

DESCRIPTION AND OPERATION

Climate Control System

⚠ 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. During decomposition it releases irritating and toxic gases (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.
- 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 carrying out 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 be mixed. Doing so can damage the A/C system.

- Charge the A/C system with the engine running.
- 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. Federal law **REQUIRES** that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as MACS, ASI, etc. 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 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 substitutes 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 contamination 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.
- Before charging, evacuate a system that has been opened to install a new component or a system that has discharged through leakage.
- Seal open fittings 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 new component until ready to install.

DESCRIPTION AND OPERATION (Continued)

- 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 seal before connecting an open fitting. Coat the fitting and the O-ring seal 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 new 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 dual 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
- effect of pressure on boiling or condensation

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 (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts 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 (converts 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 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, 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 and enters the inlet side of the A/C receiver/drier. The receiver/drier is designed to remove moisture from the refrigerant.

The outlet of the receiver/drier is connected to the thermostatic expansion valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high and low pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

DESCRIPTION AND OPERATION (Continued)

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler 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 refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle powertrain control module (PCM).

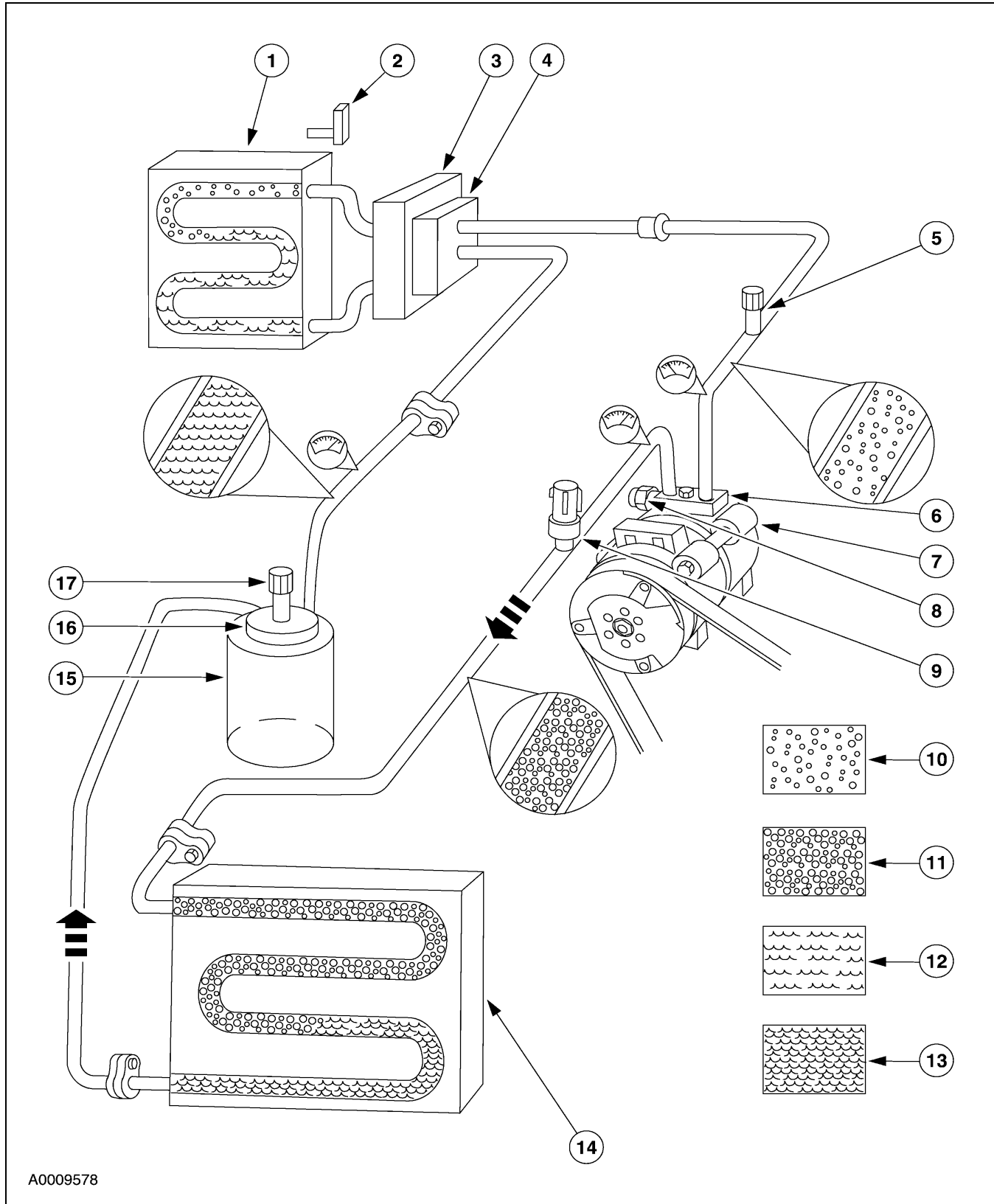
The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

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

DESCRIPTION AND OPERATION (Continued)

Thermostatic Expansion Valve Type Refrigerant System



DESCRIPTION AND OPERATION (Continued)

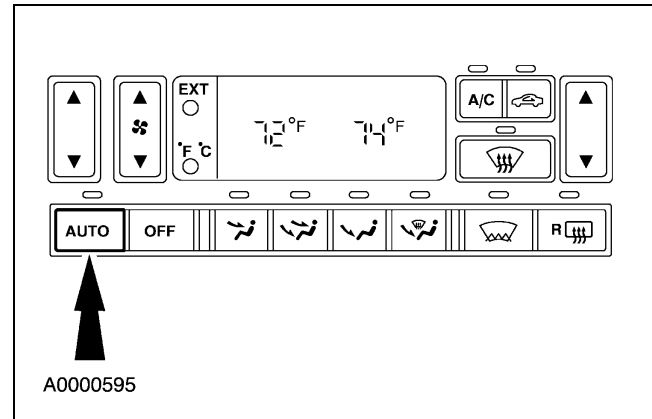
Item	Part Number	Description
1	19860	A/C evaporator core
2	19C734	A/C evaporator core outlet temperature thermistor
3	19849	Thermostatic expansion valve
4	19835	Manifold and tube assembly — thermostatic expansion valve
5	19D701	A/C charge valve port (low side)
6	19D734	Manifold and tube assembly — A/C compressor
7	19703	A/C compressor
8	19D644	A/C pressure relief valve
9	19D594	A/C pressure transducer
10	—	Low pressure vapor
11	—	High pressure vapor
12	—	Low pressure liquid
13	—	High pressure liquid
14	19712	A/C condenser core
15	19959	A/C receiver/drier
16	19835	Manifold and tube assembly — receiver/drier
17	19D701	A/C charge valve port (high side)

Dual Automatic Temperature Control (DATC) Module Description

The DATC system automatically maintains a selected temperature for vehicle interior comfort and regulates the volume of airflow between the instrument panel registers, floor ducts, windshield defroster nozzle, and side window demisters. The system will automatically select between fresh and recirculated air with an optional manual override. The DATC system will also include a manual A/C override, blower speed override, and airflow direction overrides.

The dual temperature zone feature provides the driver and the front seat passenger with their own independent temperature set points. The DATC system provides both the driver and front seat passenger with their selected temperature for interior comfort. In situations where the difference between the driver and the front seat passenger set points are very large, the DATC will tend to favor the driver's setting and make the front seat passenger as comfortable as possible.

The driver and front seat passenger will not have independent air distribution mode or fan controls so the system is dual temperature only. In some cases the passenger temperature set point may influence the air distribution mode or blower speed in automatic mode.

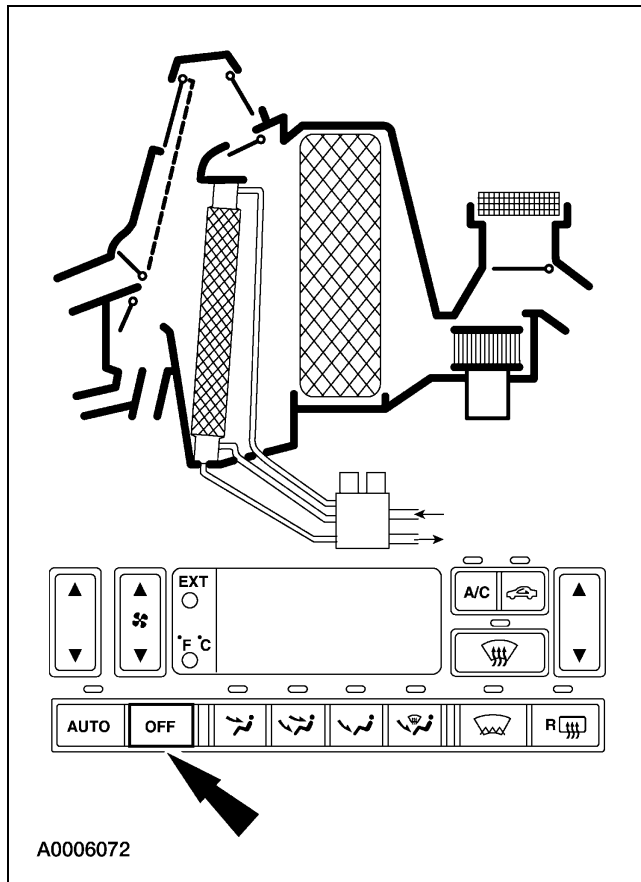
System Air Flow**AUTO**

When AUTO is selected:

- The temperature control setting(s) are manually set to the desired setting(s).
- The air inlet door actuator is automatically controlled by the DATC module, based on the temperature setting(s), but can be manually overridden by selecting the recirculation button.
- The panel door, floor door, defrost door and cold air bypass door actuators are automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting any of the air distribution buttons.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C compressor is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by selecting the A/C button. The A/C compressor will not operate if the outside temperature is lower than approximately 2°C (35°F).
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

DESCRIPTION AND OPERATION (Continued)

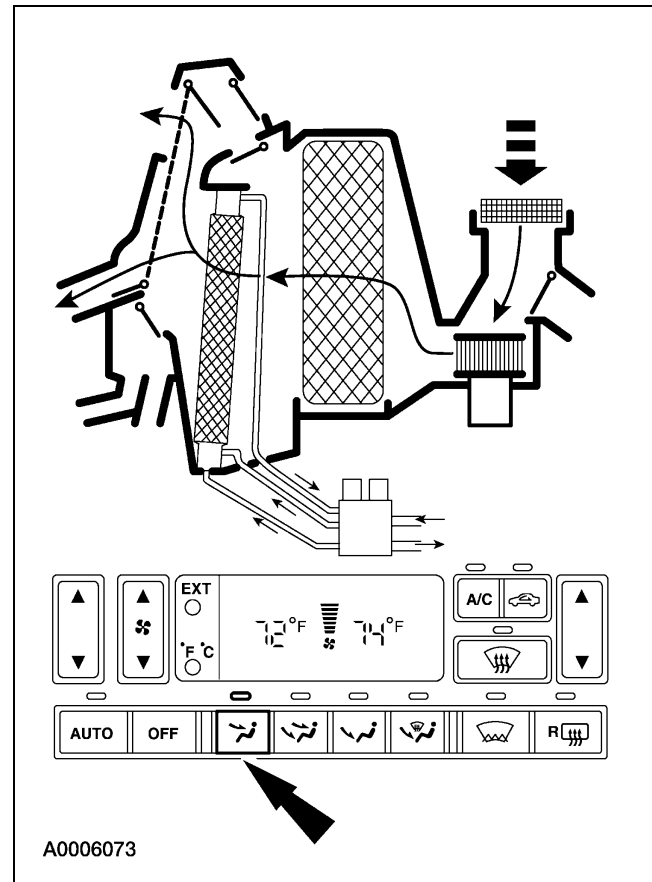
OFF



When OFF is selected:

- The air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment.
- The floor door actuator positions the floor door in the open position, and the panel door actuator, defrost door actuator, and cold air bypass door actuator position the panel door, defrost door, and cold air bypass door in the closed positions. This closes off airflow to the defrost duct, the side window demisters and the instrument panel A/C registers.
- The dual coolant control valve is in the closed position, preventing the flow of hot coolant to the heater core.
- The blower motor is off.

PANEL



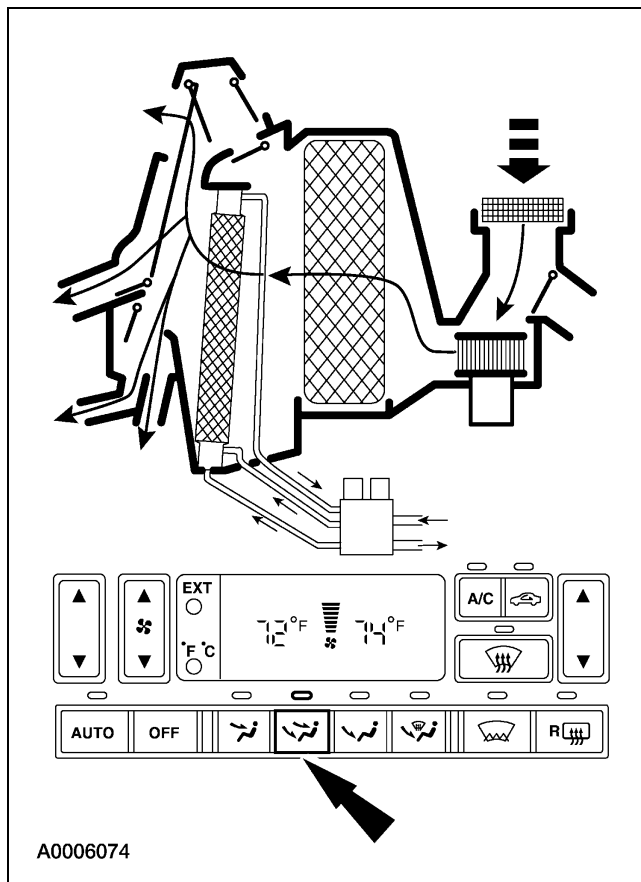
When PANEL is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door actuator positions the panel door in the open position and the floor door and defrost door actuators position the floor door and defrost door in the closed position, directing airflow to the instrument panel A/C registers. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).

DESCRIPTION AND OPERATION (Continued)

- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

PANEL/FLOOR

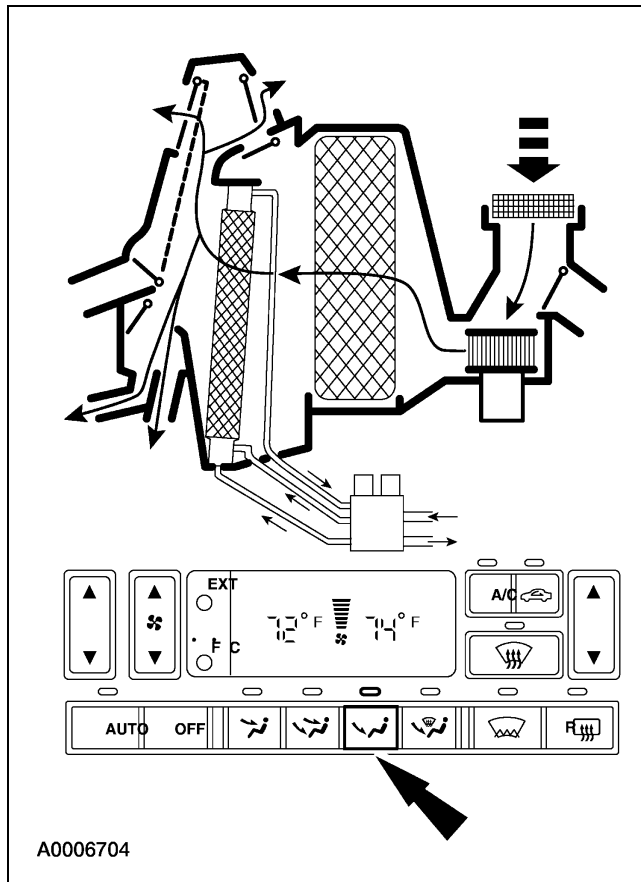


When PANEL/FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door as to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The panel door and floor door actuators position the panel door and floor door in the open position and the defrost door actuator positions the defrost door in the closed position, directing airflow to the instrument panel A/C registers and the floor duct. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature setting(s).
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

DESCRIPTION AND OPERATION (Continued)

FLOOR

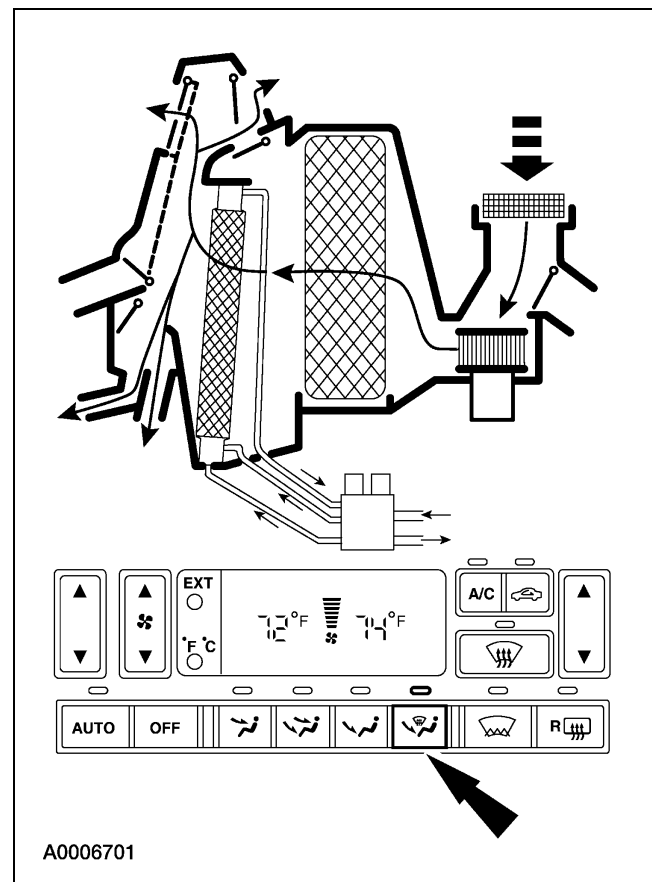


When FLOOR is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door as to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately one to four minutes to prevent window fogging.
- The floor door actuator positions the floor door in the open position and the panel door and defrost door actuators position the panel door and defrost door in the closed position, directing airflow to the floor duct. A small amount of airflow from the outboard instrument panel A/C registers will be present. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).

- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

FLOOR/DEFROST

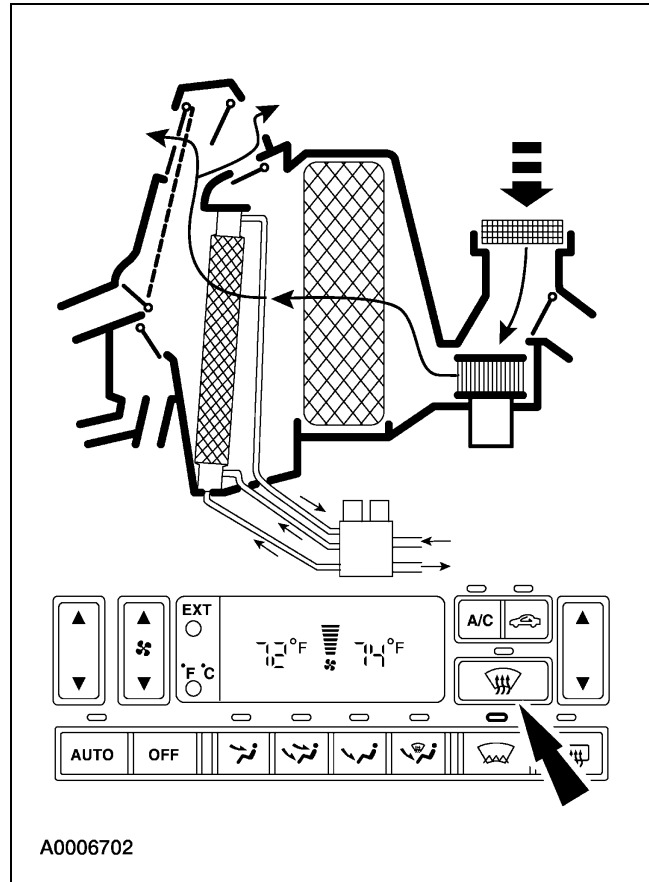


DESCRIPTION AND OPERATION (Continued)

When FLOOR/DEFROST is selected:

- The Recirc request button is enabled. If the Recirc request button is selected (indicator on), the air inlet door actuator positions the air inlet door to close off outside air from entering the passenger compartment. If the Recirc request button is not selected (indicator off), the air inlet door actuator positions the air inlet door as to admit only outside air into the passenger compartment. The DATC will automatically revert to the outside air position after approximately one to four minutes to prevent window fogging.
- The floor door and defrost door actuators position the floor door and defrost door in the open position and the panel door actuator positions the panel door in the closed position, directing airflow to the floor duct, the windshield defroster ducts, and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present. The cold air bypass door actuator is automatically controlled by the DATC module based on the temperature setting(s).
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is enabled. When the A/C request button is selected (indicator on), the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F). When the A/C request button is not selected (indicator off), the A/C compressor will not operate and the air cannot be cooled below the outside temperature.
- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

DEFROST



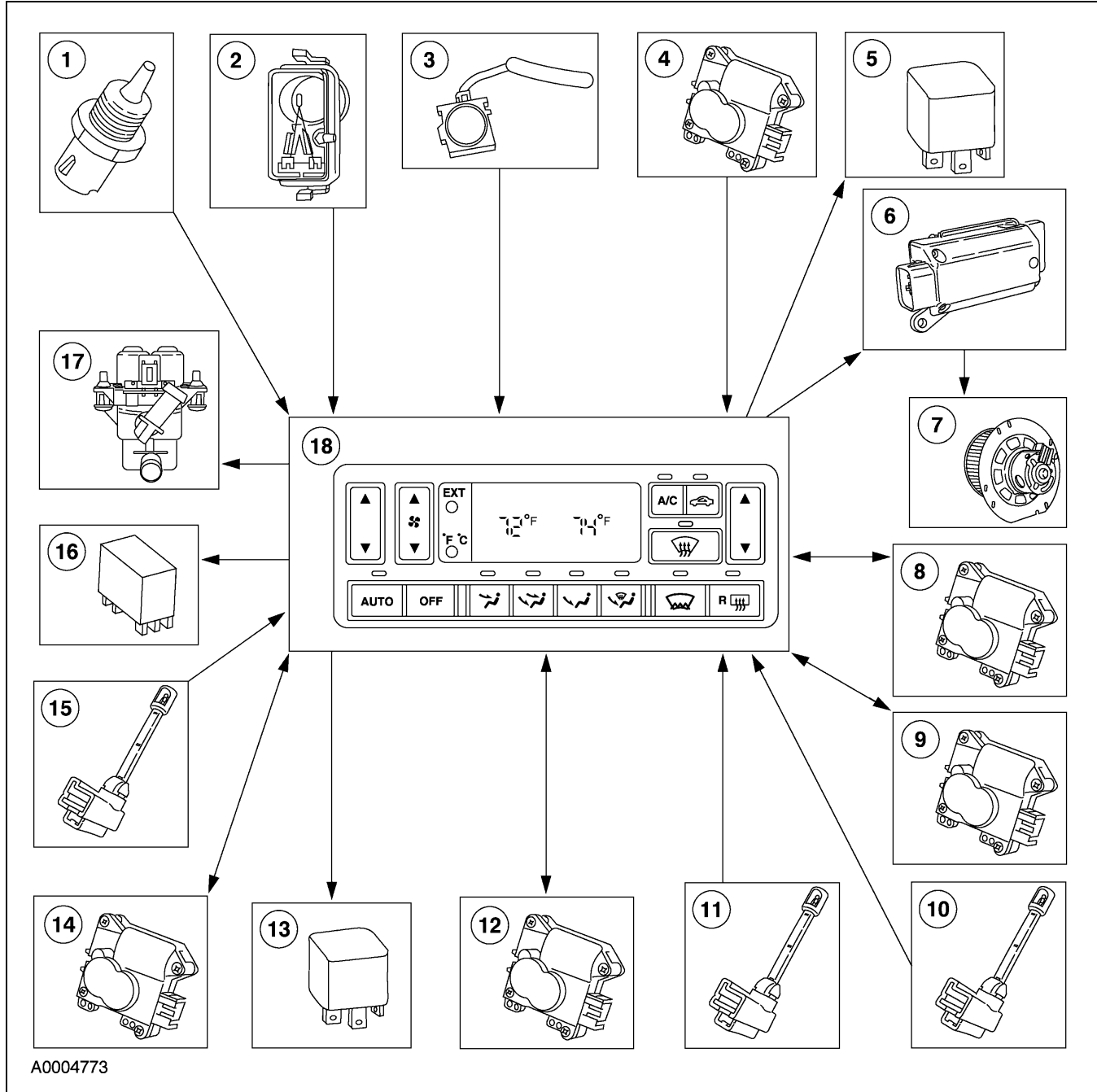
When DEFROST is selected:

- The Recirc request button is disabled. The air inlet door actuator positions the air inlet door to admit only outside air into the passenger compartment.
- The defrost door actuator positions the defrost door in the open position and the panel door, floor door, and cold air bypass door actuators position the panel door, floor door, and cold air bypass door in the closed position, directing airflow to the windshield defroster ducts and the side window demisters. A small amount of airflow from the outboard instrument panel A/C registers will be present.
- The dual coolant control valve is automatically controlled by the DATC module based on the temperature settings.
- The A/C request button is disabled. To reduce fogging, the A/C compressor will operate if the outside air temperature is above approximately 2°C (35°F).

DESCRIPTION AND OPERATION (Continued)

- The blower motor is on. The blower motor speed is automatically controlled by the DATC module based on the temperature setting(s), but can be manually overridden by adjusting the blower speed rocker button.

Climate Control System Electrical Components — Directly Linked to DATC Module



DESCRIPTION AND OPERATION (Continued)

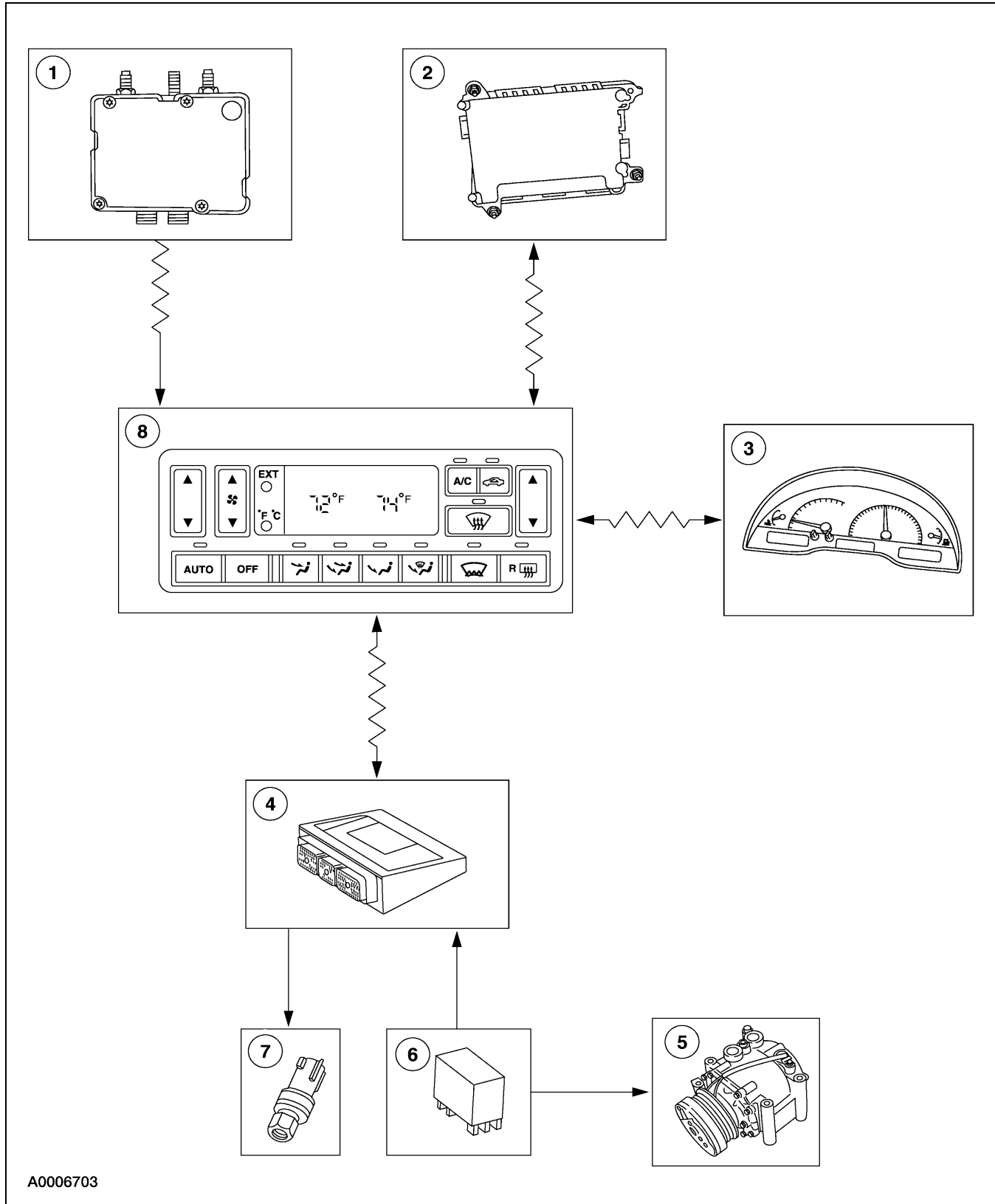
Item	Part Number	Description
1	12A647	Ambient air temperature sensor
2	19C734	In-vehicle temperature control sensor
3	19E663	Dual sunload sensor
4	19E616	Panel door actuator
5	14N089	Blower motor relay
6	19E624	Blower motor speed control
7	19805	Blower motor
7	18504	Blower wheel (not serviced with motor)
8	19E616	Air inlet door actuator
9	19E616	Cold air bypass door actuator

(Continued)

Item	Part Number	Description
10	19C734	Passenger air discharge temperature sensor
11	19C734	Evaporator discharge air temperature sensor
12	19E616	Floor door actuator
13	14N089	Heated wiper park relay
14	19E616	Defrost door actuator
15	19C734	Driver air discharge temperature sensor
16	14N089	Auxiliary water pump relay
17	18495	Dual coolant control valve
18	19980	Dual automatic temperature control module

DESCRIPTION AND OPERATION (Continued)

Climate Control System Components — J1850 Communications Network (SCP) Linked



DESCRIPTION AND OPERATION (Continued)

Item	Part Number	Description
1	2C219	ABS module
2	24994	Rear electronic module (REM)
3	10849	Instrument cluster module
4	12A696	Powertrain control module

(Continued)

Item	Part Number	Description
5	19703	A/C compressor
6	14N089	A/C clutch relay
7	19D594	A/C pressure transducer
8	19980	Dual automatic temperature control module