

# SECTION 1B

# AIR CONDITIONING

When performing air conditioning diagnosis on vehicles equipped with a catalytic converter, it will be necessary to WARM the engine to a NORMAL operating temperature BEFORE attempting to idle the engine for periods greater than five (5) minutes. Once the engine attains normal idle, diagnosis and adjustments can be made.

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Also see Section 6B - Cooling System for related information, diagnosis and art.

### GENERAL DESCRIPTION

The Cycling Clutch Orifice Tube (C.C.O.T.) refrigeration system is designed to cycle a compressor on and off to maintain desired cooling and to prevent evaporator freeze. Passenger compartment comfort is maintained by the temperature lever on the controller.

Control of the refrigeration cycle (on and off operation of the compressor) is done with a switch which senses low side pressure as an indicator of evaporator temperature. The pressure cycling switch is the freeze protection device in the system and senses refrigerant pressure on the suction side of the system. This switch is located on a standard Schrader-type valve low-side fitting. During air temperatures of 16-26°C (60-80°F), the equalized pressures within the charged A/C system will close the contacts of the pressure switch. When an air conditioning mode (max, norm, bi-level, defrost) is selected, electrical energy is supplied to the compressor clutch coil. As the compressor reduces the evaporator pressure to approximately 175 kPa (25 psi), the pressure switch will open, de-energizing the compressor clutch. As the system equalizes and the pressure reaches approximately 315 kPa (46 psi), the pressure switch contacts close, re-energizing the clutch coil. This cycling continues and maintains evaporator discharge air temperature at approximately 1°C (33°F). Because of this cycling, some slight increases and decreases of engine speed/power may be noticed under certain conditions. This is normal as the system is designed to cycle to maintain desired cooling, thus preventing evaporator freeze-up.

The high-side, high pressure compressor cut-off switch in the rear head of the compressor is a protective device intended to prevent excessive compressor head pressures and reduce the chance of refrigerant escape through a safety relief valve. Normally closed, this switch will open the circuit at a high-side pressure of approximately 2760 kPa (430 psi + 20 psi) and reclose the circuit at approximately 1370 kPa (200 psi ± 50 psi).

Additional compressor protection results from the operating characteristics of the low-side pressure cycling system. If a massive discharge occurs in the low side of the system or the orifice tube becomes plugged, low-side pressures could be insufficient to close the contacts of the pressure switch. In the event of a low charge, insufficient

cooling accompanied by rapid compressor clutch cycling will be noticed at high air temperatures.

The compressor, depending upon engine usage, is also cut-off under certain other conditions, such as wide-open throttle, low idle speed, low air temperature and high power steering loads. A/C Electrical System diagnosis is found in the electrical diagnosis section of this book.

Diagnostic charts for the C.C.O.T. system are on the following pages. If replacement of the pressure cycling switch is necessary, it is important to note that this may be done without removing the refrigerant charge. A Schrader-type valve is located in the pressure switch fitting. During replacement of the pressure switch, a new oiled O-ring must be installed and the switch assembled to the specified torque 6-13 N·m (5-10 lb. ft.).

When the engine is turned "**OFF**" with the A/C system operating, the refrigerant in the system will flow from the high pressure side of the expansion tube (orifice) to the low pressure side until the pressure is equalized. This may be detected as a hissing sound for 30 to 60 seconds and is a normal condition.

### SYSTEM COMPONENTS-FUNCTIONAL

#### Compressor

All compressors are 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.

The compressor shaft is driven the compressor performs two main functions. It compresses the low pressure refrigerant vapor, from the evaporator into a high pressure, high temperature vapor. Also, the compressor pumps refrigerant and refrigerant oil through the A/C system. Complete compressor overhaul procedures can be found in Section 1D of the General Service Manual.

#### Pressure Relief Valve

The compressor is equipped with a pressure relief valve which is placed in the system as a safety factor. Under

certain conditions, the refrigerant on the discharge side may exceed the designed operating pressure. To prevent system damage, the valve is designed to open automatically at approximately 3036 kPa (440 psi). Any condition that causes this valve to open should be corrected, and the refrigerant oil and refrigerant should be replaced as necessary.

### Muffler

A muffler is used on some refrigerant systems to reduce compressor noises and high pressure line vibrations. If a muffler is malfunctioning, it should be replaced.

### Condenser Core

The condenser assembly in front of the radiator is made up of coils which carry the refrigerant and cooling fins to provide rapid transfer of heat. The air passing through the condenser cools the high pressure refrigerant vapor causing it to condense into a liquid.

### Expansion (Orifice) Tube

The plastic expansion tube, with its mesh screen and orifice, is located in the evaporator inlet pipe at the liquid line connection. It provides a restriction to the high pressure liquid refrigerant in the liquid line, metering the flow of refrigerant to the evaporator as a low pressure liquid.

The expansion tube and orifice are protected from contamination by filter screens on both inlet and outlet sides.

The tube is serviced only as a replacement assembly.

### Evaporator Core

The evaporator is a device which cools and dehumidifies the air before it enters the car. High pressure liquid refrigerant flows through the expansion tube (orifice) into the low pressure area of the evaporator. The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

### Accumulator

Connected to the evaporator outlet pipe, the sealed accumulator assembly acts as a refrigerant storing container receiving vapor and some liquid and refrigerant oil from the evaporator.

At the bottom of the accumulator is the desiccant which acts as a drying agent for moisture that may have entered the system. An oil bleed hole is also located near the bottom of the accumulator outlet pipe to provide an oil return path to the compressor.

A low-side pressure Schrader valve service fitting is located near the top of the accumulator. A similar Schrader fitting is provided for mounting the pressure cycling switch. It is not necessary to discharge the system to replace the switch. The accumulator is serviced only as a replacement assembly.

### Heater Core

The heater core heats the air before it enters the car. Engine coolant is circulated through the core to heat the outside air passing over the fins of the core. The core is functional at all times (no water valve) and may be used to temper conditioned air in the A/C mode, as well as heat or vent mode.

## SYSTEM COMPONENTS-CONTROL

### Controller

The operation of the A/C system is controlled by the switch and the lever on the control head. The compressor clutch and blower are connected electrically to the control head by a wiring harness. The blower circuit is open in the off mode and air flow is provided by the four blower speeds available in the remaining modes. Cooled and dehumidified air is available in the max, normal, bi-level and defrost modes.

Temperature is controlled by the position of the temperature lever on the control head. A self-adjusting cable connects this lever to the temperature valve which controls air flow through the heater core. As the temperature lever is cycled through its range of travel, a sliding clip on the cable at the temperature valve connection will assume a position assuring that the temperature valve will seat in both extreme positions. Temperature valve position is independent of mode selection. Heater air can be mixed with cool air to modify the temperature. The temperature cable attaches to the right side of the air conditioning module. The temperature door on some models is controlled electrically, thereby eliminating the need for vacuum control valves and lines.

The electric engine cooling fan on some cars is not part of the A/C system; however, the fan is operational anytime the A/C control is in Max., Norm, or Bi-Level modes. Some models provide for engine cooling fan operation when the controller is in the defrost mode. This added feature is part of the A/C controller function and is aimed at preventing excessive compressor head temperatures. It also allows the A/C system to function more efficiently. On some models during road speed (above 35 mph) conditions when air flow through the condenser coil is adequate for efficient cooling, the engine cooling fan will be turned off. The operation of the cooling fan is controlled by the ECM through the cooling fan relay.

Complete wiring diagrams and diagnosis for the A/C Electrical System are in the electrical diagnosis section of this book. This section also contains additional diagnostic information regarding air flows and vacuum logic.

### Vacuum Lines

Vacuum lines are molded to a connector which is attached to a vacuum control switch on the control head assembly.

In case of leakage or hose collapse, it will not be necessary to replace the entire harness assembly. Replacement can be made by cutting the hose and inserting a plastic connector. If an entire hose must be replaced, cut all hoses off at the connector and then attach hoses directly to the control head vacuum switch.

### Vacuum Tank

During heavy acceleration, the vacuum supply from the engine drops. A check valve in the vacuum tank maintains vacuum so that, under load conditions, vacuum will be available for continuous use.

## RELAYS AND SWITCHES

### High Pressure Compressor Cut-Off Switch

The high-side, high pressure cut-off switch in the rear head of the compressor is a protective device intended to prevent excessive compressor head pressures and reduce the change of refrigerant escape through a safety relief valve. Normally closed, this switch will open the circuit at a

high-side pressure of approximately 2700 kPa (430 psi  $\pm$  20 psi) and reclose the circuit at approximately 1379 kPa (200 psi  $\pm$  50 psi).

### Low-Pressure Cut-Off Switch

Compressor protection is provided on some cars by a low-pressure cut-off switch which will open in the event of a low-charge condition.

### Pressure Cycling Switch

The refrigeration cycle (on and off operation of the compressor) is controlled by a switch which senses the low-side pressure as an indicator of evaporator temperature. The pressure cycling switch is the freeze protection device in the system and senses refrigerant pressure on the suction side of the system. This switch is located on a standard Schrader-type valve low-side fitting.

Additional compressor protection results from the operating characteristics of the low-side pressure cycling system. If a massive discharge occurs in the low side of the system or the orifice tube becomes plugged, low-side pressures could be insufficient to close the contacts of the pressure switch. In the event of a low charge, insufficient cooling accompanied by rapid compressor clutch cycling will be noticed at high air temperatures.

### Power Steering Cut-Off Switch

Engine idle quality on some cars is maintained by cutting off the compressor when high power steering loads are imposed.

### Wide-Open Throttle (WOT) Compressor Cut-Out Switch

A switch located on the accelerator pedal assembly of vehicles with automatic transmission opens the circuit to the compressor clutch during full throttle acceleration. The switch activates a relay that controls the compressor clutch. A pressure sensitive switch located in the transmission overrides the compressor cut-out switch if the transmission is in high gear when full throttle acceleration is called for.

### Air Conditioning Time Delay Relay

This relay on some cars controls the current to the entire air conditioning system and provides a short delay of air conditioning operation upon start up. Whenever the air conditioning system is operating, current is also applied to the idle stop solenoid (automatic transmissions only) to increase engine idle speed. The relay is controlled by the engine temperature (Hot Light) switch. When the engine temperature switch makes contact, the relay interrupts current to the A/C system and holds the system off while the switch is closed. When the engine temperature switch closes, a short time delay is provided to prevent the relay from responding to brief closures of the switch, thereby preventing compressor clutch chatter.

### Compressor Control Relay

The compressor on some cars is cut off under certain other engine operating conditions by one or more A/C control relays; wide-open throttle, low air temperature, engine overheat and low engine speed.

### Constant Run Relay

Engine idle quality on some cars is maintained by a "constant run" system (constant run relay) that eliminates

compressor cycling during engine idle for a predetermined time after the vehicle has come to rest from road speed. If the idle period continues for an extended time, the A/C system may return to a conventional C.C.O.T. mode for a short time to prevent system freeze-up. The A/C control relay and constant run relays are both controlled by the Electronic Control Module (ECM) which determines operating conditions by evaluating input from the distributor (engine speed), vehicle speed sensor, air sensor and A/C compressor "on" signal.

### Air Temperature Sensor

An air temperature sensor is used on some cars to prevent compressor operation below a specific air temperature when compressor damage could occur.

## DIAGNOSIS

### TESTING THE REFRIGERANT SYSTEM

If a malfunction in the refrigerant system is suspected due to abnormal system pressures, check the following:

1. Check outer surfaces of radiator and condenser cores to be sure air flow is not blocked by dirt, leaves or other foreign material. Be sure to check between the condenser and radiator as well as the outer surfaces.
2. Restrictions or kinks in evaporator core or condenser core, hoses, tubes, etc.
3. Refrigerant leaks.
4. Check all air ducts for leaks or restrictions. Low air flow rate may indicate a restricted evaporator core.
5. Compressor clutch slippage.
6. Improper drive belt tension.
7. Plugged accumulator or expansion (orifice) tube.
8. Excessive moisture in refrigerant system.

### LEAK TESTING THE REFRIGERANT SYSTEM

Whenever a refrigerant leak is suspected in the system or a service operation performed which results in disturbing lines or connections, it is advisable to test for leaks. **Liquid Leak Detectors**

There are a number of locations (fittings, valves, etc.) on the air conditioning system where a liquid leak detector solution may be used to pinpoint refrigerant leaks.

By applying test solution to the area in question with the swab that is attached to the bottle cap, bubbles will form within seconds if there is a leak.

For restricted access areas, such as sections of the evaporator and condenser, an electronic leak detector, such as J-23400 or equivalent, is more practical for determining and locating leaks.

### RED DYE LEAK DETECTOR

#### All Series

Some vehicles with factory-installed air conditioning are charged with a red dye leak detector. A bright red color (usually oil) will appear at the point of leakage. The dye is mixable both in the liquid R-12 and in the compressor oil. The dye leaves the compressor in the oil which is carried along with hot R-12 discharge gas. In the condenser, the dye and the oil are dissolved in the liquid R-12. The resulting mixture usually has a faint pink color. The darkness or lightness of the color depends upon the oil moving through the compressor. Leak detection in the condenser and liquid line may be slower due to the low amount of red dye in the oil. In the evaporator when the R-12 flashed to a gas the dye remains in the oil. It is then returned to the compressor by

1B-4 AIR CONDITIONING

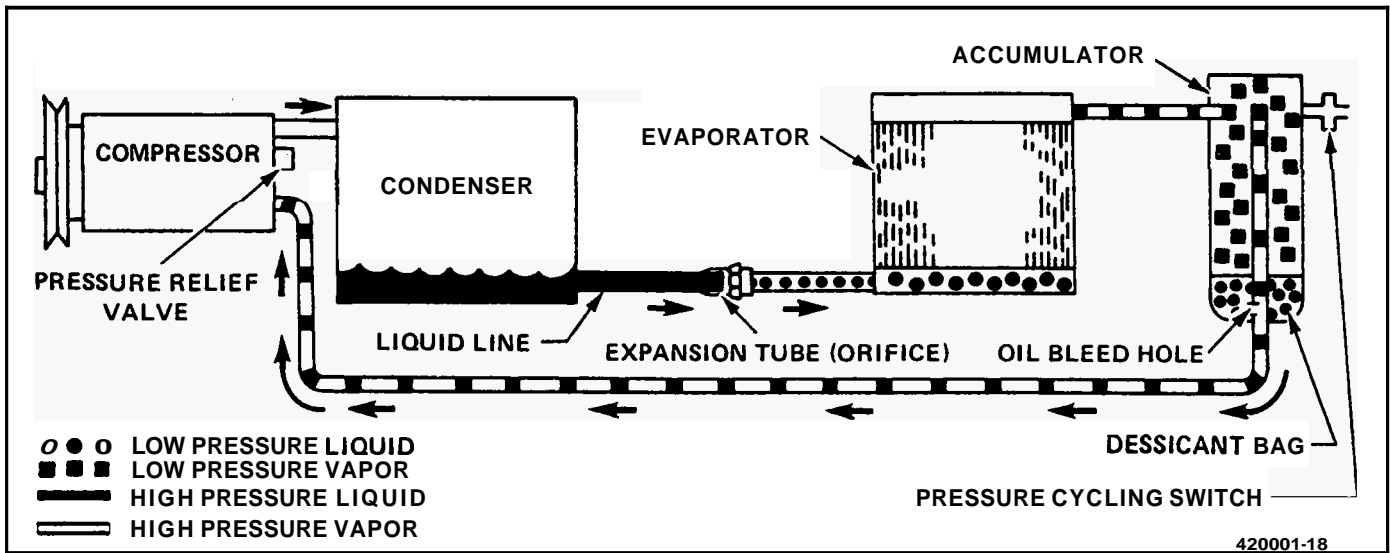


Figure 1B-1 C.C.O.T. A/C System

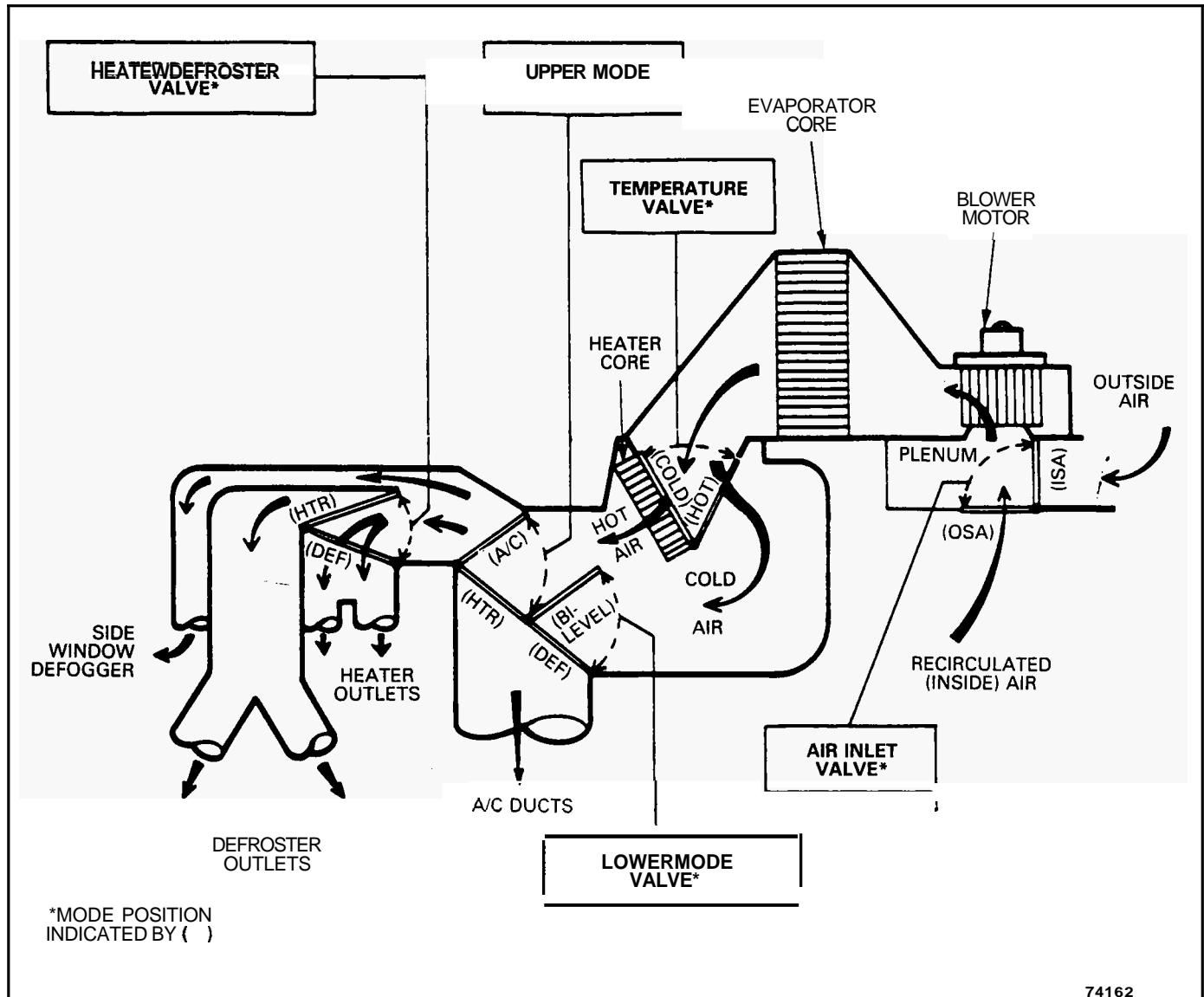


Figure 1B-2 A/C Air Flow

- |   |  |
|---|--|
| <p><b>1</b> NO BLOWER OPERATION WITH MODE LEVER IN "OFF" POSITION</p> <p><b>2</b> IN THIS MODE LEVER POSITION, MAXIMUM COOLING IS OFFERED WITH THE CONDITIONED AIR DISTRIBUTED THROUGH I.P. OUTLETS AND SLIGHT AMOUNT TO FLOOR AT ANY BLOWER SPEED</p> <p><b>3</b> CONDITIONED AIR IS DIRECTED THROUGH I.P. OUTLETS AND SLIGHT AMOUNT TO FLOOR</p> <p><b>4</b> CONDITIONED AIR IS DIRECTED THROUGH I.P. AND FLOOR DISTRIBUTOR OUTLETS WITH SOME ALSO TO WINDSHIELD</p> <p><b>5</b> A NON-COMPRESSOR OPERATING POSITION, WITH OUTSIDE AIR DELIVERED THROUGH I.P. OUTLETS</p> | <p><b>6</b> A NON-COMPRESSOR OPERATING POSITION WITH OUTSIDE AIR DISTRIBUTED ABOUT 80% TO FLOOR (AND 20% TO WINDSHIELD AND SIDE WINDOWS: SOME MODELS).</p> <p><b>7</b> CONDITIONED AIR DISTRIBUTED ABOUT 80% TO WINDSHIELD AND SIDE WINDOWS, AND 20% TO FLOOR.</p> <p><b>8</b> TEMPERATURE LEVER POSITION REGULATES TEMPERATURE OF THE AIR ENTERING THE PASSENGER COMPARTMENT BY CABLE OPERATION OF THE HEATER CORE</p> <p><b>9</b> TEMPERATURE DOOR VACUUM OPERATED SYSTEM SELECTOR (MODE) LEVER</p> <p><b>10</b> FAN CONTROL (DESIGN VARIES WITH MODEL).</p> |
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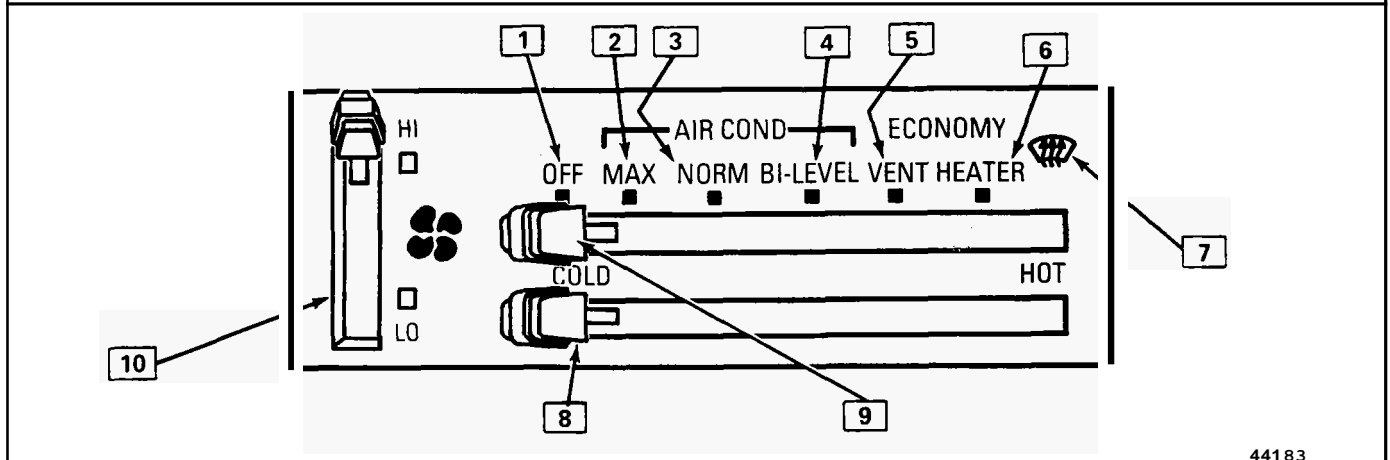


Figure 1B-3 A/C Controller

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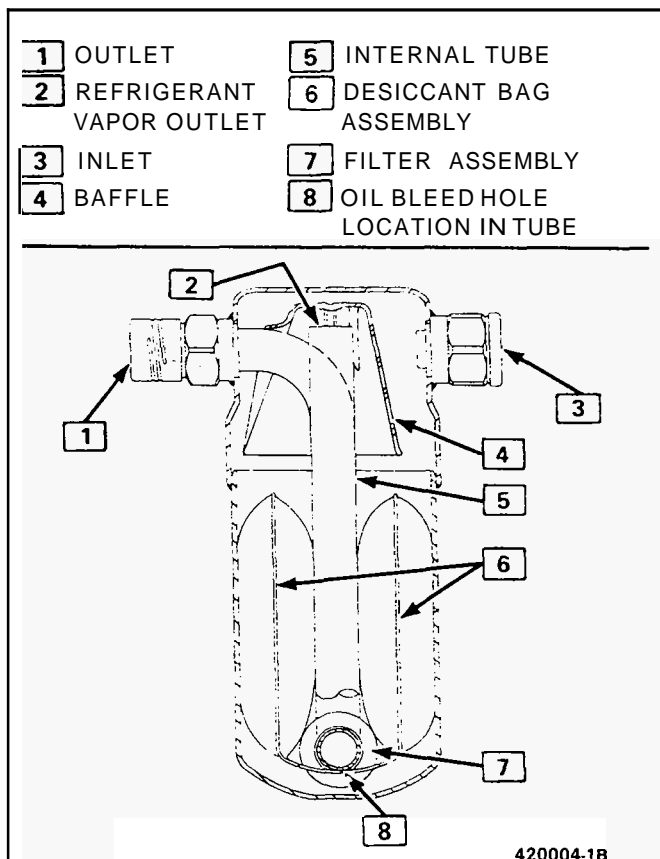


Figure 1B-4 Accumulator-Interior Parts

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It is then returned to the compressor by the suction line as an oil film. Leaks show up in a matter of minutes on the suction side in a bright red color.

In most cases, the red stain will be visible where the leak is located. Most leaks show up in a short period of time; however, some may take up to **24** hours to have enough color to see. If leaks develop in parts of systems which are difficult to see, or if dirt and oil have gathered around connections, it is suggested the area be wiped with a white cloth or paper towel. Always wipe up the dye after repairing a leak, so that the next technician does not look for a leak at that point.

The dye amount supplied with the refrigerant is designed to give maximum leak detection when the entire refrigerant charge is replaced in most systems. This will give the best results in detecting leaks quickly, as the oil will have a good dark red color. Some systems can get by on less than a full replacement charge and this can best be determined by experience. The first amount of dye is strong enough to last through many recharges before more dye is needed. If new dye is to be added with the **R-12**, it must be charged as a liquid. If charged as a vapor, the dye will be left behind as a liquid in the container. Only use **GM** approved dye when adding to the system.

The red dye can stain some materials and it may be necessary to clean it from floors, hands, and clothing. Here are some suggestions for preventing red dye stains:

1. Wrap a cloth or paper towel around couplings and fittings before disconnecting charging hoses containing red dye leak detector.
2. Surround valve or hose outlets with several layers of cloth before venting.
3. Open valves slowly. This will keep liquid refrigerant and oil from blowing out of the system.
4. Wear gloves and eye protection.
5. Wipe surfaces quickly with a clean cloth.

Solvents that will help in removing the red dye include:

1. Lacquer thinner
2. Virginia No. 10 solvent
3. Stoddard solvent and other similar solvents

The solvents are more effective if used right away.

Most of the dye can be removed from clothing by washing or by dry cleaning.

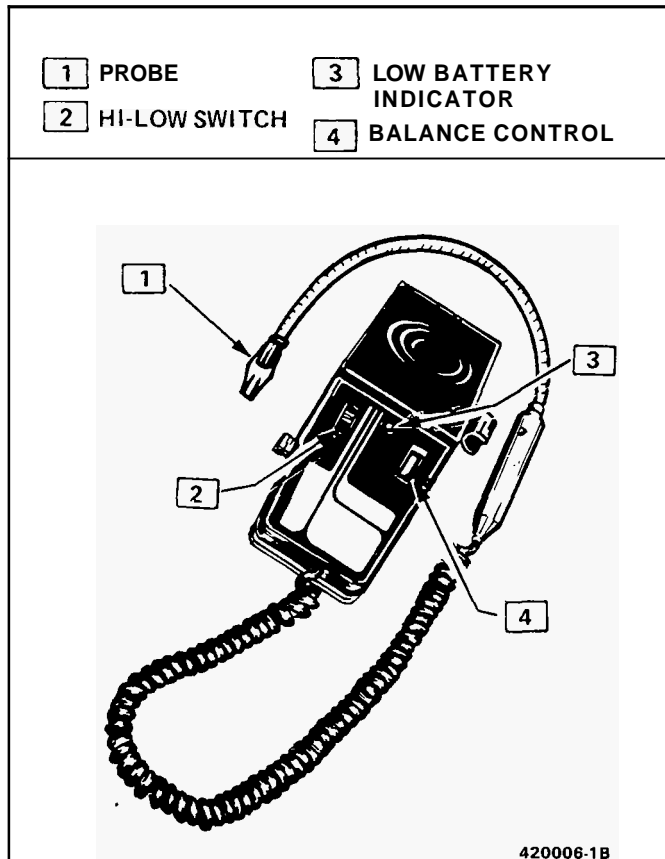


Figure 1B-5 Electronic Leak Detector J-29547

## ELECTRONIC LEAK TESTERS

(Figure 1B-5)

Electronic leak testers can accurately determine leaks in areas that are difficult to-test with liquid leak detectors due to poor visibility or inaccessibility.

The H-10 Leak Detector J-26934 is a 110-volt, A/C powered tester while the Refrigerant Leak Detector J-29547 is a portable, battery operated model. Both models provide visual and/or audible signals to indicate leak detection.

The successful use of electronic leak detectors depends upon carefully following the manufacturers instructions regarding calibration, operation and maintenance. Battery condition is especially important to the accuracy of the portable battery powered model J-29547 and is monitored by a low battery indicator.

## ELECTRICAL/VACUUM SYSTEM DIAGNOSIS

When diagnosing problems in the electrical systems of the air conditioning system, consult the electrical diagnosis section of this book.

### Operational Test

To aid in determining whether or not the air conditioning, electrical, air, and refrigeration systems are operating properly, see Section 1B for FUNCTIONAL

TESTING. Also refer to Section on electrical diagnosis which provides additional electrical diagrams and diagnosis.

1. Operation of the air conditioning blower at all four speeds with the (mode) lever in any position except "OFF" and engagement of the compressor clutch would indicate that the electrical circuits are functioning properly. (The blower will not operate in any speed with the mode lever in the "OFF" position.)
2. The same HAND-FELT temperature of the evaporator inlet pipe **AND** the accumulator surface of an operating system would indicate a properly charged Refrigeration-12 system.
3. Operation of the A/C control selector (mode) lever to distribute air from designed outlets would indicate proper functioning.

### Insufficient Heat

Check duct work for proper installation. Check blower operation. Inspect temperature lever and cable for proper installation and operation. Check water control valve as follows:

1. Start engine and allow to warm up.
2. Set control panel mode lever for "MAX" mode.
3. Feel hose from water valve to heater core. Hose should not be hot. This indicates that the water control valve and that the water supply to the heater core is shut off. In any other position of the control panel MODE lever, water should flow to the heater core. If not, check water control valve.
4. Vacuum should be applied to water valve and water flow to the heater core should stop when temperature lever is placed at the maximum cold position in any A/C mode position.

### Insufficient Cooling "Quick-Check" Procedure

The following C.C.O.T. "HAND-FEEL" procedure can be used to quickly determine whether or not the A/C system has the proper charge of Refrigerant-12 (providing air temperature is above 21°C (70°F). This check can be made in a matter of minutes, simplifying system diagnosis by pinpointing the problem to the amount of R-12 charge in the system or by eliminating low charge possibility from the overall checkout.

1. Engine must be warm and at normal idle speed.
2. Hood and body doors open.
3. Selector (mode) lever set at "NORM."
4. Temperature lever at full COLD.
5. Blower on "HI."
6. "Hand-Feel" temperature of evaporator inlet pipe after orifice, and accumulator surface, with compressor engaged.
  - a. **BOTH SAME TEMPERATURE AND BOTH SOME DEGREE COOLER THAN AMBIENT**--Proper condition: check for other problems (see C.C.O.T. A/C System Diagnostic Procedure).
  - b. **INLET PIPE COOLER** than accumulator surface--Low refrigerant charge.
    - o Add slight amounts 120ml (1/4 lbs.) of R-12 refrigerant until both feel the same temperature. Allow stabilization time between additions.
    - o Then add 420ml (.88 lbs.) 1 can additional R-12 refrigerant. (The 420ml/14 fl.oz. disposable can of R-12 refrigerant is equivalent to .88 lbs.)

- c. INLET PIPE HAS FROST  
ACCUMULATION--Accumulator surface  
warmer; proceed as in Step b above.

## SERVICE PROCEDURES

Before attempting any service which requires opening of refrigerant lines or components, the person doing the work should be thoroughly familiar with the information under HANDLING REFRIGERANT-12, HANDLING REFRIGERANT LINES AND FITTINGS AND MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM. Very carefully follow the DISCHARGING, ADDING OIL, EVACUATING AND CHARGING PROCEDURES FOR C.C.O.T. A/C SYSTEMS instructions given on the following pages for the unit being serviced.

Sealing caps should be removed from sub-assemblies just prior to making connections for final assembly. Use a small amount of clean 525 viscosity refrigerant oil on all tube and hose joints. Always use new O-rings dipped in the clean 525 viscosity refrigerant oil when assembling joints. The oil will aid in assembly and help provide a leak-proof joint. When tightening joints, use a second wrench to hold stationary part of connection so that a solid feel can be attained. This will indicate proper assembly.

Tighten all tubing connections as shown in torque chart (Fig. 1B-7). Insufficient or excessive torque when tightening can result in loose joints or deformed joint parts. Either condition can result in refrigerant leakage.

### O-RING REPLACEMENT

When replacing O-rings on air conditioning coupled hose assembly connections, the connection design should be carefully identified to assure installation of the correct O-ring.

Some connections will implement a "captive O-ring" design connector that will use an O-ring groove to hold the O-ring (see Figure 1B-8).

Assembly and tightening procedure is the same as the standard O-ring design, however, the "captive O-ring" design uses different O-rings.

### HANDLING REFRIGERANT-12

Always wear goggles and wrap a clean cloth around fittings, valves, and connections when performing work that involves opening the refrigerant system. Always work in a well ventilated area and do not weld or steam clean on or near any car-installed air conditioning lines or components.

**CAUTION: If Refrigerant-12 should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.**

All Refrigerant-12 drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for this same reason.

If it is necessary to transport or carry any container of Refrigerant-12 in a vehicle, do not carry it in the passenger compartment.

If the occasion arises to fill a small Refrigerant-12 drum from a large one, never fill the drum completely. Space should always be allowed above the liquid for expansion.

## HANDLING OF REFRIGERANT LINES AND FITTINGS

Tighten all tubing connections as shown in torque chart (Fig. 1B-7). Insufficient or excessive torque when tightening can result in loose joints or deformed joint parts. Either condition can result in refrigerant leakage.

All metal tubing lines should be free of dents or kinks to prevent loss of system capacity due to line restriction.

- The flexible hose lines should never be bent to a radius of less than four (4) times the diameter of the hose.
- The flexible hose lines should never be allowed to come within a distance of 63.5mm (2-1/2") of the exhaust manifold.
- Flexible hose lines should be inspected regularly for leaks or brittleness and replaced with new lines if deterioration or leaking is found.
- When disconnecting any fitting in the refrigeration system, the system must first be discharged of all Refrigerant-12. Proceed very cautiously regardless of gage readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid Refrigerant-12 in the line. If pressure is noticed when fitting is loosened, allow it to bleed off as described under DISCHARGING, ADDING OIL, EVACUATING AND CHARGING PROCEDURES FOR C.C.O.T. A/C SYSTEMS.
- In the event any refrigerant line is opened to the atmosphere, it should be immediately capped or taped to prevent entrance of moisture and dirt, which can cause internal compressor wear or plugged lines, in the condenser and evaporator core and expansion (orifice) tubes or compressor inlet screens.
- The use of the proper wrenches when making connections on O-ring fittings is important. The opposing fitting should always be backed up with a wrench to prevent distortion of connecting lines or components. When connecting the flexible hose connections, it is important that the swaged fitting and the flare nut, as well as the coupling to which it is attached, be held at the same time using three (3) different wrenches to prevent turning the fitting and damaging the ground seat.
- O-rings and seats must be in perfect condition. A burr or piece of dirt may cause a refrigerant leak. When replacing the O-ring, first dip it in clean 525 viscosity refrigeration oil.
- Where steel to aluminum connections are being made, use torque for aluminum tubing (see Fig. 1B-7).

## MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation and life of the air conditioning system is dependent upon the chemical stability of the refrigeration system. When foreign materials, such as dirt, air, or moisture, contaminate the refrigeration system, they will change the stability of the Refrigerant-12 and 525 viscosity compressor oil. They will also effect pressure-temperature relationship, reduce efficient operation and possibly cause interior corrosion and abnormal wear of moving parts.

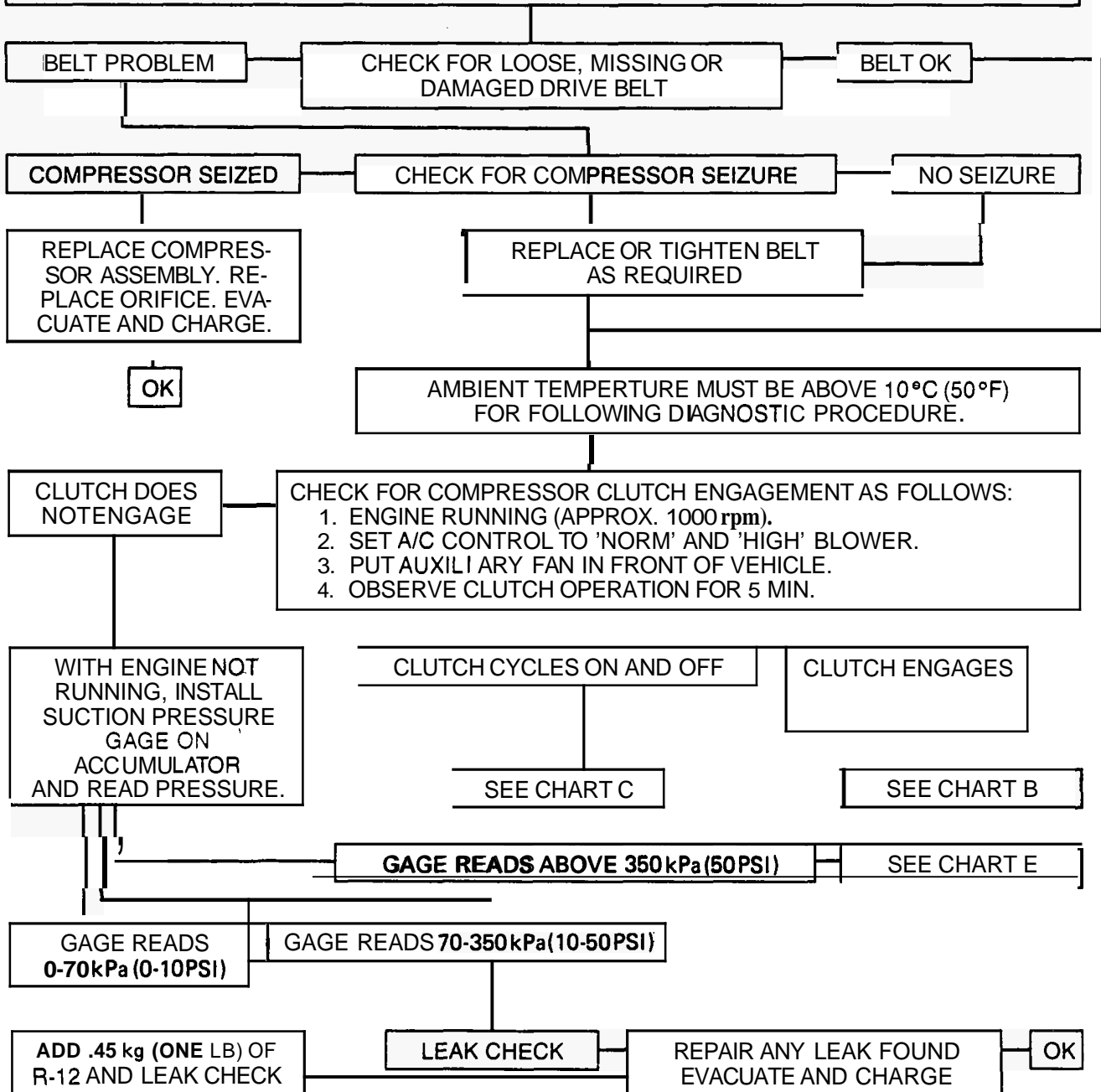
The following general practices should be observed to insure chemical stability in the system:

1. Before disconnecting a refrigerant connection, wipe away any dirt or oil at and near the connection to reduce the possibility of dirt entering the system. Both sides of the connection should be capped, plugged or

**V-5 SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART A"**

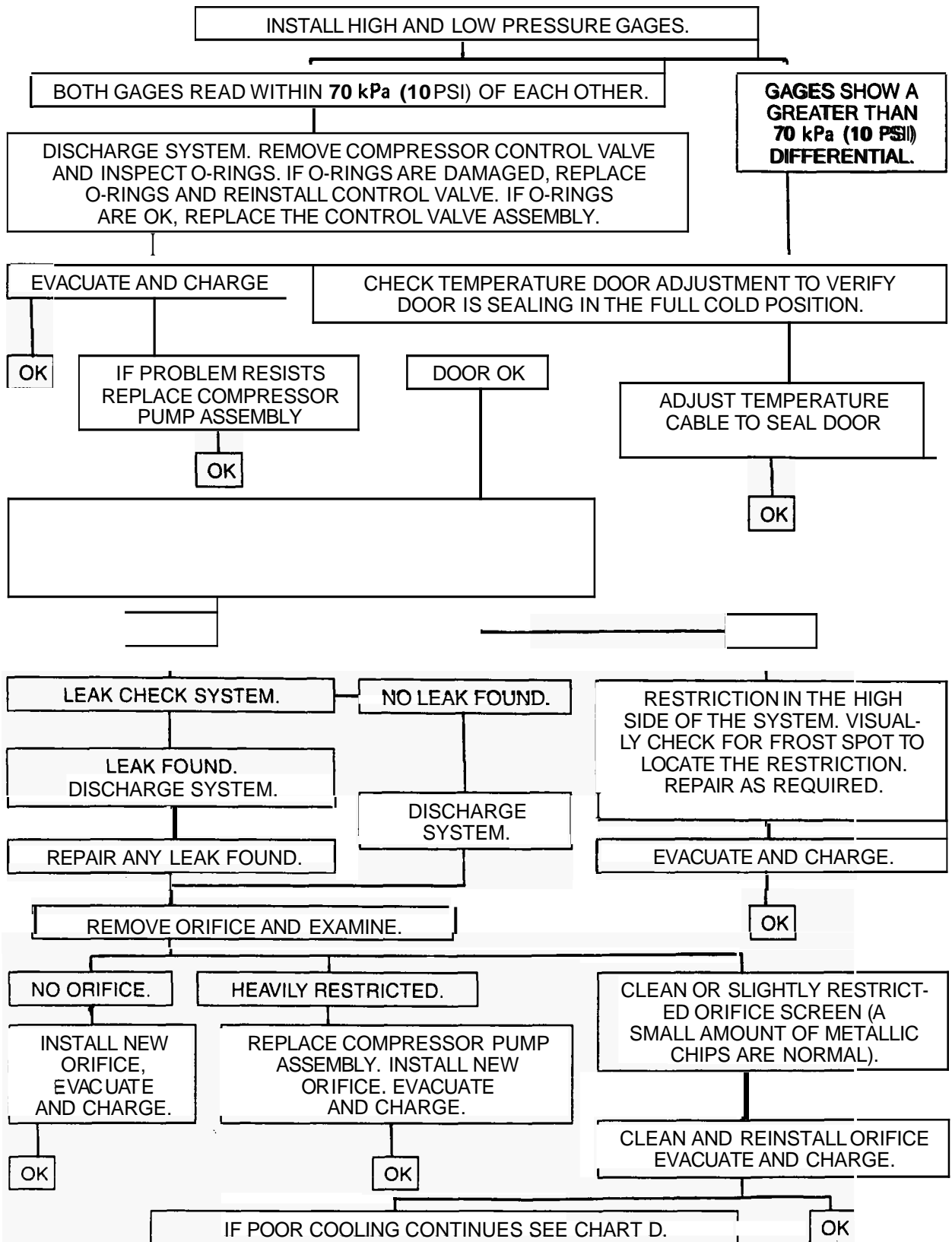
**CHECK FOR:**

1. BLOWN A/C FUSE AND/OR GAGE FUSE.
2. LOOSE OR DISCONNECTED A/C WIRE CONNECTOR.
3. CHECK BLOWER FOR FAN OPERATION.
4. ENGINE COOLING FAN OPERATION (FAN OPERATES IN ALL A/C MODES AS FOLLOWS:
  - A. DISCONNECT ENGINE COOLANT TEMPERATURE FAN SWITCH.
  - B. WITH IGNITION ON AND ENGINE NOT RUNNING, SET A/C CONTROL TO A/C MODE.
  - C. ENGINE COOLING FAN SHOULD RUN.
  - D. RECONNECT ENGINE COOLANT TEMPERATURE FAN SWITCH.





**V-5 SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART B"**



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Figure 1B-6B V-5 A/C System Insufficient Cooling Diagnostic Procedure (2 of 4)

**V-5 SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART C"**

DISCONNECT THE ENGINE COOLING FAN AND SET THE A/C CONTROL TO "NORM" AND HIGH BLOWER. WITH THE HOOD RAISED AND THE ENGINE RUNNING (APPROX. 1000 RPM), ALLOW THE COMPRESSOR TO CYCLE OFF BY THE HIGH PRESSURE CUT OUT SWITCH. IF COMPRESSOR KNOCKING NOISE **IS** OBSERVED WHEN THE COMPRESSOR REENGAGES, OR THE HIGH PRESSURE RELIEF VALVE **IS** ACTIVATED DURING THIS PROCEDURE—SYSTEM OIL CHARGE **IS** TOO HIGH. IMPORTANT! WITH THE ENGINE COOLING FAN DISCONNECTED DURING THIS PROCEDURE, DO NOT LET THE ENGINE OVERHEAT. IF THE HOT LIGHT **IS** OBSERVED DURING THIS PROCEDURE, RECONNECT THE ENGINE COOLING FAN, SHUT A/C OFF, IDLE FOR 10 MIN. TO COOL THE ENGINE AND REFER TO "SYSTEM OIL CHARGE TOO HIGH" BELOW.

SYSTEM OIL CHARGE TOO HIGH.

REENGAGEMENT NOT OVERLY NOISY AND

RECONNECT ENGINE COOLING FAN. SET A/C CONTROL TO 'NORM' AND HIGH BLOWER AND IDLE ENGINE FOR 5 MINUTES. SHUT ENGINE OFF, DISCHARGE SYSTEM AND REMOVE AND DRAIN OIL FROM BOTH THE COMPRESSOR AND THE ACCUMULATOR. REINSTALL THE ACCUMULATOR AND ADD **90 ml (3.0 OZ)** OF OIL TO THE CRANK CASE OF THE COMPRESSOR. REINSTALL THE COMPRESSOR.

RECONNECT ENGINE COOLING FAN AND SEE CHART B.

EVACUATE AND CHARGE

OK

**V-5 SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART D"**

INSTALL LOW PRESSURE GAGE ON THE ACCUMULATOR. SET A/C CONTROL TO 'MAX' AND LOW BLOWER. WITH THE WINDOWS CLOSED AND THE DOORS SHUT, IDLE FOR 10 MIN. (APPROX. 1500 RPM). READ ACCUMULATOR PRESSURE.

GREATER THAN 240 kPa (35 PSI).

200-240 kPa (29-35 PSI).

LESS THAN 200 kPa (29 PSI).

DISCHARGE SYSTEM.

REPLACE COMPRESSOR CONTROL VALVE. EVACUATE AND CHARGE.

OK

DISCHARGE SYSTEM.

REPLACE COMPRESSOR CONTROL VALVE. EVACUATE AND CHARGE. (THIS CONDITION MAY RESULT IN CORE FREEZE AND REDUCED AIR FLOW.)

OK

IF PROBLEM PERSISTS, REPLACE COMPRESSOR PUMP ASSEMBLY.

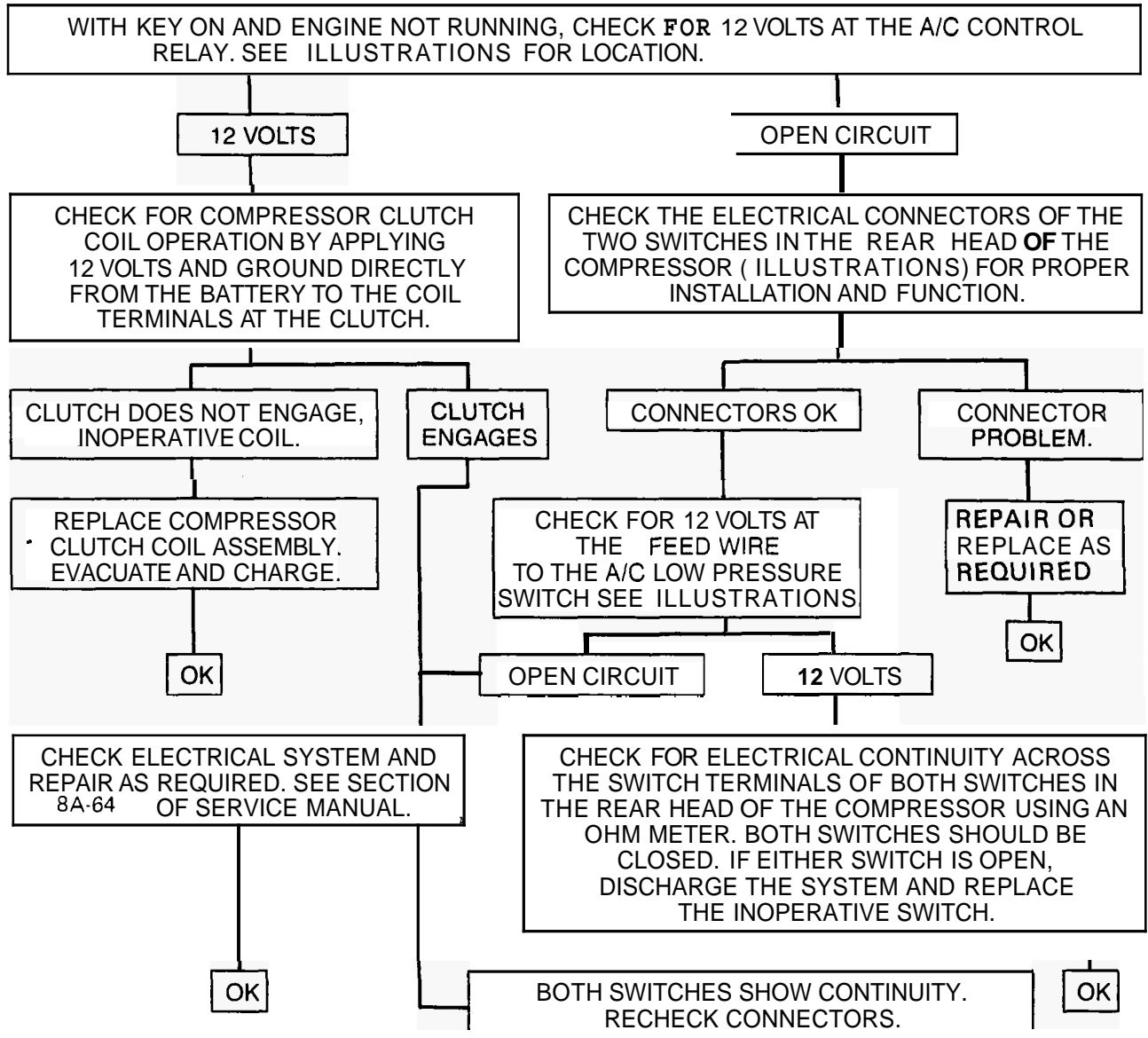
OK

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H20009-1B

Figure 1B-6C V-5 A/C System Insufficient Cooling Diagnostic Procedure (3 of 4)

V-5 SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART E"



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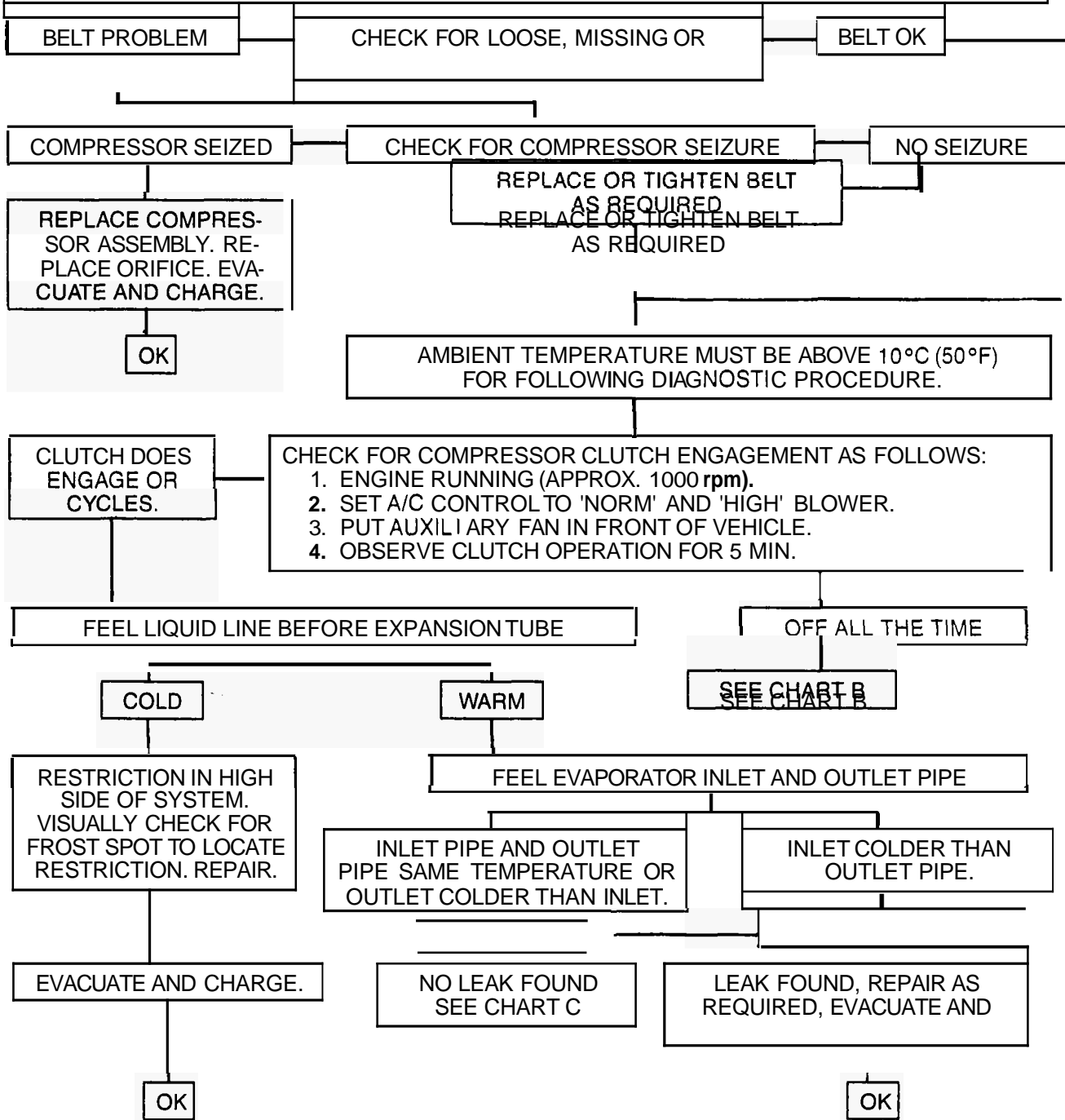
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Figure 1B-6D V-5 A/C System Insufficient Cooling Diagnostic Procedure (4 of 4)

**C.C.O.T. SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART A"**

**CHECK FOR:**

1. BLOWN A/C FUSE AND/OR GAGE FUSE.
2. LOOSE OR DISCONNECTED A/C WIRE CONNECTOR.
3. CHECK BLOWER FOR FAN OPERATION.
4. ENGINE COOLING FAN OPERATION (FAN OPERATES IN ALL A/C MODES AS FOLLOWS:
  - A. DISCONNECT ENGINE COOLANT TEMPERATURE FAN SWITCH.
  - B. WITH IGNITION ON AND ENGINE NOT RUNNING, SET A/C CONTROL TO A/C MC
  - C. ENGINE COOLING FAN SHOULD RUN.
  - D. RECONNECT ENGINE COOLANT TEMPERATURE FAN SWITCH.

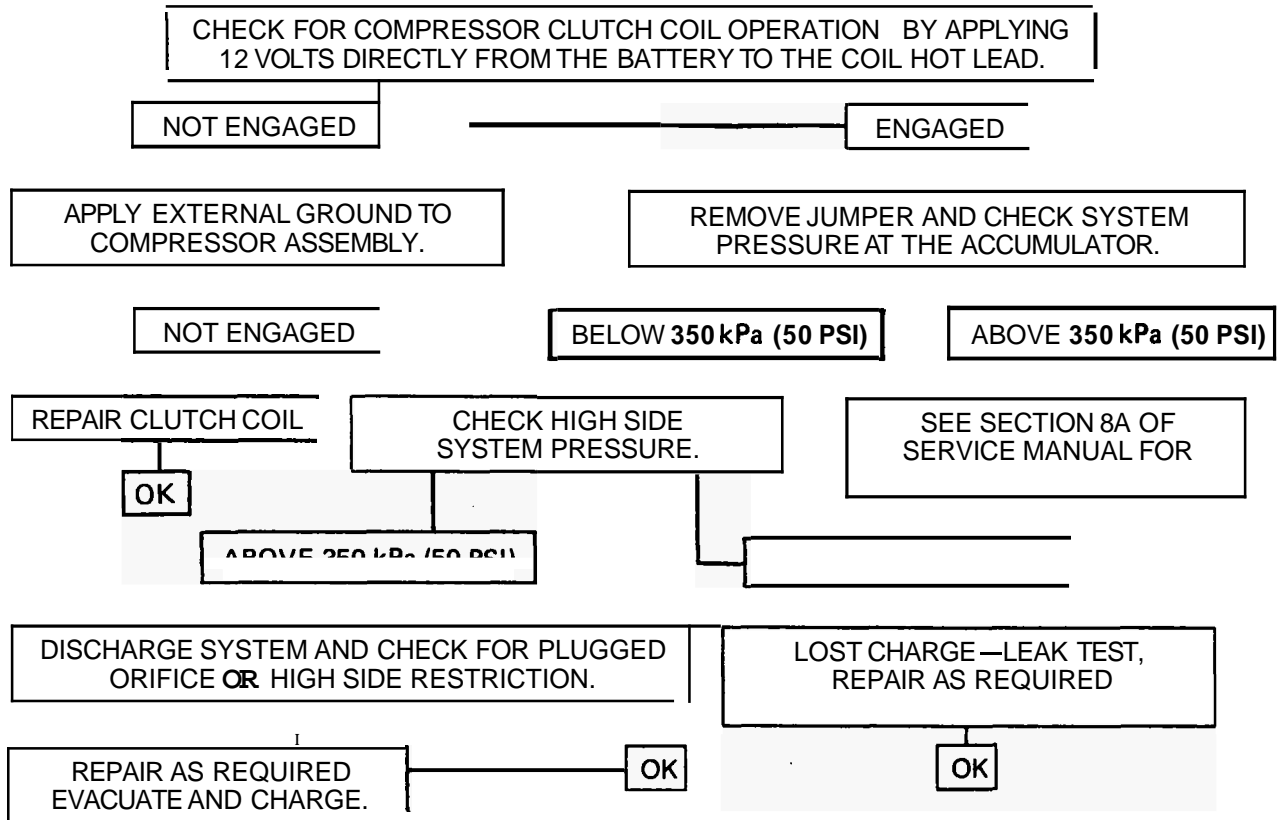


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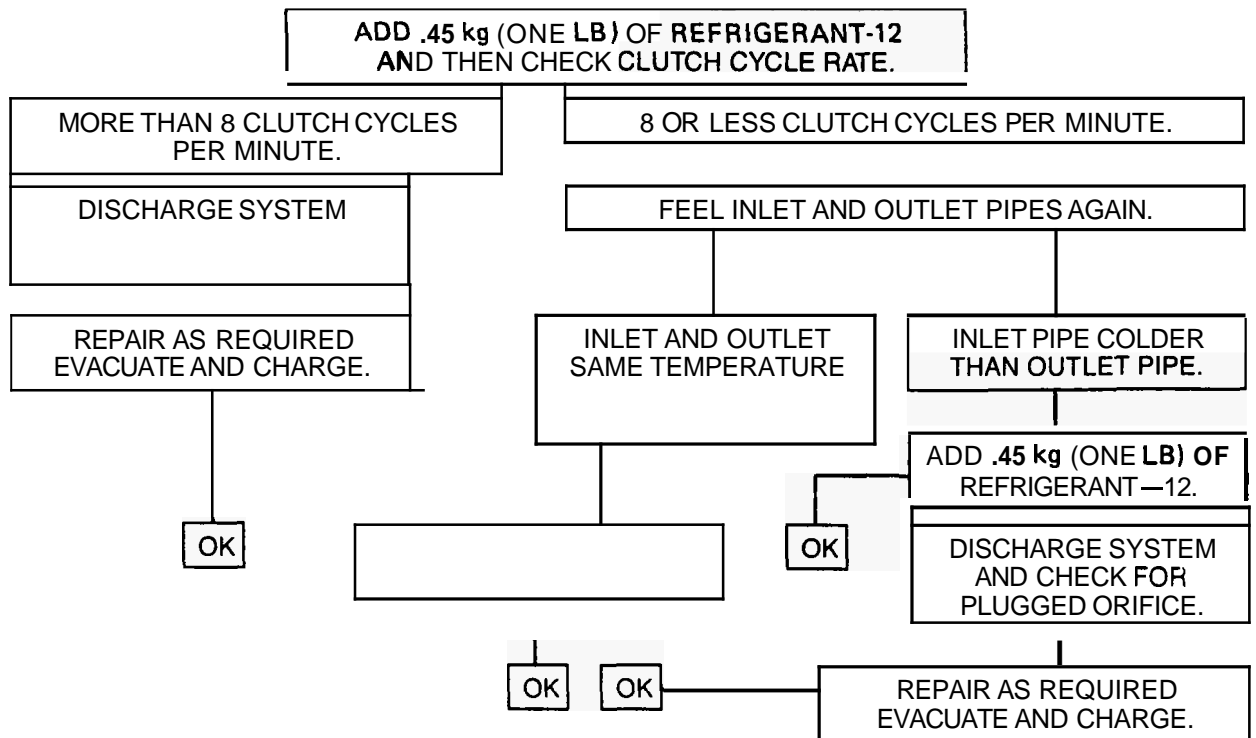
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Figure 1B-6E C.C.O.T. A/C System Insufficient Cooling Diagnostic Procedure (1 of 4)

**C.C.O.T SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART B"**



**C.C.O.T. SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART C"**

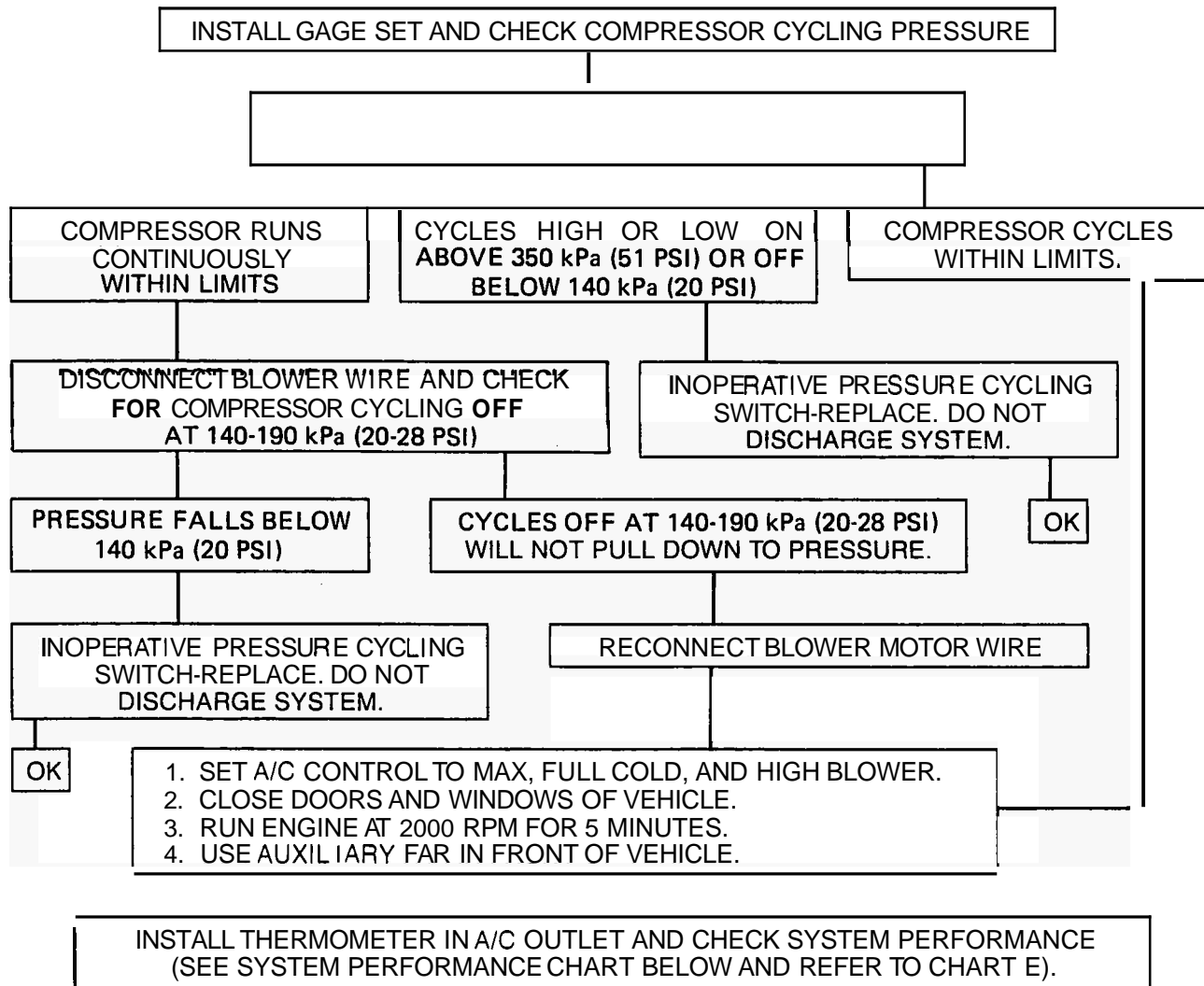


H20013.1B



Figure 1B-6F C.C.O.T. A/C System Insufficient Cooling Diagnostic Procedure (2 of 4)

**C.C.O.T. SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING " CHART D"**



**PERFORMANCE CHART FOR C.C.O.T. SYSTEMS**

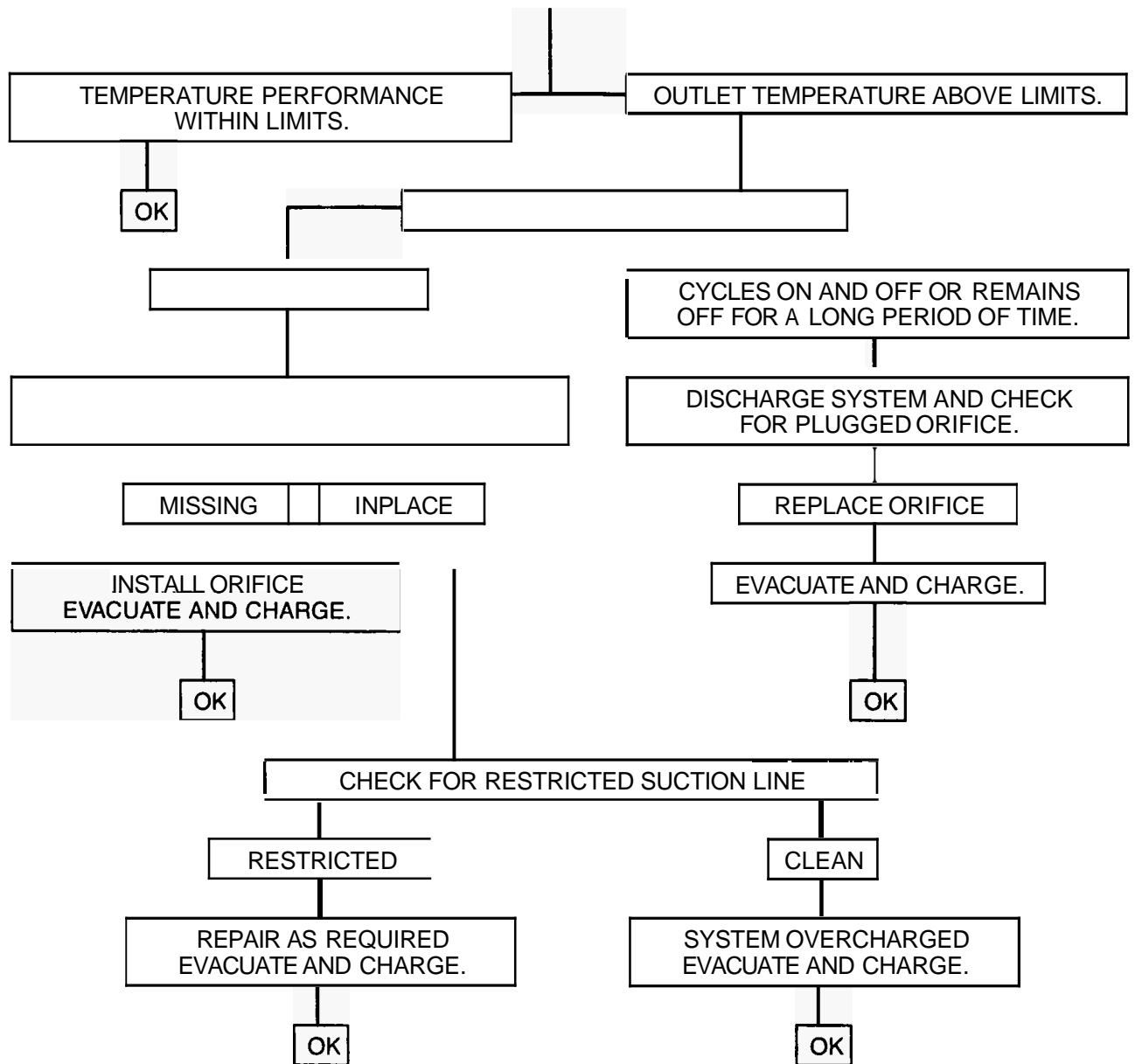
TEMPERATURE OF AIR ENTERING CONDENSER	°F (°C)	70 (21)	80 (27)	90 (32)	100 (38)
COMPRESSOR OUT PRESSURE	PSI (KPA)	135-170 (950-1200)	165-200 (1150-1400)	200-245 (1400-1700)	245-300 (1700-2050)
ACCUMULATOR PRESSURE	PSI (KPA)	22-28 (150-193)	22-29 (150-200)	26-35 (180-240)	30-40 (205-275)
AVERAGE A/C AIR DISCHARGE	°F (°C)	36-43 (2.2-6.0)	36-43 (2.2-6.0)	36-43 (2.2-6.0)	42-48 (5.5-9.0)

\*

H20014-1B

Figure 1B-6G C.C.O.T. A/C System Insufficient Cooling Diagnostic Procedure (3 of 4)

**C.C.O.T. SYSTEM AIR CONDITIONING DIAGNOSIS  
INSUFFICIENT COOLING "CHART E"**



\*

H20015-1B

Figure 1B-6H C.C.O.T. A/C System Insufficient Cooling Diagnostic Procedure (4 of 4)

METAL TUBE OUTSIDE DIAMETER	THREAD AND FITTING SIZE	STEEL TUBING TORQUE		ALUMINUM OR COPPER TUBING		NOMINAL TORQUE WRENCH %SPAN
		LB. FT.	N·m	LB. FT.	N·m	
1/4	7/16	10-15	14-20	5-7	7-9	50
3/8	5/8	30-35	41-48	11-13	15-18	
1/2	3/4	30-35	41-48	15-20	20-27	
5/8	7/8	30-35	41-48	21-27	29-37	70 1/8"
3/4	1-1/16"	30-35	41-48	28-33	30-45	70 1/4"

Figure 1B-7 Pipe & Hose Connection Torque Chart

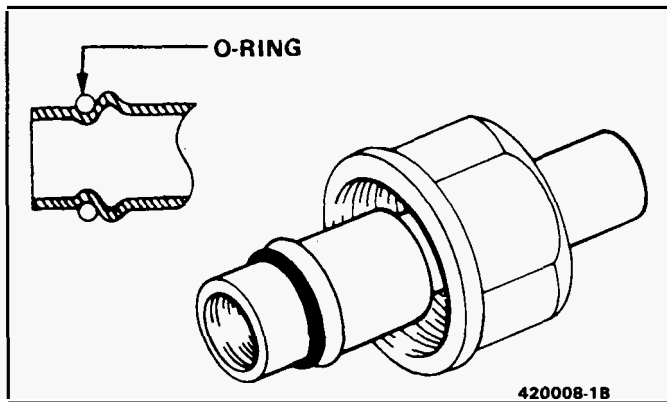


Figure 1B-8 Captive O-Ring Design

J-23575-01 and 420ml (14 oz.) disposable cans of Refrigerant-12 (Fig. 1B-10).

Charging lines from the charging station or manifold and gage set require the use of gage adapters to connect to the system service fitting. A straight gage adapter J-5420 and a 90° angle gage adapter J-9459 are available (see A/C Special Tools).

Always wear goggles and wrap a clean cloth around fittings and connections when doing work that involves opening the refrigeration system. If liquid refrigerant comes into contact with the skin or eyes, injury may result.

- o Before removing and replacing any of the air conditioning refrigeration lines or components, the system must be completely discharged of Refrigerant-12.
- o Always use service valve and pressure gage sets during evacuation and charging procedures.
- o Do not charge while compressor system is hot.
- o Always discharge system at low-side service fitting and perform the entire evacuate and charging procedure through the low-side service fitting.
- o Do not connect high pressure line or any line to the high-side service fitting during discharging and charging procedures.

**CAUTION: Never remove a gage line from its adapter when line is connected to A/C system. Always remove the line adapter from the service fitting to disconnect a line. Do not remove charging hose at gage set while attached to service low-side fitting. This will result in complete discharge of system due to the depressed Schrader valve in service low-side fitting and may cause personal injury due to escaping Refrigerant-12.**

### Discharging the C.C.O.T. A/C System

In replacing any of the air conditioning refrigeration components, the system must be completely discharged of Refrigerant-12.

#### ALWAYS DISCHARGE SYSTEM AT LOW-SIDE SERVICE FITTING

1. With ignition turned "OFF," remove protective cap from LOW-SIDE service fitting on Accumulator and connect charging station J-23500-01 or equivalent gage set. If charging station J-23500-01 or equivalent is not being used, discharge system by slowly connecting a gage hose to low-side service fitting on accumulator and discharging into oil bottle (Fig. 1B-9). As hose is slowly tightened down onto Schrader valve, Refrigerant-12 will begin to discharge from the system into the container. If no discharge occurs,

taped as soon as possible to prevent the entry of dirt, foreign material and moisture.

2. Keep tools clean and dry. This includes the manifold gage set and replacement parts.
3. When adding 525 viscosity refrigerant oil (see ADDING OIL in the DISCHARGING, ADDING OIL, EVACUATING AND CHARGING PROCEDURES FOR C.C.O.T. A/C SYSTEMS,) the transfer device and container should be clean and dry to assure that refrigeration oil remains as moisture-free as possible.
4. When it is necessary to "open" an A/C system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the A/C system open any longer than necessary.
5. Any time the A/C system has been "opened," it should be properly evacuated before recharging with Refrigerant-12 according to the DISCHARGING, ADDING OIL, EVACUATING & CHARGING PROCEDURES FOR C.C.O.T. A/C SYSTEMS.

All service parts are dehydrated and sealed prior to shipping. They should remain sealed until just prior to making connections. All parts should be at room temperature before uncapping (this prevents condensation of moisture from the air entering the system). If, for any reason, caps are removed but the connections are not made, parts should be resealed as soon as possible.

### DISCHARGING, ADDING OIL, EVACUATING AND CHARGING PROCEDURES FOR C.C.O.T. A/C SYSTEMS

The refrigerant system may be discharged, evacuated and charged using air conditioning service charging station 5-23500-01 or equivalent, or the manifold and gage set



check for missing or defective Schrader depressor in hose fitting.

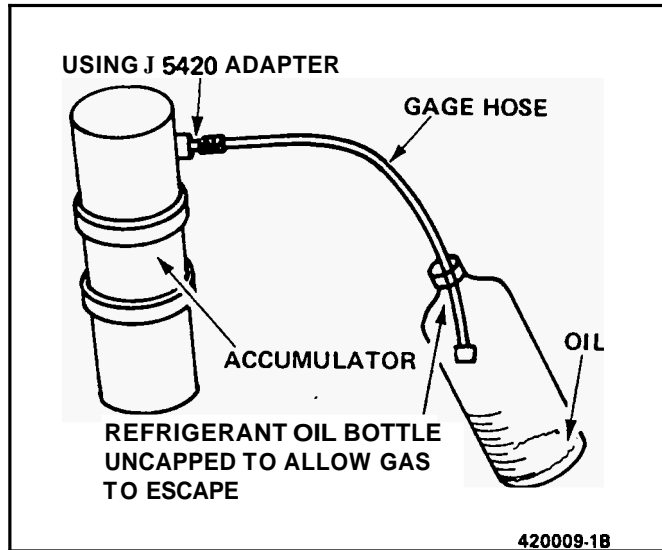


Figure 1B-9 Discharging the C.C.O.T.A/C System Without Charging Station

2. With the low-side of system fully discharged, check high-side system fitting (on liquid line or muffler) for remaining pressure.
3. If pressure is found, attempt to discharge high-side using same procedure as used for low-side. (This condition indicates a restriction on the high-side and the cause must be diagnosed and corrected before evacuating and charging the system.)
4. When the system is completely discharged (no vapor escaping with hose fully tightened down), measure, record amount, and discard the collected refrigerant oil. If the measured quantity is 15ml (1/2 fl. oz.) or more, this amount of new 525 viscosity refrigerant oil must be added to system, plus any quantity in removed parts before system evacuation and charging with Refrigerant-12 (see C.C.O.T. REFRIGERANT OIL DISTRIBUTION for specific quantity of oil normally retained in removed parts).

### Adding Oil to the Air Conditioning Refrigerant System

ADDING OIL TO THE C.C.O.T. A/C SYSTEM should take place AFTER discharge and BEFORE evacuation procedures by removing the refrigeration suction hose at the accumulator outlet pipe connection, pouring the correct quantity of new refrigerant oil into the hose or pipe and then properly reconnecting hose to pipe (see Discharging Step No. 4 and C.C.O.T. REFRIGERANT OIL DISTRIBUTION for specific quantity instructions).

### C.C.O.T. Refrigerant Oil Distribution

R-4 COMPRESSOR SYSTEM - Requires 180ml (6 fluid ounces) of 525 viscosity refrigerant oil.

DA-6 COMPRESSOR SYSTEM - Requires 240ml (8 fluid ounces) of 525 viscosity refrigerant oil.

V-5 COMPRESSOR SYSTEM - Requires 240ml (8 fluid ounces) of 525 viscosity refrigerant oil.

New oil quantities must be added to the system during component replacement and conditions stated as follows:

1. With no signs of excessive oil leakage, add;
  - a. Compressor - Remove, drain oil, measure, replace same amount of new oil plus 30ml (1 fl. oz.).

- b. Evaporator - Add 90ml (3 fl. oz.).
- c. Condenser - Add 30ml (1 fl. oz.).
- d. Accumulator - R-4 Compressor - Remove, drain oil, measure, replace same amount of new oil plus 60 ml (2 fl. oz.) to compensate for that retained by the original accumulator dessicant. DA-6 Compressor - Remove, drain oil, measure, replace same amount of new oil plus 90 ml (3 fl. oz.) to compensate for that retained by the original accumulator dessicant. If no oil can be drained from old accumulator, add 60 ml (2 fl. oz.) new oil to the new accumulator.

2. With signs of excessive oil leakage;

### R-4 Compressor System

Remove only the accumulator. Drain, measure and record quantity of oil in accumulator. It is not necessary to remove and drain the R-4 compressor because the compressor only retains a minimum quantity of oil.

If less than 90ml (3 fl. oz.), add 90ml (3 fl.oz.) of new oil to system.

If more than 90ml (3 fl.oz.), add same amount of new oil as drained.

If a new accumulator must be added to R-4 system, add 60ml (2 fl. oz.) additional oil to compensate for that retained by the original accumulator dessicant.

### DA-6 Compressor Systems

Remove only the accumulator. Drain, measure and record quantity of oil in accumulator. It is not necessary to remove and drain the DA-6 compressor because the compressor only retains a minimum quantity of oil, it doesn't have an oil sump area.

If less than 90ml (3 oz.), add 90ml (3 oz.) of new oil to system. If more than 90ml (3 oz.) add the same amount of new oil as drained. If a new accumulator must be added to DA-6 system, add 90ml (3 oz.) additional oil to compensate for that absorbed by the original accumulator dessicant.

### DA-5 Compressor Systems

Remove the accumulator and the compressor and drain them and measure the amount of oil removed.

- If less than 90ml (3 oz.) is drained, add 90ml (3 oz.) of new oil to system.
- If more than 90ml (3 oz.) of oil was drained, add the same amount of new oil.

If the accumulator must be replaced, add the amount of oil drained plus 90ml (3 oz.) more to allow for the oil retained by the original accumulators dessicant.

### Evacuating and Charging the C.C.O.T. A/C System

If the system has been opened for any repair, or the Refrigerant-12 charge lost, the system must be evacuated prior to charging.

Evacuation and charging is a combined procedure, and all gage lines must be purged with R-12 prior to charging.

There are three evacuate and charge procedures.

1. J-23500-01 Charging Station Method
2. Disposable Can Method
3. Drum Method

**NOTICE:** Under no circumstances should alcohol be used in the system in an attempt to remove moisture. Damage to the system components could occur.

## Gage Calibration

Prior to evacuation, check the low pressure gage for proper calibration and determine if vacuum system is operating properly.

With the gage disconnected from the refrigeration system, be sure that the pointer indicates to the center of "O". Lightly tap gage a few times to be sure pointer is not sticking. If necessary, calibrate as follows:

1. Remove cover from gage.
2. Holding gage pointer adjusting screw firmly with one hand, carefully force pointer in the proper direction to position pointer at the "O" position. Tap gage a few times to be sure pointer is not sticking. Replace gage cover.

## Vacuum System Check

Before connecting vacuum pump to the A/C system, run pump connected to the low pressure gage to determine the vacuum pump capability. If the vacuum system is unable to reach 711.2-736.6mm (28"-29") or more vacuum, the system should be checked for leaks. If no leaks are found, the vacuum pump may require repair.

### J-23500-01 OR EQUIVALENT CHARGING STATION METHOD

Follow charging instructions provided with the 5-23500-01 Charging Station or equivalent in use with the following exceptions:

1. Do not connect the high pressure line to the air conditioning system.
2. Keep the high pressure valve on the charging station closed at all times.
3. Perform the entire evacuate and charge procedure through the accumulator low-side pressure service fitting.
4. Following these procedures will prevent accidental high-side vehicle system pressure being subjected to the charging station in the event an error is made in valve sequence during compressor operation to pull in the Refrigerant-12 charge.

### DISPOSABLE CAN OR REFRIGERANT DRUM METHOD

If the Refrigerant-12 drum is used, place it on a scale and note the total weight before charging. Watch the scale during charging to determine the amount of R-12 used.

If disposable 420ml (14 ounce) R-12 cans are used, close the tapping valve and then attach can(s) following instructions included with the tapping valve or tapping manifold adapter.

1. Connect manifold gage set J-23575-01 as follows. Also see Fig. 1B-10.
  - a. Low pressure gage to accumulator fitting.
  - b. Gage set center hose to Refrigerant-12 source.
  - c. High pressure gage to vacuum pump.
2. To begin evacuation of the A/C System with manifold gage set and vacuum pump as illustrated in Fig. 1B-10, slowly open high- and low-side gage valves and begin vacuum pump operation. Pump the system until the low-side gage reaches 711.2 - 736.6mm (28"-29") vacuum.

Note that in all evacuation procedures, the specification of 711.2- 736.6mm (28"-29") vacuum is used. This specification can only be reached at or near sea level. For each 304.8m (1,000 feet) above sea level, specification should be lowered by one inch vacuum.

At 1524m (5,000 feet) elevation, only 584.2 - 609.6mm (23"-24") of vacuum is required.

If prescribed vacuum can't be reached, close vacuum control valve, shut off pump and look for a leak at connections or pump.

3. When gage reaches prescribed vacuum, the system is fully evacuated. Close the high-side gage set valve and turn off the vacuum pump.
4. Watch low-side gage to be sure vacuum holds for five (5) minutes. If vacuum is held, disconnect vacuum hose at gage set and then proceed to charging.
5. If vacuum does not hold for five (5) minutes, charge system with 420ml (1/2 pound) Refrigerant-12 and leak check. Discharge system again and repair leak as necessary. Repeat evacuation procedure.

## To Begin Charging of the C.C.O.T. A/C System

1. Start engine, run until engine reaches operation temperature, set A/C mode control lever on "OFF."
2. With the Refrigerant-12 drum or 420ml (14 ounce) can(s) inverted, open R-12 source valve(s) and allow 480ml (1 pound) or one 420ml (14 oz.) can of liquid R-12 to flow into system through low-side service fitting.
3. As soon as 480ml (1 lb.) or one 420ml (14 oz.) can of R-12 has been added to system, immediately engage the compressor by setting the A/C control button to NORM and blower speed on HI, to draw in the remainder of the R-12 charge. See specifications for total R-12 charge.

The charging operation can be speeded up by using a large volume fan to pass air over the condenser. If condenser temperature is maintained below charging cylinder temperature, Refrigerant-12 will enter the system more rapidly.

4. Turn off R-12 source valve and run engine for 30 seconds to clear lines and gages.
5. With the engine running, remove the charging low-side hose adapter from the accumulator service fitting. Unscrew rapidly to avoid excess R-12 escape from system.

**CAUTION: NEVER REMOVE A GAGE LINE FROM ITS ADAPTER WHEN LINE IS CONNECTED TO A/C SYSTEM. ALWAYS REMOVE THE LINE ADAPTER FROM THE SERVICE FITTING TO DISCONNECT A LINE. DO NOT REMOVE CHARGING HOSE AT GAGE SET WHILE ATTACHED TO ACCUMULATOR. THIS WILL RESULT IN COMPLETE DISCHARGE OF SYSTEM DUE TO THE DEPRESSED SCHRADER VALVE IN SERVICE LOW-SIDE FITTING, AND MAY CAUSE PERSONAL INJURY DUE TO ESCAPING REFRIGERANT-12.**

6. Replace protective cap on accumulator fitting.
7. Turn engine off.
8. Leak check system with electronic leak detector 5-29547 or equivalent (see Diagnosis).
9. Start engine.
10. With system fully charged and leak-checked, continue to operate system performance.

## SYSTEM FLUSHING PROCEDURE

To assure removal of any system contamination (i.e., metal particles) resulting from a damaged or seized compressor, follow the flush procedure outlined below:

1. Add a partial charge of 2 lbs. (.90 Kg.) of refrigerant to the discharged system.

## CONDITIONING

- Apply a small amount of lubricant to inside of socket and slide over barbed end of can fitting, round end towards can and hex end away from can (Figure 1B-11).
- Push cut end of hose over barbed end of can fitting until all barbs are covered. Hose end should be 1/8 inch past last barb (Figure 1B-11).
- Hold hose in position. Slide socket towards hose while turning **counterclockwise** to thread onto hose. Use open end wrench to turn socket onto hose until round end of socket is 7/8" or one socket length from shoulder on fitting stem.
- Approximately 1/8" of hose end should protrude from round end of socket when socket has been adequately threaded onto hose (Figure 1B-11).
- Repeat assembly procedure for opposite end of can.
- Reinstall hose/can assembly and evacuate/recharge system per recommended procedure, using additional 1/2 pound of refrigerant to compensate for filter dryer volume. If system has been severely contaminated, replacement of the orifice tube may be required.

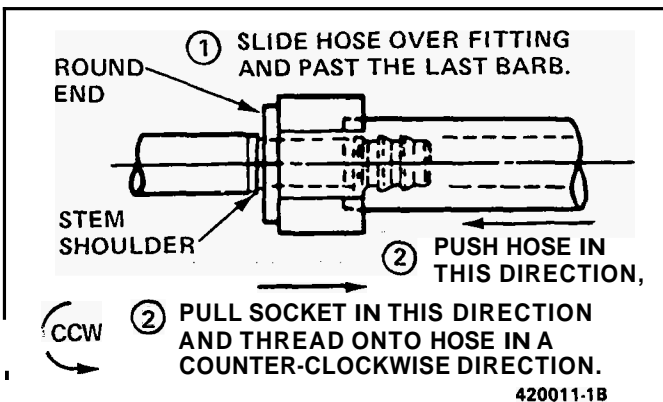


Figure 1B-11 Nylon Line Filter Installation

### Aluminum Line Installation

- Discharge air conditioning system per recommended procedure.
- If possible, select an installation location adjacent to area (fender well, etc.) that will allow use of optional bracket.
- Remove a 4-3/4" section of the line. Remove burrs and loose particles from cut ends.
- Insert pipe end into can fitting until pipe bottoms in the fitting body (Figure 1B-12). If the fitting requires assembly, the tapered end of the ferrule goes into the fitting body.
- Tighten fitting nut to "finger tight." Then with open-end wrench, tighten fitting nut an additional 3/4 turn while holding the can with a second open-end wrench. (Figure 1B-12).
- Repeat assembly procedure for opposite end of can.
- Evacuate/recharge system per recommended procedure, using additional 1/2 pound of refrigerant to compensate for filter dryer volume. If system has been severely contaminated, replacement of the orifice tube may be required.

### EXPANSION TUBE (ORIFICE)

#### Remove and Install

- Discharge system.
- Loosen nut at liquid line to evaporator inlet pipe and remove tube carefully with needle nosed pliers or Tool J-26549-C or equivalent.

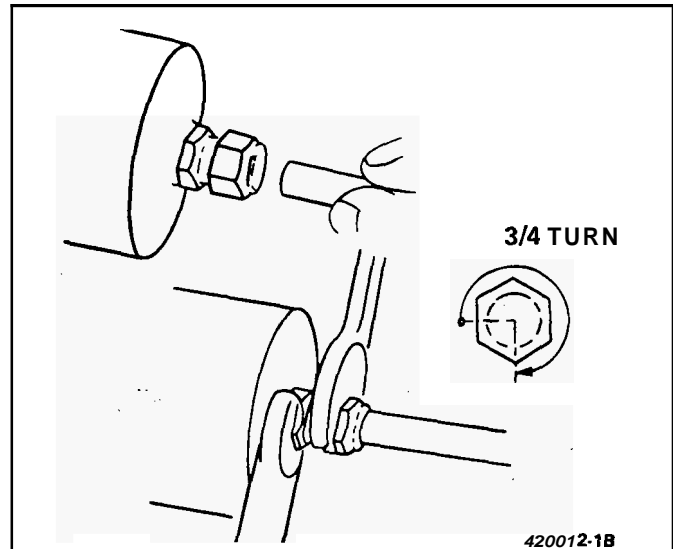


Figure 1B-12 Aluminum Line Filter Installation

- Install new orifice tube with shorter screen end in first.
  - Install liquid line and torque to proper specification.
  - Evacuate and charge system.
- In the event that difficulty is encountered during the removal of a restricted or plugged expansion tube (orifice tube), the following procedure is recommended:
- Remove as much of any impacted residue as possible.
  - Carefully apply heat with heat gun (hair drier, epoxy drier or equivalent) approximately 1/4 inch from dimples on inlet pipe. Do no overheat pipe.

**NOTICE:** If the system has a pressure switch near the orifice tube location, it should be removed prior to heating the pipe to avoid damage to switch.

- While applying heat, use orifice removal tool J26549-C to grip the orifice tube. Use a turning motion along with a push-pull motion to loosen to the impacted orifice tube and remove it.
- Swab inside of evaporator inlet pipe with R-11 or equivalent solvent.
- Add 1 oz. of 525 viscosity refrigerant oil to system.
- Lubricate new orifice tube and O-ring with 525 Viscosity refrigerant oil and insert into inlet pipe. Install in proper direction (smaller screen first).

### ACCUMULATOR ASSEMBLY

The accumulator assembly for the C.C.O.T. refrigerant system has a service replacement which includes two (2) O-rings (for the inlet and outlet connections). The dessicant within the shell is NOT serviced separately - it is part of the sealed accumulator assembly. See C.C.O.T. REFRIGERANT OIL DISTRIBUTION for conditions when the accumulator must be removed from the vehicle to measure the amount of oil present inside the accumulator.

The accumulator assembly should only be replaced when:

- A physical perforation to the accumulator is found, resulting in a leak.
- The expansion (orifice) tube screen experiences continued or repeated plugging.
- An evaporator fails due to inside-out (internal) corrosion.

DO NOT REPLACE the accumulator assembly when:

## IN-LINE AIR CONDITIONING INSTALLATION

## Nylon Hose Installation Procedure

1. Discharge air conditioning system.
2. Select and mark hoses for installation.
3. If practical, use well, etc.) the hoses.
4. At marked cutting as loose fragments.

An in-line air conditioning servicing vehicle which have system contamination and can be replaced at higher mileage. The in-line filter/dryer is a less expensive alternative replacement of the receiver assembly. The parts are available that allow installation at various locations, depending upon availability.

When making connections, O-rings or cross threading may occur. Evacuate and recharge system.

USING J 23390 OPERATOR VALVE FOR 12 LB. CO<sub>2</sub> SYSTEM WITH DISPOSABLE CAN OR REFRIGERANT



Figure 1B-10 Charging the C.O.T. A/C System with Disposable Can or Refrigerant

1. Start engine. Assume control is set to "Max" position and blower set on "HI". Run engine at idle for a minimum of five minutes to allow sufficient compressor operation.
2. Shut off engine and discharge system. Cap the open end of the liquid line at the evaporator inlet. Cap the expansion tube and O-ring from the evaporator inlet. Cap evaporator inlet while system is open to keep air, moisture, and dirt from entering evaporator.
3. Using a needle nose pliers, tool J-26549-C or equivalent, grip the plastic tip of the expansion (orifice) tube and remove the expansion tube and O-ring from the evaporator inlet. Cap evaporator inlet while system is open to keep air, moisture, and dirt from entering evaporator.
4. Using an air hose, blow off any metal particles or other contaminants from expansion tube. Thoroughly dry the expansion tube and assure no metal particles or contaminants are present before reinstallation. If the expansion tube cannot be cleaned, replacement is recommended.
5. Remove evaporator inlet cap and pour the exact amount of fresh 525 viscosity refrigerant oil lost during rapid discharge (as measured in system discharge, step 3 above) directly into the liquid line. Insert the expansion tube into the inlet line with short end first and push until the tube reaches a firm stop. This indicates proper seating of the O-ring. Tighten Remove cap on condenser to evaporate liquid line. Connect the liquid line to the evaporator inlet. Tighten to 17 N·m (12 lb.ft.).
6. Always slip the lubricated O-ring onto the flange tube to insure proper locating and sealing. Backing wrenches of the required size must be used during the final tightening of all O-ring and flare-type

1. Merely a dent is found in the outer shell of the accumulator.
2. A vehicle is involved in a collision and no physical perforation to the accumulator is found. An open refrigerant line should be capped or have a plastic bag tightly taped around it.

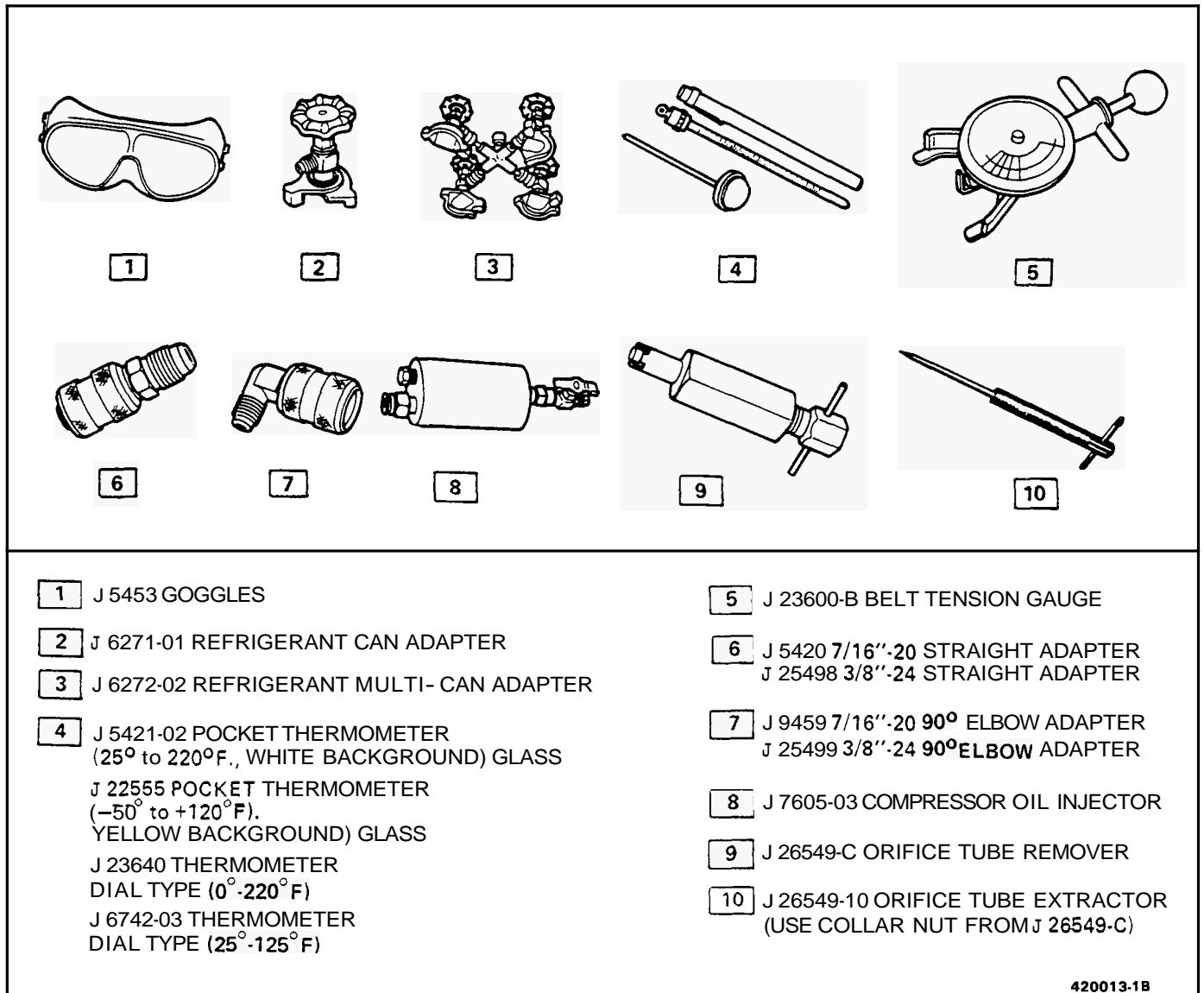


Figure 1B-13 A/C Special Tools

## A CARLINE

### GENERAL INFORMATION

Tighten all tubing connections as shown in torque chart (Figure 1B-7). Insufficient or excessive torque when tightening can result in loose joints or deformed joint parts. Either condition can result in refrigerant leakage.

### R-12 CHARGING CAPACITIES

A Model ..... 1246ml (44 fluid ounce, 2.75 lbs.)

The 420ml (14 fl. oz.) disposable can of R-12 refrigerant is equivalent to .88 lb.

### ON-CAR SERVICE

- To service air conditioning, defroster, and heater duct work, see Section 8C - Instrument Panel.

### TEMPERATURE CABLE ADJUSTMENT

1. Attach cable to the control assembly.
2. Place temperature lever in "COLD" position.
3. Place opposite loop of cable on heater case temperature door post.
4. Push cable sheath toward temperature lever until temperature door seats and lash is out of cable and control.
5. Tighten screw to secure cable.
6. Move temperature lever from "COLD" to "HOT" to allow the cable to self-adjust.

## PRESSURE CYCLING SWITCH

### Remove or Disconnect

1. Negative battery cable.
2. Electrical connections at switch.
3. Pressure cycling switch and discard O-ring. (The switch is mounted on a Schrader valve; do not discharge the system.)

### Install or Connect

1. Pressure cycling switch and new O-ring. Tighten to 5 N·m (44lbs. in.).
2. Electrical connections
3. Negative battery cable

## COMPRESSOR HIGH PRESSURE CUT-OFF SWITCH

### Remove or Disconnect

1. Negative battery cable
2. Discharge system.
3. Coupled hose assembly at rear of compressor
4. Electrical connection at switch
5. Switch and O-ring seal from rear head of compressor

### Install or Connect

1. Switch and new O-ring seal
2. Electrical connection at switch
3. Coupled hose assembly at rear of connector
4. Negative battery cable
5. Evacuate and charge system

## COUPLED HOSE ASSEMBLY

### Remove or Disconnect

1. Discharge system.
2. Coupled hose assembly from compressor
3. High-pressure line at condenser fitting and low-pressure line at accumulator outlet fitting
4. Hose clamps and remove assembly

### Install or Connect

1. High-pressure line at condenser fitting and low-pressure line at accumulator fitting
2. Assembly to compressor
3. Hose clamps
4. Evacuate and charge system.

## LIQUID LINE

### Remove or Disconnect

1. Discharge system.
2. Loosen connections at condenser outlet and evaporator inlet.
3. Liquid line positioning clamp and bracket screws and remove liquid line

### Install or Connect

1. Liquid line and clamp
2. Connections at condenser outlet and evaporator inlet

3. Evacuate and charge system.

## CONDENSER

### Remove or Disconnect

1. Discharge the system.
2. High-pressure line to condenser fitting and liquid line fitting at condenser
3. Grill center support, and (4) screws securing condenser
4. Condenser

### Install or Connect

1. Condenser and tighten (4) retaining screws
2. Grille center support
3. High-pressure line and liquid line fittings at the condenser
4. Evacuate and charge system

## ACCUMULATOR

### Remove or Disconnect

1. Discharge the system.
2. Low-pressure return lines at both the inlet and the outlet accumulator connections
3. Pressure cycling switch connection and remove the switch
4. Loosen the lower bracket bolt and spread the bracket. Rotate the accumulator and remove.

### Install or Connect

1. Position the accumulator in the securing bracket and tighten the clamp bolt.
2. Pressure switch, then reconnect the electrical connection, and connect battery.
3. Low-pressure lines at the inlet and the outlet connections on the accumulator
4. Evacuate and charge the system.

## A/C COMPRESSOR

### VIN Code R (2.5L)

### Remove or Disconnect

1. Negative battery cable
2. Electrical connections from compressor
3. Discharge system
4. Coupled hose assembly from rear head of compressor
5. Upper A/C adjustment bolt and spacer
6. Lower A/C bracket bolt and lower pivot bolt
7. Rear lower compressor adjustment nut
8. Compressor

### Install or Connect

1. Compressor and rear lower compressor adjustment nut
2. Lower A/C bracket bolt and lower pivot bolt
3. Upper A/C adjustment belt and spacer
4. Coupled hose assembly to the rear head of the compressor
5. Electrical connections
6. Evacuate and charge the system

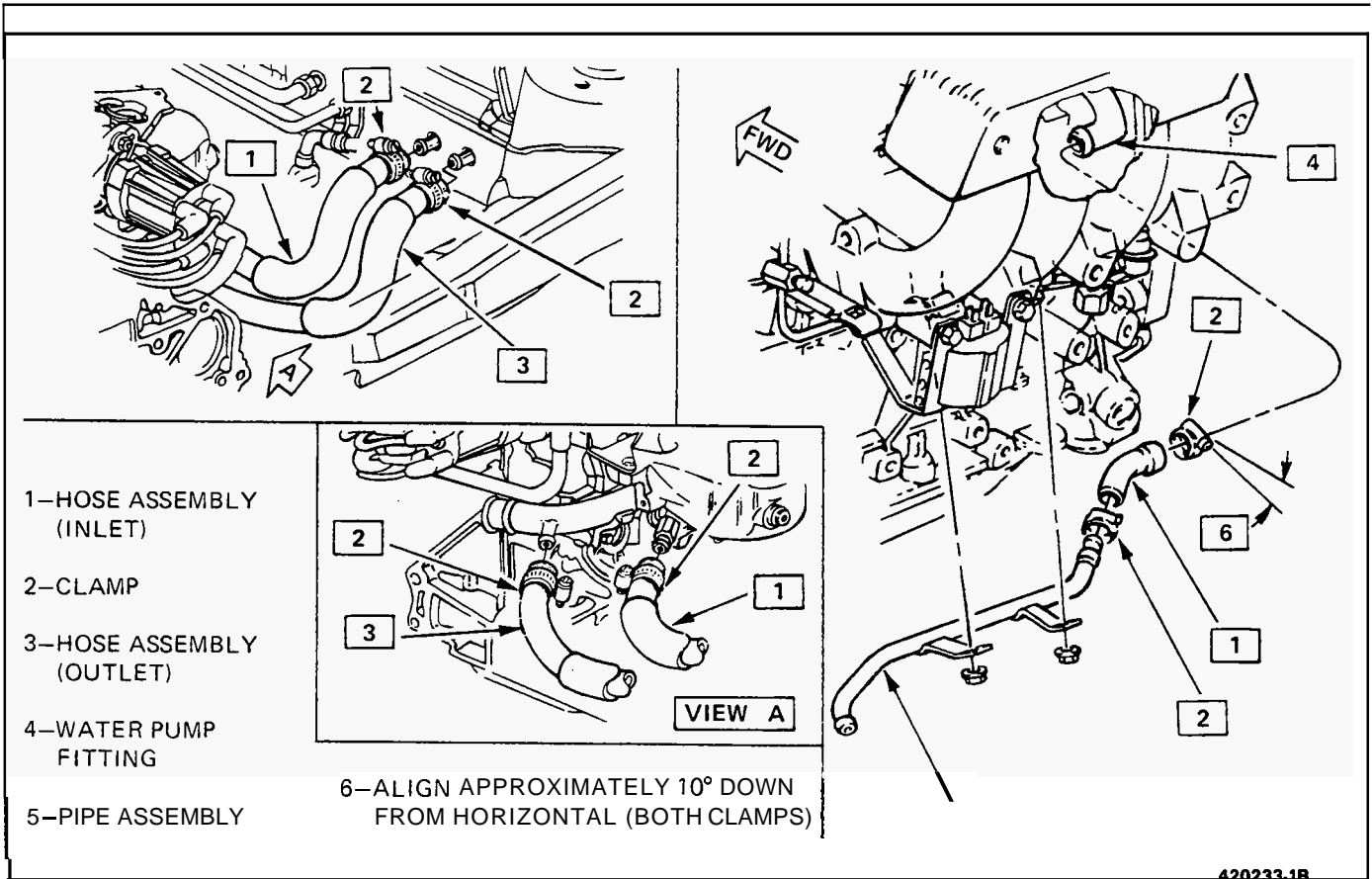


Figure 18-52 Heater Hose Routing-LL8

## B & G CARLINES

### GENERAL INFORMATION

#### R-12 CHARGING CAPACITIES

B Series .....	1.59 Kg (3.50 lbs.)	R-12
G Series .....	1.48 Kg (3.25 lbs.)	R-12

### ON CAR SERVICE

- To service air conditioning, defroster and/or heater duct work, see Section 8C - I/P.

#### A/C Control Head

(See Section 8C)

#### Temperature Cable Adjustment

##### Adjustment

- Remove push-on retainer and disengage temperature cable sliding clip from bellcrank post.
- The temperature door's threaded operating rod should be snapped into the bellcrank's white nylon retaining button groove so that 6mm (.25 inch) of threaded rod end is exposed beyond the outer edge (towards you as you snap it into place) of the white button.
- Re-engage temperature cable retaining clip to bellcrank's vertical post.
- Move temperature control lever full travel in both directions (full HOT-full COLD) to automatically allow cable adjustment. The temperature door should make a "thud" as it's open and closed position.

#### Pressure Cycling Switch



##### Remove or Disconnect

- Harness connector from switch.
- Switch from schrader valve fitting (valve prevents loss of refrigerant) on accumulator.
- Discard O-ring



##### Install or Connect

- New O-ring (coat O-ring with 525 refrigerant oil).
- Switch on schrader valve fitting on accumulator
- Harness connector to switch

#### Blower Assembly



##### Remove or Disconnect

- Two (2) electrical connectors
- Six (6) screws holding blower assembly to blower case
- Lift blower and fan assembly straight up to remove



##### Install or Connect

- Blower and fan assembly to blower case with six (6) screws
- Two (2) electrical connectors

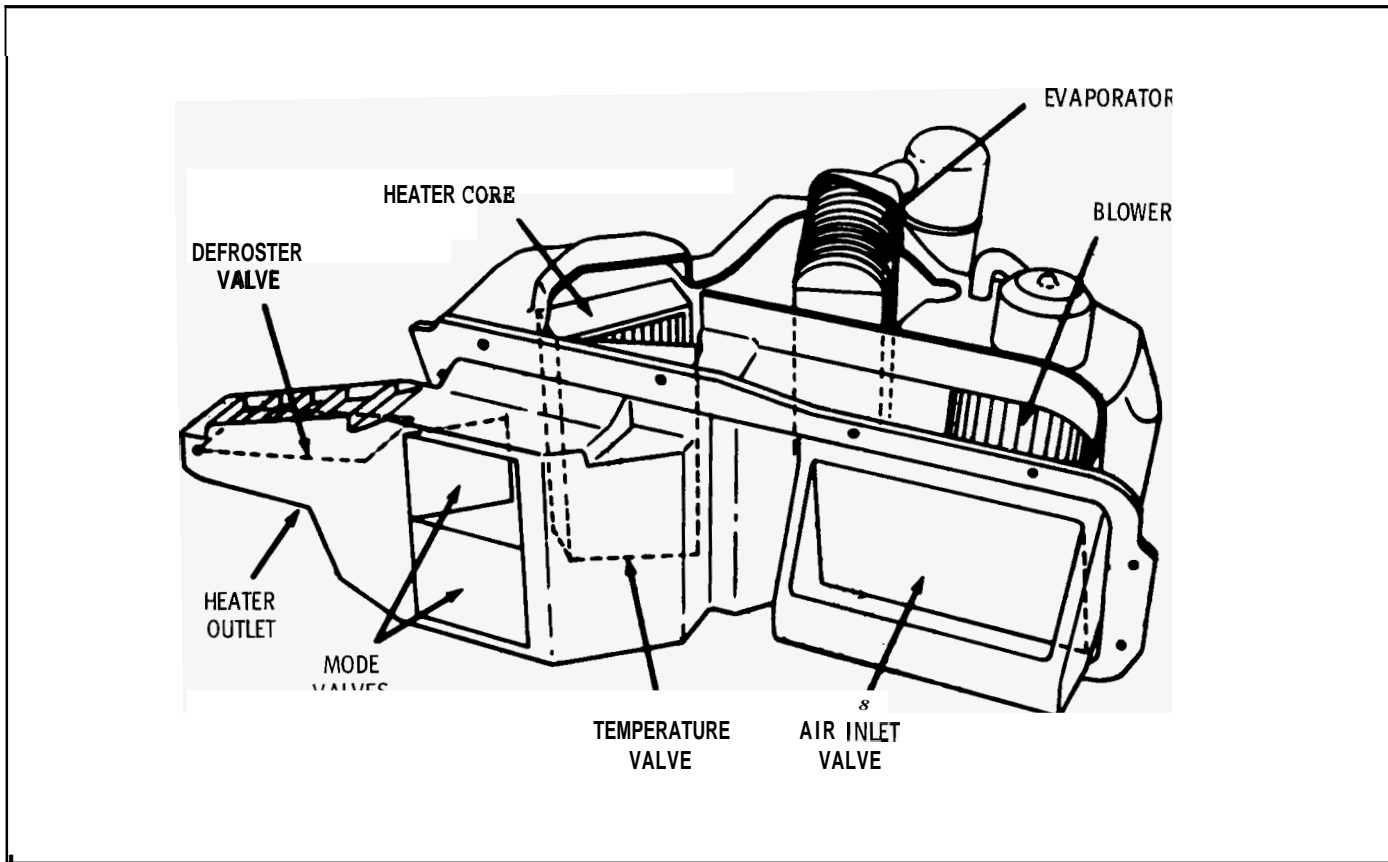


Figure 18-57 A/C Module

**Evaporator Core-Heater Core or Temperature Door**

**Remove or Disconnect**

1. Negative battery cable.
2. Electrical harness from blower motor, resistor, pressure cycling switch and hi-blower relay.
4. Disconnect heater core ground strap.

**! Important**

Do not perform Steps 5, 6 & 7 if only heater core is to be removed.

5. Discharge A/C system.
6. Refrigerant line at evaporator inlet pipe.
7. Compressor suction hose at accumulator outlet pipe.
8. Cap all open lines.
9. Remove right end of hood seal and remove air inlet screens screws.
10. Remove case to dash bolts along top, upper to lower case screws around flange, and upper to lower case screws inside air intake plenum.
11. Upper case by lifting straight up
12. Accumulator pipe bracket to case screws.
13. Evaporator core by lifting straight up
14. Heater core hoses and heater core
15. Temperature door and housing

**Install or Connect**

Replace sealer during reassembly to prevent air and water leaks.

1. Temperature door and housing
2. Heater core and hoses

3. Evaporator core
4. Accumulator pipe bracket to case.
5. Upper case
6. Right end of hood seal and air inlet screens
7. Compressor suction hose to accumulator outlet pipe
8. Refrigerant line to evaporator inlet pipe
9. Electrical harness to blower motor, resistor, pressure cycling switch, and hi-blower relay
10. Heater core ground strap
11. Evacuate and charge A/C system
12. Negative battery cable

**Lower Blower and Evaporator Case**

**Remove or Disconnect**

1. Perform Steps 1 through 15 of evaporator and heater core removal.
2. Right front wheel and inner fender panel.
3. Remaining case to dash panel screws and lower case to distributor case screw at rear of evaporator core compartment.
4. All wires and feed through hole in lower case.

**Install or Connect**

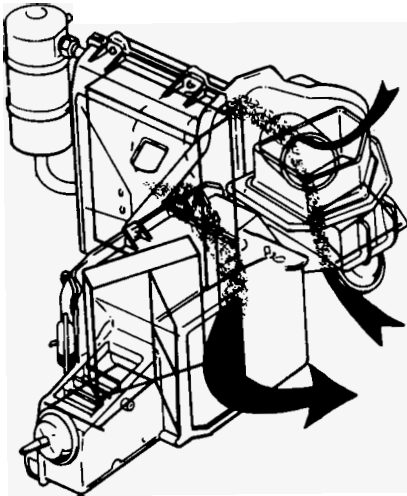
**! Important**

Replace all necessary sealer during reassembly to prevent water and air leaks.

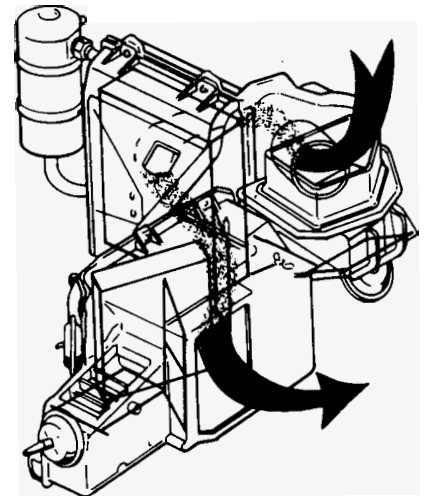
1. Case to dash panel and lower case to distributor case with screws previously removed
2. Right front inner fender panel and wheel



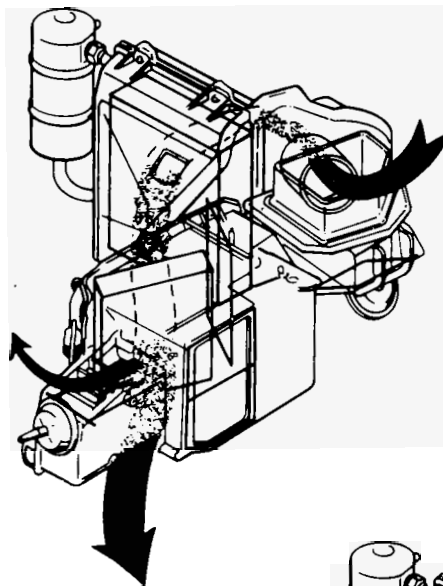
**MAX A/C MODE**



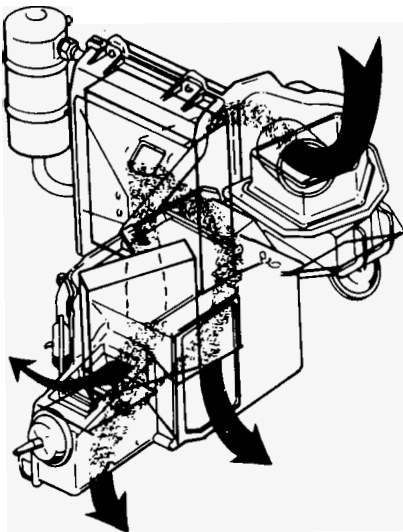
**NORMAL A/C AND VENT MODE**



**HEAT MODE**



**BI-LEVEL A/C MODE**



**DEFROST MODE**

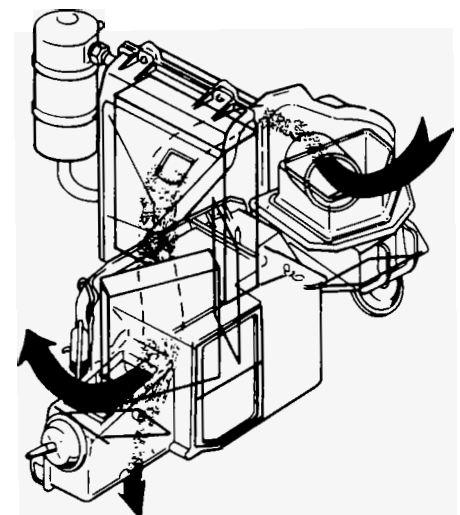
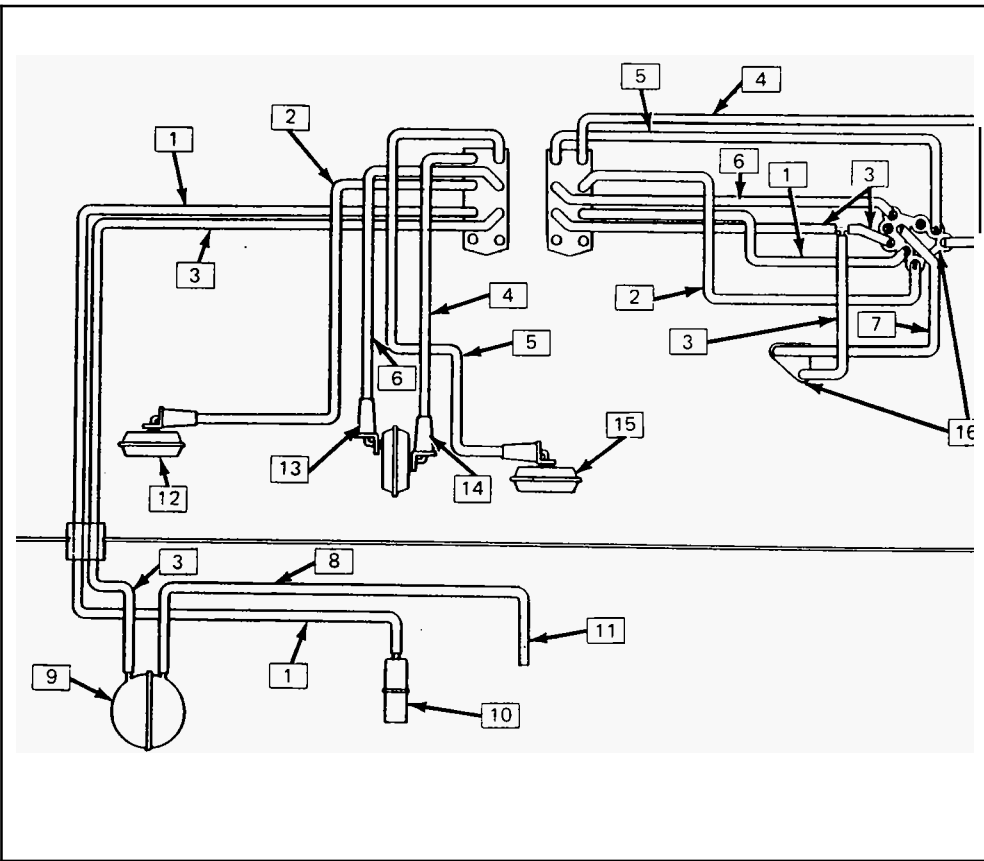


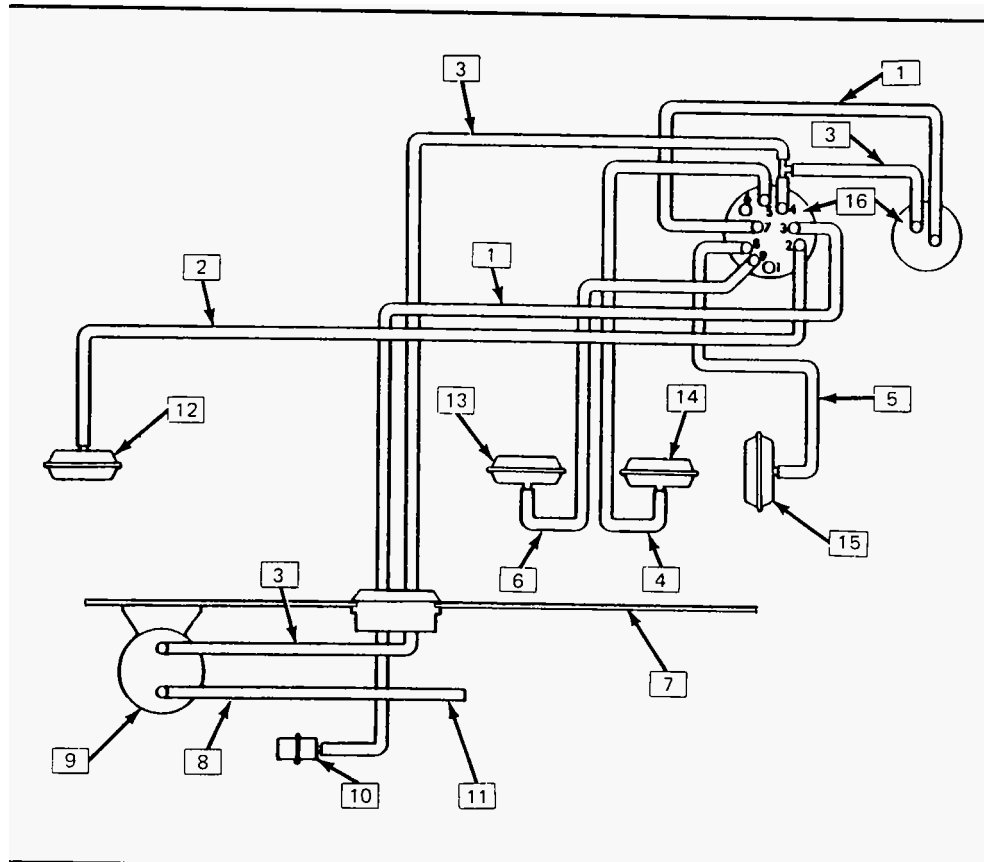
Figure 18-58 A/C Air Flow



- 1 GRAY
- 2 ORANGE
- 3 PURPLE
- 4 YELLOW
- 5 BLUE
- 6 RED
- 7 WHITE
- 8 BLACK
- 9 VACUUMTANK
- 10 WATER VALVE
- 11 TO VACUUM SOURCE
- 12 RECIRC. OUTSIDE AIR
- 13 HEATER
- 14 A/C
- 15 DEFROSTER
- 16 TO CONTROL HEAD

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Figure 18-59 Vacuum Diagram "G" Series



- 1 GRAY
- 2 ORANGE
- 3 VIOLET
- 4 TAN
- 5 BLUE
- 6 RED
- 7 DASH
- 8 BLACK
- 9 VACUUMTANK
- 10 WATER VALVE
- 11 TO VACUUM SOURCE
- 12 RECIRC. OUTSIDE AIR
- 13 UPPER MODE
- 14 LOWER MODE
- 15 DEFROSTER
- 16 TO CONTROL HEAD

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Figure 16-60 Vacuum Diagram "B" Series

<p>TEST CONDITIONS:</p> <p>PRIOR TO TEST: THE ENGINE SHOULD IDLE, WITH THE TEMPERATURE MODE LEVER SET TO MAXIMUM "COLD" FOR ABOUT 20 MINUTES OR UNTIL THE ENGINE THERMOSTAT IS OPEN.</p> <p>TEST:</p> <ol style="list-style-type: none"> <li>1) SLIDE MODE LEVER TO "OFF". SET BLOWER SWITCH TO "HI" AND LEAVE THE TEMPERATURE LEVER IN THE MAXIMUM "COLD" POSITION. RESULTS: THE BLOWER SHOULD NOT OPERATE ON "E" SERIES BLOWER AIR. THE SAME TEMPERATURE AS AIR OUTSIDE THE VEHICLE WILL BE DISCHARGED FROM THE HEATER OUTLET. THE BLOWER WILL RUN ON "LO" SPEED ONLY. THE COMPRESSOR IS NOT RUNNING.</li> <li>2) SLIDE THE MODE LEVER TO "NORM". RESULTS: BLOWER AIR INCREASES TO "HI" SPEED AND EXITS FROM THE A/C OUTLETS. THE COMPRESSOR COMES ON AND MAY CYCLE OFF AND ON. AIR TEMPERATURE SHOULD BE ABOUT 45°F AT THE A/C OUTLETS.</li> <li>3) SLIDE THE MODE LEVER TO "B/L". RESULTS: AIR EXITS FROM THE A/C OUTLETS AND THE HEATER OUTLET. THE AIR SPEED FROM THE A/C OUTLETS DECREASES SOME FROM STEP 2. THE COMPRESSOR COMES ON AND MAY CYCLE OFF AND ON. AIR TEMPERATURE SHOULD BE ABOUT 45°F FROM BOTH THE HEATER AND A/C OUTLETS.</li> <li>4) SLIDE THE MODE LEVER TO "VENT". RESULTS: AIR EXITS FROM THE A/C OUTLETS ONLY. THE AIR SPEED SHOULD BE "HI" (COMPARABLE TO STEP 2). THE COMPRESSOR IS NOT RUNNING. AIR TEMPERATURE SHOULD BE EQUIVALENT TO AIR OUTSIDE THE VEHICLE.</li> </ol>	<ol style="list-style-type: none"> <li>5) SLIDE THE MODE LEVER TO "HEATER". RESULTS: AIR EXITS MAINLY FROM THE HEATER OUTLET WITH SOME AIR FROM THE DEFROSTER NOZZLE. THE COMPRESSOR IS NOT RUNNING. AIR TEMPERATURE SHOULD BE EQUIVALENT TO AIR OUTSIDE THE VEHICLE. BLOWER SPEED SHOULD STILL BE "HI".</li> <li>6) SLIDE THE TEMPERATURE LEVER FROM MAXIMUM "COLD" TO MAXIMUM "HOT" (FAR LEFT TO FAR RIGHT). RESULTS: THE AIR TEMPERATURE FROM THE HEATER OUTLET SHOULD RISE RAPIDLY FROM OUTSIDE AMBIENT TEMPERATURE TO ABOUT 140°F. BLOWER SPEED SHOULD STILL BE "HI".</li> <li>7) SLIDE THE MODE LEVER TO "DEFROST". RESULTS: AIR EXITS MAINLY FROM THE DEFROSTER NOZZLE WITH SOME AIR FROM THE HEATER OUTLET. THE COMPRESSOR COMES ON AND MAY CYCLE OFF AND ON. AIR TEMPERATURE SHOULD BE ABOUT 140°F. BLOWER SPEED SHOULD STILL BE "HI".</li> <li>8) MOVE THE BLOWER SWITCH TO "LO" PAUSING AT EACH OF THE TWO INTERMEDIATE POSITIONS. RESULTS: BLOWER SPEED AND AIR FLOW SHOULD DECREASE INCREMENTALLY AT EACH POSITION.</li> <li>9) SLIDE THE TEMPERATURE LEVER TO MAXIMUM "COLD" (FAR LEFT) AND THE MODE SELECTOR TO "MAX". RESULTS: AIR EXITS FROM THE A/C OUTLETS ONLY AIR NOISE IS HEARD FROM THE REAR CORNER OF THE PASSENGER COMPARTMENT AS THE SYSTEM GOES ON INSIDE AIR. THE COMPRESSOR COMES ON AND MAY CYCLE OFF AND ON. AIR TEMPERATURE SHOULD BE ABOUT 45°F AT THE A/C OUTLETS.</li> </ol>
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Figure 1B-61 A/C Functional Test

3. Perform Steps 12 through 1 of evaporator and heater core installation procedures.

## Distributor Case

### Remove or Disconnect

1. Perform Step 1 through 4 of lower blower and evaporator case removal
2. Feed wiring and vacuum harness through grommet hole in distributor case to inside of car. It may be necessary to split grommet
3. Glove box and door assembly and remove insulator panel
4. Heater outlet duct
5. Air distribution ducts from the center to the right side of the car
6. Defroster nozzle assembly from the distributor case
7. Right hand control panel trim cover
8. Screws from radio mounting plate. Pull radio part way out of instrument panel
9. Temperature cable vacuum and wiring from distributor case
10. Heater control from instrument panel and prop it out of the way
11. Distributor case through dash panel and wheel opening
12. The distributor case may now be disassembled to remove the remaining air valves and diaphragms. Clean off old sealer and replace with bead of new sealer (black strip type) on case seams.
13. Clean off old sealer around dash opening and apply medium bodied sealer.

### Install or Connect

1. Distributor case through wheel opening and dash panel
2. Heater control to instrument panel
3. Temperature cable vacuum and wiring to distributor case
4. Place radio in position and secure radio mounting plate with screws previously removed.
5. Right hand control panel trim cover
6. Defroster nozzle assembly to distributor case
7. Air distribution ducts between center and right side of car
8. Glove box and door assembly and insulator panel
9. Feed wiring and vacuum harness through grommet hole in distributor case
10. Perform Steps 4 through 1 of lower blower and evaporator case removal.

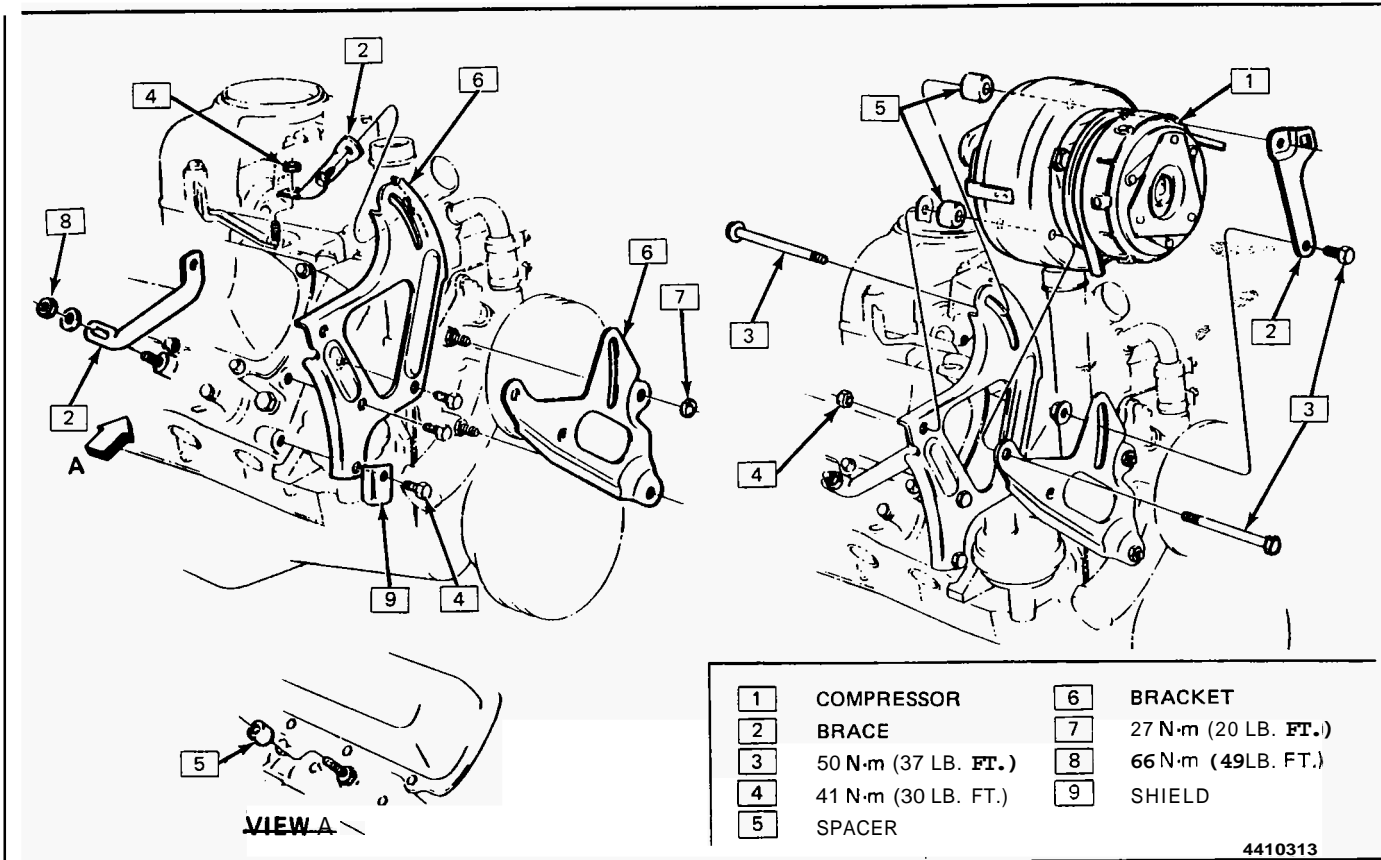


Figure 18-62 Compressor Mounting B & G Series Eng. Code Eng. Code Y

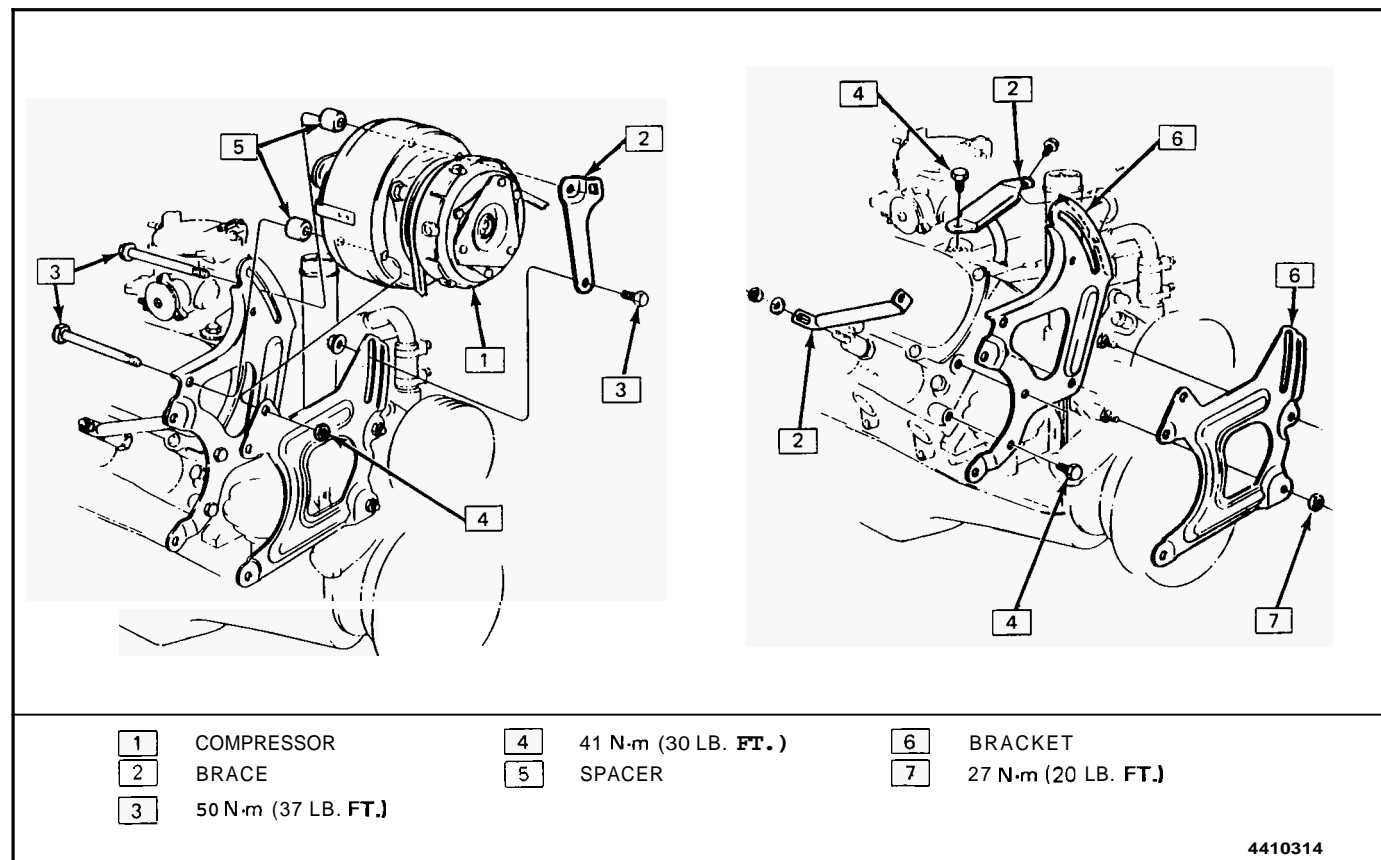


Figure 1B-63 Compressor Mounting B Series Eng. Code Y

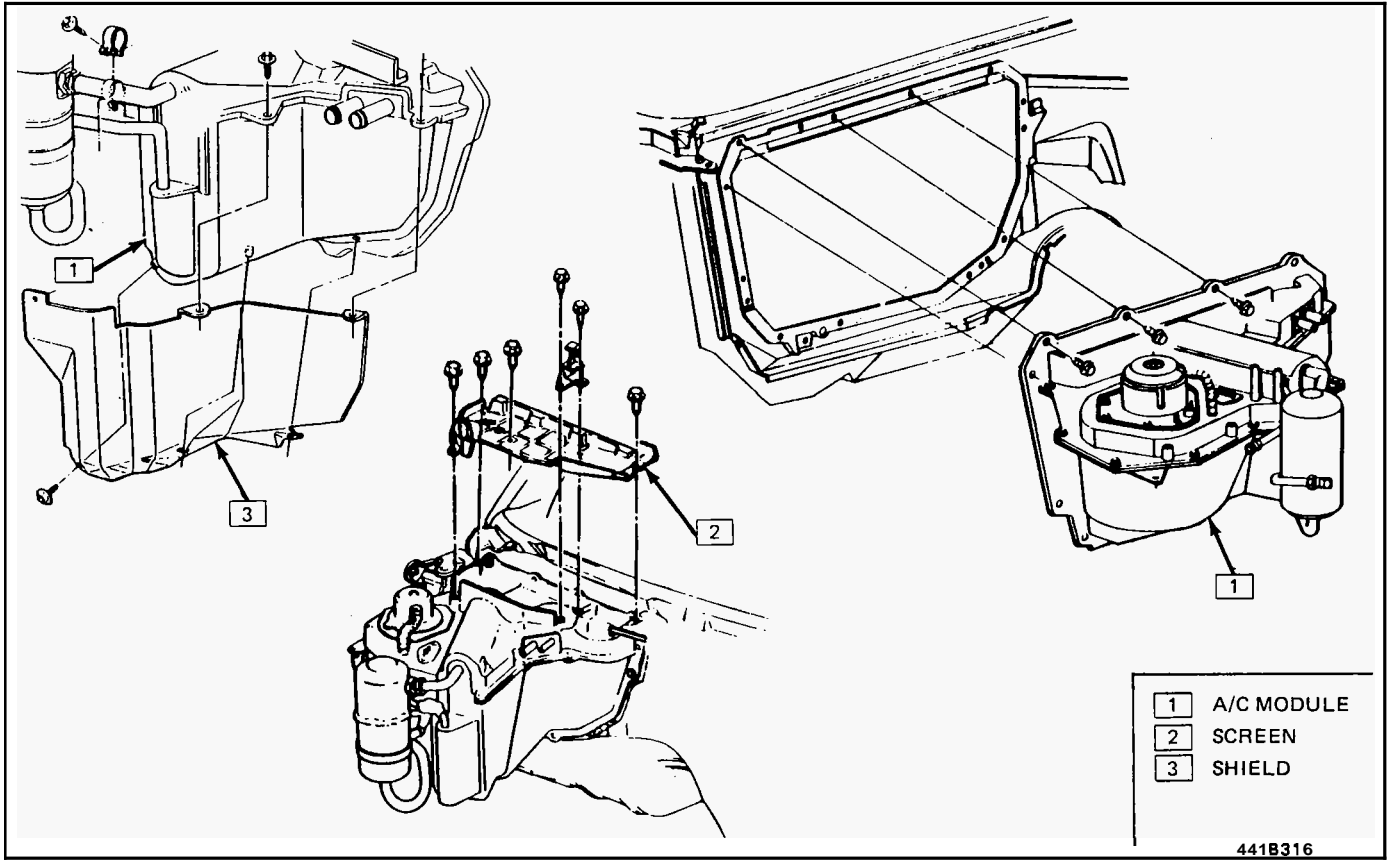


Figure 18-64 G Series A/C Module

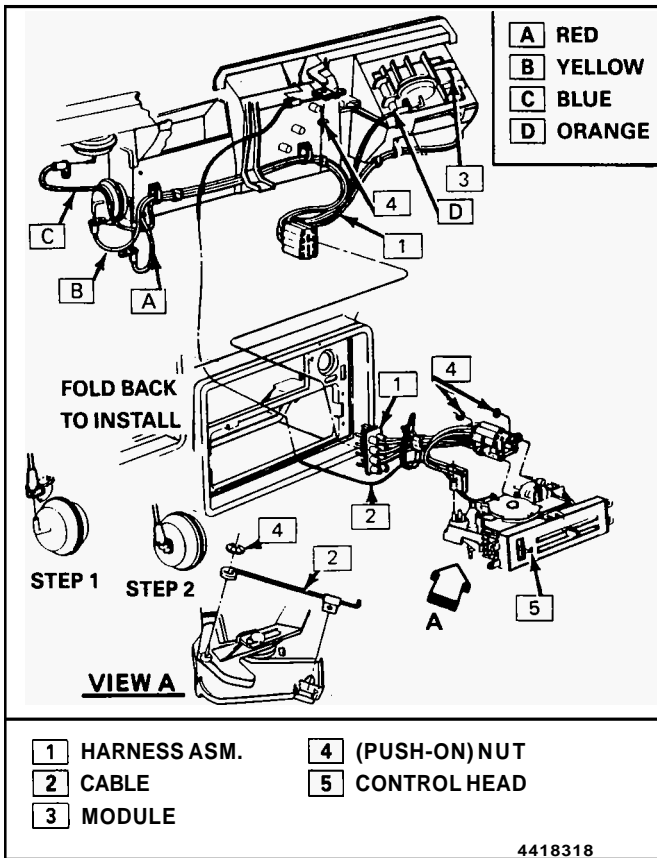


Figure 18-65 G Series Vacuum Harness

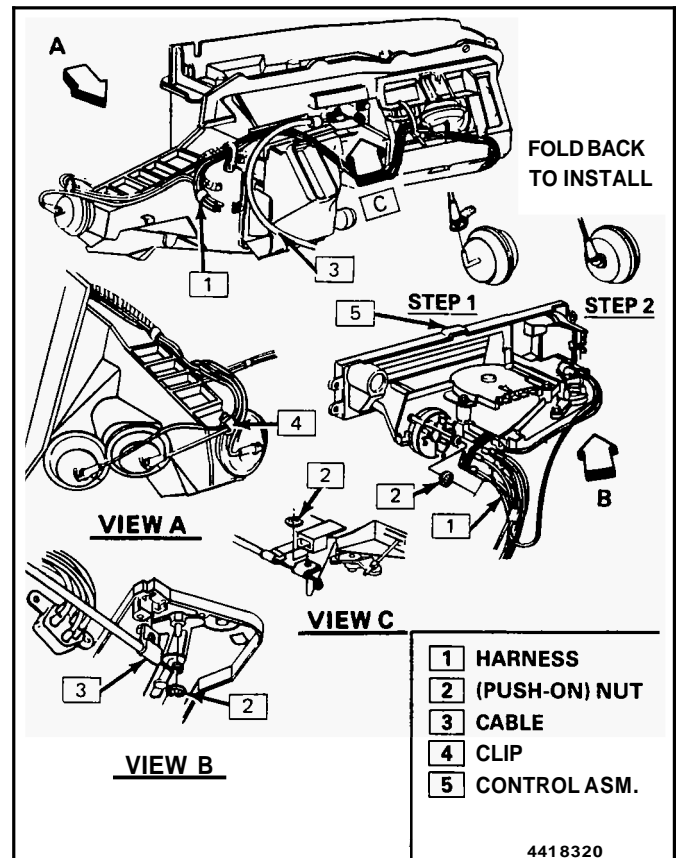


Figure 1B-66 B Series Vacuum Harness

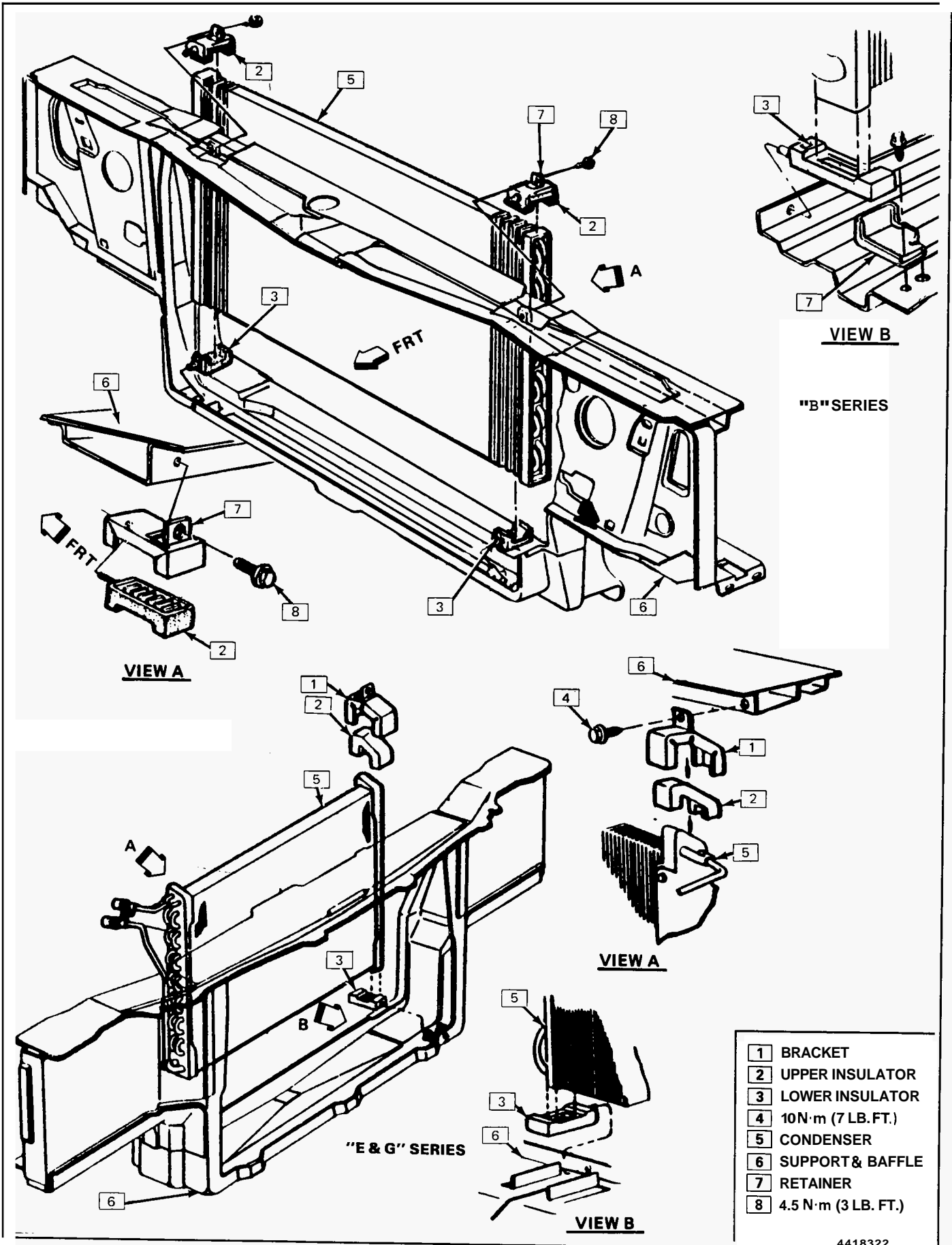
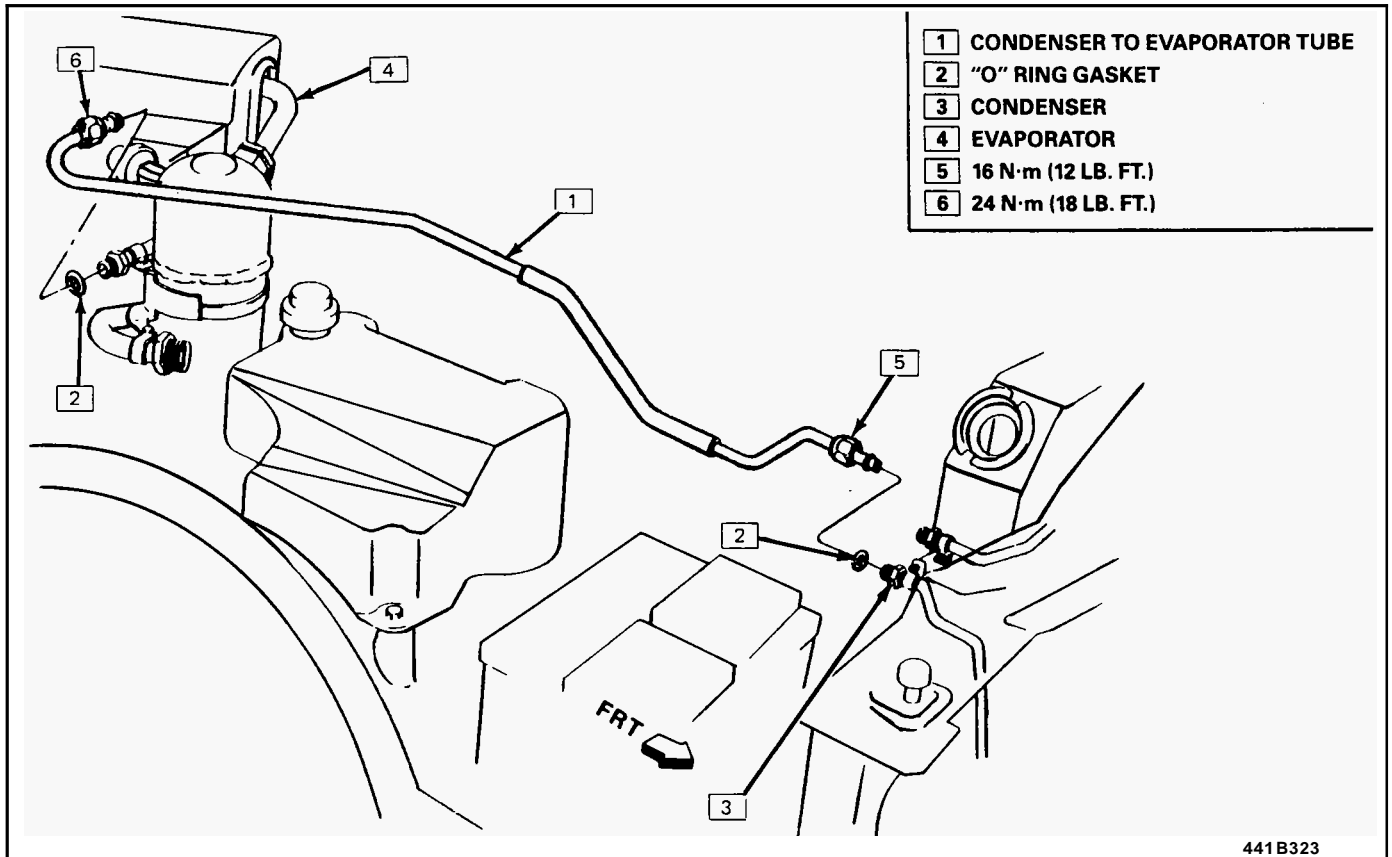
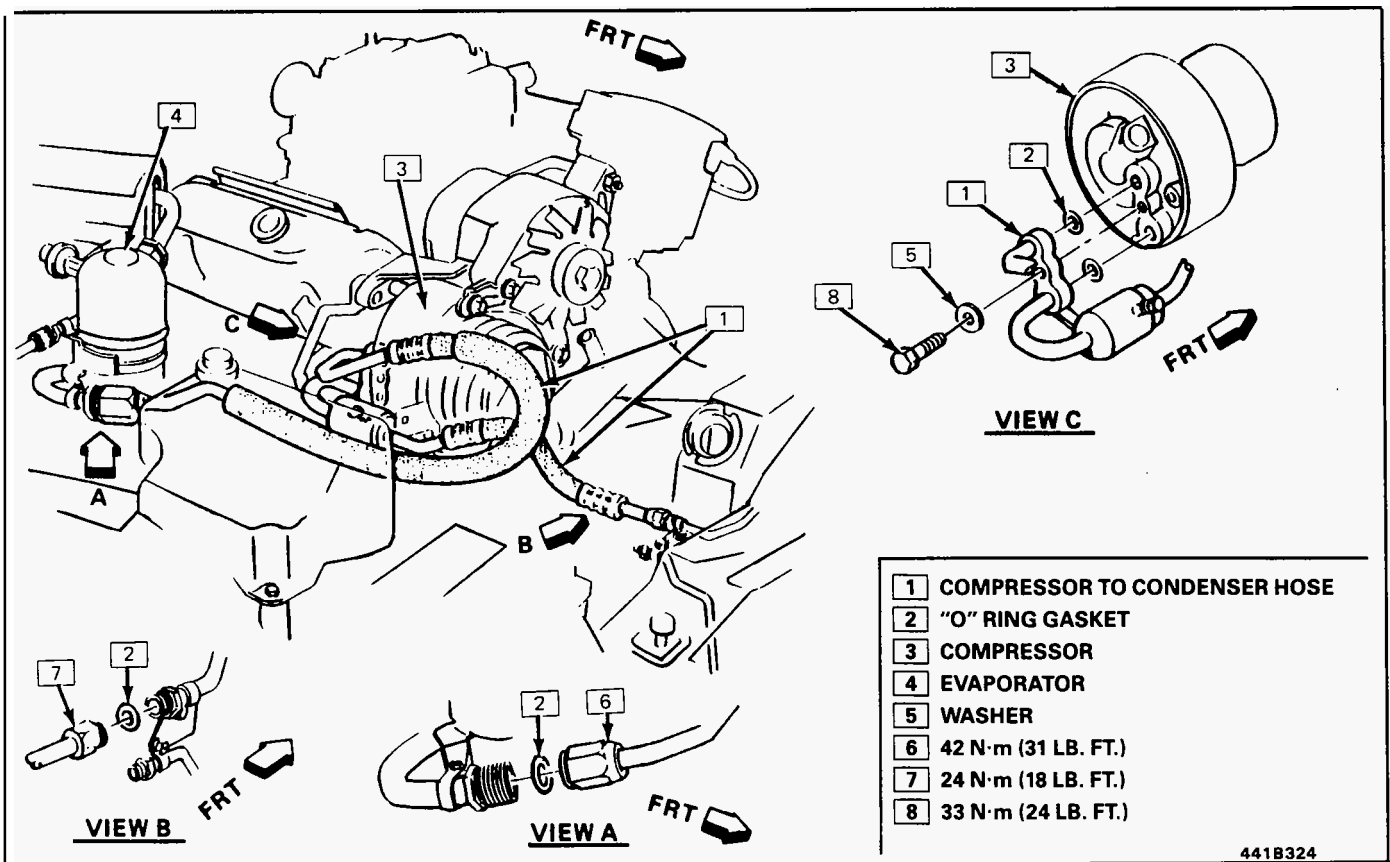


Figure 1B-67 Condenser Mounting



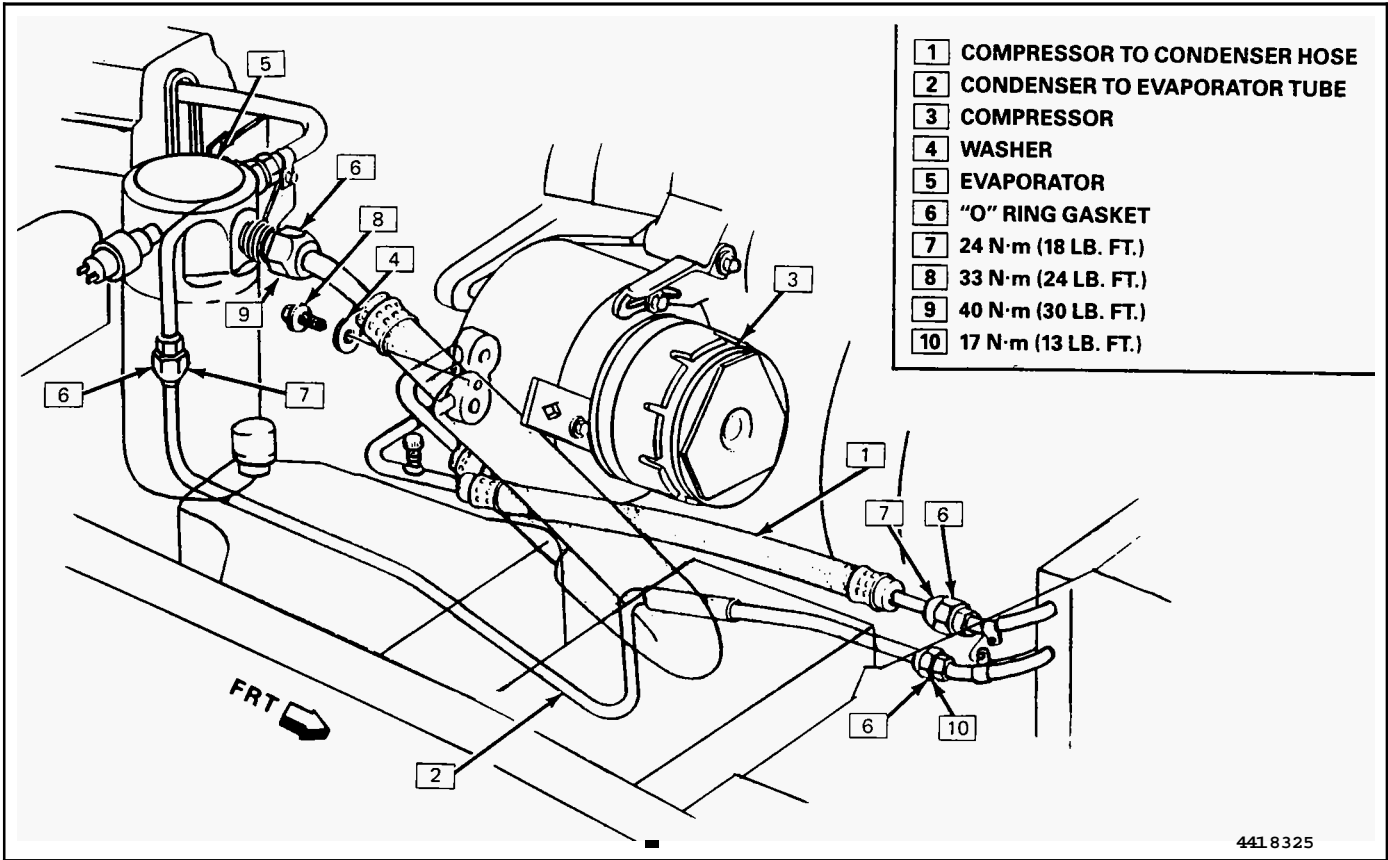
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Figure 1B-68 G Series Refrigerant Tube



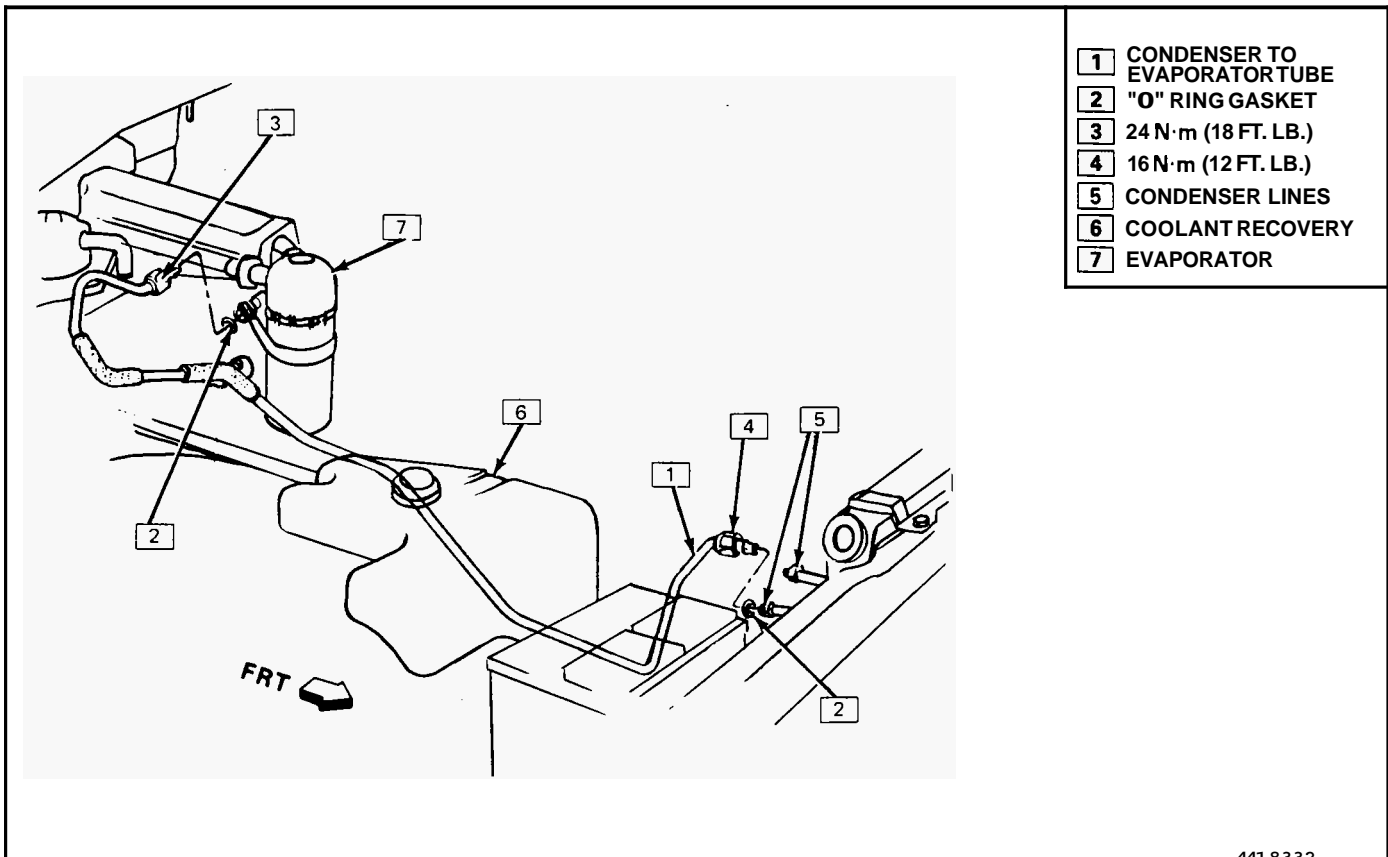
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Figure 1B-69 G Series Refrigerant Hose Eng. Code A



- 1 COMPRESSOR TO CONDENSER HOSE
- 2 CONDENSER TO EVAPORATOR TUBE
- 3 COMPRESSOR
- 4 WASHER
- 5 EVAPORATOR
- 6 "O" RING GASKET
- 7 24 N·m (18 LB. FT.)
- 8 33 N·m (24 LB. FT.)
- 9 40 N·m (30 LB. FT.)
- 10 17 N·m (13 LB. FT.)

Figure 1B-70 G Series Refrigerant Hose Eng. Code 7



- 1 CONDENSER TO EVAPORATOR TUBE
- 2 "O" RING GASKET
- 3 24 N·m (18 FT. LB.)
- 4 16 N·m (12 FT. LB.)
- 5 CONDENSER LINES
- 6 COOLANT RECOVERY
- 7 EVAPORATOR

Figure 1B-71 B Series Refrigerant Tube-Code Y



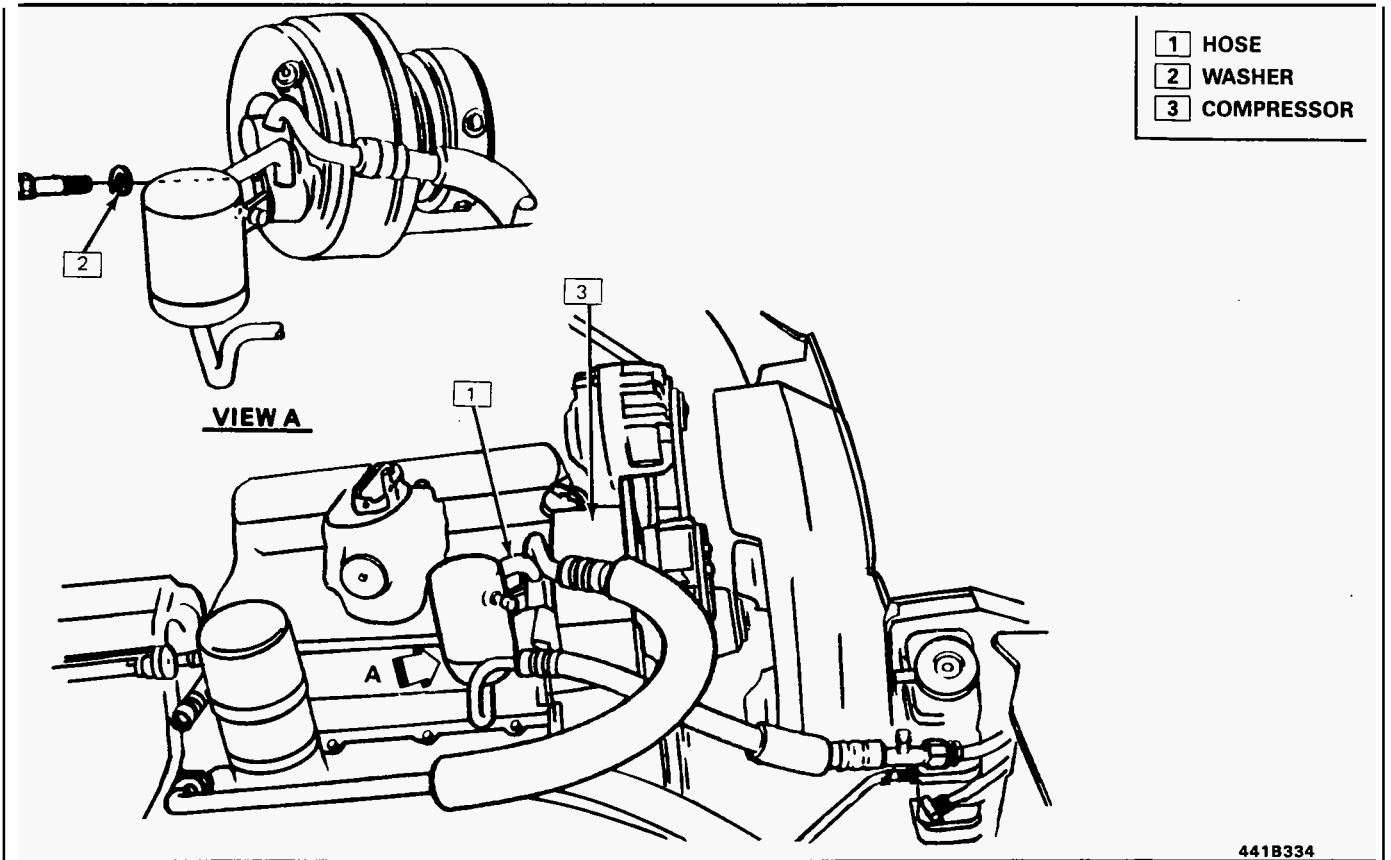


Figure 1B-72 B Series Refrigerant Lines Eng. Code Y

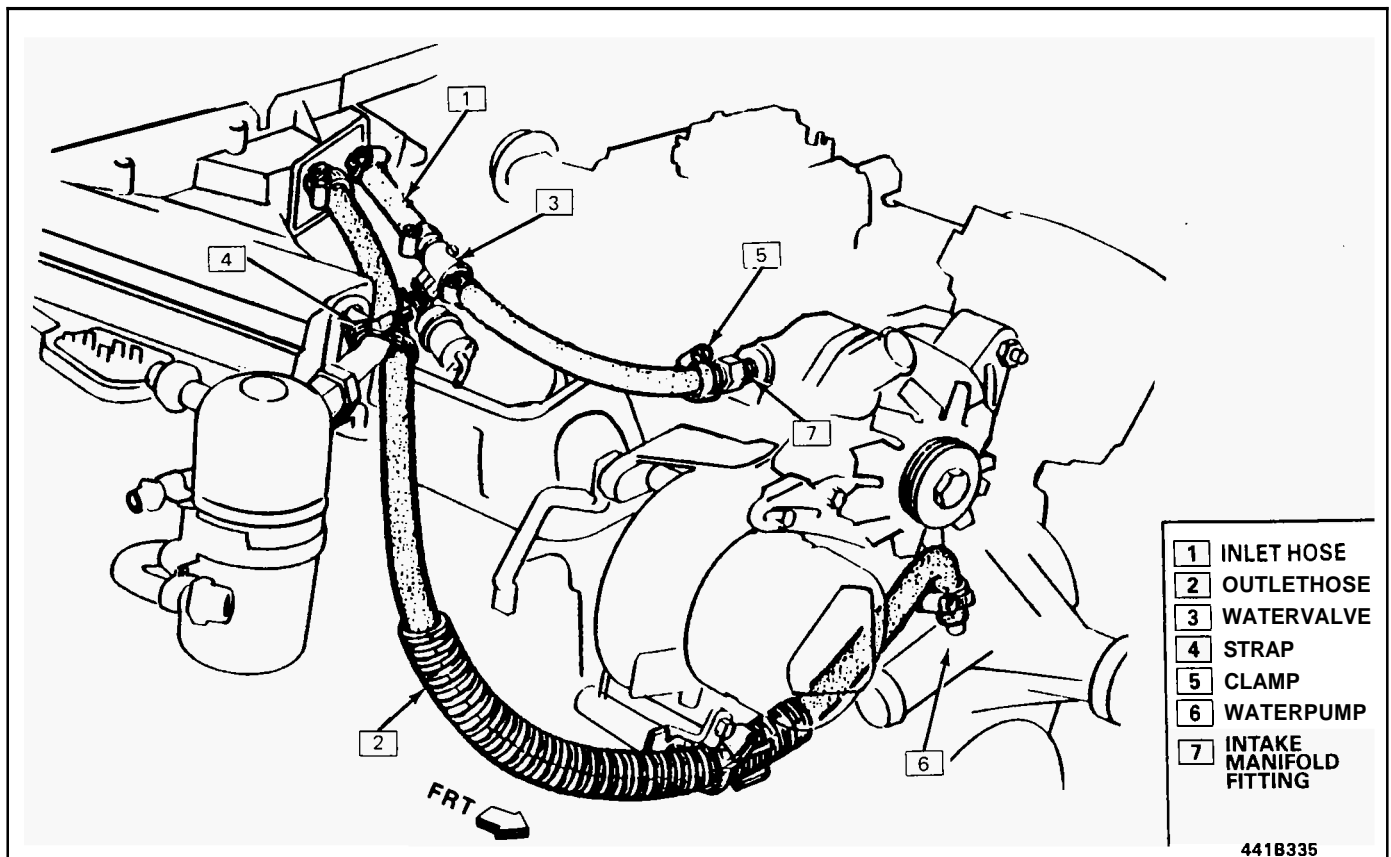


Figure 18-73 Heater Hoses G Series Eng. Code A

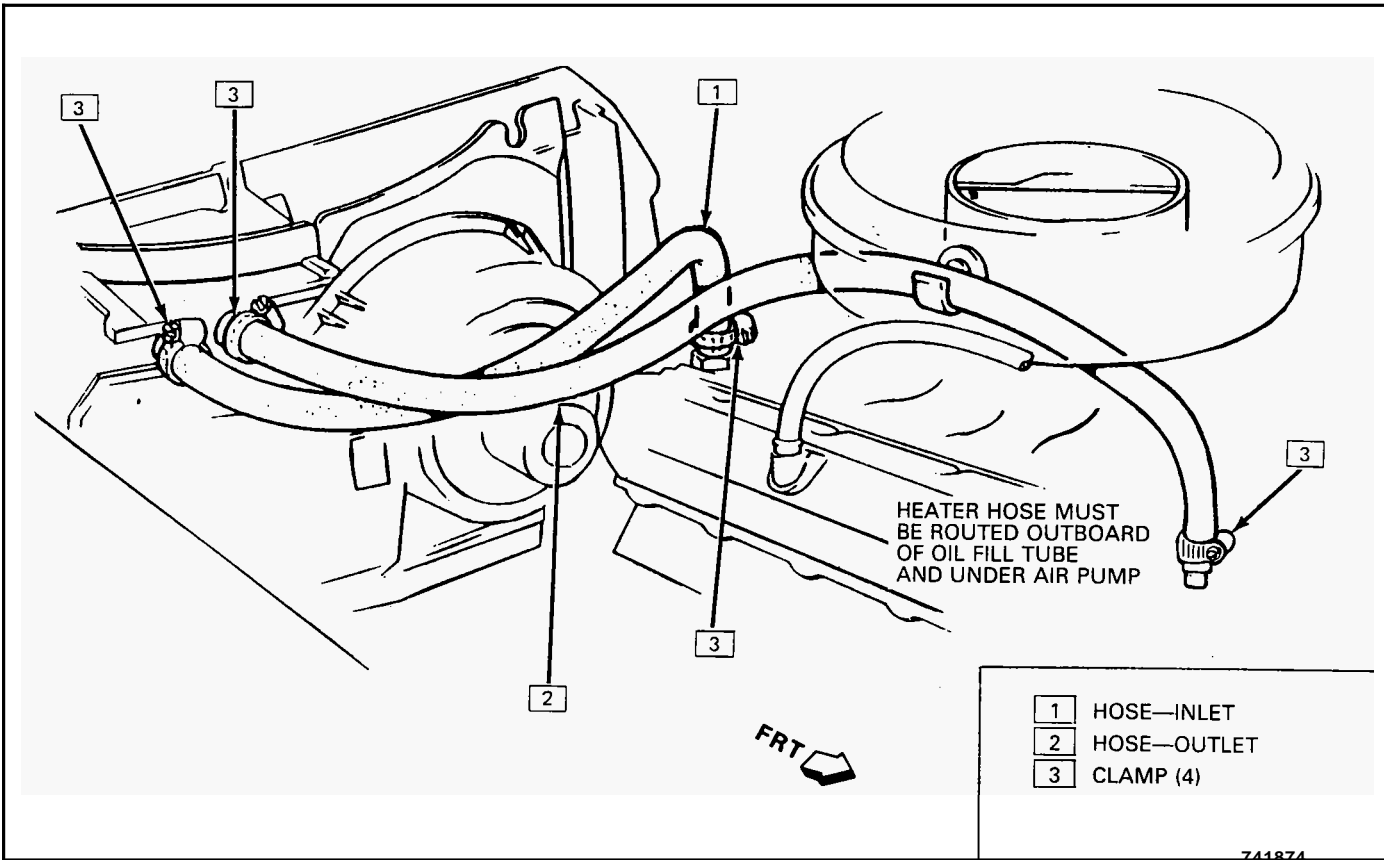


Figure 1B-74 Heater Hoses G Series Eng. Code Y

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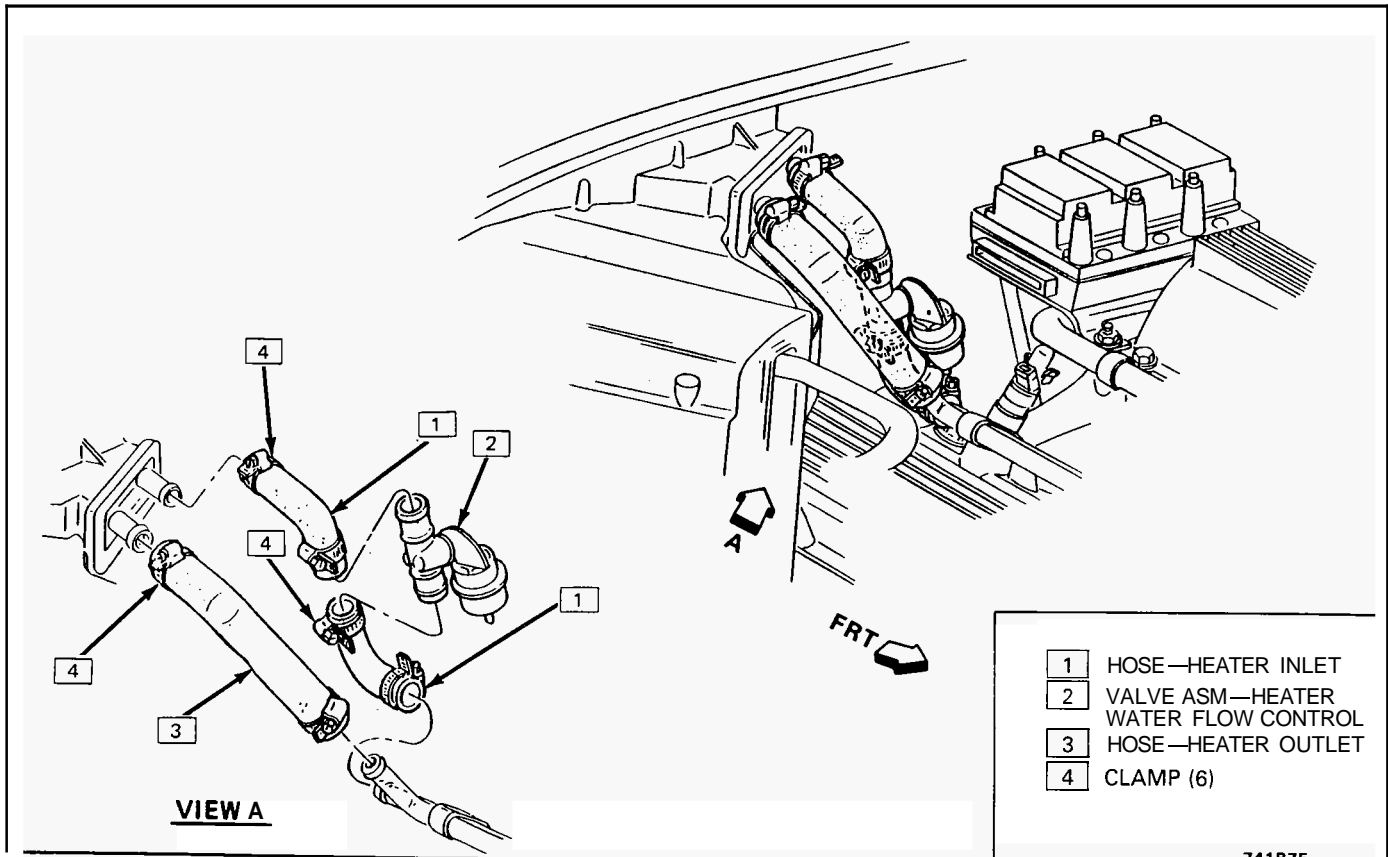


Figure 1B-75 Heater Hoses G Series Eng. Code 7

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