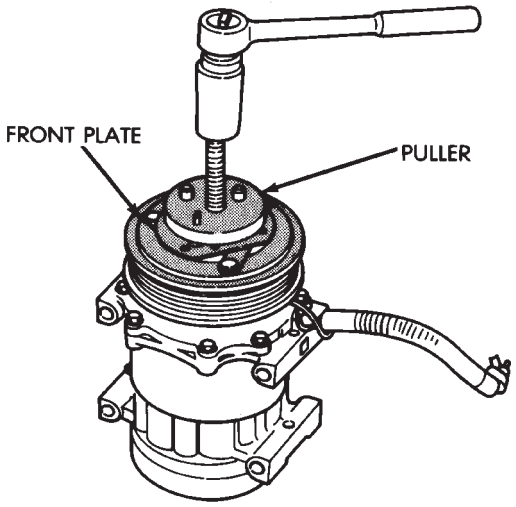


Fig. 21 Clutch Puller - Diesel Models

(6) Remove the external front housing snap ring with snap ring pliers (Fig. 22).

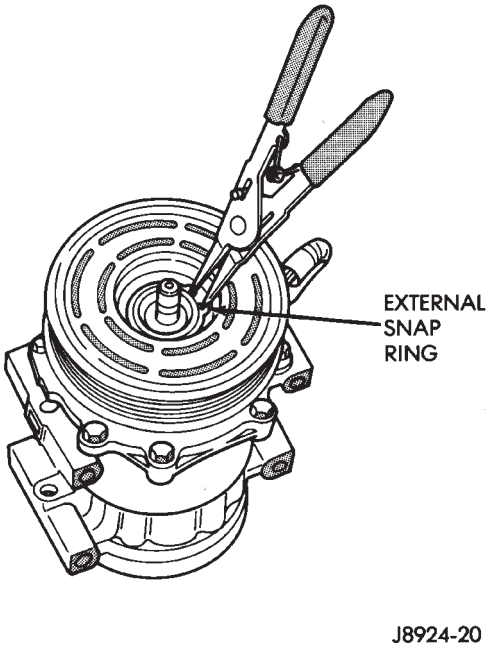


Fig. 22 External Snap Ring Remove

(7) Install the lip of the rotor puller (Special Tool C-6141-1 in Kit 6460) into the snap ring groove exposed in Step 6, and install the shaft protector (Special Tool C-6141-2 in Kit 6460) (Fig. 23).

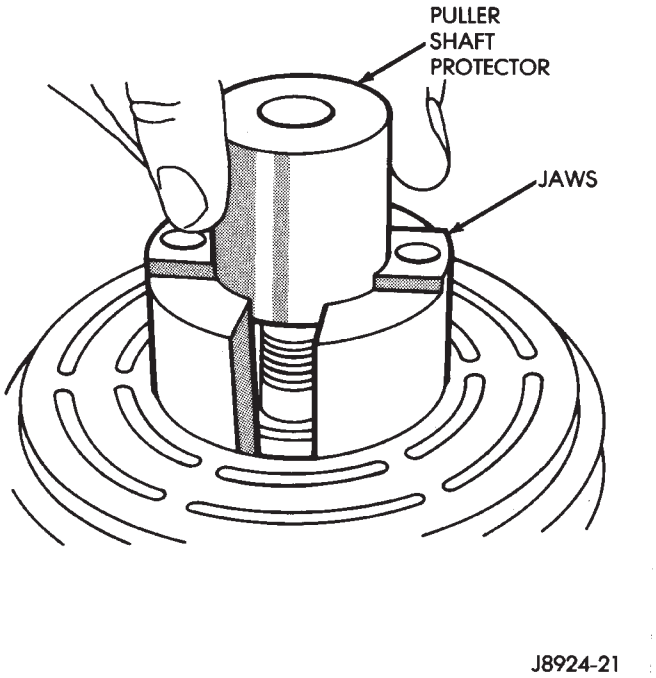


Fig. 23 Shaft Protector and Puller

(8) Install the puller through-bolts (Special Tool C-6461) through the puller flange and into the jaws of the rotor puller and tighten (Fig. 24). Turn the puller center bolt clockwise until the rotor pulley is free.

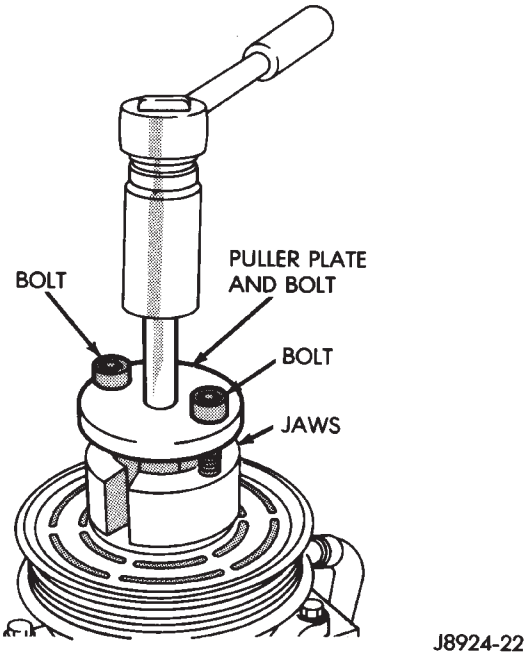


Fig. 24 Install Puller Plate

(9) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing (Fig. 25).

REMOVAL AND INSTALLATION (Continued)

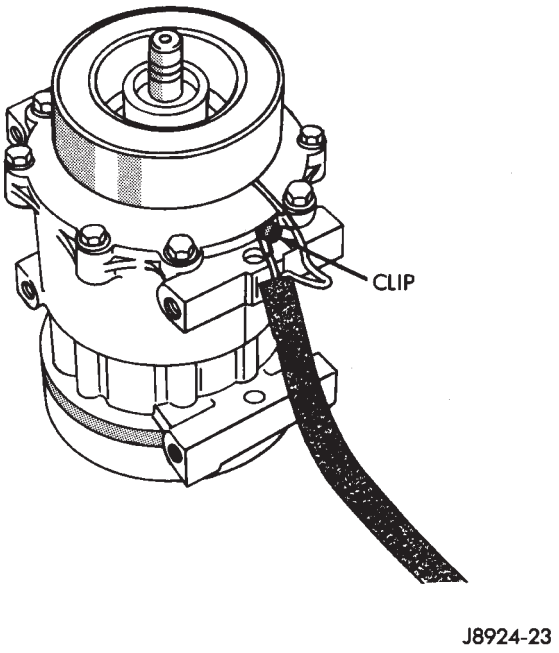


Fig. 25 Clutch Coil Lead Wire Harness

(10) Remove the snap ring from the compressor hub and remove the clutch field coil (Fig. 26). Slide the clutch field coil off of the compressor hub.

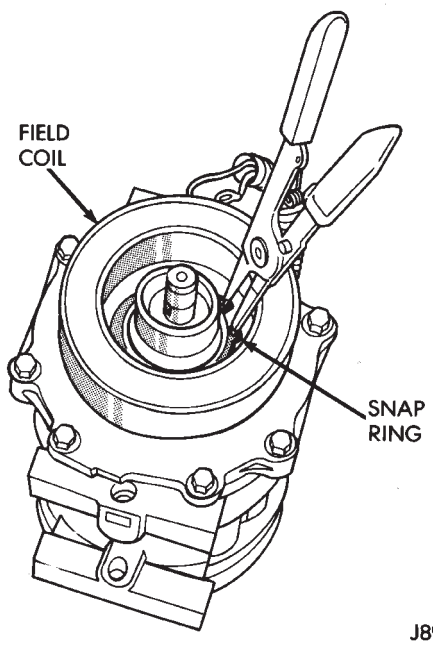


Fig. 26 Clutch Field Coil Snap Ring Remove

INSPECTION

Examine the friction surfaces of the clutch pulley and the front plate for wear. The pulley and front plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for oil. Remove the felt from the front cover. If the felt is saturated with oil, the shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

INSTALLATION

(1) Install the clutch field coil and snap ring.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Align the rotor assembly squarely on the front compressor housing hub.

(4) Thread the handle (Special Tool 6464 in Kit 6460) into the driver (Special Tool 6143 in Kit 6460) (Fig. 27).

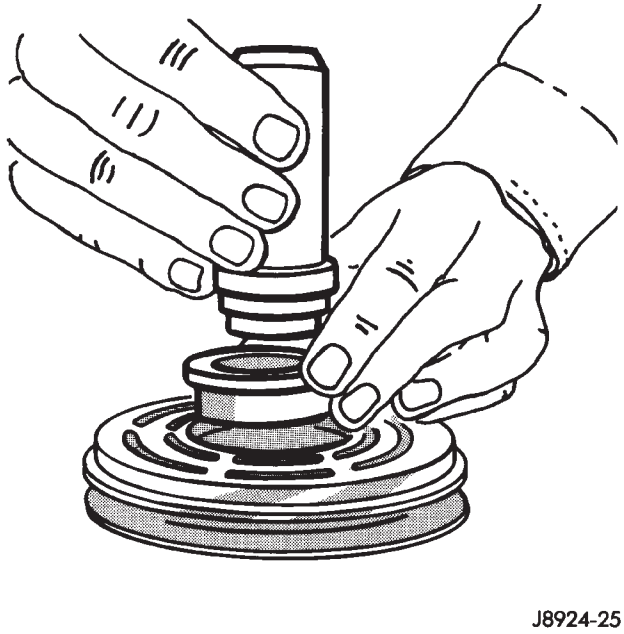


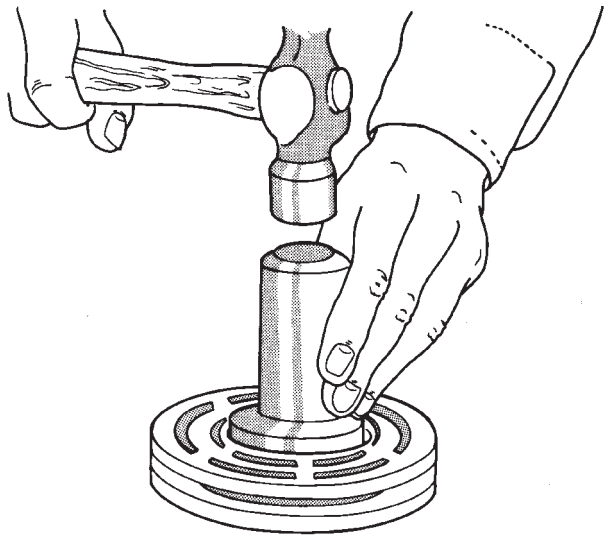
Fig. 27 Rotor Installer Set

(5) Place the driver tool assembly into the bearing cavity on the rotor. Make certain the outer edge of the tool rests firmly on the rotor bearing inner race (Fig. 28).

(6) Tap the end of the driver while guiding the rotor to prevent binding. Tap until the rotor bottoms against the compressor front housing hub. Listen for a distinct change of sound during the tapping process, to indicate the bottoming of the rotor.

(7) Install the external front rotor snap ring with snap ring pliers. The bevel side of the snap ring must be facing outward. Press the snap ring to make sure it is properly seated in the groove.

REMOVAL AND INSTALLATION (Continued)



J8924-26

Fig. 28 Rotor Install

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(8) Install the original clutch shims on the compressor shaft.

(9) Install the clutch plate. On models with the diesel engine option, install the shaft key. Use the shaft protector (Special Tool 6141-2 in Kit 6460) to install the clutch plate on the compressor shaft (Fig. 29). Tap the clutch plate over the compressor shaft until it has bottomed against the clutch shims. Listen for a distinct change of sound during the tapping process, to indicate the bottoming of the clutch plate.

(10) Replace the compressor shaft hex nut. Tighten the nut to 14.4 N·m (10.5 ft. lbs.).

(11) Check the clutch air gap with a feeler gauge (Fig. 30). If the air gap does not meet the specification, add or subtract shims as required. The air gap specification is 0.41 to 0.79 millimeter (0.016 to 0.031 inch). If the air gap is not consistent around the circumference of the clutch, lightly pry up at the minimum variations. Lightly tap down at the points of maximum variation.

NOTE: The air gap is determined by the spacer shims. When installing an original, or a new clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use 1.0, 0.50, and 0.13 millimeter (0.040, 0.020, and 0.005 inch) shims from the clutch hardware package that is provided with the new clutch.

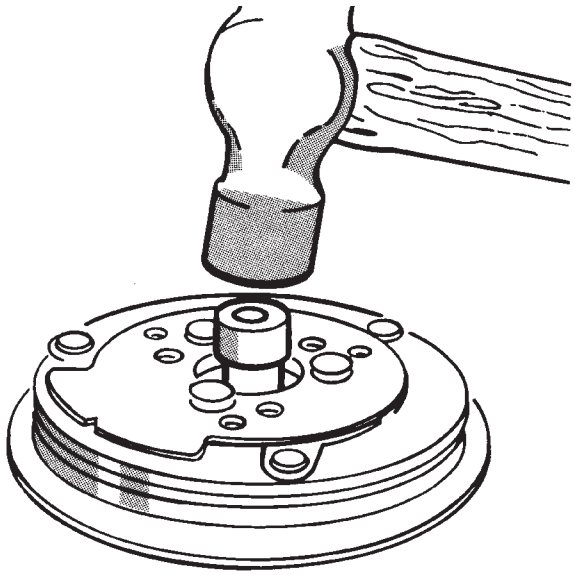


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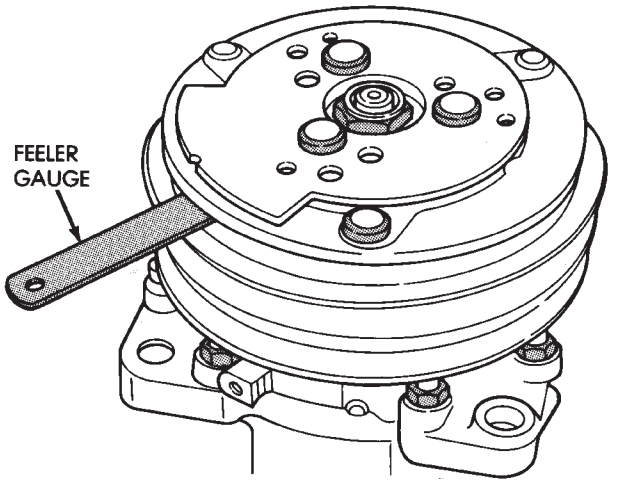
Fig. 29 Clutch Plate Install



J8924-28

Fig. 30 Check Clutch Air Gap

(12) Reverse the remaining removal procedures to complete the installation.

CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the heater-A/C control to the recirculation mode (Max-A/C), the blower motor switch in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

REMOVAL AND INSTALLATION (Continued)

COMPRESSOR CLUTCH RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 31).

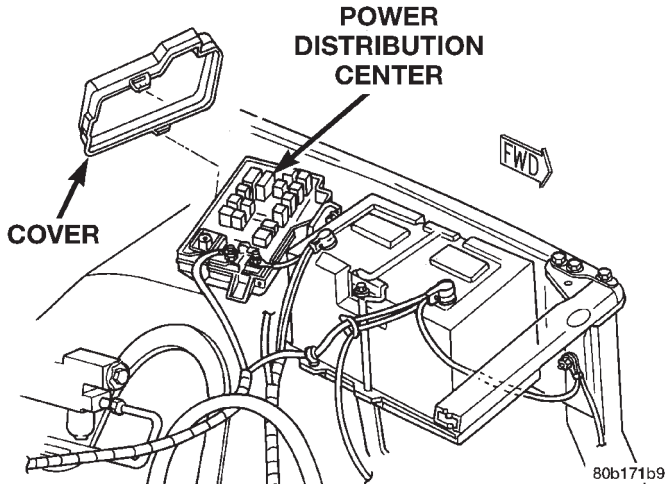


Fig. 31 Power Distribution Center

(3) Refer to the label on the PDC for compressor clutch relay identification and location.

(4) Unplug the compressor clutch relay from the PDC.

(5) Install the compressor clutch relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

LIQUID LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Disconnect the liquid line refrigerant line couplers at the condenser outlet and the evaporator inlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(4) Disengage any clips that secure the liquid line to the inner fender shield and the dash panel (Fig. 32).

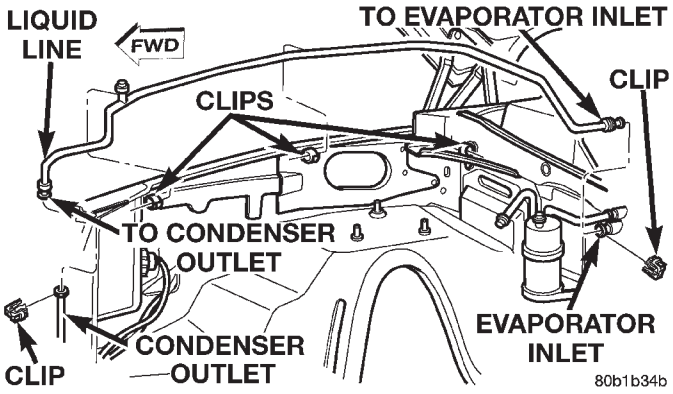


Fig. 32 Liquid Line Remove/Install

(5) Remove the liquid line from the vehicle.

INSTALLATION

(1) Install the liquid line into any clips on the inner fender shield and the dash panel.

(2) Remove the tape or plugs from the refrigerant line fittings on the liquid line, the condenser outlet, and the evaporator inlet. Connect the liquid line to the condenser and the evaporator. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(3) Connect the battery negative cable.

(4) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(5) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

FIXED ORIFICE TUBE

The fixed orifice tube is located in the liquid line, between the condenser and the evaporator coil. The orifice has filter screens on the inlet and outlet ends of the tube body. If the fixed orifice tube is faulty or plugged, the liquid line assembly must be replaced. See Liquid Line in the Removal and Installation section of this group for the service procedures.

LOW PRESSURE CYCLING CLUTCH SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

(2) Unplug the wire harness connector from the low pressure cycling clutch switch on the top of the accumulator (Fig. 33).

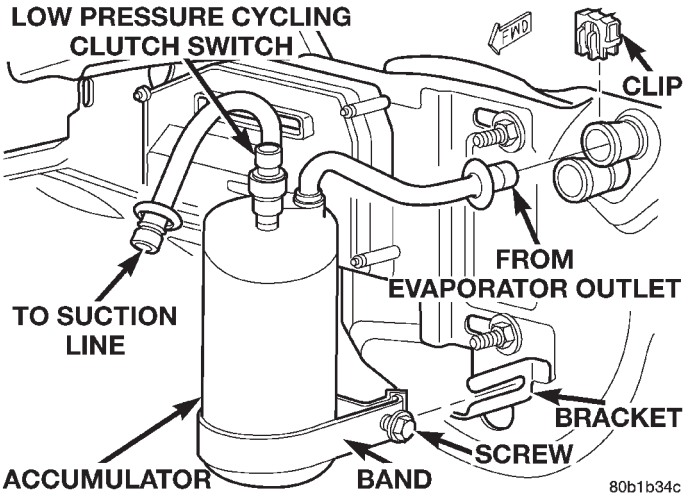


Fig. 33 Low Pressure Cycling Clutch Switch Remove/Install

(3) Unscrew the low pressure cycling clutch switch from the fitting on the top of the accumulator.

(4) Remove the O-ring seal from the accumulator fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the accumulator fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the low pressure cycling clutch switch on the accumulator fitting. The switch should be hand-tightened onto the accumulator fitting.

(3) Plug the wire harness connector into the low pressure cycling clutch switch.

(4) Connect the battery negative cable.

ACCUMULATOR

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Remove the low pressure cycling clutch switch from the accumulator. See Low Pressure Cycling Clutch Switch in the Removal and Installation section of this group for the procedures.

(4) Loosen the screw that secures the accumulator retaining band to the support bracket on the dash panel (Fig. 34).

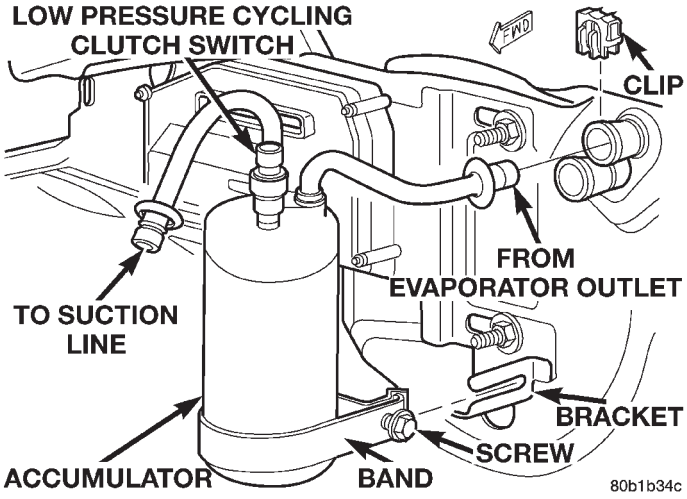


Fig. 34 Accumulator Remove/Install

(5) Disconnect the suction line refrigerant line fitting from the accumulator outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disconnect the accumulator inlet refrigerant line fitting from the evaporator outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(7) Pull the accumulator and retaining band unit forward until the screw in the band is clear of the slotted hole in the support bracket on the dash panel.

(8) Remove the accumulator from the engine compartment.

INSTALLATION

(1) Install the accumulator and retaining band as a unit by sliding the screw in the band into the slotted hole in the support bracket on the dash panel.

(2) Remove the tape or plugs from the refrigerant line fittings on the accumulator inlet and the evaporator outlet. Connect the accumulator inlet refrigerant line coupler to the evaporator outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(3) Tighten the accumulator retaining band screw to 4.5 N·m (40 in. lbs.).

(4) Remove the tape or plugs from the refrigerant line fittings on the suction line and the accumulator

REMOVAL AND INSTALLATION (Continued)

outlet. Connect the suction line refrigerant line coupler to the accumulator outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(5) Reinstall the low pressure cycling clutch switch on the accumulator. See Low Pressure Cycling Clutch Switch in the Removal and Installation section of this group for the procedures.

(6) Connect the battery negative cable.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(8) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

NOTE: If the accumulator is replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

CONDENSER

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

CAUTION: Before removing the condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Remove the nut that secures the block fitting to the stud on the condenser inlet and disconnect the discharge line from the condenser. Install plugs in, or tape over all of the opened refrigerant line fittings.

(4) Disconnect the refrigerant line fitting that secures the liquid line to the condenser outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) On gasoline engine models:

(a) Remove the two screws that secure the condenser upper mounting brackets to the outside of the upper radiator crossmember (Fig. 35).

(b) Tilt the condenser away from the engine compartment far enough to grasp the top of the condenser with both hands.

(c) Lift the condenser far enough to remove the two lower condenser locators from the isolators in the holes of the lower crossmember.

(d) Remove the condenser from the vehicle.

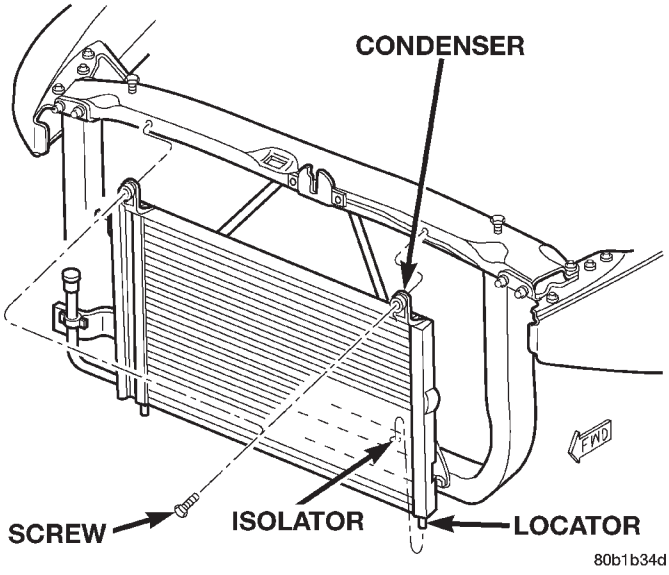


Fig. 35 Condenser Remove/Install - Gasoline Engine

(6) On diesel engine models:

(a) Remove the two screws that secure the brackets on the passenger side end of the condenser to the charge air cooler (Fig. 36).

(b) Remove the two nuts that secure the driver side end of the condenser to the studs on the charge air cooler.

(c) Remove the condenser from the vehicle.

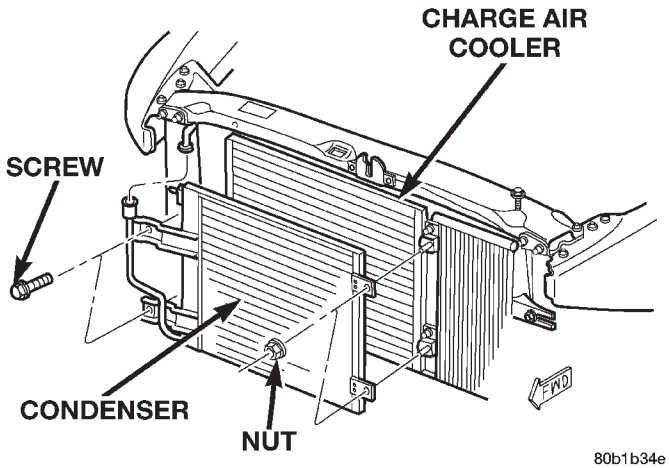


Fig. 36 Condenser Remove/Install - Diesel Engine

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) On gasoline engine models:

(a) Insert the two lower condenser locators into the isolators in the holes of the lower crossmember.

(b) Tilt the condenser up towards the engine compartment far enough to align the upper mounting bracket holes with the holes in the upper radiator crossmember.

(c) Install the two screws that secure the condenser upper mounting brackets to the outside of the upper radiator crossmember. Tighten the mounting screws to 10.5 N·m (95 in. lbs.).

(2) On diesel engine models:

(a) Install the driver side condenser mounting brackets over the two studs on the charge air cooler.

(b) Install the two screws that secure the brackets on the passenger side end of the condenser to the charge air cooler. Tighten the mounting screws to 10.5 N·m (95 in. lbs.).

(c) Install the two nuts that secure the driver side end of the condenser to the studs on the charge air cooler. Tighten the mounting nuts to 10.5 N·m (95 in. lbs.).

(3) Remove the plugs or tape from the refrigerant line fittings on the liquid line and the condenser outlet. Connect the liquid line to the condenser outlet. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(4) Install a new gasket and the discharge line block fitting over the stud on the condenser inlet. Tighten the mounting nut to 20 N·m (180 in. lbs.).

(5) Check that all of the condenser and radiator air seals are in their proper locations.

(6) Connect the battery negative cable.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(8) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

NOTE: If the condenser is replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

VACUUM CHECK VALVE

(1) On models with a gasoline engine, unplug the vacuum supply line connector at the vacuum check valve (Fig. 37). On models with a diesel engine, remove the clamp from the vacuum supply line connector and unplug the connector from the vacuum check valve (Fig. 38).

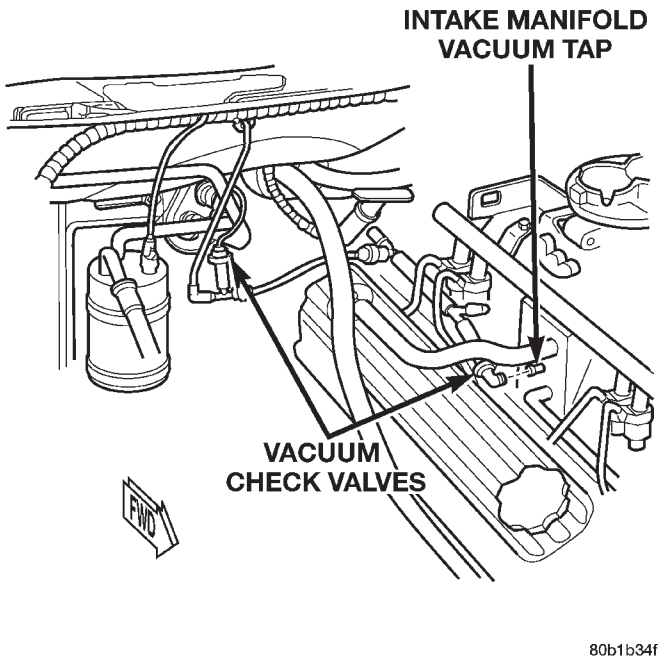


Fig. 37 Vacuum Check Valves - Gasoline Engine

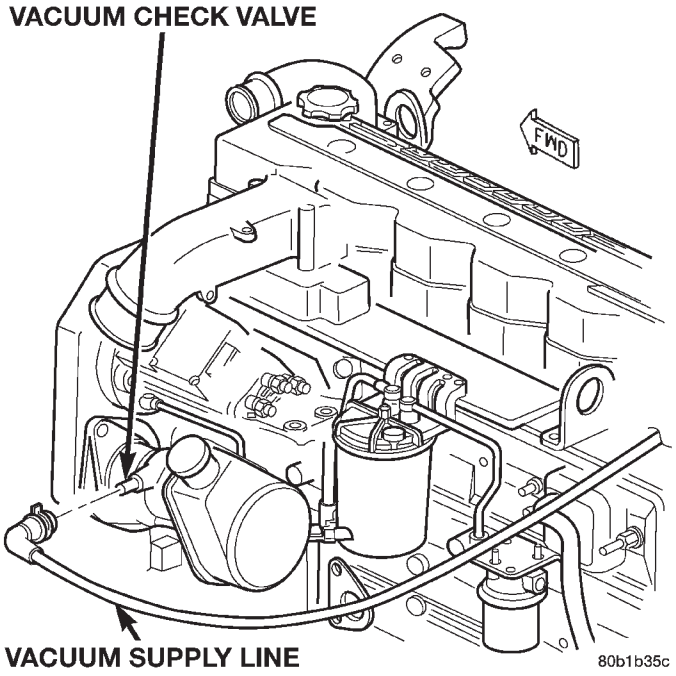


Fig. 38 Vacuum Check Valve - Diesel Engine

(2) On models with a gasoline engine, note the orientation of the check valve in the vacuum supply line for correct reinstallation.

(3) On models with a gasoline engine, unplug the vacuum check valve from the vacuum supply line fitting. On models with a diesel engine, unscrew the check valve and nipple unit from the engine vacuum pump.

REMOVAL AND INSTALLATION (Continued)

(4) Reverse the removal procedures to install. On models with a diesel engine, tighten the check valve and nipple unit to 24 N·m (18 ft. lbs.).

VACUUM RESERVOIR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. Refer to Wiper Arm in the Removal and Installation section of Group 8K - Wiper and Washer Systems for the procedures.

(3) Remove the weatherstrip along the front edge of the cowl plenum cover/grille panel and the cowl plenum panel (Fig. 39).

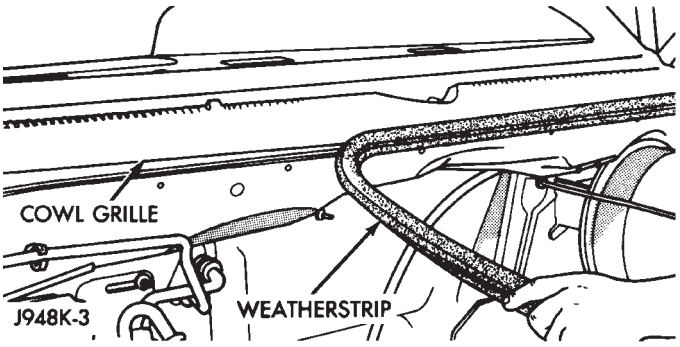


Fig. 39 Cowl Plenum Cover/Grille Panel Weatherstrip

(4) Remove the plastic screws that secure the cowl plenum cover/grille panel to the studs on the cowl top panel near the base of the windshield (Fig. 40).

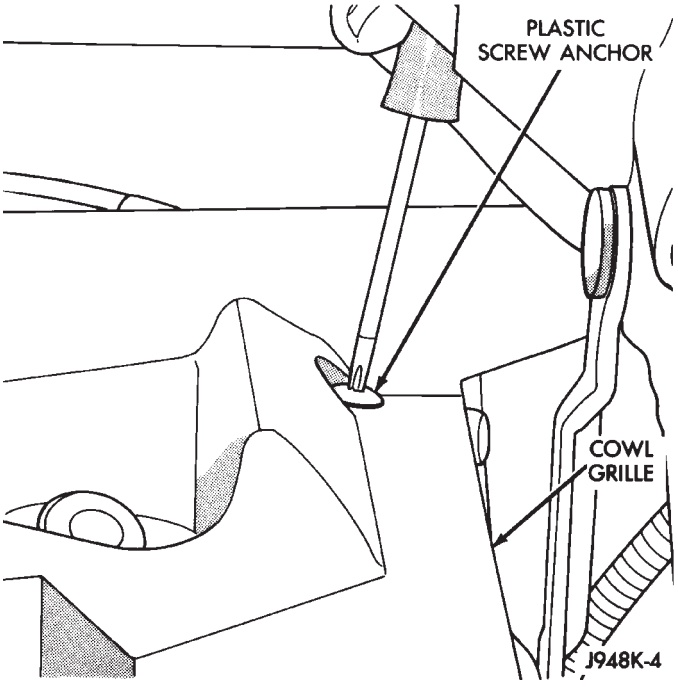


Fig. 40 Cowl Plenum Plastic Screws Remove/Install

(5) Lift the cowl plenum cover/grille panel from the cowl top far enough to access the vacuum reservoir near the right end of the cowl plenum.

(6) Disconnect the vacuum supply hose from the vacuum reservoir, which is secured to the dash panel near the right end of the cowl plenum (Fig. 41).

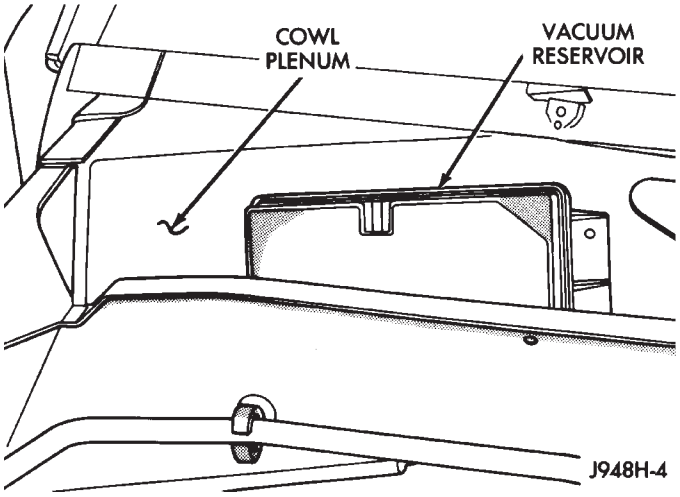


Fig. 41 Vacuum Reservoir

(7) Remove the two nuts that secure the reservoir to the studs on the dash panel near the right end of the cowl plenum.

(8) Remove the vacuum reservoir from the dash panel studs.

(9) Reverse the removal procedures to install. Tighten the mounting nuts to 2.8 N·m (25 in. lbs.).

HEATER-A/C CONTROL

WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRE-CAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Reach under the instrument panel near the driver side of the floor panel transmission tunnel and unplug the heater-A/C control to heater-A/C housing vacuum harness connector.

(3) While still reaching under the instrument panel, disengage the retainer on the heater-A/C control half of the vacuum harness from the hole in the center distribution duct (Fig. 42).

REMOVAL AND INSTALLATION (Continued)

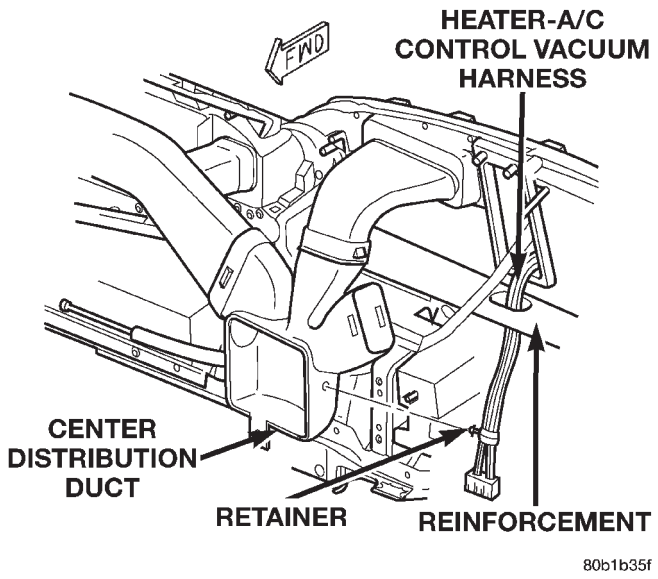


Fig. 42 Heater-A/C Control Vacuum Harness Routing

(4) Remove the cluster bezel from the instrument panel. Refer to Cluster Bezel in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Remove the four screws that secure the heater-A/C control to the instrument panel (Fig. 43).

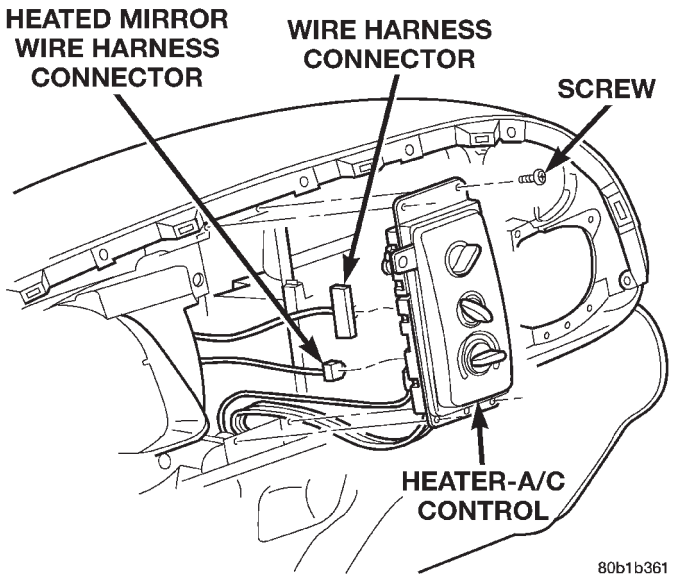


Fig. 43 Heater-A/C Control Remove/Install

(6) Pull the heater-A/C control assembly away from the instrument panel far enough to access the connections on the back of the control.

(7) Unplug the wire harness connector from the back of the heater-A/C control.

(8) On vehicles with heated mirrors, unplug the heated mirror wire harness connector from the back of the heater-A/C control.

(9) Release the temperature control cable housing flag retainer latch in the receptacle on the back of the heater-A/C control and disengage the flag retainer from the receptacle (Fig. 44).

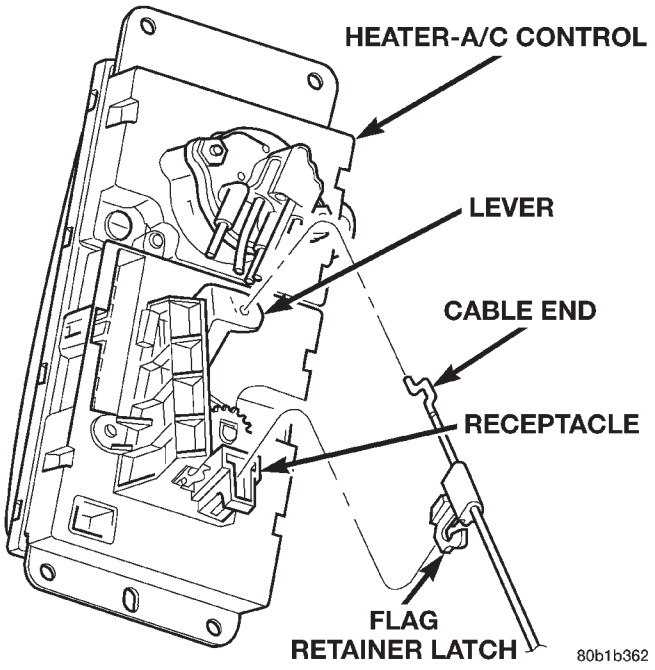


Fig. 44 Heater-A/C Control Temperature Control Cable Remove/Install

(10) Rotate the heater-A/C control assembly as needed to disengage the cable end from the hole on the end of the temperature control lever.

(11) Remove the heater-A/C control from the instrument panel.

INSTALLATION

(1) Connect the temperature control cable core end to the temperature control lever on the back of the heater-A/C control.

(2) Connect the temperature control cable housing flag retainer to the receptacle on the back of the heater-A/C control.

(3) Plug the wire harness connector(s) into the receptacle(s) on the back of the heater-A/C control.

(4) Route the heater-A/C vacuum harness through the hole in the reinforcement below the heater-A/C control opening of the instrument panel.

(5) Position the heater-A/C control in the instrument panel and secure it with four screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Reinstall the cluster bezel to the instrument panel. Refer to Cluster Bezel in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(7) Reach under the instrument panel to reinstall the heater-A/C control vacuum harness retainer to the side of the center distribution duct.

REMOVAL AND INSTALLATION (Continued)

(8) Plug in the two halves of the heater-A/C control to heater-A/C housing vacuum harness connector.

(9) Connect the battery negative cable.

(10) Adjust the temperature control cable. See Temperature Control Cable in the Adjustments section of this group for the procedures.

HEATER-A/C CONTROL KNOB

Each of the three heater-only or heater-A/C control knobs can be removed for service replacement.

(1) Rotate the control knob to its full clockwise position.

(2) Grasp the knob firmly and pull it straight out from the control.

(3) Reverse the removal procedures to install.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the blower motor cooling tube from the nipple on the blower motor housing (Fig. 45).

(3) Disengage the blower motor wire harness from the wire harness retainer.

(4) Unplug the blower motor wire harness connector from the heater-A/C housing wire harness.

(5) Remove the three screws that secure the blower motor and blower wheel assembly to the heater-A/C housing.

(6) Lower the blower motor and wheel from the heater-A/C housing.

(7) Remove the blower wheel retainer clip and remove the wheel from the blower motor shaft (Fig. 46).

INSTALLATION

(1) Press the blower wheel hub onto the blower motor shaft. Be sure the flat on the blower motor shaft is indexed to the flat on the inside of the blower wheel hub.

(2) Install the retainer clip over the blower wheel hub. The ears of the retainer clip must be indexed over the flats on the blower motor shaft and blower wheel hub.

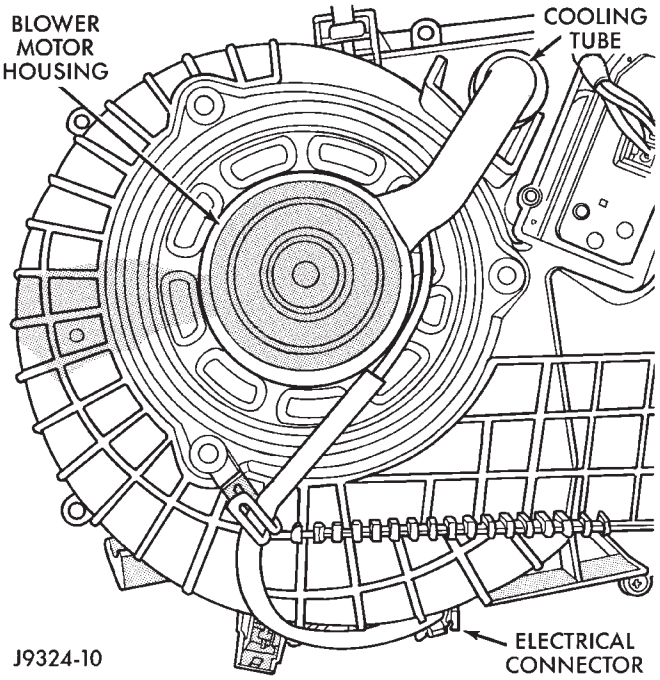


Fig. 45 Blower Motor Remove/Install

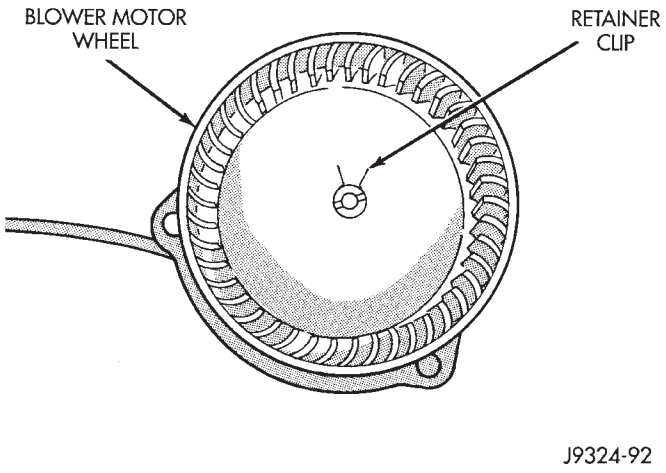


Fig. 46 Blower Motor Wheel Remove/Install

(3) Be certain that the blower motor seal is installed on the blower motor housing (Fig. 47).

(4) Install the blower motor in the heater-A/C housing with three mounting screws. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(5) Plug the blower motor wire harness connector into the heater-A/C housing wire harness.

(6) Install the blower motor wire harness into the wire harness retainer.

(7) Connect the blower motor cooling tube to the nipple on the blower motor housing.

(8) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

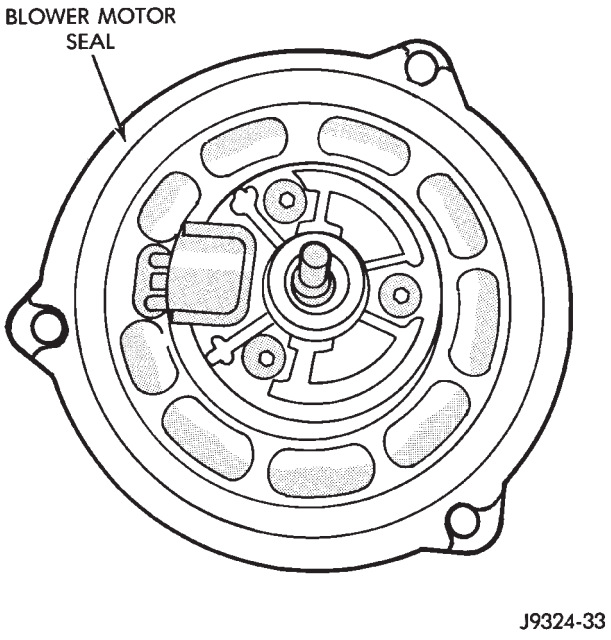


Fig. 47 Blower Motor Seal

BLOWER MOTOR RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 48).

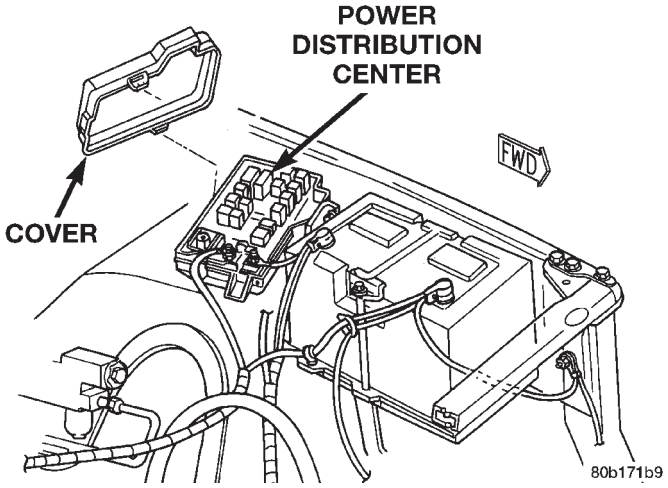


Fig. 48 Power Distribution Center

(3) Refer to the label on the PDC for blower motor relay identification and location.

(4) Unplug the blower motor relay from the PDC.

(5) Install the blower motor relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

BLOWER MOTOR RESISTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Reach under the passenger side end of the heater-A/C housing and unplug the wire harness connector from the blower motor resistor.

(3) Remove the screws that secure the blower motor resistor to the heater-A/C housing.

(4) Remove the blower motor resistor from the heater-A/C housing (Fig. 49).

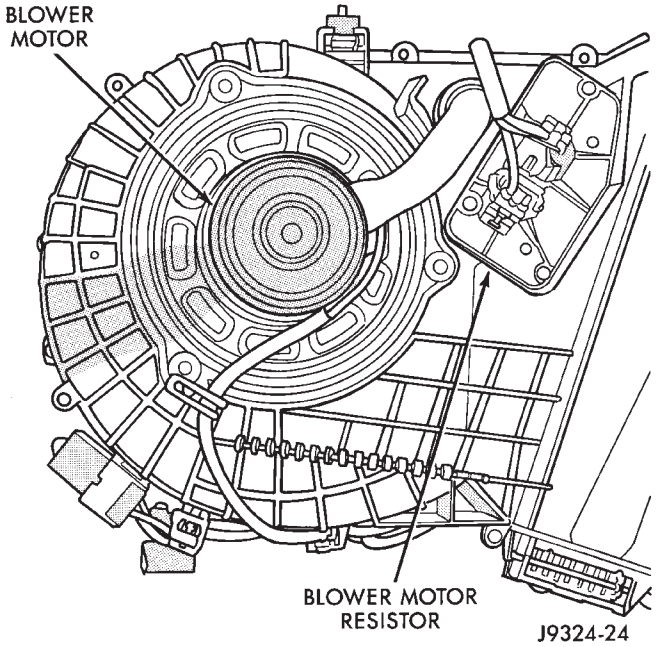


Fig. 49 Blower Motor Resistor - Typical

INSTALLATION

(1) Install the blower motor resistor into the heater-A/C housing and secure it with the mounting screws. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug the wire harness connector into the blower motor resistor.

(3) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

TEMPERATURE CONTROL CABLE

The temperature control cable self-adjuster clip can be accessed and repositioned on the cable core without removal of the temperature control cable from the heater-A/C housing by reaching through the glove box opening as described in the Removal procedures that follow. Reposition the self-adjuster clip as shown in (Fig. 51), then see Temperature Control Cable in the Adjustments section of this group for the procedures to complete the cable adjustment.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel. Refer to Glove Box in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Disconnect the temperature control cable from the heater-A/C control. See Heater-A/C Control in the Removal and Installation section of this group for the procedures.

(4) Reach through the instrument panel glove box opening to disconnect the temperature control cable housing flag retainer from the receptacle on the top of the heater-A/C housing (Fig. 50).

(5) Pull the temperature control cable core self-adjuster clip off of the pin on the end of the blend-air door lever.

(6) Remove the temperature control cable from the vehicle.

INSTALLATION

Before installing the temperature control cable, be certain that the self-adjuster clip is properly positioned (Fig. 51). This measurement is made between the self-adjuster clip and the cable end on the heater-A/C housing end of the cable. If the self-adjuster clip is not properly positioned, slide the clip up or down the cable core as required to achieve the specified dimension.

(1) Push the temperature control cable core self-adjuster clip onto the pin on the end of the blend-air door lever.

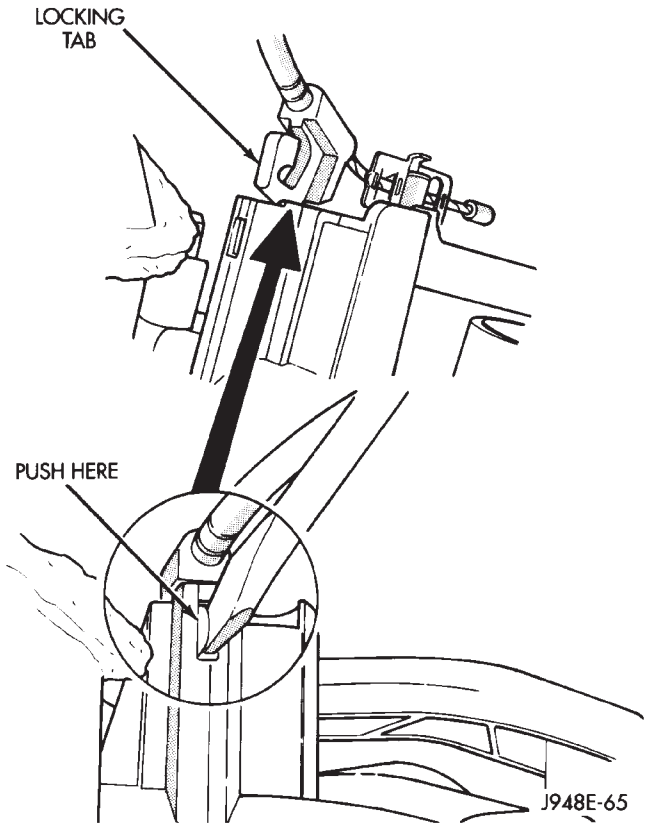


Fig. 50 Temperature Control Cable Remove/Install

(2) Snap the temperature control cable housing flag retainer into the receiver on the top of the heater-A/C housing.

(3) Reinstall the glove box in the instrument panel. Refer to Glove Box in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Connect the temperature control cable to the heater-A/C control. See Heater-A/C Control in the Removal and Installation section of this group for the procedures.

(5) Connect the battery negative cable.

(6) Adjust the temperature control cable. See Temperature Control Cable in the Adjustments section of this group for the procedures.

HEATER-A/C HOUSING

The heater-A/C housing assembly must be removed from the vehicle and disassembled for service access of the heater core, evaporator coil, and each of the various mode control doors.

REMOVAL AND INSTALLATION (Continued)

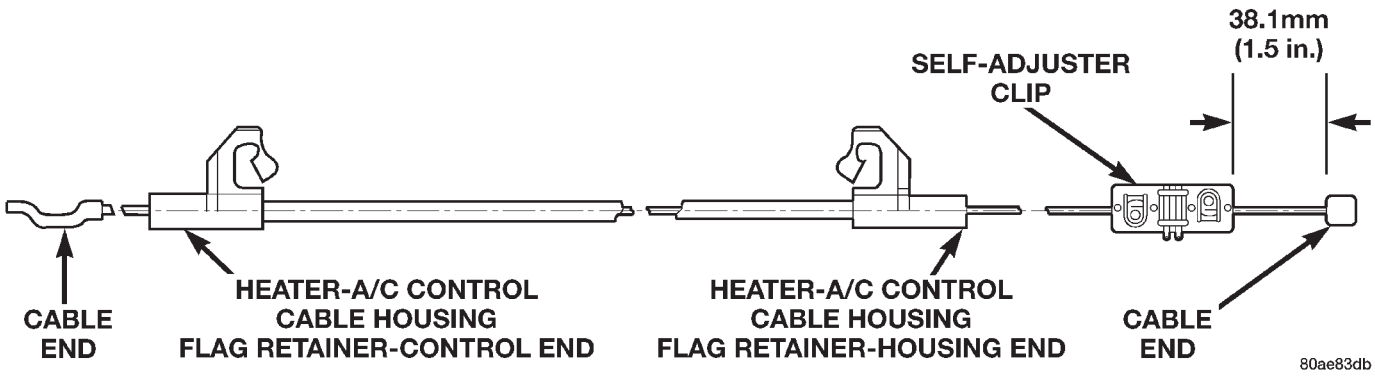


Fig. 51 Temperature Control Cable Self-Adjuster Clip

WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRE-CAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) If the vehicle is not equipped with air conditioning, go to Step 6. If the vehicle is equipped with air conditioning, recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(4) Disconnect the liquid line refrigerant line fitting from the evaporator inlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Disconnect the accumulator inlet tube refrigerant line fitting from the evaporator outlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Drain the engine cooling system. Refer to Group 7 - Cooling System for the procedures.

(7) Disconnect the heater hoses from the heater core tubes. Refer to Group 7 - Cooling System for the procedures. Install plugs in, or tape over the opened heater core tubes.

(8) Remove the Powertrain Control Module (PCM) from the dash panel and set it aside, but do not unplug the PCM wire harness connectors. Refer to Group 14 - Fuel Systems for the procedures.

(9) Remove the nuts from the heater-A/C housing mounting studs on the engine compartment side of the dash panel.

(10) Remove the nuts that secure the heater-A/C housing to the mounting studs on the passenger compartment side of the dash panel (Fig. 52).

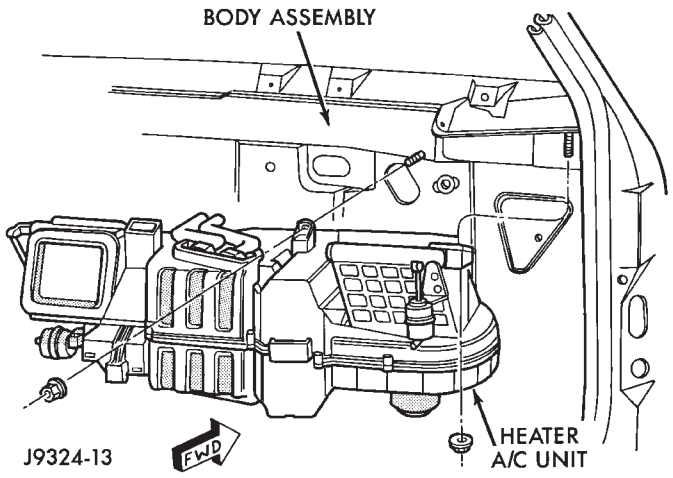


Fig. 52 Heater-A/C Housing Remove/Install

(11) Pull the heater-A/C housing rearward far enough for the mounting studs and the evaporator condensate drain tube to clear the dash panel holes.

(12) Remove the heater-A/C housing from the vehicle.

DISASSEMBLY

(1) Place the heater-A/C housing upside down on a work bench.

(2) Remove the screw that secures the floor duct to the bottom of the heater-A/C housing and slide the floor duct off of the center heat duct adaptor.

(3) Unsnap the center heat duct adaptor from the bottom of the heater-A/C housing and remove the screw that was hidden by the adaptor.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the remaining screws on the bottom of the heater-A/C housing that secure the two housing halves together.

(5) Place the heater-A/C housing right side up on the work bench.

(6) Separate the top half of the heater-A/C housing from the bottom half and set it aside.

ASSEMBLY

(1) Position the top half of the heater-A/C housing over the bottom half. Be certain that the mode door pivot pins are properly inserted in their pivot holes.

(2) Place the heater-A/C housing upside down on the work bench.

(3) Install and tighten the screws on the bottom of the heater-A/C housing that secure the two housing halves together. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Snap the center heat duct adaptor onto the bottom of the heater-A/C housing.

(5) Slide the floor duct onto the center heat duct adaptor and secure it with a screw to the bottom of the heater-A/C housing. Tighten the mounting screw to 2.2 N·m (20 in. lbs.).

(6) Reinstall the heater-A/C housing in the vehicle.

INSTALLATION

(1) Position the heater-A/C housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes.

(2) Install the nuts that secure the heater-A/C housing to the mounting studs on the passenger compartment side of the dash panel. Tighten the nuts to 4.5 N·m (40 in. lbs.).

(3) Install and tighten the nuts onto the heater-A/C housing mounting studs on the engine compartment side of the dash panel. Tighten the nuts to 7 N·m (60 in. lbs.).

(4) Unplug or remove the tape from the heater core tubes. Connect the heater hoses to the heater core tubes and fill the engine cooling system. Refer to Group 7 - Cooling System for the procedures.

(5) If the vehicle is not equipped with air conditioning, go to Step 10. If the vehicle is equipped with air conditioning, unplug or remove the tape from the accumulator inlet tube and the evaporator outlet tube fittings. Connect the accumulator inlet tube coupler to the evaporator outlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(6) Unplug or remove the tape from the liquid line and the evaporator inlet tube fittings. Connect the liquid line coupler to the evaporator inlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(8) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

(9) Reinstall the PCM to the dash panel. Refer to Group 14 - Fuel Systems for the procedures.

(10) Reinstall the instrument panel in the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(11) Connect the battery negative cable.

(12) Start the engine and check for proper operation of the heating and air conditioning systems.

MODE DOOR VACUUM ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

HEAT-DEFROST DOOR ACTUATOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the heater-A/C housing from the vehicle and place it on a work bench. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(3) Unplug the two vacuum harness connectors from the heat-defrost door actuator (Fig. 53).

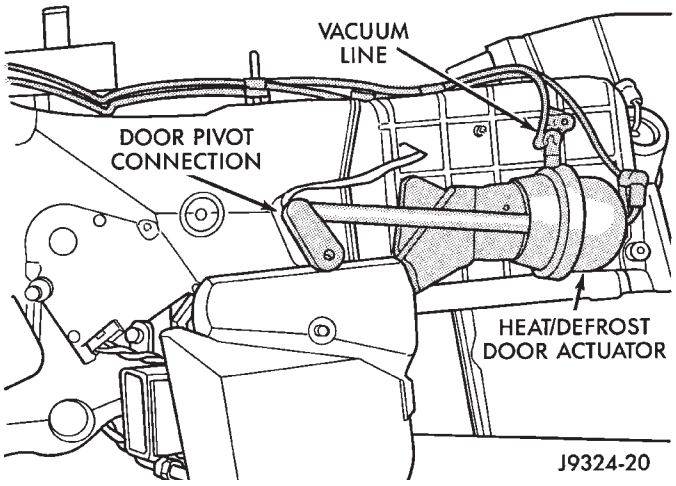


Fig. 53 Heat-Defrost Door Actuator

REMOVAL AND INSTALLATION (Continued)

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the heat-defrost door crank arm off of the heat-defrost door pivot.

(5) Remove the two screws that secure the heat-defrost door actuator to the heater-A/C housing.

(6) Remove the heat-defrost door actuator from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the heat-defrost door actuator mounting screws to 2.2 N·m (20 in. lbs.).

PANEL-DEFROST DOOR ACTUATOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel assembly from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Unplug the vacuum harness connector from the panel-defrost door actuator (Fig. 54).

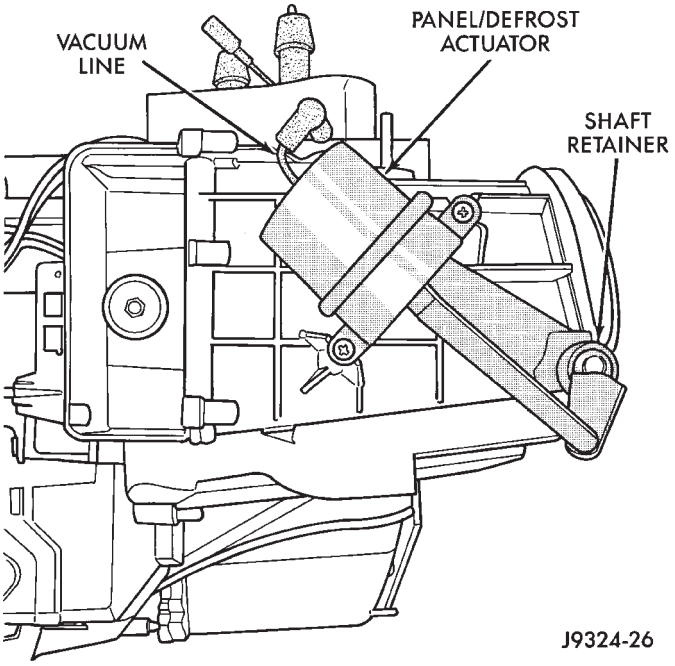


Fig. 54 Panel-Defrost Door Actuator

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel-defrost door crank arm off of the panel-defrost door pivot.

(5) Remove the two screws that secure the panel-defrost door actuator to the heater-A/C housing.

(6) Remove the panel-defrost door actuator from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the panel-defrost door actuator mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR ACTUATOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel. Refer to Glove Box in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Reach through the glove box opening to access and unplug the vacuum harness connector from the recirculation air door actuator (Fig. 55).

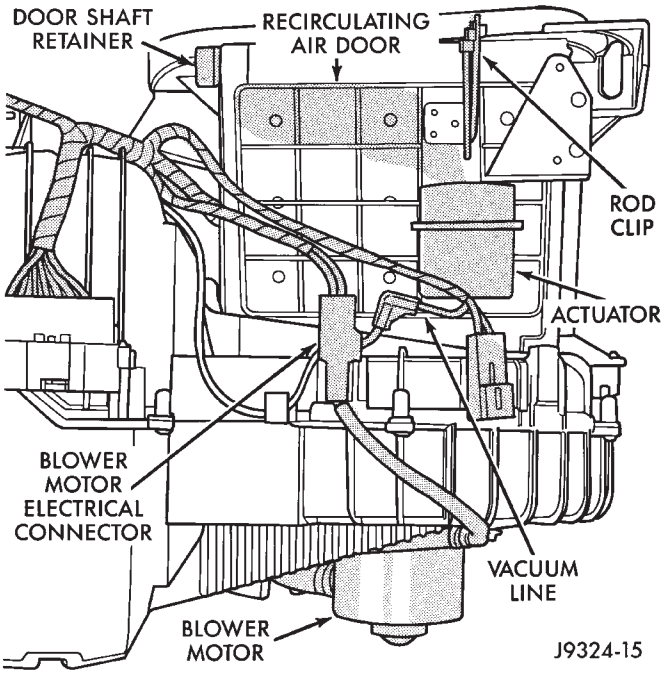


Fig. 55 Recirculation Air Door Actuator

(4) Loosen the two nuts on the studs that secure the recirculation air door actuator to the mounting bracket on the heater-A/C housing.

(5) Slide the two actuator mounting studs out of the slots in the actuator mounting bracket.

(6) Pull the recirculation actuator downward far enough to access the clip that retains the actuator link to the recirculation air door lever.

(7) Unsnap the clip from the recirculation actuator link and disengage the link from the recirculation air door lever.

(8) Remove the recirculation actuator from the heater-A/C housing.

(9) When reinstalling the recirculation actuator, insert a screwdriver or another suitable tool through the recirculation air intake grille to prop the recirculation air door up in the open position far enough to access the recirculation air door lever through the instrument panel glove box opening.

(10) Reverse the remaining removal procedures to install. Tighten the mounting nuts until the recirculation air door actuator is seated to the mounting bracket on the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

HEATER-A/C HOUSING DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRE-CAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

BLEND-AIR DOOR

(1) Remove the heater-A/C housing from the vehicle, and disassemble the housing halves. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the blend-air door pivot shaft out of the pivot hole in the bottom of the heater-A/C housing (Fig. 56).

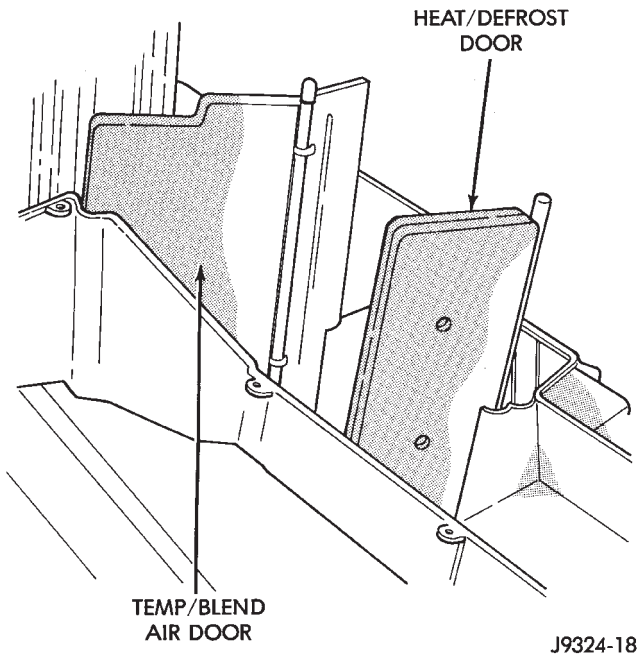


Fig. 56 Blend-Air Door

(3) Reverse the removal procedures to install.

HEAT-DEFROST DOOR

(1) Remove the heat-defrost door actuator from the heater-A/C housing. See Mode Door Vacuum Actuator in the Removal and Installation section of this group for the procedures.

(2) Disassemble the heater-A/C housing halves. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(3) Remove the heat-defrost door from the heater-A/C housing.

(4) Reverse the removal procedures to install.

PANEL-DEFROST DOOR

(1) Remove the panel-defrost door actuator from the heater-A/C housing. See Mode Door Vacuum Actuator in the Removal and Installation section of this group for the procedures.

(2) Remove the defroster and demister duct adapter from the heater-A/C housing. See Ducts and Outlets in the Removal and Installation section of this group for the procedures.

(3) Lift the panel-defrost door out of the top opening of the heater-A/C housing.

(4) Reverse the removal procedures to install.

RECIRCULATION AIR DOOR

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Unsnap the recirculation air door vacuum actuator link clip and disengage the link from the recirculation air door lever. See Mode Door Vacuum Actuators in the Removal and Installation section of this group for the procedures.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the retainer off of the recirculation air door pivot shaft.

(4) Remove the recirculation air door through the outside air intake opening on the top of the heater-A/C housing.

(5) Reverse the removal procedures to install.

EVAPORATOR COIL

WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRE-CAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle, and disassemble the housing halves. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the evaporator coil out of the heater-A/C housing (Fig. 57).

INSTALLATION

(1) Insert the evaporator coil into the bottom of the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

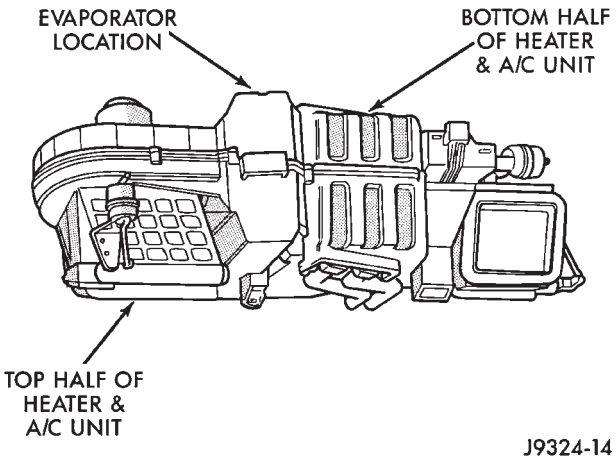


Fig. 57 Evaporator Coil Location in Heater-A/C Housing (Upside Down)

(2) Reassemble and reinstall the heater-A/C housing in the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

NOTE: If the evaporator is replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.

HEATER CORE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Remove the screws and retainers that secure the heater core to the heater-A/C housing.

(3) Lift the heater core straight up and out of the heater-A/C housing (Fig. 58).

INSTALLATION

(1) Lower the heater core into the heater-A/C housing.

(2) Position the retainers over the heater core tubes. Install and tighten the screws that secure the heater core and retainers to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

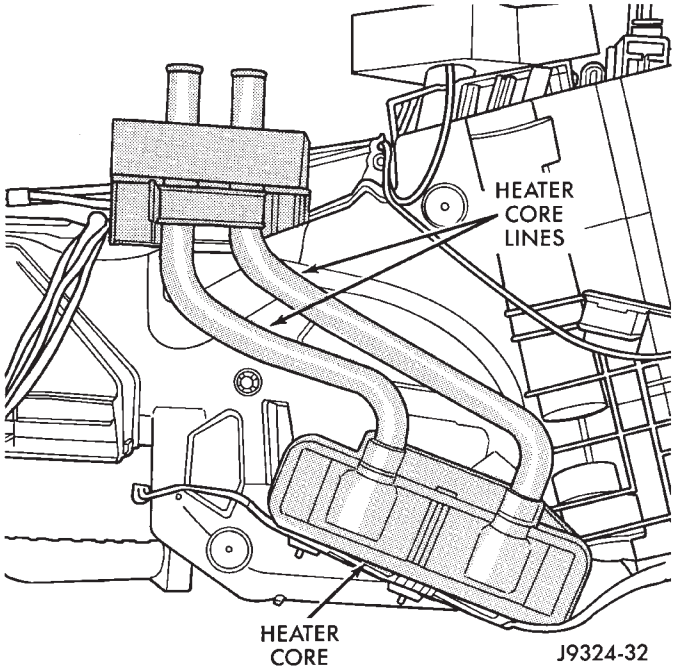


Fig. 58 Heater Core Remove/Install

(3) Reinstall the heater-A/C housing in the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

DUCTS AND OUTLETS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

PANEL AND CENTER DISTRIBUTION DUCTS

The panel and center distribution ducts (Fig. 59) are only serviced as part of the instrument panel assembly. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.
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REMOVAL AND INSTALLATION (Continued)

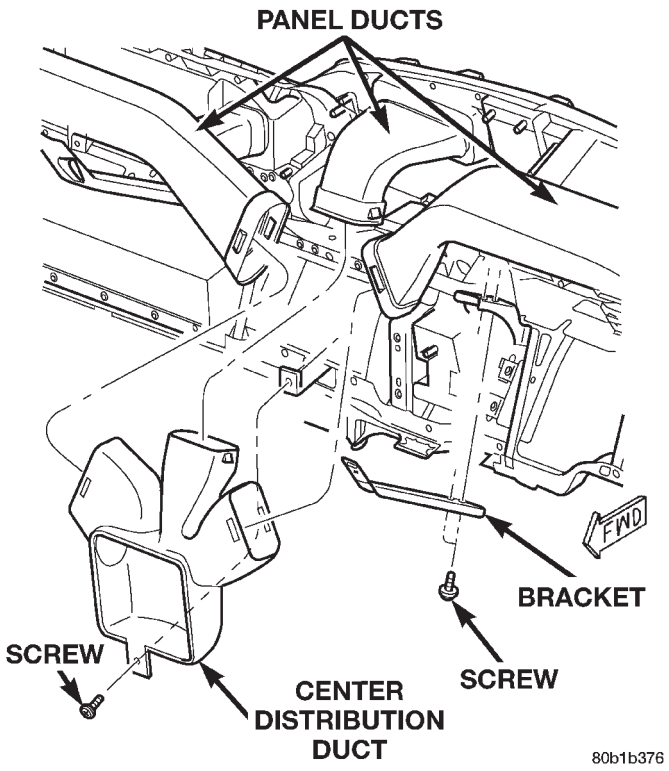

Fig. 59 Panel and Center Distribution Ducts

PANEL OUTLET BARRELS

WARNING: THE PANEL OUTLET BARRELS INSTALLED IN THE PASSENGER SIDE AIRBAG DOOR PANEL OUTLET HOUSINGS MUST NEVER BE REINSTALLED FOLLOWING REMOVAL FOR ANY REASON. THEY MUST BE REPLACED WITH NEW BARRELS. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry near the center of either side of the panel outlet barrel to release the snap-fit pivots on the barrel from the pivot pins in the outlet housing of the passenger side airbag module or the instrument cluster bezel (Fig. 60).

(2) Remove the barrel from the panel outlet housing.

(3) To install a new panel outlet barrel, position the barrel in the outlet housing and press inwards firmly and evenly near the center of both sides of the panel outlet barrel until the pivots snap into place.

DEMISTER OUTLET GRILLES

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry at the perimeter edges of the demister grille to release the snap features from the instrument panel top cover.

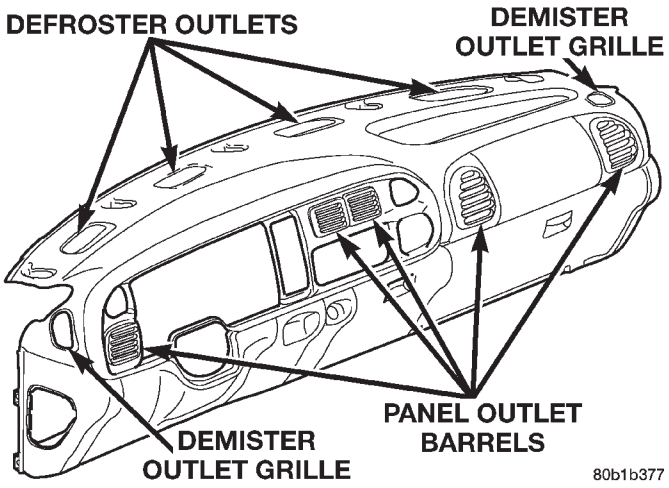

Fig. 60 Panel Outlet Barrels

(2) Remove the demister grille from the instrument panel.

(3) To install the demister grille, position the grille in the opening of the instrument panel top cover and press inwards firmly and evenly near the center of both sides of the grille until it snaps into place.

DEFROSTER AND DEMISTER DUCTS

The defroster duct and the main demister duct are a single molded plastic unit. The defroster outlet grilles are heat-staked to the defroster outlets and cannot be serviced separately. The demister tubes on each end of the main demister duct are only serviced in the instrument panel assembly.

(1) Remove the instrument panel top cover from the instrument panel. Refer to Instrument Panel Top Cover in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the screws that secure the defroster and demister ducts to the instrument panel brackets (Fig. 61).

(3) Disengage the demister tubes from each end of the main demister duct.

(4) Remove the defroster and demister duct unit from the instrument panel.

(5) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

DEFROSTER AND DEMISTER DUCT ADAPTER

(1) Roll the instrument panel assembly down, but do not remove it from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry at the perimeter edges of the defroster and demister duct adapter to release

REMOVAL AND INSTALLATION (Continued)

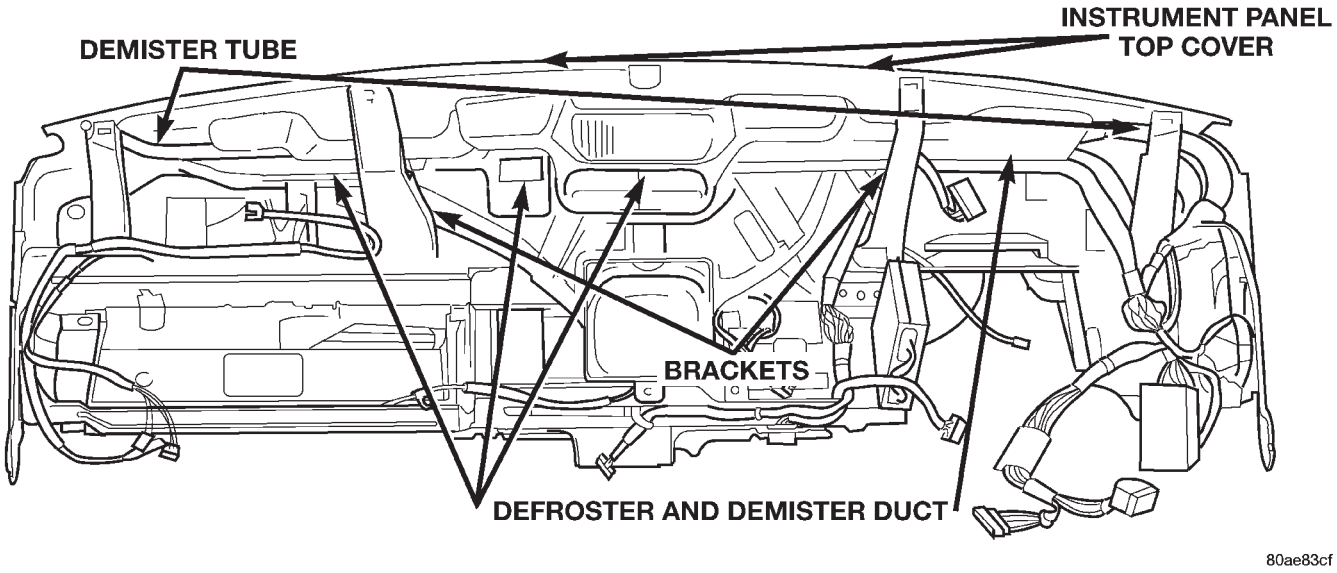

Fig. 61 Defroster and Demister Duct Remove/Install

the snap features from the top of the heater-A/C housing (Fig. 62).

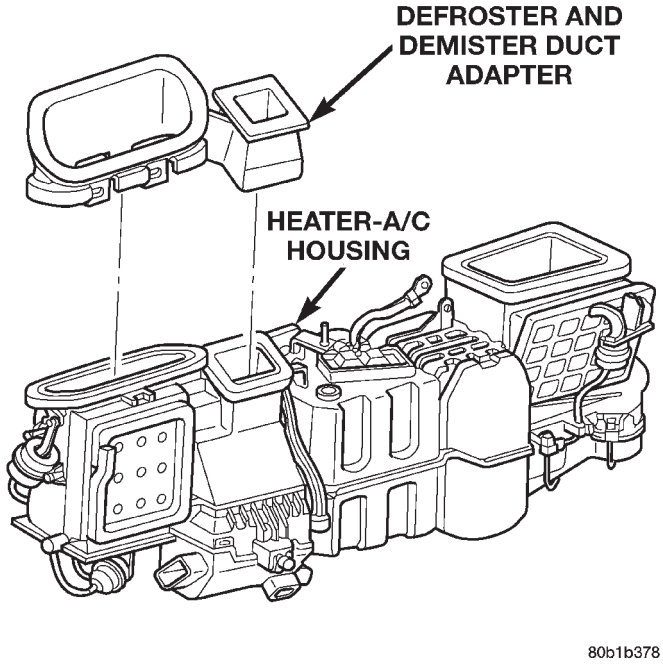

Fig. 62 Defroster and Demister Duct Adapter Remove/Install

(3) Remove the defroster and demister duct adapter from the top of the heater-A/C housing.

(4) Reverse the removal procedures to install.

HEATER-A/C HOUSING INLET BAFFLE

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Slide the heater-A/C housing inlet baffle (Fig. 63) all the way to one side of the cowl plenum opening.

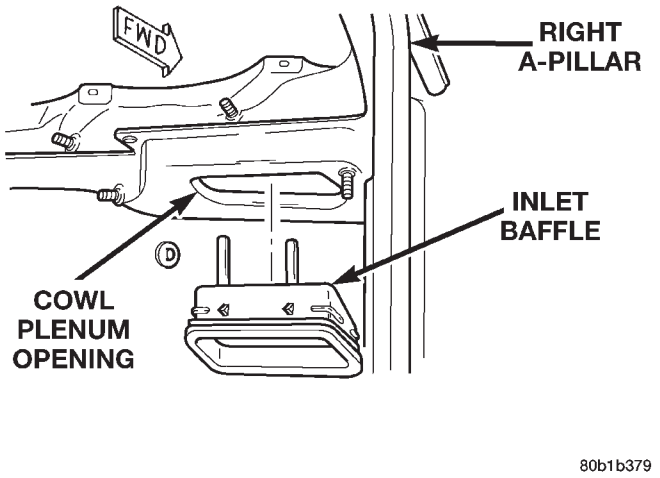

Fig. 63 Heater-A/C Housing Inlet Baffle Remove/ Install

(3) Pull downwards sharply and firmly on the opposite side of the heater-A/C housing inlet baffle to disengage the snap features from the cowl plenum opening.

(4) Remove the heater-A/C housing inlet baffle from the cowl plenum panel.

(5) When reinstalling the heater-A/C housing inlet baffle to the cowl plenum panel opening, be certain that the snap features on each side of the adapter are fully engaged with the sides of the plenum panel opening. This must be a water tight connection to prevent leaks.

(6) Reverse the remaining removal procedures to complete the installation.

ADJUSTMENTS

TEMPERATURE CONTROL CABLE

Any time the heater-A/C control or the temperature control cable are removed and/or replaced, the following procedure must be performed.

(1) The temperature control cable housing and core must be installed at both the heater-A/C control and the heater-A/C housing ends, and the heater-A/C control must be installed in the instrument panel. See Heater-A/C Control and Temperature Control Cable in the Removal and Installation section of this group for the procedures.

(2) Rotate the temperature control knob on the heater-A/C control so that the knob pointer is in the 3 o'clock position.

(3) Pull the temperature control knob straight out from the heater-A/C control base until the perimeter of the knob (not the knob pointer) protrudes about 6 millimeters (0.25 inch) from the face of the control base.

(4) Rotate the temperature control knob to its full counterclockwise stop. The knob pointer should be aimed at a position about 8 millimeters (0.315 inch) beyond the end of the graduated blue strobe temperature control graphic on the face of the heater-A/C control base. If the knob is not pointed to the correct position, go back to Step 2 and repeat the adjustment procedure.

(5) Rotate the temperature control knob clockwise until the knob pointer is in its full clockwise position again.

(6) Push the temperature control knob straight in towards the heater-A/C control base until the perimeter of the knob (not the knob pointer) is flush with the face of the heater-A/C control base.

(7) Rotate the knob to its full counterclockwise stop again. The knob pointer should be aimed at the end of the graduated blue strobe temperature control graphic on the face of the heater-A/C control base. If OK, go to Step 8. If not OK, go back to Step 2.

(8) Rotate the knob to its full clockwise stop and release the knob. If the knob springs back from the clockwise stop, the self-adjuster clip that secures the temperature control cable to the blend-air door lever is improperly installed. See Temperature Control Cable in the Removal and Installation section of this group for the procedures. If the knob does not spring back, the temperature control cable adjustment is complete.

(9) Rotate the temperature control knob quickly to the full hot and full cold positions. There should be a distinct sound of the blend-air door closing against its stops within the heater-A/C housing at each end of the temperature control knob travel. If not OK, check the blend air door for proper installation, obstructions or faulty seals. See Heater-A/C Mode Door in the Removal and Installation section of this group for the procedures.