

SECTION 1B1

MANUAL CONTROL AIR CONDITIONING

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location View in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

OVERVIEW

Figures 1 through 3

The air conditioning system (C60) delivers air that has been heated or cooled and dehumidified for occupant comfort. It also provides power ventilation, and windshield assembly defrosting and side window defogging.

During most operating conditions, outside air is drawn through the heater and air conditioning module assembly by the blower motor assembly. Additional out-

side air is also forced into the vehicle by forward movement of the vehicle.

Within the heater and air conditioning evaporator module assembly, air is pushed by the blower motor assembly through the evaporator, then through the heater core assembly, depending on the temperature valve setting, and into the passenger compartment. For air conditioning or defroster operation at ambient temperatures above 7°C (45°F), the refrigeration system will chill the evaporator to almost freezing. As the air passes through the evaporator, the air temperature drops which causes moisture in the air to condense on the evaporator core fins.

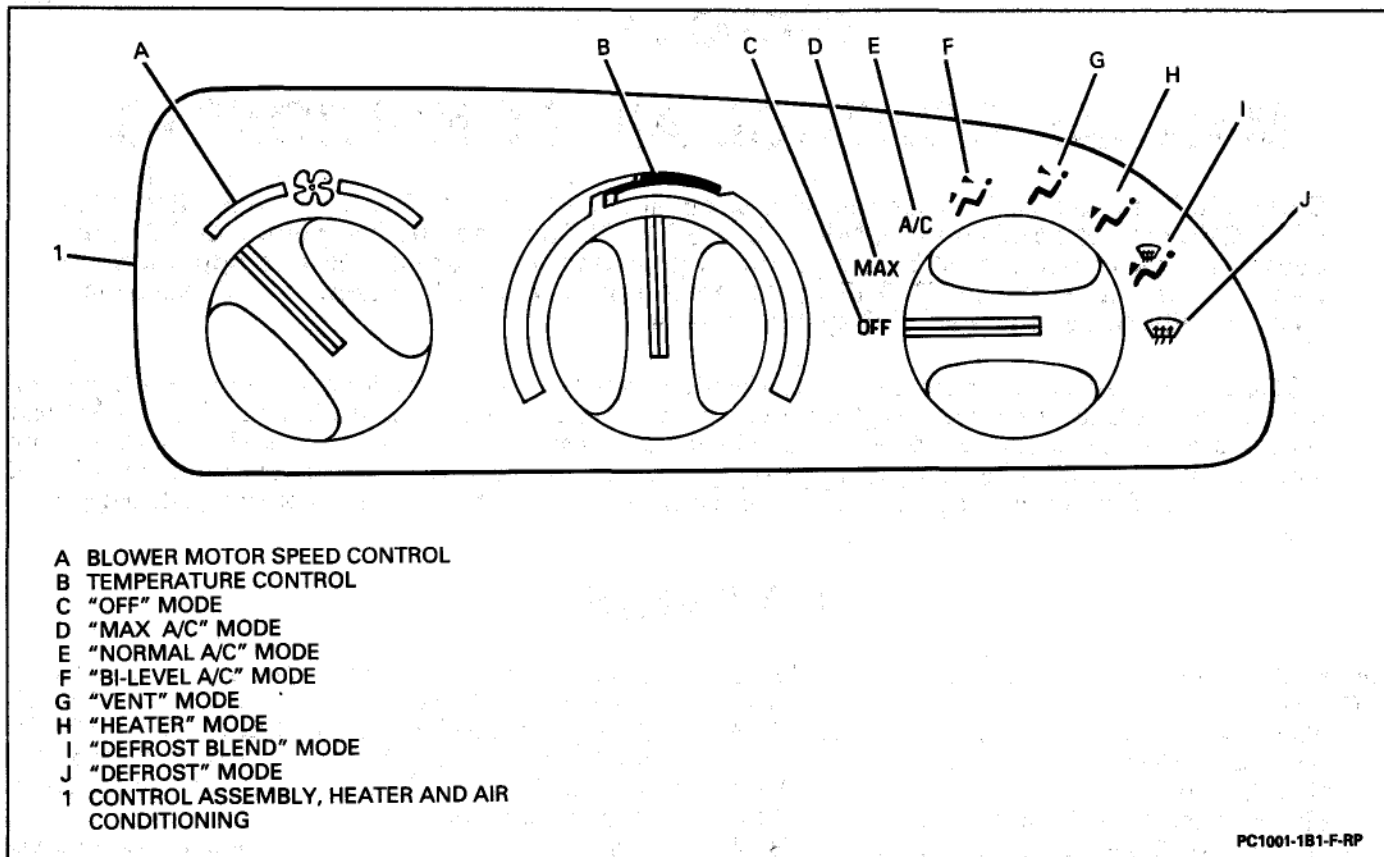


Figure 1 – Heater and Air Conditioning Control Assembly – (Chevrolet)

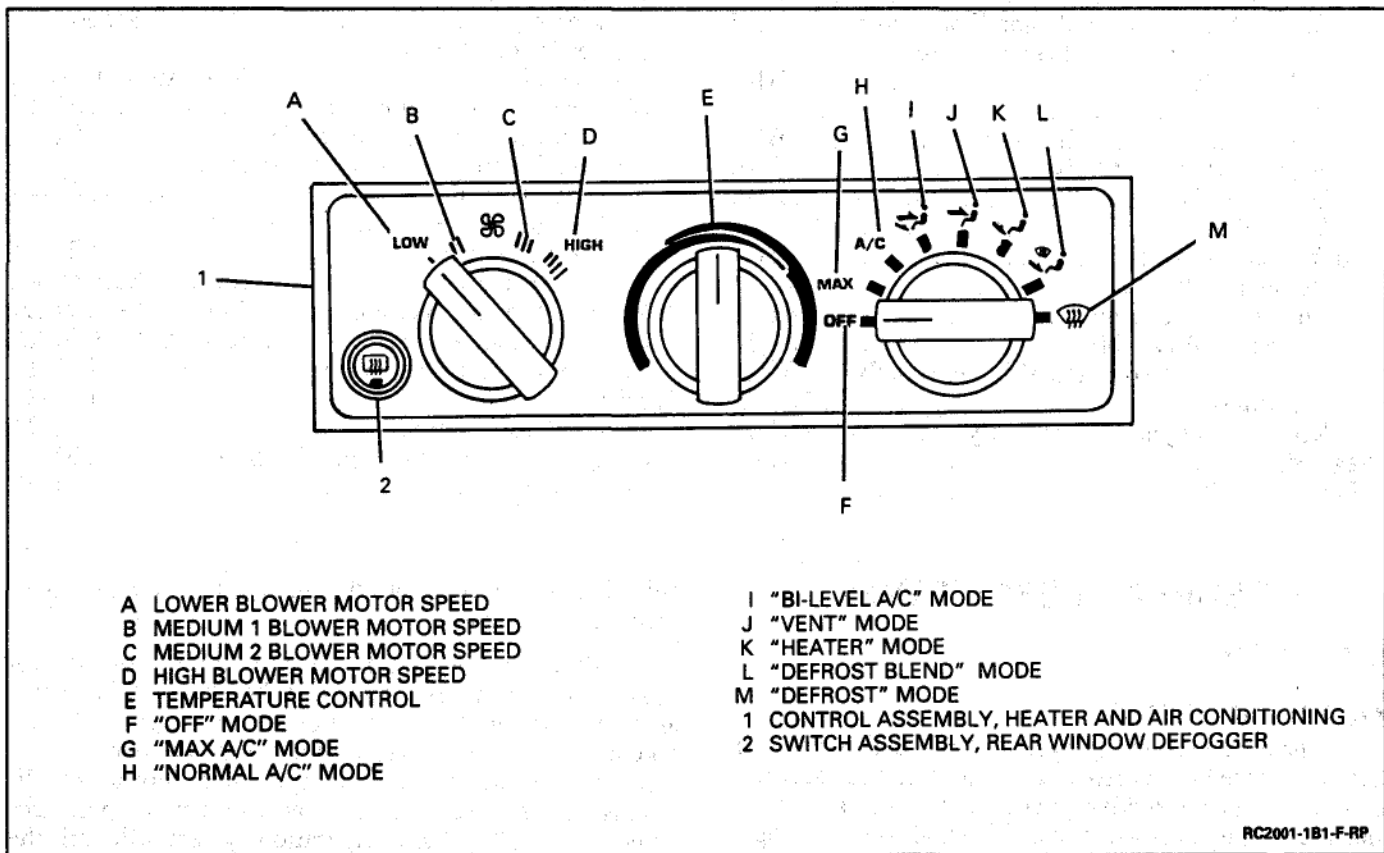


Figure 2 – Heater and Air Conditioning Control Assembly – (Pontiac)

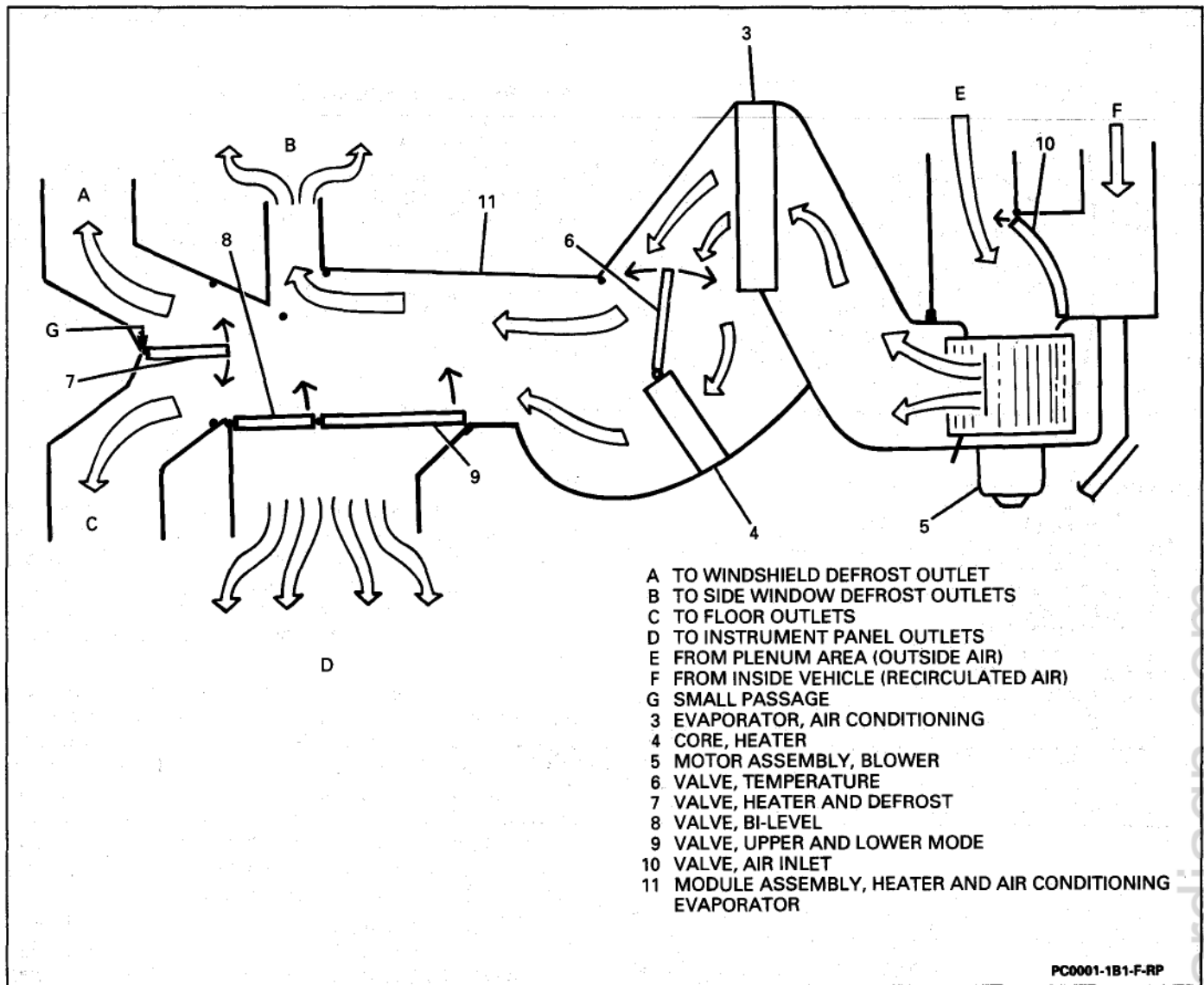


Figure 3 – Air Distribution System

This moisture leaves the vehicle by gravity feed through a drain hole, dehumidifying the vehicle.

From the evaporator, some or all of the air may pass through the heater core assembly, which is warmed by engine coolant. Any of the air which is not to be heated will mix with the heated air before entering the passenger compartment.

When maximum air conditioning mode is selected, most of the air entering the blower motor assembly is taken from the passenger compartment (recirculated) where it is most likely to be cooler than the outside air. Only outside air is used in all other modes.

CONTROL ASSEMBLY

Temperature Control

Figures 1 and 2

The temperature control is mechanically linked to the air temperature valve (door) by a temperature control cable. Rotating the temperature control clockwise allows more of the incoming or recirculated air to flow through

the heater core assembly, thus increasing the air temperature entering the vehicle. Rotating the temperature control counterclockwise decreases air flow through the heater core assembly, thus decreasing the air temperature entering the vehicle.

Mode Control

Figures 1 and 2

The mode control has eight settings: "OFF," "MAX," "A/C," "BI-LEVEL A/C," "VENT," "HEATER," "DEFROST BLEND," and "DEFROST." Some settings are symbols on the heater and air conditioning control assembly (1). These symbols are identified in Figures 1 and 2. Each setting is described below.

"OFF" Mode

At this setting, electrical power is not supplied to the blower motor assembly and A/C is not requested to the powertrain control module (PCM). A small amount of air which is forced into the heater and air conditioning module assembly by forward movement of the vehicle will still be discharged through the air outlets. This is the

only mode in which the blower motor assembly does not operate.

"MAX" A/C Mode

The "MAX" A/C setting is one of five settings which requests A/C operation to the PCM. At this setting the blower motor assembly will operate in one of the four blower motor speed control settings and air will be discharged from the instrument panel air outlets only.

To provide maximum air conditioning, most of the air entering the heater and air conditioning module assembly is taken from the vehicle interior (recirculated) where it is most likely cooler than the outside air. This is the only mode in which air is recirculated, all other modes use outside air only. This setting would be most useful during conditions of high temperature and humidity, or when the outside air may have an objectionable odor.

Normal "A/C" Mode

The normal "A/C" setting functions the same as "MAX" A/C setting, except only outside air enters the module. There may be a slight reduction of blower noise compared to "MAX" A/C mode because the recirculation valve (door) is closed.

"BI-LEVEL A/C" Mode

The "BI-LEVEL A/C" setting requests A/C to the PCM and allows the blower motor assembly to operate in one of four settings similar to "MAX" A/C, except only outside air enters the module and air is distributed through the instrument panel outlets and the floor outlets (bi-level).

"VENT" Mode

The "VENT" setting does not request A/C to the PCM but allows the blower motor assembly to operate normally. This is one of two economy modes (other than "OFF") in which A/C is not requested. Air is discharged through the instrument panel outlets only.

"HEATER" Mode

The "HEATER" setting functions the same as the "VENT" setting, except most of the air is discharged through the floor outlets with a small amount discharged through the defroster outlets. The "HEATER" mode is the normal selection for cold weather operation unless windshield defrosting or side window defogging is required.

"DEFROST BLEND" Mode

The "DEFROST BLEND" setting allows operation of the blower motor assembly and sends an A/C request signal to the PCM for compressor operation. During this setting, air is discharged through the defroster and floor air outlets. This setting allows greater passenger comfort than "DEFROST" but is not as effective in defrosting the windshield assembly and side windows.

"DEFROST" Mode

The "DEFROST" setting functions the same as "DEFROST BLEND" setting except most of the air is discharged through the defroster outlets with a small

amount going through the heater and side window defoggers.

Blower Motor Speed Control

Figures 1 and 2

With the ignition switch in the "RUN" position, the blower motor assembly runs in all mode control positions except "OFF." Blower motor assembly speed is controlled by a four-position electrical blower motor speed control switch at the left side of the control assembly. The blower motor speed control switch provides a choice of a low blower motor assembly speed, two medium speeds, and a high speed.

Electrical power is routed from the HVAC fuse number 3 in the fuse block to the mode control switch. The mode control switch breaks the circuit when it is in the "OFF" position, and closes the circuit in all other positions.

From the mode control switch, the circuit then goes to the blower motor speed control switch. When the blower motor speed control switch is in "LOW," current is conducted to the resistor assembly. At the resistor assembly, the current passes through all three resistors and is reduced to provide the low blower motor assembly speed.

When the blower switch is in either of the two medium speed positions, it closes to send current through either two or one of the resistors in the resistor assembly. Because the current follows the path of least resistance, the circuit branch leading directly to all three resistors becomes ineffective and the current bypasses either one or two resistors, depending upon which medium speed position is selected. The reduced resistance increases current flow and blower motor assembly speed.

When the blower motor speed control switch is in the "HIGH" position, it energizes the high blower relay and power is taken from a separate circuit that is protected by a fusible link. This separate power circuit is "hot" at all times and has the capacity to handle the current demands of the blower motor assembly at high speed.

The circuit to the blower motor assembly is completed to ground at the instrument panel assembly through the instrument panel wiring harness. Refer to SECTION 8A for more electrical information.

AIR DISTRIBUTION SYSTEM

Figures 3 through 6

Air enters the heater and air conditioning evaporator module assembly where it may be cooled for air conditioning or defrost modes, and then heated as necessary before being sent to the proper outlets for discharge into the passenger compartment. Within the heater and air conditioning evaporator module assembly, valves (doors) guide the airflow in response to the position of the mode control.

Vacuum System

All valves in the heater and air conditioning evaporator module assembly except the temperature valve are controlled by engine vacuum drawn from the vacuum tank assembly, mounted to the right side body rail, just

behind the radiator support. The vacuum is routed by a vacuum selector valve in the control assembly to spring-loaded vacuum actuator assemblies on the heater and air conditioning evaporator module assembly. Vacuum stored in the vacuum tank assembly is prevented from bleeding back to its source during conditions of low engine manifold vacuum (acceleration, hard pulling, etc.) by a check valve in the vacuum source hose.

The vacuum selector valve in the control assembly is controlled by the mode control. For each mode control position, the vacuum selector valve directs vacuum to specific hoses to overcome the force of the spring within the appropriate vacuum actuator assemblies. The vacuum selector valve also vents the hoses to each remaining vacuum actuator assembly to normal air pressure, allowing the actuator spring to expand. This results in the valves (doors) being properly positioned for the selected operating mode.

The heater and defrost valve uses a three-position vacuum actuator. A three-position vacuum actuator has a diaphragm with a spring on both sides. At rest (no vacuum applied) the diaphragm will be in a mid-position, allowing for a "blend" mode. When vacuum is applied to either end of the diaphragm, the diaphragm will move the heater and defrost valve to either stop, which will direct airflow to either the defroster outlets or the floor outlets.

When air is directed to the floor outlets, as in "HEATER" mode, a small amount of air still bleeds through the defroster outlets to help eliminate re-fogging of the windshield.

Other Components

Other components of the air distribution system include the plenum, the blower motor assembly, the evaporator and the heater core assembly. The plenum provides a source of outside air to the system. The blower motor assembly draws air from the plenum or from the vehicle interior into the heater and air conditioning evaporator module assembly and forces it through the air distribution system to the outlets. The evaporator is a part of the refrigeration system. It cools the air from the blower motor assembly when operating in an air conditioning or defrosting mode. The heater core assembly provides heat which can be used to warm the air downstream from the evaporator.

Air Inlet Valve

The first valve in the air distribution system is the air inlet valve. This two-position valve controls the two air entrances which feed air to the blower motor assembly. When "MAX" A/C mode is selected, vacuum is applied to the air inlet vacuum actuator assembly and the air inlet valve opens the entrance which supplies inside air from the passenger compartment. In this position, the air inlet valve partially closes the entrance for outside air so only a slight amount can enter. Recirculating the cooled air inside the passenger compartment when outside temperature is very high gives a faster cool down to a more comfortable temperature.

When any other operating mode (including "OFF") is selected, the air inlet vacuum actuator assembly is vented to normal air pressure and the air inlet valve com-

pletely closes off the entrance for inside air. Only fresh outside air is used in the system in these modes.

Blower Motor Assembly and Evaporator

In any operating mode except "OFF," the blower motor assembly draws in air from the plenum and pushes it through the evaporator. When any air conditioning or defrost mode is selected, the air conditioning refrigeration system chills the core of the evaporator to slightly above freezing temperature. This cools the airflow and causes excess humidity to condense on the fins of the evaporator. The condensed moisture drips to the bottom of the case and drains out through a hole that lets the water fall on the road surface below the vehicle. From the evaporator, the air flows toward the temperature valve and heater core assembly.

Temperature Valve and Heater Core Assembly

The temperature control in the control assembly is linked to the temperature valve by a flexible control cable assembly. When the temperature control is rotated fully counterclockwise to the full "COOL" position, the temperature valve is held snugly against the air entrance to the heater core assembly. This causes all of the airflow from the evaporator to bypass the heater core assembly and there is no heat transfer.

As the temperature control is moved clockwise away from the full "COOL" position, the temperature valve moves away from the air inlet to the heater core assembly to allow some air to flow through it. The farther the temperature control is rotated clockwise, the more the temperature valve is turned away from the heater core air inlet and the greater the airflow through the heater core assembly. Heating a greater proportion of the total airflow in this manner results in a warmer discharge of air because the heated and unheated airflows join and are mixed together thoroughly beyond the heater core.

When the temperature lever is rotated fully clockwise to the full "WARM" position, the temperature valve blocks off the passage that allows air to bypass the heater core assembly and causes all of the airflow to pass through the heater core assembly.

Bi-Level Valve

Figure 3

The bi-level valve (8) at its "at rest" (no vacuum) position, seats against the upper and lower mode valve (9) and the heater and air conditioning evaporator module assembly (11). The bi-level valve (8) can be opened by either the bi-level valve vacuum actuator assembly or the upper and lower mode valve vacuum actuator assembly. When opened by the bi-level valve vacuum actuator assembly, as in "BI-LEVEL A/C" mode air will exit the instrument panel outlets, floor outlets and a small amount will exit the defroster outlets.

When the bi-level valve (8) is opened by the upper and lower mode valve vacuum actuator assembly, as in "MAX" A/C, normal "A/C" and "VENT" modes both the upper and lower mode valve (9) and the bi-level valve (8) move at the same time, directing all airflow through the instrument panel outlets.

Upper and Lower Mode Valve

Figure 3

The upper and lower mode valve (9), in its "at rest" (no vacuum) position, seats against the evaporator module assembly. The upper and lower mode valve (9), when opened by the upper and lower mode valve actuator assembly, will also move the bi-level valve (8) at the same time. When the upper and lower mode valve (9) is opened, as in "MAX" A/C, normal "A/C" and "VENT" modes all air is directed to the instrument panel outlets.

Heater and Defrost Valve

Figure 3

The heater and defrost valve (7) is operated by a three-position heater and defrost vacuum actuator assembly. At its "at rest" (no vacuum applied to either side) position, the heater and defrost valve (7) is positioned to allow airflow through both the floor outlets and defroster outlets, as when in "DEFROST BLEND" mode. During the "DEFROST" mode, vacuum is applied to one side of the heater and defrost vacuum actuator assembly, causing the heater and defrost valve (7) to direct all airflow to the defroster outlets. A small passage within the heater and air conditioning evaporator module assembly (11) will allow some air to bleed out the floor outlets. During the "HEATER" mode, vacuum is applied to the opposite side of the heater and defrost vacuum actuator assembly causing the heater and defrost valve (7) to direct all airflow to the floor outlets with a small bleed to the defroster outlets.

Ducts and Outlets

Figures 4 and 5

There are five adjustable high-level outlets in the instrument panel assembly, three near the center and one at each extreme end of the panel assembly. In addition, there are two side window defrost outlets, one at each end of the instrument panel upper trim pad assembly. All seven outlets are fed by the air distributor assembly.

Heated or cooled air can be directed to the windshield assembly through the air distributor assembly and through the floor air outlet duct.

Ventilation

Figure 7

The air distribution system provides fresh air ventilation for the passenger compartment in all operating modes. A small amount of the air circulated within the passenger compartment in the "MAX" A/C mode is taken from outside the vehicle, and all of the air circulated in the other modes is from outside. Even in the "OFF" mode, fresh outside air is forced into the air distribution system by the forward movement of the vehicle.

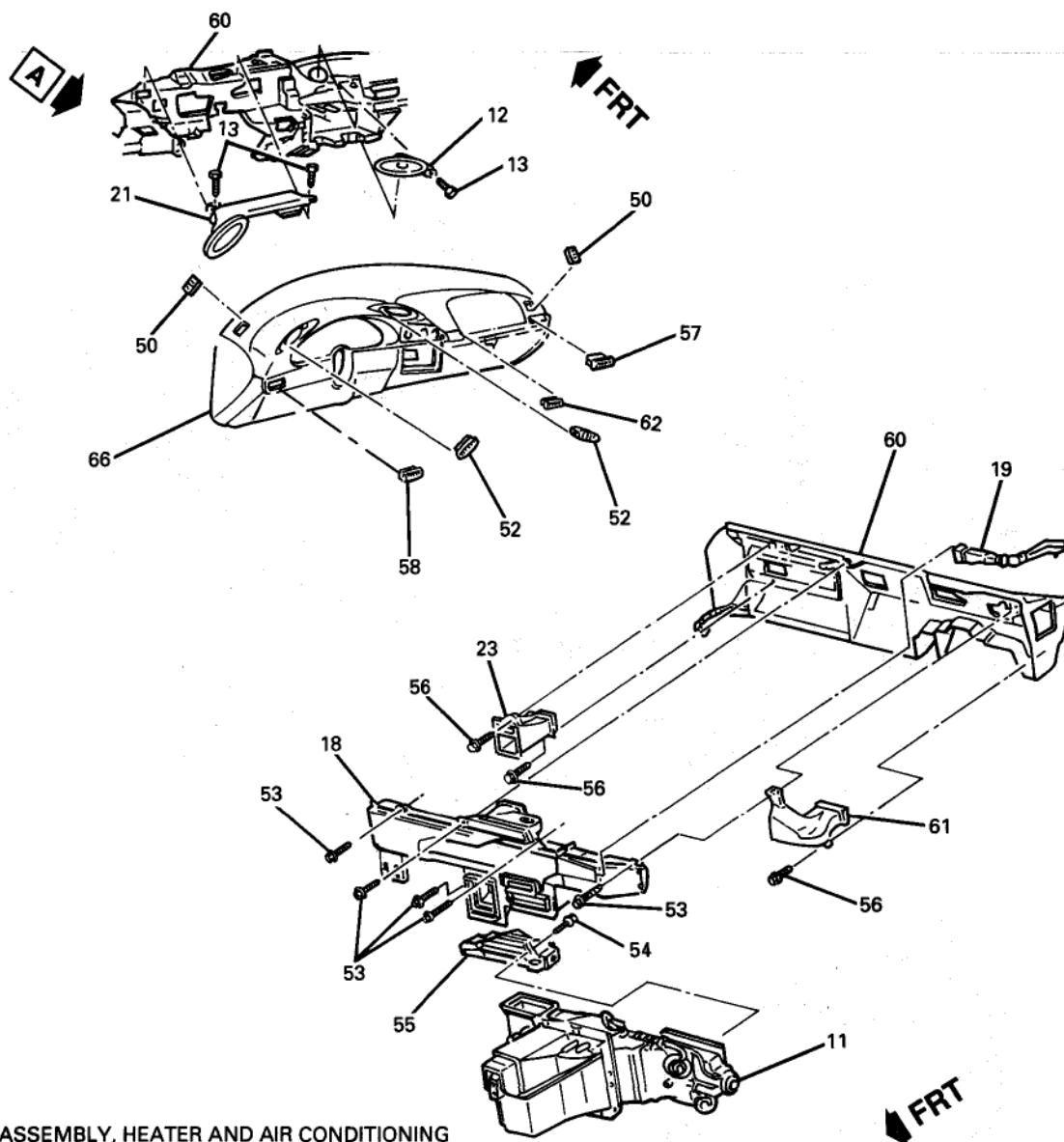
After being warmed or cooled to the desired temperature, the air is discharged from the outlets appropriate to the selected operating mode. When all windows are closed, the addition of outside air builds a slight positive pressure within the passenger compartment. The pressure forces stale air to leave the vehicle through a pressure relief valve assembly, mounted to the left side quarter panel, behind the rear fascia after it has circulated through the passenger compartment.

REFRIGERATION SYSTEM

Figure 8

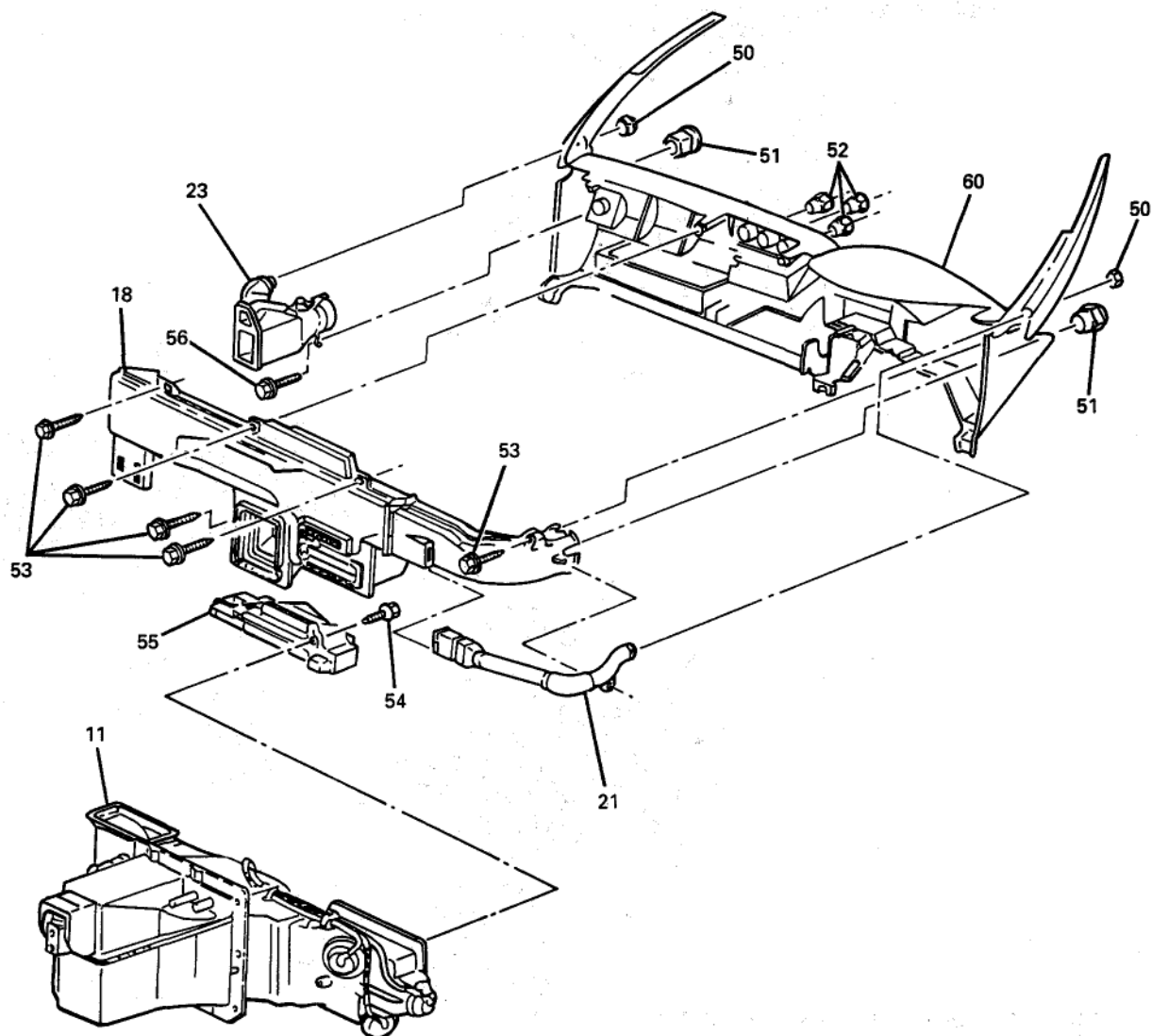
The refrigeration system cools the air flowing through the air distribution system during air conditioning operation. It also operates when the "DEFROST" or "DEFROST BLEND" mode is selected, dehumidifying the air to aid in fog removal from the windshield assembly. Refrigeration system components and their functions are as follows:

- Refrigerant circulates through the refrigeration system to absorb heat from the air being cooled, and to give off the heat to the air outside the vehicle. The refrigerant also carries a polyalkylene glycol (PAG) refrigerant oil throughout the system, primarily to lubricate parts of the compressor assembly (28).
- An engine-driven compressor assembly (28) pumps the refrigerant through the refrigeration system.
- A condenser assembly (29) cools the refrigerant in the same way that the engine cooling system radiator assembly cools the engine coolant.
- A receiver dehydrator assembly (30) dries and filters the refrigerant. It also separates the liquid and the vapor to provide only liquid to the thermostatic expansion valve assembly.
- Lines (metal tubes and nylon-core composite hoses) and leak-resistant connectors join the compressor assembly (28), condenser assembly (29), receiver dehydrator assembly (30), evaporator (3) and other components to provide a closed-loop circuit for the refrigerant.
- The A/C refrigerant pressure sensor assembly (26) attached to the air conditioning evaporator line and senses refrigerant pressure on the air conditioning system high side. The purpose of the A/C refrigerant pressure sensor assembly (26) is to inform the PCM of high side refrigerant pressure status so the PCM can disable the compressor assembly (28) before high side pressure becomes too high.
- The thermostatic expansion valve assembly (31) lowers the pressure of the refrigerant from the receiver dehydrator assembly (30) by restricting the flow. This prepares the refrigerant to pick up heat.
- An evaporator (3) in the path of the airflow through the air distribution system absorbs heat from the moving air and passes it on to the refrigerant inside the core of the evaporator (3). This causes the refrigerant to boil and leave the evaporator (3) as a vapor.
- The air conditioning evaporator temperature sensor assembly (25) mounted to the heater and air conditioning evaporator module assembly has a probe inserted into the evaporator (3) which measures



- 11 MODULE ASSEMBLY, HEATER AND AIR CONDITIONING EVAPORATOR
- 12 DUCT, INSTRUMENT PANEL CENTER AIR OUTLET
- 13 SCREW, INSTRUMENT PANEL CENTER AIR OUTLET DUCT
- 18 DISTRIBUTOR ASSEMBLY, WINDSHIELD DEFROSTER NOZZLE AND AIR
- 19 DUCT, SIDE WINDOW DEFOGGER OUTLET (LEFT SIDE)
- 21 DUCT, INSTRUMENT PANEL CENTER AIR OUTLET
- 23 DUCT, INSTRUMENT PANEL OUTER AIR OUTLET (RIGHT SIDE)
- 50 GRILLE, SIDE WINDOW DEFOGGER OUTLET
- 52 OUTLET, INSTRUMENT PANEL CENTER AIR
- 53 SCREW, AIR DISTRIBUTOR DUCT
- 54 SCREW, FLOOR AIR OUTLET DUCT
- 55 DUCT, FLOOR AIR OUTLET
- 56 SCREW, INSTRUMENT PANEL OUTER AIR OUTLET DUCT
- 57 OUTLET, INSTRUMENT UPPER OUTER AIR
- 58 OUTLET, INSTRUMENT PANEL LOWER OUTER AIR
- 60 CARRIER ASSEMBLY, INSTRUMENT PANEL
- 61 DUCT, INSTRUMENT PANEL OUTER AIR OUTLET (LEFT SIDE)
- 62 OUTLET, INSTRUMENT PANEL CENTER AIR
- 66 PANEL ASSEMBLY, INSTRUMENT

Figure 4 – Air Ducts and Outlets – (Chevrolet)



- 11 MODULE ASSEMBLY, HEATER AND AIR CONDITIONING EVAPORATOR
- 18 DISTRIBUTOR ASSEMBLY, WINDSHIELD DEFOGGER NOZZLE AND AIR
- 21 DUCT, SIDE WINDOW DEFOGGER OUTLET (LEFT SIDE)
- 23 DUCT, INSTRUMENT PANEL OUTER AIR OUTLET
- 50 GRILLE, SIDE WINDOW DEFOGGER OUTLET
- 51 OUTLET, INSTRUMENT PANEL OUTER AIR
- 52 OUTLET, INSTRUMENT PANEL CENTER AIR
- 53 SCREW, AIR DISTRIBUTOR DUCT
- 54 SCREW, FLOOR AIR OUTLET DUCT
- 55 DUCT, FLOOR AIR OUTLET
- 56 SCREW, INSTRUMENT PANEL OUTER AIR OUTLET DUCT
- 60 CARRIER ASSEMBLY, INSTRUMENT PANEL

Figure 5 – Air Ducts and Outlets – (Pontiac)

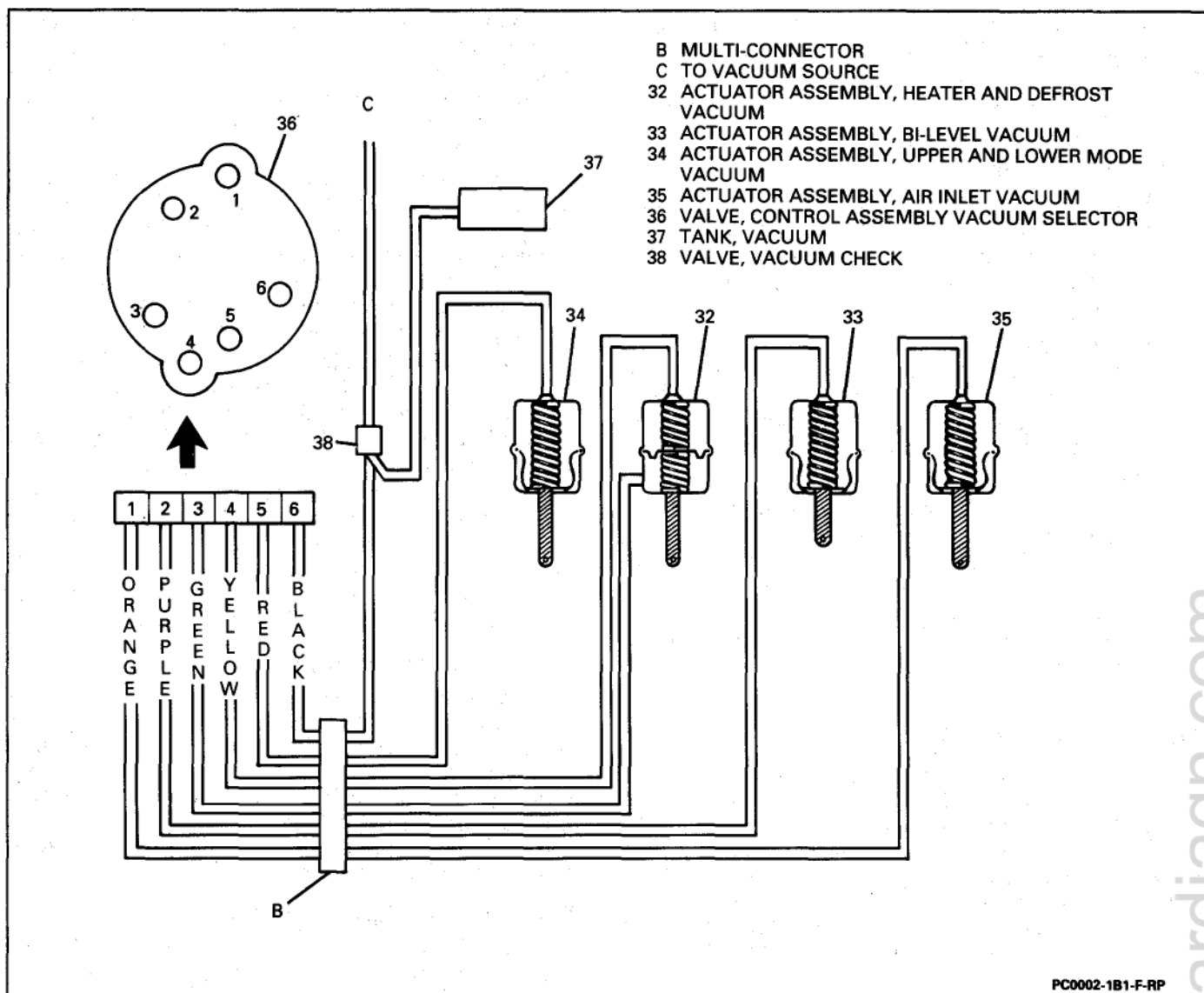


Figure 6 - Vacuum Circuit Diagram

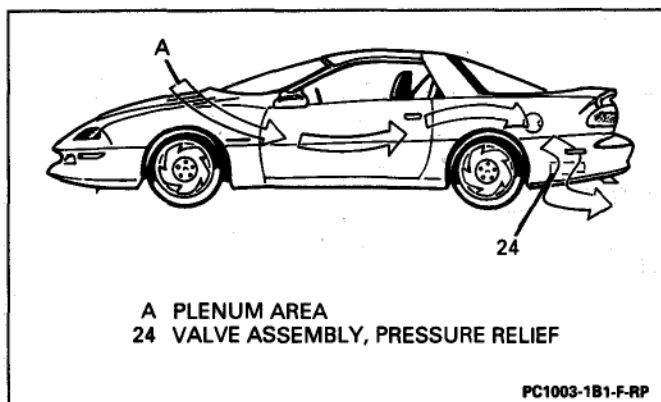


Figure 7 - Ventilation Airflow (Typical)

evaporator temperature and sends a signal to the PCM. Within the probe is a thermistor which varies resistance according to temperature, as temperature increases, thermistor resistance decreases. The purpose of this evaporator temperature sensor assembly (25) is to inform the PCM of the evaporator temper-

ature so the compressor can be disabled before the evaporator (3) freezes.

Refrigerant-134a

CAUTION: Avoid breathing A/C Refrigerant-134a and lubricant vapor or mist. Exposure may irritate eyes, nose, and throat. To remove R-134a from the A/C system, use service equipment certified to meet the requirements of SAE J2210 (R-134a recycling equipment). If accidental system discharge occurs, ventilate work area before resuming service. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.

Like the coolant in the engine cooling system, the refrigerant is the substance in the air conditioning system that absorbs, carries and then releases heat. Although various substances are used as refrigerants in other types of refrigeration systems, past automotive air conditioning systems used a type called Refrigerant-12 (R-12).

This vehicle uses a new type of refrigerant called Refrigerant-134a (R-134a). It is a non-toxic, non-flammable, clear colorless liquefied gas.

While the R-134a A/C system is very similar to an R-12 A/C system, the differences in the refrigerant, lubricants, and service equipment are important.

NOTICE: R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. R-12 in a R-134a system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance.

Refrigerant-134a carries a charge of a special lubricating oil, polyalkylene glycol (PAG) refrigerant oil. GM PAG refrigerant oil will have a slight blue tint. The oil is hygroscopic (absorbs water from the atmosphere) and should be stored in closed containers.

Use only polyalkylene glycol (PAG) synthetic refrigerant oil for internal circulation through the R-134A A/C system and only mineral base 525 viscosity refrigerant oil on fittings threads and O-rings. If lubricants other than those specified are used, compressor failure and/or fitting seizure is likely to occur.

Compressor Assembly

The compressor assembly (28) is belt driven from the engine crankshaft through the compressor clutch pulley. The compressor pulley rotates without driving the compressor shaft until an electromagnetic clutch coil is energized. When voltage is applied to energize the clutch coil, the clutch plate and hub assembly is drawn rearward toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit to drive the compressor shaft.

As the compressor shaft is driven, the compressor assembly (28) compresses the low-pressure refrigerant vapor from the evaporator into a high-pressure, high-temperature vapor. Carried with the refrigerant is the refrigerant oil which is used to lubricate the compressor assembly (28).

The compressor assembly (28) has a unique lubrication system. The crankcase-suction bleed is routed through the rotating wobble-plate for lubrication of the wobble-plate bearing. The rotation acts as an oil separator, which removes some of the oil from the crankcase-suction bleed, rerouting it to the crankcase where it can lubricate the compressor mechanism.

Up to 118 ml (4 fluid ounces) of oil can collect in the crankcase. Therefore, it is important when replacing a compressor assembly (28) that the oil in the old compressor crankcase be drained and measured (discard after recording amount).

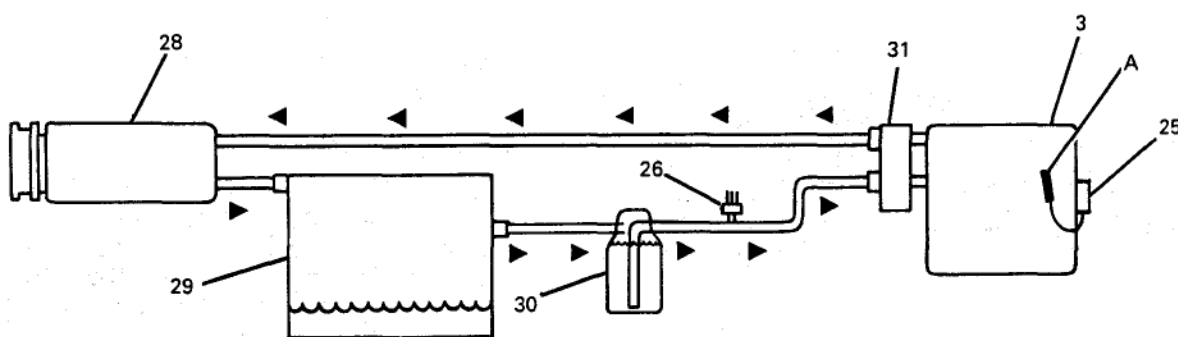
All replacement compressor assemblies from service parts will have 237 ml (8 fluid ounces) of oil in the crankcase. The oil must be drained and retained. Then replace the oil in the same amount as previously recorded from the old compressor assembly. For compressor assembly overhaul, refer to SECTION 1D2.

Condenser Assembly

The high-pressure refrigerant line from the compressor assembly (28) goes to the condenser assembly (29). The condenser assembly (29), is made up of coils which carry hot refrigerant vapor routed from the compressor assembly (28). Thin cooling fins on the coils transfer heat to the air passing through the condenser assembly (29). This cools the high-pressure refrigerant vapor and causes it to condense into a high-pressure liquid.

Thermostatic Expansion Valve Assembly

The thermostatic expansion valve assembly (31) controls the flow of refrigerant in the air conditioning



- A PROBE, AIR CONDITIONING EVAPORATOR TEMPERATURE SENSOR
- 3 EVAPORATOR, AIR CONDITIONING
- 25 SENSOR ASSEMBLY, AIR CONDITIONING EVAPORATOR TEMPERATURE
- 26 SENSOR ASSEMBLY, AIR CONDITIONING REFRIGERANT PRESSURE

- 28 COMPRESSOR ASSEMBLY, AIR CONDITIONING
- 29 CONDENSER ASSEMBLY, AIR CONDITIONING
- 30 RECEIVER DEHYDRATOR ASSEMBLY, AIR CONDITIONING
- 31 VALVE ASSEMBLY, AIR CONDITIONING THERMOSTATIC EXPANSION

RC0002-1B1-F-RP

Figure 8 - Refrigeration System Schematic

system. The valve assembly (31) is a mechanical device and does not control compressor assembly cycling. The valve assembly (31) replaces the orifice tube used in the CCOT air conditioning systems. It functions by sensing pressure and temperature on the low side of the system and then meters the high side of the system to achieve optimal refrigeration performance.

Evaporator

Air passing through the evaporator (3) gives off some of its heat to the evaporator core fins when the refrigeration system is operating. Refer to "Air Distribution System" in this section. The heat is conducted through the thin metal walls of the evaporator core to the low-pressure liquid refrigerant flowing through the evaporator core tubes, causing the refrigerant to boil and vaporize. The refrigerant leaves the evaporator as a low-pressure vapor, carrying off the heat it absorbed from the evaporator surfaces.

Receiver Dehydrator Assembly

The receiver dehydrator assembly (30) is a sealed container that serves as a refrigerant storage container. A bag of desiccant (a moisture absorbing material) in the base of the receiver dehydrator assembly (30) collects and holds any traces of moisture in the refrigerant that could otherwise create problems such as corrosion or freezing in the refrigeration system.

Recent improvement in refrigerant hose materials and the increased use of metal lines have reduced the chances for entry of moisture into the refrigerant, and an improvement in desiccant has increased its moisture-holding capacity. As a result, the receiver dehydrator assembly (30) should be replaced only if leaking as a result of perforation, a damaged O-ring seat or damaged threads, or if the system has been opened to outside air for an extended period.

DIAGNOSIS

FUNCTIONAL TEST

Figure 9

The following operational test sequence will aid in determining whether the air conditioning electrical, air, vacuum and refrigeration systems are working properly. Temperature of the air should be at least 16°C (60°F). The air conditioning system can not be properly tested unless it is at least this warm.

The engine should be started and allowed to idle for about 20 minutes or until the engine cooling system thermostat is open.

Perform steps 1-9 on Figure 9 and compare vehicle response to the normal system response shown on the chart. If vehicle does not respond correctly during any of these steps, begin diagnosis as noted below:

- Insufficient heating. Refer to SECTION 1A.
- Insufficient cooling. Refer to "Insufficient Cooling Check" in this section.
- Improper air delivery. Refer to "Improper Air Delivery" in this section.

- Blower motor assembly inoperative or incorrect speed. Refer to SECTION 8A.

INSUFFICIENT COOLING CHECK

Figure 10

To help eliminate any possible mis-diagnosis, "functional test" must be performed first. Insufficient cooling could be caused by one of several components or systems such as the air conditioning compressor assembly, refrigeration system, air delivery system or powertrain control module (PCM). Proper diagnosis of insufficient cooling because the air conditioning compressor is inoperative must begin with an "on board diagnostic system check" of the PCM. Refer to SECTION 6E3.

IMPROPER AIR DELIVERY

Figures 11 and 12

System Description

This system is operated completely by vacuum, except for the electrically powered blower motor assembly (5). Engine vacuum is routed through a vacuum check valve (38) then to the control assembly vacuum selector valve (36) and to the vacuum tank (37). The vacuum check valve (38) is used to prevent vacuum loss due to heavy acceleration or steep uphill traveling when the engine assembly is under a heavy load.

When vacuum is applied to a vacuum actuator assembly, the vacuum actuator assembly will apply sufficient force to overcome any resistance due to air flow from the blower motor assembly (5) and from the actuator internal spring, and move the air valve (door) to its correct position.

Preliminary Inspection

1. Inspect vacuum lines at engine assembly and vacuum check valve (38) for proper connection.
2. Disconnect vacuum line leading to engine assembly at vacuum check valve (38). Start engine assembly and check for presence of vacuum, if no vacuum is present, replace vacuum line.
3. Disconnect vacuum line leading to vacuum tank (37) at vacuum check valve (38). Using hand vacuum pump, apply vacuum to vacuum line leading to vacuum tank (37). If vacuum does not hold, replace vacuum line and/or vacuum tank (37).
4. Disconnect vacuum line leading to control assembly (1) at vacuum check valve (38). Apply vacuum to check valve port. If vacuum does not hold, replace vacuum check valve (38).
5. Quickly rotate temperature control from "FULL COLD" to "FULL HOT" several times. Listen for temperature valve (6) to seat in both positions. If the sound indicates that the temperature valve (6) is not fully seating or opening, check the mechanical linkage between the control mechanism and the temperature valve (6).
6. Make sure all six vacuum line seals are positioned correctly at vacuum line multi-connector under right-hand sound insulator panel assembly.
7. Perform diagnosis. Refer to Figure 12.

HEATER AND AIR CONDITIONING CONTROL ASSEMBLY SETTING					SYSTEM RESPONSE				
STEP	MODE CONTROL LEVER SETTING	TEMPERATURE CONTROL LEVER SETTING	BLOWER MOTOR ASSEMBLY SWITCH	BLOWER MOTOR ASSEMBLY SPEED	HEATER OUTLETS	A/C OUTLETS	DEFROSTER OUTLETS	COMMENTS	OUTLET TEMPERATURE
1	OFF	COLD	LOW	OFF	NO AIR FLOW	NO AIR FLOW	NO AIR FLOW		AMBIENT
2	MAX A/C	COLD	LOW	LOW	NO AIR FLOW	AIR FLOW	NO AIR FLOW	A, E	AT LEAST 11°C (20°F) COOLER THAN AMBIENT
3	MAX A/C	COLD	LOW TO HIGH	LOW TO HIGH	NO AIR FLOW	AIR FLOW	NO AIR FLOW	B, E	AT LEAST 11°C (20°F) COOLER THAN AMBIENT
4	NORMAL A/C	MID-RANGE	HIGH	HIGH	NO AIR FLOW	AIR FLOW	NO AIR FLOW	A	SLIGHTLY WARM
5	BI-LEVEL A/C	COLD	HIGH	HIGH	AIR FLOW	AIR FLOW	MINIMUM AIR FLOW	A	AT LEAST 11°C (20°F) COOLER THAN AMBIENT
6	VENT	COLD	HIGH	HIGH	NO AIR FLOW	AIR FLOW	NO AIR FLOW	A	AMBIENT
7	HEATER	HOT	HIGH	HIGH	AIR FLOW	NO AIR FLOW	MINIMUM AIR FLOW	A, C, D	AT LEAST 49°C (120°F)
8	DEFROSTER BLEND	HOT	HIGH	HIGH	AIR FLOW	NO AIR FLOW	AIR FLOW	A, D	AT LEAST 49°C (120°F)
9	DEFROST	HOT	HIGH	HIGH	MINIMUM AIR FLOW	NO AIR FLOW	AIR FLOW	A, D	AT LEAST 49°C (120°F)

A ENGAGEMENT OF DETENT MUST BE FELT IN EACH MODE CONTROL LEVER SETTING.
 B A NOTICEABLE BLOWER MOTOR ASSEMBLY SPEED INCREASE MUST OCCUR FROM LOW, MEDIUM LOW, MEDIUM HIGH AND HIGH.
 C TEMPERATURE LEVER MUST TRAVEL FROM FULL COLD TO FULL HOT.
 D AIR FLOW MUST ALSO BE PRESENT AT SIDE WINDOW DEFOGGER OUTLETS.
 E INSTRUMENT PANEL OUTLETS MUST HOLD THEIR POSITION DURING HIGH BLOWER MOTOR ASSEMBLY SPEED BUT SHOULD BE MOVEABLE BY HAND.

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Figure 9 – Functional Test

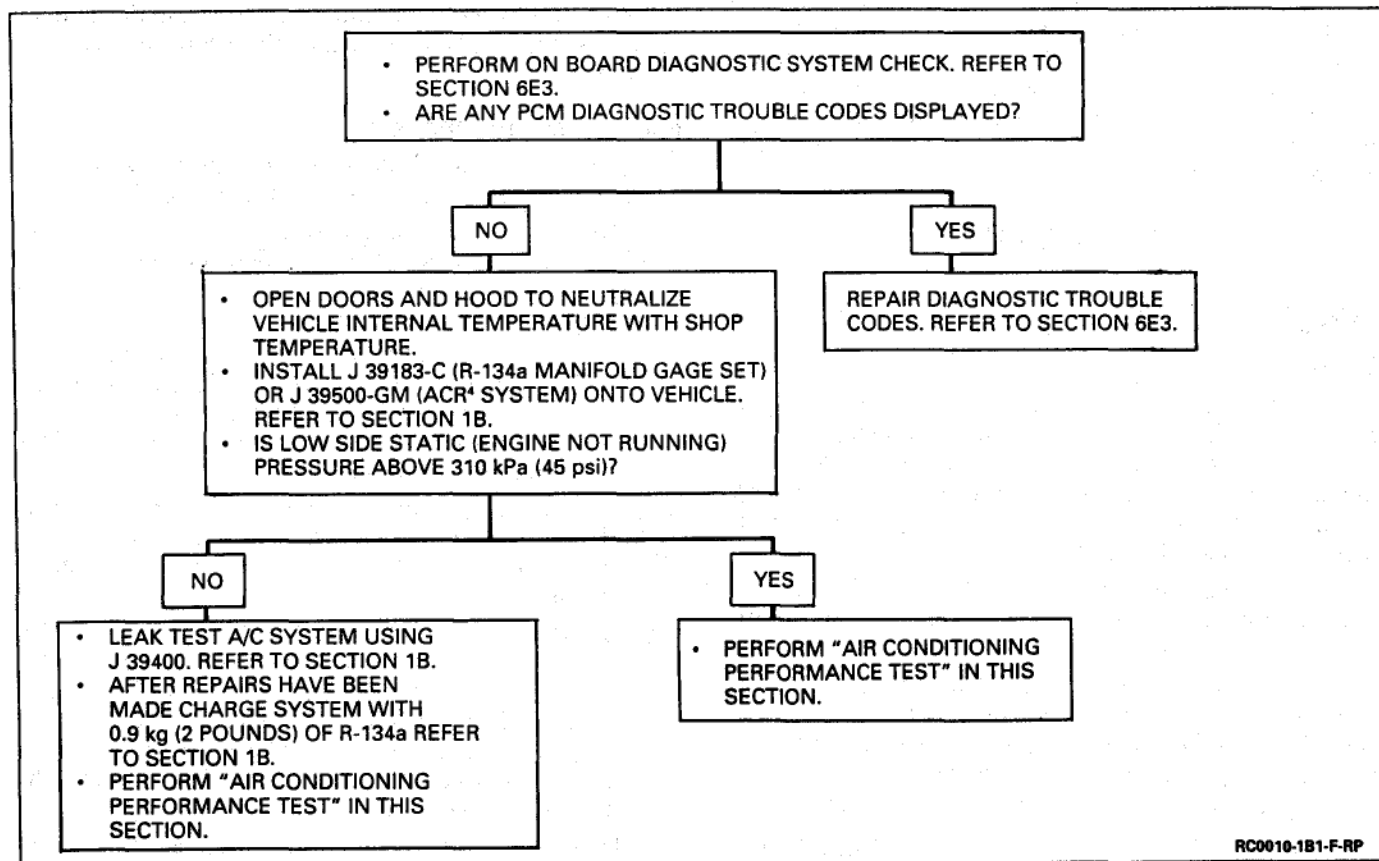


Figure 10 – Insufficient Cooling Check

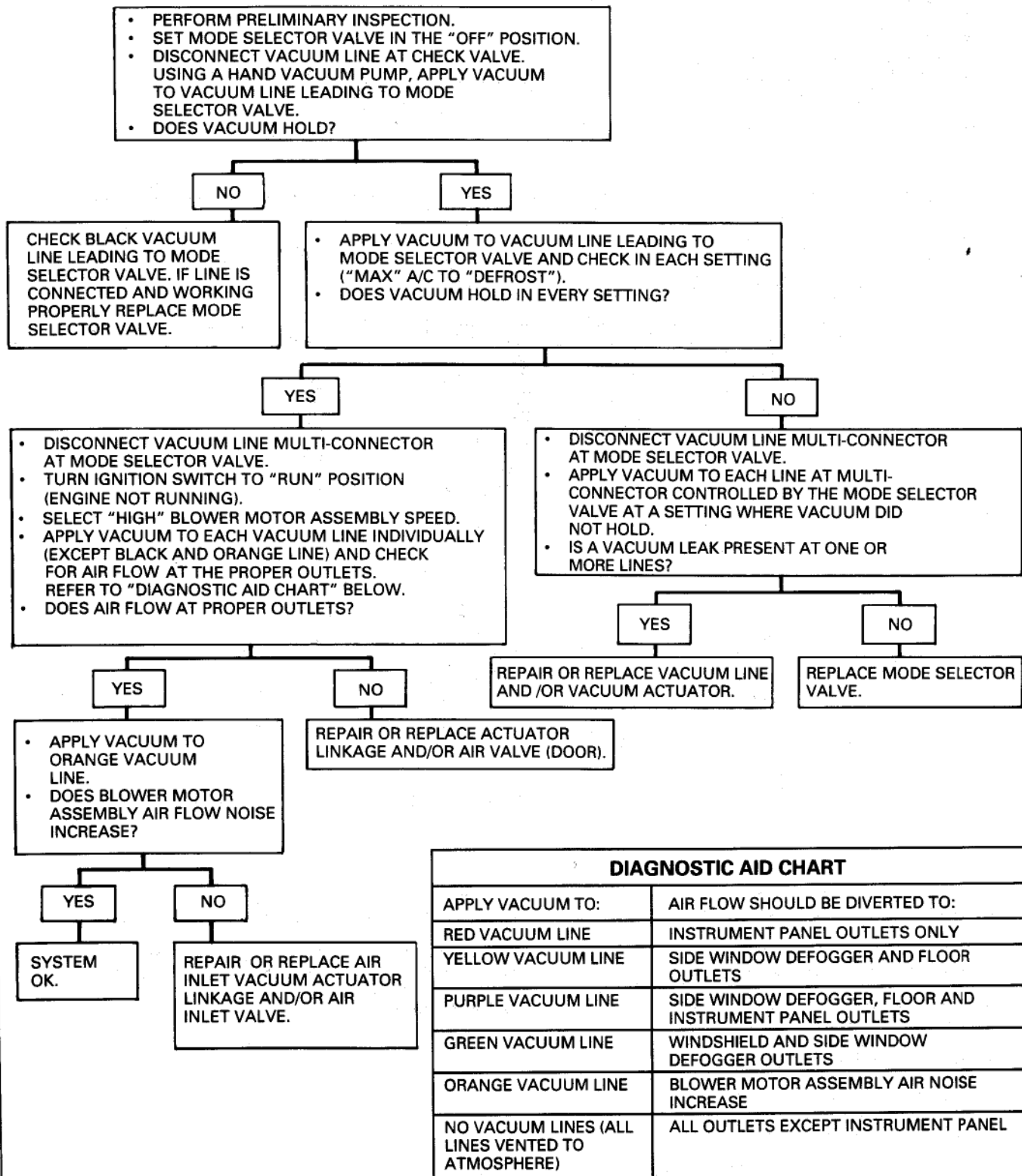


Figure 12 – Improper Air Delivery Diagnostic Chart

AIR CONDITIONING PERFORMANCE TEST

Figures 13, 14 and 15

Tools Required:

- J 39500 ACR⁴ System or
- J 39183-C R-134a Manifold Gauge Set
- J 6742-03 Precision Thermometer (or Equivalent)

Before performing the air conditioning performance test, a functional test should be made to assure that the air distribution system valves are functioning properly to route all the air passing through the evaporator to the outlets. Refer to "Functional Test" in this section.

Performance testing provides a measure of air conditioning system operating efficiency by measuring and comparing pressures at the high-pressure and low-pressure sides of the refrigeration system, the temperature of the air being discharged into the passenger compartment, and the evaporator temperature.

Start with the air conditioning performance test in Figure 13, and compare vehicle air conditioning system performance with the chart in Figure 14. If system performance is not within specifications, proceed to the refrigeration system diagnostic chart in Figure 15 to pinpoint the problem.

ON-VEHICLE SERVICE

BLOWER MOTOR ASSEMBLY RELAY

The blower motor assembly relay is located in the underhood electrical center. Refer to the label located under the underhood electrical center cover for relay identification.

AIR CONDITIONING COMPRESSOR RELAY

The air conditioning compressor relay is located in the underhood electrical center. Refer to the label located under the underhood electrical center cover for relay identification.

AIR CONDITIONING EVAPORATOR TEMPERATURE SENSOR ASSEMBLY

Figures 16 and 17

Remove or Disconnect

1. Heater core assembly. Refer to SECTION 1A.
2. Evaporator temperature sensor assembly electrical connector.
3. Evaporator temperature sensor assembly probe from evaporator.
 - Use needle-nose pliers to pull probe straight out.
4. Evaporator temperature sensor assembly (25) from heater and air conditioning evaporator module assembly (11).
 - Remove grommet with evaporator temperature sensor assembly (25).

Install or Connect

1. Evaporator temperature sensor assembly (25) to heater and air conditioning evaporator module assembly (11).
 - Seat grommet in heater and air conditioning module assembly (11).

Important

- Do not insert probe into existing hole. Use alternate location near the existing hole shown in the condensate screen and insert probe straight into evaporator. If probe is not inserted straight into evaporator, incorrect evaporator temperature reading may result, causing evaporator freeze-up.
2. Evaporator temperature sensor assembly probe straight into evaporator in new location near previous location.
 3. Evaporator temperature sensor assembly electrical connector.
 4. Heater core assembly. Refer to SECTION 1A.

AIR CONDITIONING REFRIGERANT PRESSURE SENSOR ASSEMBLY

Figure 18

Remove or Disconnect

1. Electrical connector at sensor assembly (26).
2. Sensor assembly (26) and seal (39).
 - Sensor assembly (26) is mounted on a Schrader® type valve so it is not necessary to discharge the refrigeration system.
 - Discard seal (39).

Install or Connect

1. New seal (39) to sensor assembly fitting.
 - Coat seal (39) with mineral base 525 viscosity refrigerant oil.
2. Sensor assembly (26).

Tighten

- Sensor assembly (26) to 6 N•m (53 lb. in.).
3. Electrical connector to sensor assembly (26).

AIR CONDITIONING EVAPORATOR

Figures 16, 17 and 19

Remove or Disconnect

1. Discharge refrigerant into a recovery station. Refer to SECTION 1B.
2. Right-hand instrument panel sound insulator panel assembly. Refer to SECTION 8C.
3. Heater hoses at heater core assembly. Refer to SECTION 1A.

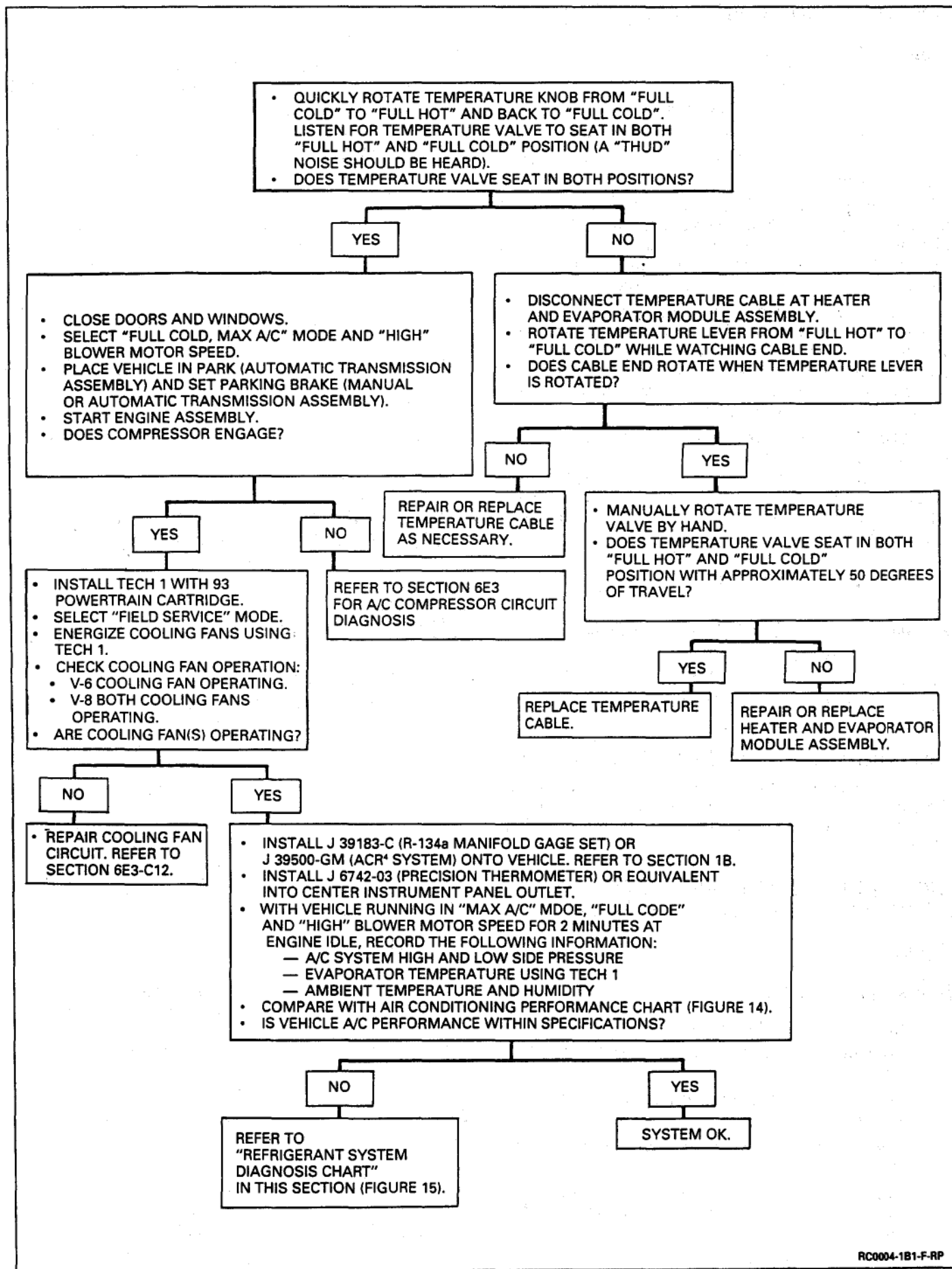


Figure 13 – Air Conditioning Performance Test

TEMPERATURE	HUMIDITY	GAGE PRESSURES		CENTER OUTLET TEMP	EVAP ASSEMBLY TEMP DISPLAYED ON TECH 1
		LOW	HIGH		
21° - 27°C (70° - 80°F)	LESS THAN 50%	110 - 165 kPa (16 - 24 psi)	793-1310 kPa (115 - 190 psi)	3° - 9°C (38° - 48°F)	1° - 6°C (33° - 43°F)
	HIGHER THAN 50%	145 - 200 kPa (21 - 29 psi)	793 - 1379 kPa (115 - 200 psi)	4° - 13°C (40° - 55°F)	2° - 10°C (35° - 50°F)
27° - 33°C (80° - 90°F)	LESS THAN 50%	131 - 207 kPa (19 - 30 psi)	965 - 1482 kPa (140 - 215 psi)	3° - 13°C (38° - 55°F)	1° - 10°C (33° - 50°F)
	HIGHER THAN 50%	165 - 269 kPa (24 - 39 psi)	1034 - 1620 kPa (150 - 235 psi)	7° - 18°C (45° - 65°F)	4° - 16°C (40° - 60°F)
33° - 38°C (90° - 100°F)	LESS THAN 40%	172 - 290 kPa (25 - 42 psi)	1138 - 1793 kPa (165 - 260 psi)	7° - 17°C (45° - 63°F)	4° - 14°C (40° - 58°F)
	HIGHER THAN 40%	234 - 296 kPa (34 - 43 psi)	1276 - 1862 kPa (185 - 270 psi)	13° - 20°C (55° - 68°F)	10° - 18°C (50° - 65°F)
38° - 44°C (100° - 110°F)	LESS THAN 20%	255 - 296 kPa (37 - 43 psi)	1448 - 2000 kPa (210 - 290 psi)	12° - 18°C (53° - 64°F)	9° - 16°C (48° - 61°F)
	HIGHER THAN 20%	262 - 352 kPa (38 - 51 psi)	1517 - 2137 kPa (220 - 310 psi)	14° - 21°C (58° - 70°F)	13° - 18°C (55° - 65°F)

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Figure 14 – Air Conditioning Performance Chart

4. Instrument panel compartment. Refer to SECTION 8C.
5. Heater core assembly. Refer to SECTION 1A.
6. Air conditioning evaporator temperature sensor assembly. Refer to "Air Conditioning Evaporator Temperature Sensor Assembly" in this section.
7. Temperature control cable assembly at temperature valve case assembly. Refer to SECTION 1A.
8. Bolts/screws (48) located in engine compartment from temperature valve case assembly (42).
9. Temperature valve case assembly (42).
 - Slide case assembly (42) downward to disengage upper case clip.
 - Remove from under the instrument panel assembly.
10. Thermostatic expansion valve assembly. Refer to SECTION 1B.

Important

- Remove perforated section of heater and air conditioning evaporator module assembly as one piece (it will be reused).
 - Water can leak onto carpeting when doing this procedure. It is recommended that a mat be placed on passenger side floor.
11. Using a small hand saw, remove perforated section of heater and air conditioning evaporator module assembly (Figure 16).

Important

- This piece of material is required to keep condensate from draining inside vehicle.
12. Bolts/screws (41) retaining air conditioning evaporator (3).
 13. Air conditioning evaporator (3) from heater and air conditioning module assembly (11).
 - Slide evaporator (3) to the left, then pull out through the opening enlarged in step 11.

Install or Connect

1. Air conditioning evaporator (3) to heater and air conditioning module assembly (11).
 - If replacing old evaporator (3), transfer condensate screen to new evaporator (3).
 - If replacing old evaporator (3), install new evaporator core gasket in same position as original with appropriate adhesive.
 - Insert evaporator (3) into module assembly (11) through the opening enlarged during removal, slide to the right until fully seated.
2. Bolts/screws (41) to air conditioning evaporator (3).
3. Refrigerant oil into evaporator (3), if necessary.
 - If installing new evaporator (3), add 89 ml (3 fluid ounces) of polyalkylene glycol (PAG) synthetic refrigerant oil, GM P/N 12345923.
4. Thermostatic expansion valve assembly. Refer to SECTION 1B.

PERFORM AIR CONDITIONING PERFORMANCE TEST BEFORE REFRIGERATION SYSTEM DIAGNOSIS

CONDITIONS				POSSIBLE FAULT	CORRECTIVE ACTION
CENTER OUTLET TEMP	LOW SIDE PRESSURE	HIGH SIDE PRESSURE	TECH 1 EVAPORATOR TEMPERATURE		
OK OR HIGH	OK OR LOW	OK OR LOW	HIGHER	LOW REFRIGERANT CHARGE RECEIVER AND DEHYDRATOR ASSEMBLY PLUGGED DEBRIS PLUGGING THERMOSTATIC EXPANSION VALVE INOPERATIVE THERMOSTATIC EXPANSION VALVE EVAPORATOR TEMPERATURE SENSOR OUT OF POSITION	RECOVER, MEASURE AND RECHARGE A/C SYSTEM. REFER TO SECTION 1B. CHECK FOR PRESSURE DIFFERENCE GREATER THAN 138 kPa (20 PSI) BETWEEN TECH 1 AND HIGH GAUGE, REPLACE RECEIVER AND DEHYDRATOR ASSEMBLY. CLEAN THERMOSTATIC EXPANSION VALVE. TEST THERMOSTATIC EXPANSION VALVE. SET A/C BLOWER ON LOW AND REV ENGINE TO 1,500 RPM. IF LOW GAGE GOES OR REMAINS ABOVE 193 kPa (28 PSI), THERMOSTATIC EXPANSION VALVE IS STUCK OPEN; REPLACE IT. IF LOW GAGE GOES BELOW 138 kPa (20 PSI) SYSTEM OK. REINSTALL EVAPORATOR TEMPERATURE SENSOR. REFER TO "AIR CONDITIONING EVAPORATOR TEMPERATURE SENSOR ASSEMBLY" IN THIS SECTION.
HIGHER	HIGHER	LOW	HIGH	A/C COMPRESSOR FAULT INOPERATIVE THERMOSTATIC EXPANSION VALVE	PERFORM COMPRESSOR TEST TEST THERMOSTATIC EXPANSION VALVE. SET A/C BLOWER ON LOW AND REV ENGINE TO 1,500 RPM. IF LOW GAGE GOES OR REMAINS ABOVE 193 kPa (28 PSI), THERMOSTATIC EXPANSION VALVE IS STUCK OPEN; REPLACE IT. IF LOW GAGE GOES BELOW 138 kPa (20 PSI) SYSTEM OK.
HIGHER	HIGHER	HIGHER	HIGHER	CONDENSOR AIR RESTRICTION CONDENSOR AIR RECIRCULATION HIGH REFRIGERANT CHARGE TOO MUCH REFRIGERANT OIL FAN PROBLEMS	CLEAN, REMOVE RESTRICTION. INSTALL OR REPOSITION AIR CONTROL BAFFLES. RECOVER, MEASURE AND RECHARGE A/C SYSTEM. REFER TO SECTION 1B. FLUSH A/C SYSTEM. REFER TO SECTION 1B.
OK	OK	HIGH	OK		CHECK FLOW DIRECTION, RELAY, ETC.
OK	OK OR LOW	OK	LOW	CIRCUIT FAULT	PERFORM A/C ELECTRICAL CIRCUIT TEST.

Figure 15 – Refrigeration System Diagnostic Chart

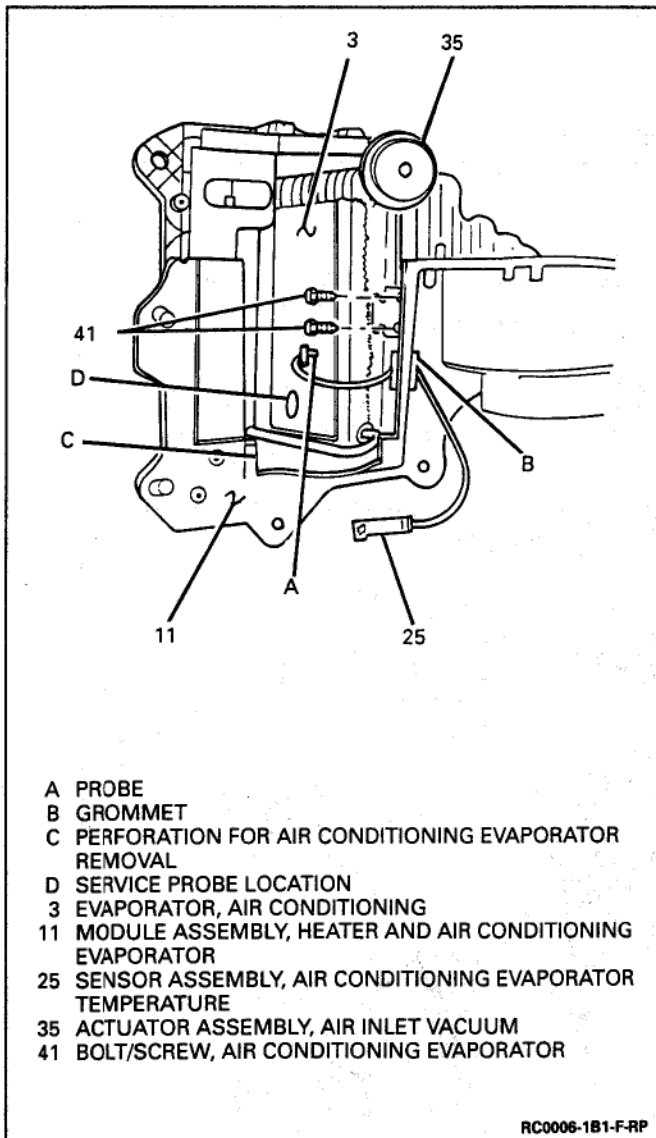


Figure 16 – Air Conditioning Evaporator Temperature Sensor Assembly

5. Apply sealer GM P/N 3012078 (do not use epoxy glue) between evaporator (3) and evaporator upper and lower case (44 and 45) just behind thermostatic expansion valve assembly to prevent air entry from the engine compartment into the passenger compartment.
6. Position perforated section of heater and air conditioning evaporator module assembly and use epoxy glue to adhere it to module assembly. After epoxy dries, use thumb to grade sealant on inside and outside to ensure water-tight seal.
7. Temperature valve case assembly (42).
 - Install from under instrument panel assembly.
 - Slide case assembly (42) upward into position until upper clip engages.
8. Bolts/screws (48) to temperature valve case assembly (42).
 - Tighten bolts/screws (48) evenly to compress flange seal.

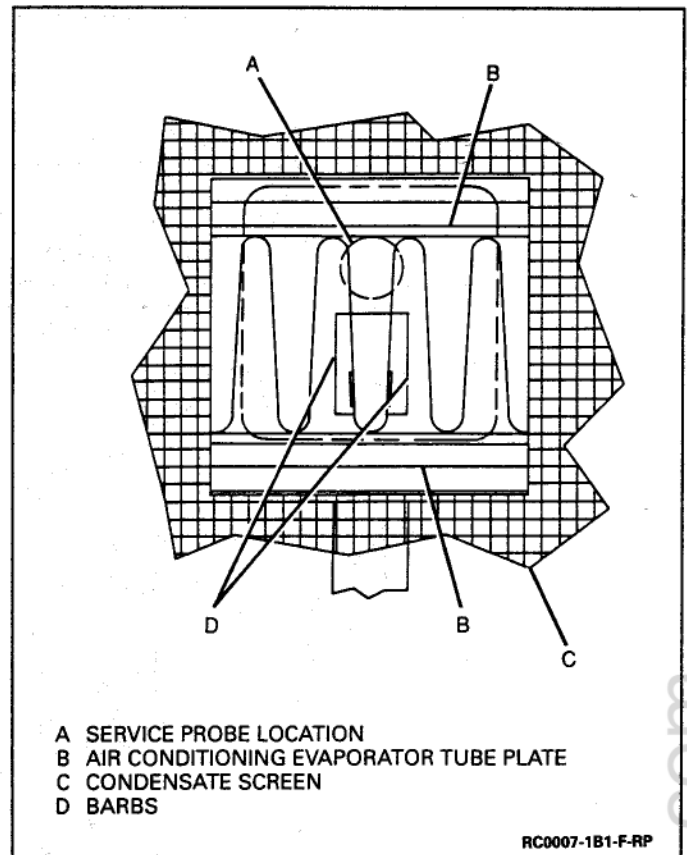


Figure 17 – Air Conditioning Evaporator Temperature Sensor Assembly Installation

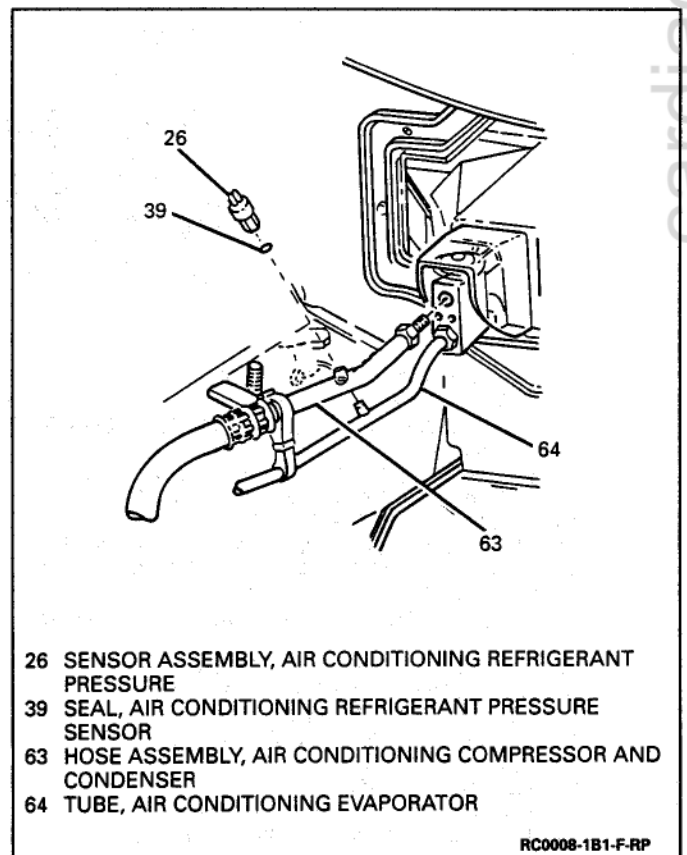
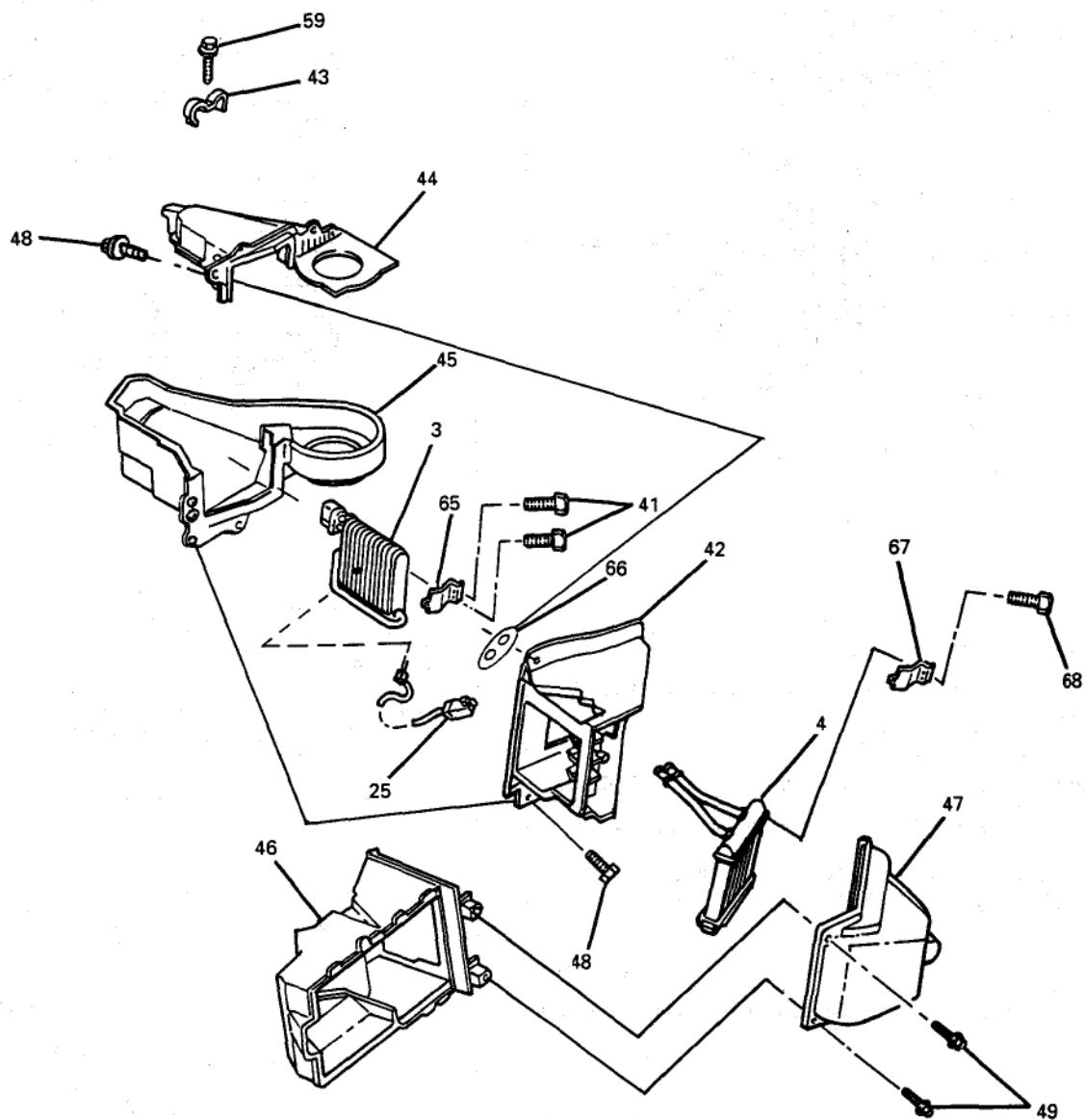


Figure 18 – Air Conditioning Refrigerant Sensor and Cutoff Switch



- 3 EVAPORATOR, AIR CONDITIONING
- 4 CORE ASSEMBLY, HEATER
- 25 SENSOR ASSEMBLY, AIR CONDITIONING EVAPORATOR TEMPERATURE
- 41 BOLT/SCREW, AIR CONDITIONING EVAPORATOR
- 42 CASE ASSEMBLY, TEMPERATURE VALVE
- 43 CLAMP, HEATER CORE TUBE
- 44 CASE, AIR CONDITIONING EVAPORATOR UPPER
- 45 CASE, AIR CONDITIONING EVAPORATOR LOWER
- 46 CASE, AIR DISTRIBUTOR UPPER
- 47 COVER, HEATER AND AIR CONDITIONING EVAPORATOR CASE
- 48 BOLT/SCREW, TEMPERATURE VALVE CASE ASSEMBLY
- 49 BOLT/SCREW, HEATER AND AIR CONDITIONING EVAPORATOR CASE OVER
- 59 BOLT/SCREW, HEATER CORE TUBE CLAMP
- 65 CLAMP, AIR CONDITIONING EVAPORATOR
- 66 SEAL, HEATER PIPE
- 67 BRACKET, HEATER CORE ASSEMBLY
- 68 BOLT/SCREW, HEATER CORE ASSEMBLY

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Figure 19 – Air Conditioning Evaporator and Components

9. Temperature control cable assembly at temperature valve case assembly. Refer to SECTION 1A.
10. Air conditioning evaporator temperature sensor assembly. Refer to "Air Conditioning Evaporator Temperature Sensor Assembly" in this section.
11. Heater core assembly. Refer to SECTION 1A.
12. Instrument panel compartment. Refer to SECTION 8C.
13. Heater hoses to heater core assembly. Refer to SECTION 1A.
14. Right-hand instrument panel sound insulator panel assembly. Refer to SECTION 8C.
15. Fill radiator and bleed cooling system. Refer to SECTION 6B.
16. Refrigerant.

SPECIFICATIONS

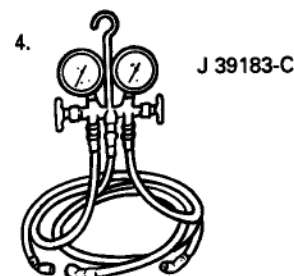
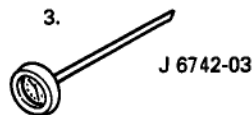
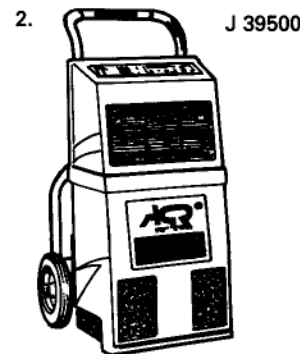
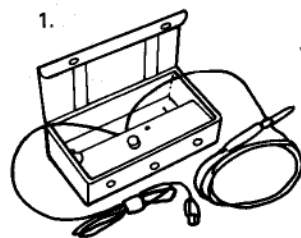
GENERAL SPECIFICATIONS

A/C System O-ring and Fitting Lubricant	Mineral Base 525 Viscosity Refrigerant Oil, GM P/N 12301108 or equivalent
A/C System Internal Lubricant (Including Compressor)	Polyalkylene Glycol (PAG) Synthetic Refrigerant Oil, GM P/N 12345923 or equivalent
A/C System R-134a Capacity	0.91 kg (2.0 lbs.)

COMPONENT TIGHTENING SPECIFICATIONS

Air Conditioning Compressor Low Pressure Cutout Switch Assembly	6 N•m (53 lb. in.)
Air Conditioning Refrigerant Pressure Sensor Assembly	6 N•m (53 lb. in.)

SPECIAL TOOLS



1. R-12 AND R-134a HALOGEN LEAK DETECTOR
2. AIR CONDITIONING REFRIGERANT RECOVERY, RECYCLING AND RECHARGING SYSTEM (ACR)
3. PRECISION THERMOMETER
4. R-134a MANIFOLD GAUGE SET

