Climate Control System

Cautions and Warnings

WARNING: To avoid accidental deployment and possible injury, the air bag system backup power supply must be depleted before repairing any climate control components. To deplete the backup power supply, disconnect the battery positive cable and wait one minute.

WARNING: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.

WARNING: R-134a is classified as a safe refrigerant, but misuse can make it dangerous. The following precautions must be observed.

- **Always wear safety goggles when repairing an air conditioning system.**
- **Avoid contact with liquid refrigerant r-134a. R-134a vaporizes at approximately -25°c (-13°f) under atmospheric pressure and it will freeze skin tissue.**
- **Never allow refrigerant r-134a gas to escape in quantity in an occupied space. R-134a is non-toxic, but it will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing r-134a gas. R-134a is non-toxic at all normal conditions, but when it is exposed to high temperatures, such as a torch flame, it decomposes. One of the products of the chemical breakdown is a phosgene gas, which is highly toxic.**
- **Do not allow any portion of the charged air conditioning system to become too hot. The pressure in an air conditioning system rises as the temperature rises and temperatures of approximately 85°c (185°f) can be dangerous.**
- **Allow the engine to cool sufficiently prior to performing maintenance or serious burns and injury can occur.**

CAUTION: To avoid damaging the vehicle or A/C components, the following precautions must be observed.

- **The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so can contaminate the shop bulk refrigerant and other vehicles.**
- **Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These two types of refrigerant must never by mixed. Doing so can damage the A/C system.**
- **Charge the A/C system with the engine running only at the low-pressure side to prevent refrigerant slugging from damaging the A/C compressor.**
- **Use only R-134a refrigerant. Due to environmental concerns, when the air conditioning system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. R-134a must never be removed without the appropriate equipment or released into the atmosphere. Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the instructions provided by the equipment manufacturer when removing refrigerant from or charging the air conditioning system.**
- **Refrigerant R-134a must not be mixed with the air for leak testing or used with air for any other**

purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.

- **A number of manufacturers are producing refrigerant products that are described as direct replacements for Refrigerant R-134a. The use of any unauthorized substitute refrigerant can severely damage the A/C components. If repair is required, use only new or recycled Refrigerant R-134a.**

 **CAUTION: To avoid contaminations of the A/C system:**

- **Never open or loosen a connection before discharging the system.**
- **When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.**
- **Evacuate a system that has been opened to replace a component or one that has discharged through leakage before charging.**
- **Seal open fitting with a cap or plug immediately after disconnecting a component from the system.**
- **Clean the outside of the fittings thoroughly before disconnecting a component from the system.**
- **Do not remove the sealing caps from a replacement component until ready to install.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install the cap immediately after using. Store the oil in a clean, moisture-free container.**
- **Install a new O-ring before connecting an open fitting. Coat the fitting and O-ring with refrigerant oil before connecting.**
- **When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that can chafe the line.**
- **Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.**
- **Do not open a refrigerant system or uncap a replacement component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.**

The electronic automatic temperature control system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.

Principles of Operation

There are four main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporization
- Relative humidity
- Effects of pressure

Heat Transfer

If two substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (changes to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (changes back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature. The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable you feel. Removing moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (changes to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

The Refrigerant Cycle

During stabilized conditions (air conditioning system shutdown), the refrigerant is in a vaporized state and pressures are equal throughout the system. When the A/C compressor is in operation it increases pressure on the refrigerant vapor raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser core, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser core and enters the inlet side of the A/C evaporator core orifice.

The A/C evaporator core orifice is the restriction in the refrigerant system that creates the high pressure buildup upstream of the A/C condenser core and separates the high and low pressure sides of the A/C system. As the liquid refrigerant leaves this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator core, it absorbs heat from the passenger compartment airflow passing over the plate/fin sections of the A/C evaporator core. This addition of heat causes the refrigerant to boil (change to gas). The now cooler passenger compartment air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The suction accumulator/drier is designed to remove moisture from the refrigerant and to prevent any liquid refrigerant that may not have been vaporized in the evaporator core from reaching the A/C compressor. The A/C compressor is designed to pump refrigerant vapor only, as liquid refrigerant will not compress and can damage the A/C compressor.

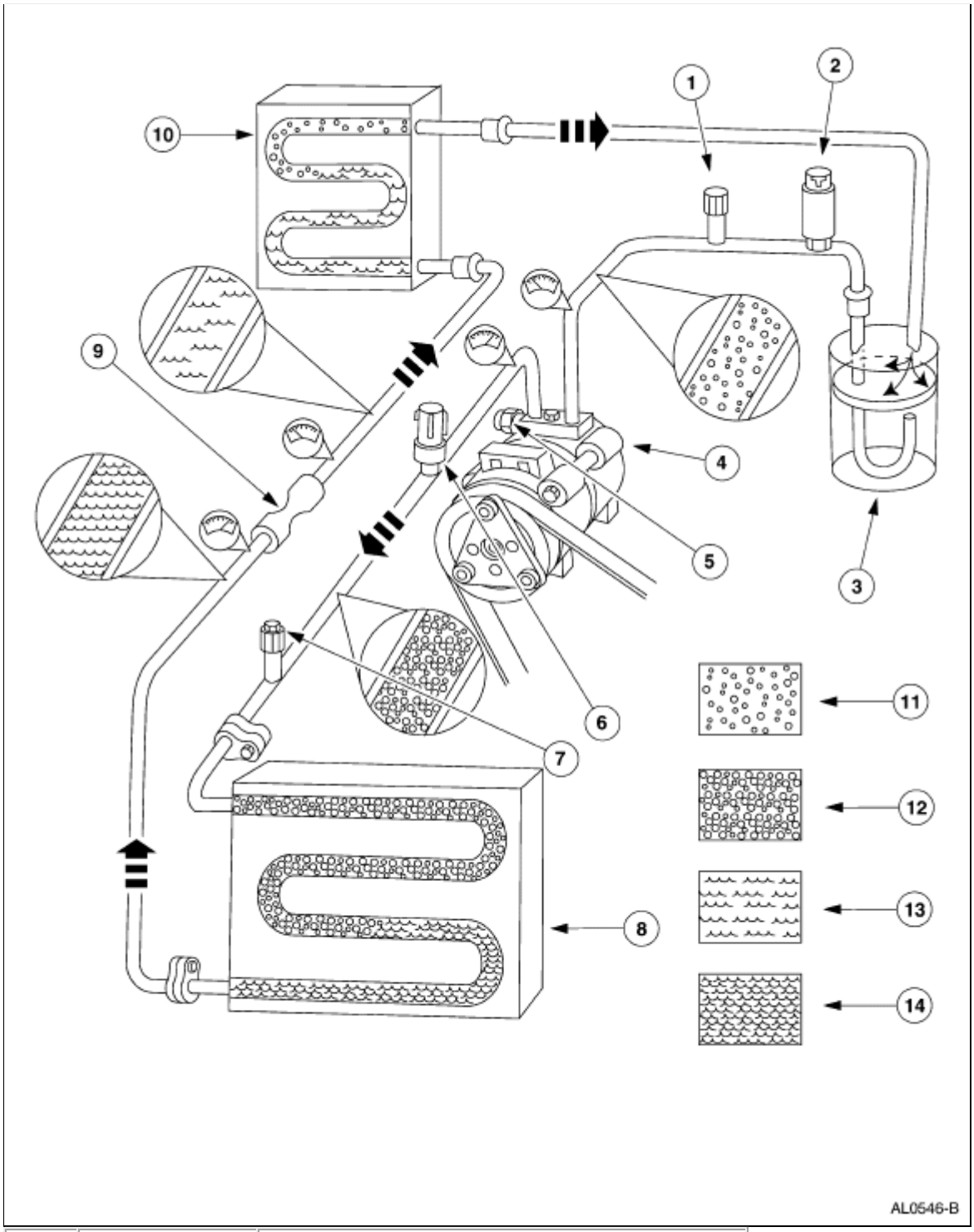
The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

The A/C cycling switch interrupts compressor operation before the external temperature of the A/C evaporator core gets low enough to cause the condensed water vapor (excess humidity) to turn to ice. It does this by monitoring low side line pressure. It is known that a refrigerant pressure of approximately 210 kPa (30 psi) will yield an operating temperature of 0°C (32°F). The A/C cycling switch controls system operation in an effort to maintain this temperature.

The high side line pressure is also monitored so that A/C compressor operation can be interrupted if system pressure becomes too high.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

Clutch Cycling Orifice Tube Type Refrigerant System

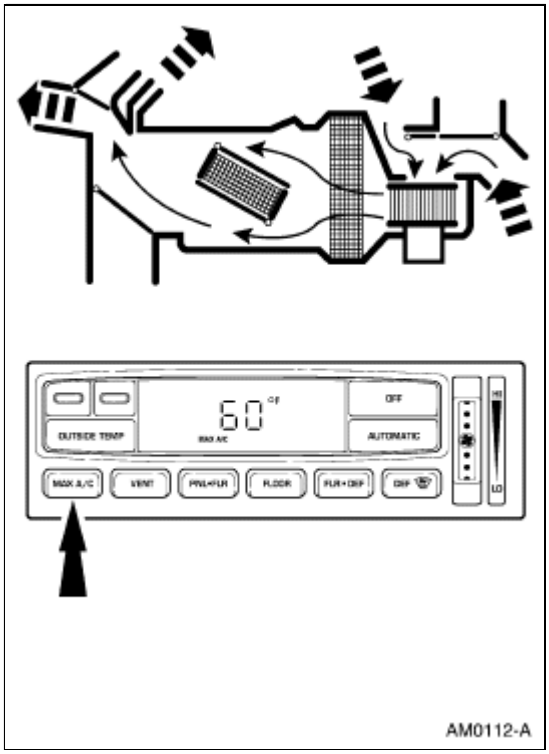


Item	Part Number	Description

1	19E762	A/C Charge Valve Port (Low Side)
2	19E561	A/C Cycling Switch
3	19C836	Suction Accumulator/Drier
4	19703	A/C Compressor
5	19D644	A/C Compressor Pressure Relief Valve
6	19D594	A/C Pressure Cut-Off Switch
7	19E762	A/C Charge Valve Port (High Side)
8	19712	A/C Condenser Core
9	19D990	A/C Evaporator Core Orifice
10	19860	A/C Evaporator Core
11	—	Low Pressure Vapor
12	—	High Pressure Vapor
13	—	Low Pressure Liquid
14	—	High Pressure Liquid

System Air Flow Description

MAX A/C

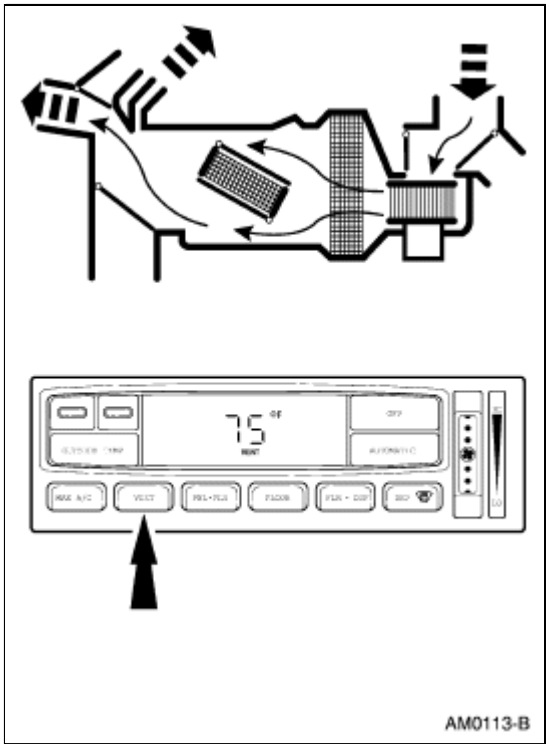


When MAX A/C is selected:

- The air inlet duct doors are at full vacuum, closing off outside air and admitting only recirculated air.
- The windshield defroster door is at full vacuum and the heater air damper door is in the no vacuum position, directing airflow to the A/C registers (19893) .

- The temperature will be set for maximum cold (60°F) but may be adjusted if desired.
- Air will be picked up at the recirc opening by the blower motor (18527). With the A/C control set for maximum cold, airflow across the A/C evaporator core (19860) will be diverted past the heater core (18476) and then directed into the passenger compartment through the instrument panel A/C registers . There is also some airflow to the A/C side window demisters.
- The A/C compressor (19703) will be enabled when MAX A/C is selected.
- The blower motor is on.

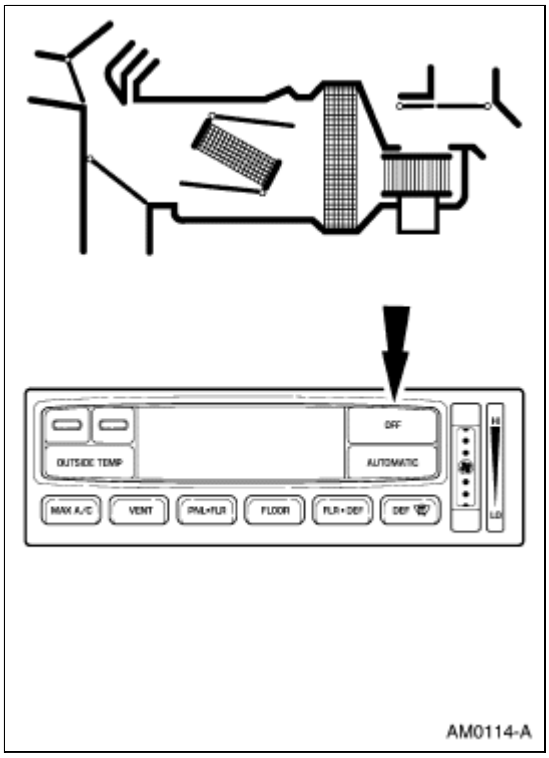
Vent



When VENT is selected:

- The air inlet duct doors, with no vacuum being applied, will block recirculated air and admit outside air. From there, air flows through the system to the instrument panel A/C registers .
- The heater air damper door is in the no vacuum position and the windshield defroster door is at the full vacuum position, directing air flow to the A/C register .
- There is also some air flow to the A/C side window demisters.
- The temperature can be adjusted to heat the air but air cannot be cooled below outside temperature.
- The blower motor is on.
- The A/C compressor (19D629) will be disabled when VENT is selected.

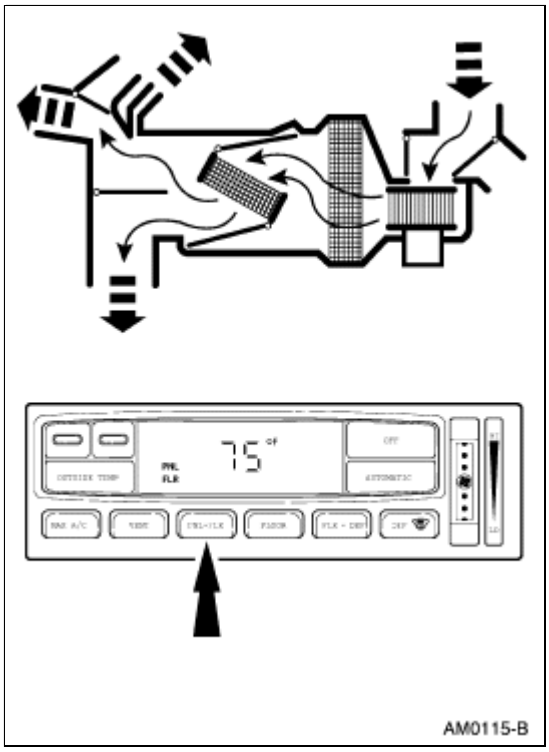
OFF



When OFF is selected:

- The A/C inlet duct doors are at full vacuum, closing off outside air and admitting only recirc air.
- The heater air damper door and the windshield defroster door are at no vacuum, closing of the passages to the A/C registers.
- The blower motor and A/C compressor are off.
- The control display will be blank.

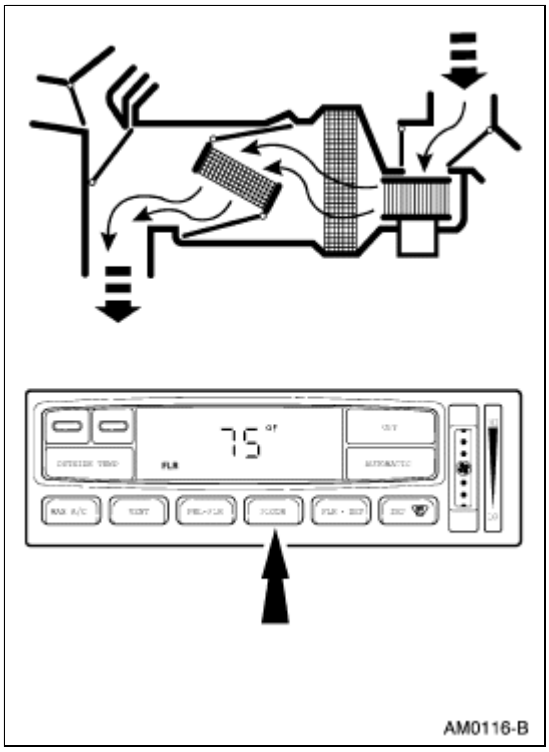
PANEL/FLOOR



When PANEL/FLOOR is selected:

- The air inlet duct doors are set at no vacuum, blocking the recirc passage and admitting outside air.
- The heater air damper door is in the partial vacuum position, allowing airflow to both the heater outlet floor duct (18C433) and the heater air plenum chamber.
- The windshield defroster door is at full vacuum, closing of airflow to the windshield defroster hose nozzle (18490) and directing airflow to the A/C registers. There is also some air flow to the A/C side window demisters.
- The A/C compressor will be enabled when PANEL/FLOOR is selected.
- The blower motor is on.

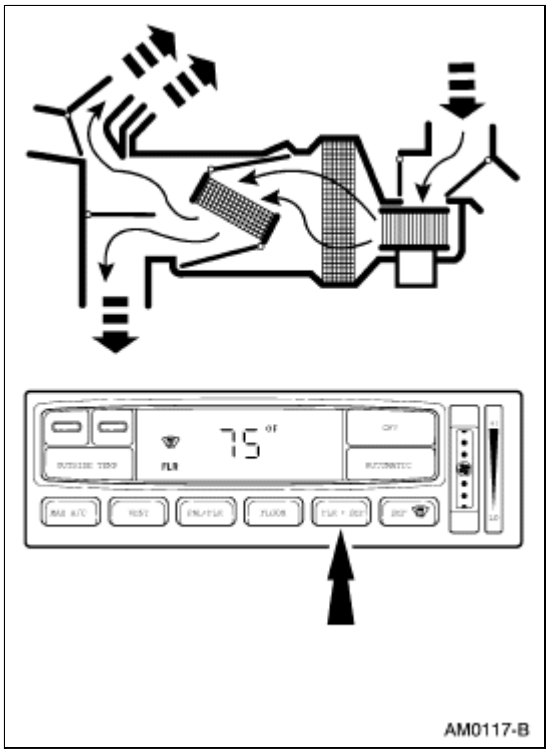
FLOOR



When FLOOR is selected:

- The air inlet duct doors are in the no vacuum position, blocking recirc air and admitting outside air.
- The heater air damper door is in the full vacuum position, directing all air flow to the heater outlet floor duct.
- The temperature can be adjusted to mix air flowing through and around the heater core to achieve the desired temperature level.
- The windshield defroster door is in the no vacuum position, blocking air circulation to the panel A/C registers.
- The A/C compressor will be disabled when FLOOR is selected.
- The blower motor is on.

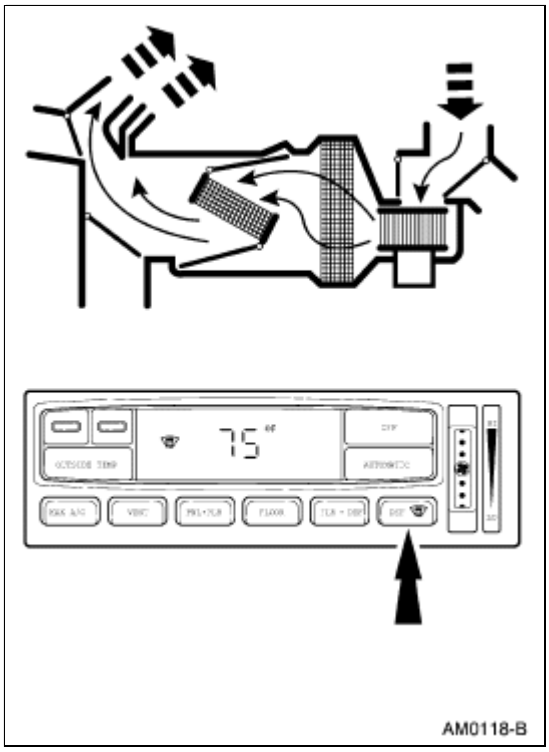
FLOOR/DEFROST



When FLOOR/DEFROST is selected:

- The air inlet duct door is in the no vacuum position blocking recirc air and admitting outside air.
- The windshield defroster door is in the no vacuum position directing airflow to the windshield defroster hose nozzle.
- The heater air damper door is in the partial vacuum position, allowing airflow to both the heater air plenum chamber and the heater outlet floor duct.
- The A/C compressor will be enabled when FLOOR/DEFROST is selected to dehumidify the air and reduce windshield fogging.
- The blower motor is on.

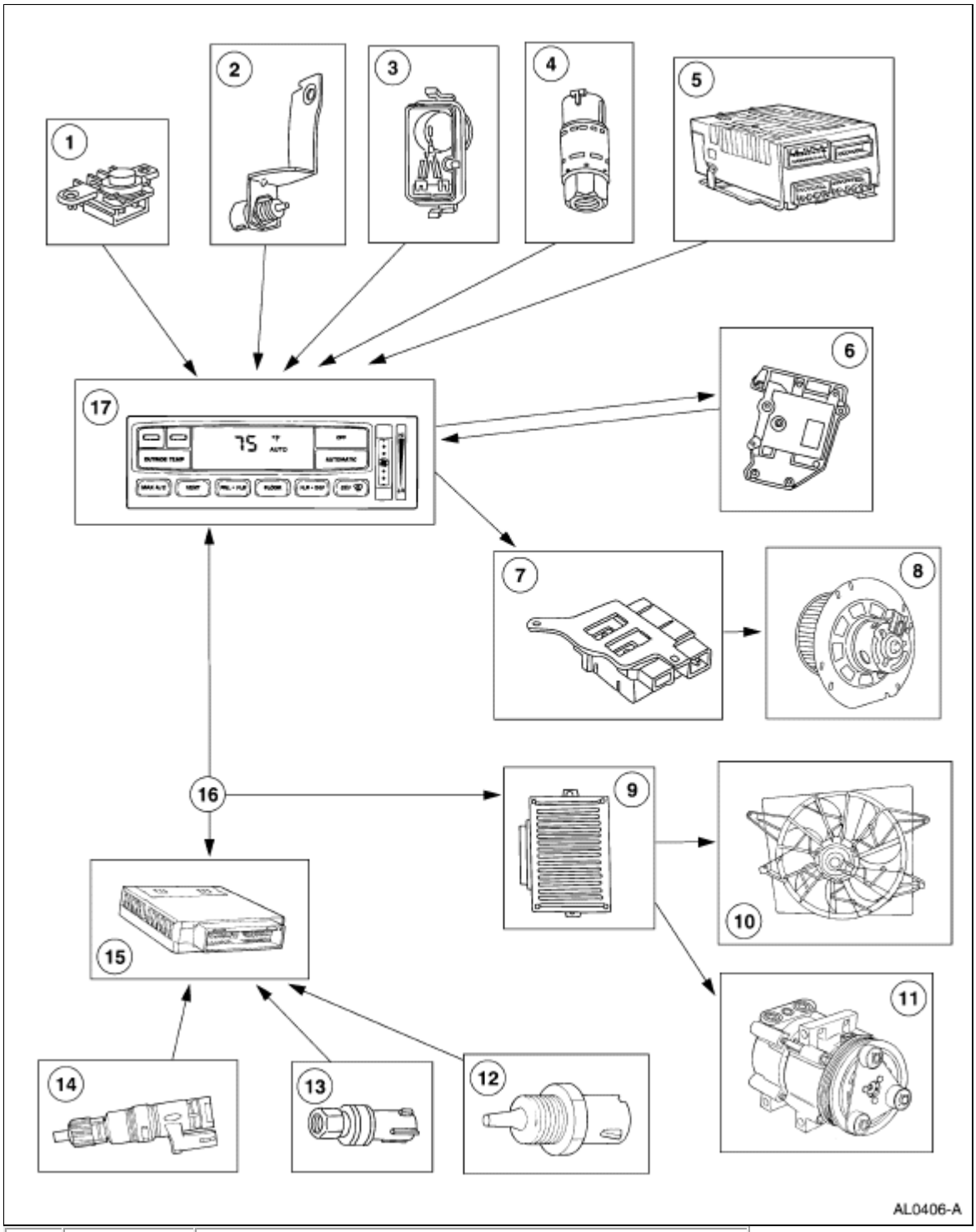
DEFROST



When DEFROST is selected:

- The air inlet duct doors are in the no vacuum position, admitting outside air.
- Both the windshield defroster door and the heater air damper door are in the no vacuum position so that most of the incoming air is directed to the windshield defroster hose nozzle. There is also airflow to the A/C side window demisters.
- The temperature setting will determine the amount of air that is directed through the heater core and the amount that bypasses the heater core.
- The A/C compressor will be enabled when DEFROST is selected to dehumidify the air and reduce windshield fogging.
- The blower motor is on.

Climate Control System Electrical Components



Item	Part Number	Description
1	19E663	A/C Sunload Sensor
2	19E702	A/C Ambient Air Temperature Sensor and Bracket
3	19D888	Automatic Temperature Control Sensor Hose and Elbow
4	19E561	A/C Cycling Switch

5	—	Steering Column/Ignition/Lighting (SCIL) Control Module (Illumination)
6	19E616	A/C Electronic Door Actuator Motor
7	19E624	A/C Blower Motor Speed Control
8	18527	Blower Motor
9	12B577	Variable Load Control Module
10	8C607	Fan Motor
11	2987	A/C Clutch Field Coil
12	12A648	Engine Coolant Temperature Sensor
13	19D594	A/C Pressure Cut-Off Switch
14	9E731	Vehicle Speed Sensor
15	12A650	Powertrain Control Module
16	—	J1850 Communication Network
17	19980	Electronic Automatic Temperature Control Module