# A/C-HEATER SYSTEM

## 1998 AIR CONDITIONING & HEAT General Motors Corp. - A/C-Heater System

## A/C SYSTEM SPECIFICATIONS

### A/C SYSTEM SPECIFICATIONS

| Application | Specification |
|---|---|
| Compressor Type | Harrison V5 5-Cyl. |
| Compressor Belt Tension | (1) |
| System Oil Capacity | 9 ozs. |
| Refrigerant (R-134a) Capacity | (2) 46.4 ozs. |
| System Operating Pressures (3) | |
| High Side | 145-261 psi (10.2-18.4 kg/cm$^2$ ) |
| Low Side | 28-30 psi (1.9-2.1 kg/cm$^2$ ) |

(1) Belt tension is adjusted by automatic belt tensioner.

(2) Use PAG Oil (Part No. 12345923).

(3) Measured at 2000 RPM with ambient temperature at 68°F (20°C).

## DESCRIPTION & OPERATION

**WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG article in the ACCESSORIES/SAFETY EQUIPMENT Section.**

**CAUTION: When discharging air conditioning system, use only approved refrigerant recovery/recycling equipment. Make every attempt to avoid discharging refrigerant into the atmosphere.**

**CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner prior to servicing vehicle.**

### A/C-HEATER CONTROL PANEL

#### AUTO Mode

Press driver's side TEMP knob to set system in AUTO mode. Once system is set, sensors will provide input to the A/C-heater system to maintain the desired interior temperature.

#### A/C Off & Off

A/C off mode, deactivates the A/C compressor. Off mode deactivates the automatic A/C-heater system, but outside air temperature remains displayed. The system will attempt to maintain the previously set temperature without the use of A/C or blower motor.

#### Temperature Control

The driver and passenger temperature control knobs provide a dual-zone heating and cooling feature. The dual-zone feature may be changed to a single-zone mode by depressing passenger knob. In all cases the passenger's control is slave to the driver's control.

**Defrost Mode**

Activating defrost mode by pushing DEFROST button will deactivate the AUTO function, the blower speed will go to 3rd speed and the recirculated air mode will deactivate if on. Pushing DEFROST button again will return system to the mode in which it was previously set.

**Fan Speed**

Blower motor speed is controlled by A/C-heater system using a blower controller. A manual fan speed change will override the AUTO mode setting.

**Recirculated Air Mode**

The recirculated air mode closes off most of the entrance of outside air and recirculates passenger compartment air.

**Defog Mode**

In this mode, air will be split equally between defroster and floor outlets.

**Bi-Level Mode**

This mode provides outside airflow to the instrument panel with a split to the floor outlet.

**Floor Mode**

In this mode, all airflow is directed to the floor outlet ducts.

**Display Panel**

The vacuum fluorescent display panel provides system operating information for the driver. The set temperature can be displayed in Fahrenheit or Celsius. To switch between Fahrenheit and Celsius, depress driver's TEMP button for at least 3 seconds.

Outside temperature reading is displayed in the same temperature value as the requested interior temperature setting. If OUTSIDE temperature displays "--", this indicates a failure of the outside temperature sensor. A freeze warning feature causes outside temperature display to flash. This feature indicates the outside temperature is cold enough to encounter ice on the road surfaces.

When AUTO is displayed, it indicates the system is in the automatic operating mode. When system is manually turned off, AC OFF will be displayed. The defrost and rear heated window functions are displayed with an appropriate icon and can be initiated by depressing the appropriate buttons.

Adjustment of fan speed is accomplished by depressing rocker button either up or down. The fan speed icon is not displayed in AUTO mode. In Manual mode, the fan speed is designated by the graduated bars.

The MODE rocker button will adjust the direction of the airflow as designated by the icon displayed on panel. The arrows show the direction of the airflow. The defog icon will appear in the grouping when set.

The recirculated air icon will be displayed when system is manually set to recirculate passenger compartment air. The recirculated air button controls the function in either the AUTO or manual mode.

**A/C COMPRESSOR CONTROLS**

When A/C button on A/C-heater control panel is pressed, an A/C compressor request signal is sent through the

refrigerant pressure switch and the Engine Control Module (ECM) to the coil of the A/C compressor relay (K60). This enables A/C compressor relay to energize, allowing ignition voltage to energize A/C compressor clutch coil and fan control relay (K87). When fan control relay energizes, battery voltage is supplied to auxiliary cooling fan No. 1 and through the normally open contacts of fan control relay (K52), to auxiliary cooling fan No. 2. If coolant temperature reaches 248°F (120°C), temperature switch No. 2 contacts will open and the compressor clutch coil is disengaged causing the A/C system to turn off. Temperature switch No. 2 will not allow A/C system to turn back on until coolant temperature has dropped to 239°F (115°C) or less.

The A/C compressor clutch coil can also be turned off by refrigerant pressure switches (low pressure switch or high pressure switch). The low pressure switch will turn A/C compressor clutch off as soon as refrigerant pressure falls to about 26 psi (1.8 $kg/cm^2$ ). This is done by opening the low pressure switch contacts and not allowing battery voltage to pass through A/C compressor relay (K60) to the compressor clutch coil. The low pressure switch activates the A/C compressor clutch when refrigerant pressure increases to about 36.3 psi (2.6 $kg/cm^2$ ).

The high pressure switch will turn A/C compressor clutch off as soon as refrigerant pressure exceeds approximately 435 psi (30.6 $kg/cm^2$ ). This is done by opening the high pressure switch contacts in refrigerant pressure switch and not allowing battery voltage to pass through A/C compressor relay (K60) to the A/C compressor clutch. The high pressure switch activates A/C compressor clutch when refrigerant pressure drops to less than about 290 psi (19.3 $kg/cm^2$ ).

When refrigerant pressure exceeds approximately 159.4 psi (11.2 $kg/cm^2$ ), the A/C control switch contacts will close and engine idle speed will increase to compensate for the RPM drop that occurs when A/C system is switched on. The A/C control switch is installed in the high pressure line, between A/C compressor and condenser. When refrigerant pressure drops to less than approximately 130. 5 psi (9.2 $kg/cm^2$ ), the A/C control switch contacts will close and allow engine idle speed to return to normal.

**ACTUATORS**

The automatic A/C-heater system uses 5 electrically operated actuators (stepper motors) and 2 vacuum actuators. The electrically operated actuators control driver's and passenger's temperature doors, inside air (panel) valve door, and mode valve (floor) door. The vacuum actuators control the interior air recirculation valve and heater cut-off valve.

**AIR DELIVERY & TEMPERATURE CONTROLS**

The outside (ambient) air temperature sensor is a thermistor that controls signal voltage to the A/C-heater control panel. The A/C-heater control panel applies voltage on the sensor's circuit. When the sensor is cold its resistance is high, and the A/C-heater control panel will see a high voltage signal. When sensor warms up its resistance is reduced and the signal voltage is pulled low through ground circuit. Signal voltage varies from 5 volts (open circuit) to zero volts (short circuit).

The headlight automatic control ambient light sensor is a photo diode that controls signal voltage to the A/C-heater control panel. The A/C-heater control panel monitors voltage on the circuit to this sensor. When sensor is exposed to direct light, the A/C-heater control panel reads a low voltage signal. As sensor becomes shaded, the signal voltage increases. Signal voltage varies from 5 volts (open circuit) to zero volts (short circuit). The light sensor influences the A/C-heater system by changing blower speed, air distribution, and the temperature depending on the sun's intensity (sunload sensor input).

The left and right duct temperature sensors are thermistors that control signal voltages to the A/C-heater control panel. When sensors are cold their resistance is high. When sensors warm up their resistance is reduced and the signal voltage is pulled low through ground circuit. Signal voltage varies from 5 volts (open circuit) to zero volts (short circuit).

## BLOWER CONTROLS

Airflow is controlled by modulating commanded blower motor voltage and varying the blower motor speed. The blower motor speed is a function of the program number when it is under automatic control. Adjustments to blower motor speed are made based on vehicle speed, coolant temperature, and solar load (sunload sensor input). There are some instances which may override the normal operation of the blower motor in order to limit snow ingestion, purge air ducts, cooling of the instrument cluster, or to enhance heater warm-up performance.

## COLD AIR PURGE

During a start in cool weather with a still warm engine, the humid air which collects around the heater core could cause windshield fogging. To prevent his, a cold air purge routine is programmed into the A/C-heater control panel. With coolant temperature at least 60°F (16°C) and the blower motor and air distribution in the AUTO mode, the air valves will move to guide the airflow away from the windshield. During the first 5 seconds, while the air valves are moving into position, the blower motor will not run. Then for the next 30 seconds, a low blower motor speed purges the moist air from the system. After that, the system reverts to its normal operating mode.

## ELECTRIC COOLING FANS

The electric cooling fan circuits consist of one engine cooling fan, 2 auxiliary cooling fans, 2 temperature switches, the A/C compressor refrigerant pressure switch, the Engine Control Module (ECM) cooling blower, the timing control pump, the auxiliary water pump, 7 fan control relays, and one engine cooling fan resistor. The auxiliary water pump is provided with battery voltage at all times, enabling it to operate anytime the ignition switch is on.

At 212°F (100°C), temperature switch No. 1 stage one contacts will close, enabling ECM relay (K48) and cooling fan control relay (K26) to energize. When ECM relay energizes, ignition voltage will be applied to the ECM cooling blower, allowing it to operate.

When cooling fan control relay (K26) energizes, battery voltage is applied to auxiliary cooling fan No. 1 and to auxiliary cooling fan No. 2 through the normally open contacts of fan control relay (K52). This will cause the auxiliary cooling fans to operate in series at half speed.

Fan control relay (K26) will also supply battery voltage to the engine cooling fan after it goes through the engine cooling fan resistor. The engine cooling fan resistor will cause the engine cooling fan to operate at half speed. Fan control relay (K26) will also supply battery voltage to the timing control pump through normally closed contacts of the auxiliary water pump relay (K22). This will allow the timing control pump to operate.

Temperature switch No. 1 stage one contacts will open when coolant temperature reaches 203°F (95°C). This will turn on all 3 fans, the ECM cooling blower and turn the timing control pump off, unless the A/C system is on.

If ignition is off and coolant temperature is greater than 212°F (100°C), both auxiliary cooling fans, the engine cooling fans and the timing control pump will remain on until the coolant temperature drops to less than 203°F (95°C).

If temperature reaches 221°F (105°C), temperature switch contacts will close enabling fan control relays (K52 and K28) to energize. When fan control relay (K52) energizes, auxiliary cooling fan No. 1 will go to full speed as it is no longer in series with auxiliary cooling fan No. 2. When fan control relay (K28) energizes, battery voltage is applied to auxiliary cooling fan No. 2 which operates at full speed.

With temperature switch No. 1 stage one contacts closed, the ECM cooling blower, the timing control pump and the engine cooling fan (half speed) will continue to operate. Temperature switch No. 2 contacts will open when coolant temperature reaches 212°F (100°C) and cause the operation of the auxiliary cooling fans to operate differently as designated by temperature switch No. 1.

If coolant temperature reaches 230°F (110°C), temperature switch No. 2 stage two contacts will close, enabling

fan control relay (K67) to energize. When fan control relay (K67) energizes, battery voltage will be applied directly to engine cooling fan, causing it to operate at full speed. All other operations that were taking place before the coolant temperature reached 230°F (110°C) will remain in effect. Temperature switch No. 1 stage two contacts will open when coolant temperature reaches 221°F (105°C) and the engine cooling fan will return to half speed.

At coolant temperatures greater than approximately 230°F (110°C), all 3 cooling fans operate at full speed. The ECM cooling blower, the timing control pump and the auxiliary water pump are also operating. Only 6 of the 7 relays operate at this time, unless the A/C system is turned on. In this case, fan control relay (K87) and the A/C compressor relay (K60) will also operate.

To prevent excessively high refrigerant pressure, auxiliary cooling fans are switched from first speed to second speed at refrigerant pressures greater than approximately 276 psi (19.4 $kg/cm^2$ ). When pressure drops less than approximately 218 psi (15.3 $kg/cm^2$ ), auxiliary cooling fans are switched back to first speed.

### HOT AIR PURGE

During a start in warm weather, warm moist air can accumulate around the evaporator. To divert this undesirable air, the A/C-heater control panel will disable the blower motor for 5 seconds while the mode valves move to divert the air to the floor outlets. After positioning the mode valves, the A/C-heater control panel will set blower motor on low for 30 seconds to purge the air from the A/C-heater module before returning to AUTO mode.

### INSIDE AIR TEMPERATURE SENSOR

The inside temperature sensor is located in A/C-heater control module, behind a small grille. Inside air temperature sensor input takes place only during initial start-up. In the case of an inside air temperature sensor failure, the A/C-heater system will default to a value of 75°F (24°C).

### OUTSIDE AIR TEMPERATURE SENSOR

The outside (ambient) temperature sensor is located on bottom of front bumper. The sensor is exposed to the airflow across the front of the vehicle and provides a sample of the outside air (ambient) temperature. In the case of an outside air temperature sensor failure, the A/C-heater system will default to a value of 60°F (15°C).

### SUNLOAD SENSOR

The sunload sensor is a photo-electric cell that provides 2 inputs to the A/C-heater system. One input is used by the A/C-heater system for temperature control compensation. The other input is used to determine the need for the twilight sentinel. This signal is sent from the A/C-heater system to the Body control Module (BCM).

The sunload sensor input to the A/C-heater system provides a means of determining the intensity of solar heat the passenger compartment is subjected to. In the case of a sunload sensor failure, the A/C-heater systems will default to a value of zero (darkness).

## ADJUSTMENTS

### CALIBRATING ACTUATORS

Turn ignition switch to ON position. On A/C-heater control panel, simultaneously press and hold AUTO and OFF buttons for at least 5 seconds.

### PROGRAMMING ECM

**NOTE: All Engine Control Module (ECM) functions must be programed using Tech 2 scan tool.**

# SELF-DIAGNOSTICS

## INTRODUCTION

**NOTE: Diagnostic Trouble Codes (DTCs) should be diagnosed and repaired before proceeding with any other tests. If no DTCs are set, diagnose problem by symptom, see appropriate symptom under TROUBLE SHOOTING .**

Diagnosis of A/C-heater system is based on Diagnostic Trouble Codes (DTCs) stored in A/C-heater control panel microprocessor. The A/C-heater control display will store either a current or history DTC depending on type of fault detected.

For system diagnosis, install a TECH 2 scan tool with appropriate cartridge and check for any DTCs that may be set. If a DTC is set, go to appropriate diagnostic procedure. See **DTC IDENTIFICATION** . Exit all scan tool tests before cycling ignition switch OFF to ON unless scan tool instructions direct otherwise. After a repair is completed, DTCs must be cleared from memory to ensure proper system operation. See **CLEARING DIAGNOSTIC TROUBLE CODES** .

## DTC IDENTIFICATION

| DTC | Fault |
|---|---|
| 10 | Inside Air Temperature Sensor Voltage Low |
| 11 | Inside Air Temperature Sensor Circuit Open |
| 12 | Left Air Outlet Temperature Sensor Voltage Low |
| 13 | Left Air Outlet Temperature Sensor Circuit Open |
| 14 | Right Air Outlet Temperature Sensor Voltage Low |
| 15 | Right Air Outlet Temperature Sensor Circuit Open |
| 16 | Interior Air Mix Door Motor Voltage Low Or Circuit Open |
| 17 | Interior Air Mix Door Motor Voltage High |
| 18 | Left Air Mix Door Motor Voltage Low Or Circuit Open |
| 19 | Left Air Mix Door Motor Voltage High |
| 20 | Right Air Mix Door Motor Voltage Low Or Circuit Open |
| 21 | Right Air Mix Door Motor Voltage High |
| 22 | Floor Air Mix Door Motor Voltage Low Or Open Circuit |
| 23 | Floor Air Mix Door Motor Voltage High |
| 24 | Defrost Air Mix Door Motor Voltage Low Or Circuit Open |
| 25 | Defrost Air Mix Door Motor Voltage High |
| 27 | Blower Motor Voltage Low Or Circuit Open |
| 28 | Air Circulation Valve Voltage Low Or Circuit Open |
| 29 | Air Circulation Valve Voltage High |
| 30 | Heating Cut-Off Valve Voltage Low Or Circuit Open |
| 31 | Heating Cut-Off Valve Voltage High |
| 35 | A/C Request Signal Voltage Circuit Open |
| 36 | A/C Request Signal Voltage Low |
| 37 | A/C-Heater Control Panel Switch Stuck |
| 38 | Sunload Sensor Supply Voltage Low |
| 39 | Sunload Sensor Supply Voltage High |
| 40 | Sunload Sensor Ground Shorted To Voltage |
| 51 | Replace A/C-Heater Control Panel |

| | |
|---|---|
| 52 | A/C-Heater Control Panel Not Programmed |
| 55 | Replace A/C-Heater Control Panel |
| 169 | Outside Air Temperature Sensor Voltage Low |
| 171 | Outside Air Temperature Sensor Circuit Open |

**CLEARING DIAGNOSTIC TROUBLE CODES**

Diagnostic Trouble Codes (DTCs) are cleared using a scan tool. After repairs are made, clear DTCs following scan tool manufacturer's instructions. If a scan tool is not available, DTCs are automatically cleared from memory after 20 ignition cycles if no faults are present.

**DTC 10: INSIDE AIR TEMPERATURE SENSOR VOLTAGE LOW**

1. Install scan tool. Select INSIDE AIR TEMP SENSOR and display voltage. If scan tool displays less than .2 volt, replace and program A/C-heater control panel. If scan tool does not display less than .2 volt, go to next step.
2. Remove A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION. Move A/C-heater control panel while monitoring scan tool. If voltage reading changes on scan tool, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION. If voltage reading does not change on scan tool, system is okay.

**DTC 11: INSIDE AIR TEMPERATURE SENSOR CIRCUIT OPEN**

1. Install scan tool. Select INSIDE AIR TEMP SENSOR and display voltage. If scan tool displays more than 4.5 volts, replace and program A/C-heater control panel. If scan tool does not display more than 4.5 volts, go to next step.
2. Remove A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION. Move A/C-heater control panel while monitoring scan tool. If voltage reading changes on scan tool, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION. If voltage reading does not change on scan tool, system is okay.

**DTC 12: LEFT AIR OUTLET TEMPERATURE SENSOR VOLTAGE LOW**

1. Install scan tool. Select LEFT AIR OUTLET SENSOR TEMPERATURE and display voltage. If scan tool displays less than .2 volt, go to next step. If scan tool does not display less than .2 volt, go to step 3).
2. Disconnect left air outlet sensor connector. If scan tool displays more than 4.5 volts, replace left air outlet temperature sensor and go to step 7). If scan tool does not display more than 4.5 volts, go to step 4).
3. Move related harnesses and harness connectors at left air outlet temperature sensor and A/C-heater control panel. If voltage reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If voltage reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
4. Turn ignition switch to ON position. Using a voltmeter, measure voltage between left air temperature sensor harness connector, terminal "B" (Green/Red wire) and ground. If voltage reading is 4.5-5.0 volts, go next step. If voltage reading is not 4.5-5.0 volts, go to step 6).
5. With voltmeter connected in previously stated position, move related harnesses and harness connectors at left air outlet temperature sensor and A/C-heater control panel. If voltage reading changes, check for short to ground in Green/Red wire between left air outlet temperature sensor harness connector, terminal "B" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 24. If voltage reading does not change, go to step 7).
6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Check for a short to ground in Green/Red wire between left air outlet temperature sensor harness connector, terminal "B"

and A/C-heater control panel 26-pin C2 harness connector, terminal No. 24. If wire is okay, replace and program A/C-heater control panel and go to next step. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

7. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

**DTC 13: LEFT AIR OUTLET TEMPERATURE SENSOR CIRCUIT OPEN**

1. Install scan tool. Select LEFT AIR OUTLET SENSOR TEMPERATURE and display voltage. If scan tool displays more than 4.5 volts, go to next step. If scan tool does not display more than 4.5 volts, go to step 3).
2. Disconnect left air outlet sensor connector. Connect a fused jumper wire between left air outlet sensor harness connector terminals. If scan tool displays less than .2 volt, replace left air outlet temperature sensor and go to step 7). If scan tool does not display less than .2 volt, go to step 4).
3. Move related harnesses and harness connectors at left air outlet temperature sensor and A/C-heater control panel. If voltage reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If voltage reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
4. Connect a fused jumper wire between left air temperature sensor harness connector, terminal "B" (Green/Red wire) and ground. If scan tool displays less than .2 volt, go to step 5). If scan tool does not display less than .2 volt, go to step 6).
5. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, check for an open in Brown/Black wire between left air outlet temperature sensor harness connector, terminal "A" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 23. If wire is okay, replace and program A/C-heater control panel and go to step 7). See **CONTROL PANEL** under REMOVAL & INSTALLATION.
6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, check for an open in Green/Red wire between left air outlet temperature sensor harness connector, terminal "B" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 24. If wire is okay, replace and program A/C-heater control panel and go to next step.
7. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

**DTC 14: RIGHT AIR OUTLET TEMPERATURE SENSOR VOLTAGE LOW**

1. Install scan tool. Select RIGHT AIR OUTLET SENSOR TEMPERATURE and display voltage. If scan tool displays less than .2 volt, go to next step. If scan tool does not display less than .2 volt, go to step 3).
2. Disconnect right air outlet temperature sensor connector. If scan tool displays more than 4.5 volts, replace right air outlet temperature sensor and go to step 7). If scan tool does not display more than 4.5 volts, go to step 4).
3. Move related harnesses and harness connectors at right air outlet temperature sensor and A/C-heater control panel. If voltage reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If voltage reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
4. Turn ignition switch to ON position. Using a voltmeter, measure voltage between right air temperature sensor harness connector, terminal "B" (Green/Brown wire) and ground. If voltage reading is 4.5-5.0 volts, go next step. If voltage reading is not 4.5-5.0 volts, go to step 6).
5. With voltmeter connected in previously stated position, move related harnesses and harness connectors at right air outlet temperature sensor and A/C-heater control panel. If voltage reading changes, check for short to ground in Green/Brown wire between right air outlet temperature sensor harness connector, terminal "B"

and A/C-heater harness control panel 26-pin C2 connector, terminal No. 25. If voltage reading does not change, go to step 7).

6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Check for a short to ground in Green/Brown wire between right air outlet temperature sensor harness connector, terminal "B" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 25. If wire is okay, replace and program A/C-heater control panel and go to next step. See procedures in **CONTROL PANEL** under REMOVAL & INSTALLATION.
7. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

**DTC 15: RIGHT AIR OUTLET TEMPERATURE SENSOR CIRCUIT OPEN**

1. Install scan tool. Select RIGHT AIR OUTLET SENSOR TEMPERATURE and display voltage. If scan tool displays more than 4.5 volts, go to next step. If scan tool does not display more than 4.5 volts, go to step 3).
2. Disconnect right air outlet temperature sensor connector. Connect a fused jumper wire between right air outlet temperature sensor harness connector terminals. If scan tool displays less than .2 volt, replace right air outlet temperature sensor and go to step 7). If scan tool does not display less than .2 volt, go to step 4).
3. Move related harnesses and harness connectors at right air outlet temperature sensor and A/C-heater control panel. If voltage reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If voltage reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
4. Connect a fused jumper wire between right air outlet temperature sensor harness connector, terminal "B" (Green/Brown wire) and ground. If voltage reading is less than .2 volt, go next step. If voltage reading is not less than .2 volt, go to step 6).
5. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, check for an open in Brown/Black wire between right air outlet temperature sensor harness connector, terminal "A" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 23. If wire is okay, replace and program A/C-heater control panel and go to step 7). Refer to **CONTROL PANEL** under REMOVAL & INSTALLATION.
6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, check for an open in Green/Brown wire between right air outlet temperature sensor harness connector, terminal "B" and A/C-heater control panel 26-pin C2 harness connector, terminal No. 25. If wire is okay, replace and program A/C-heater control panel and go to next step. Refer to **CONTROL PANEL** under REMOVAL & INSTALLATION.
7. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

**DTC 16: INTERIOR AIR MIX DOOR MOTOR VOLTAGE LOW OR CIRCUIT OPEN**

1. Install scan tool. Turn ignition switch to ON position. Select INT. AIR MIX DOOR MOT. and POS. from data list. Press AUTO button on A/C-heater control panel. Set MODE to middle vents. If scan tool displays interior air mix door motor ACTIVE and motor is at 70-100 percent, go to next step. If scan tool does not displays interior air mix door motor ACTIVE and motor is at 70-100 percent, go to step 3).
2. Press defrost button. If scan tool displays interior air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays interior air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect interior air mix door motor connector. Using an ohmmeter, check for continuity in White, Blue, Black and Gray wires between interior air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 9, 10, 11, and 12. Go to next step.

4. If wires are okay, check for a short to ground in White, Blue, Black and Gray wires between interior air mix door motor and A/C-heater control panel. If wires are okay, visually inspect connectors for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation. Go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 17: INTERIOR AIR MIX DOOR MOTOR VOLTAGE HIGH**

1. Install scan tool. Turn ignition switch to ON position. Select INT. AIR MIX DOOR MOT. and POS. from data list. Press AUTO button on A/C-heater control panel. Set MODE to middle vents. If scan tool displays interior air mix door motor ACTIVE and motor is at 70-100 percent, go to next step. If scan tool does not displays interior air mix door motor ACTIVE and motor is at 70-100 percent, go to step 3).
2. Press defrost button. If scan tool displays interior air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays interior air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect interior air mix door motor connector. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between interior air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 9, 10, 11, and 12. Turn ignition switch to ON position and check for short to battery voltage again. If wires are okay, go to next step.
4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 18: LEFT AIR MIX DOOR MOTOR VOLTAGE LOW OR CIRCUIT OPEN**

1. Install scan tool. Turn ignition switch to ON position. Select LEFT AIR MIX DOOR MOT. and POS. from data list. Press A/C then AUTO button on A/C-heater control panel. Turn left temperature knob to maximum heat. If scan tool displays left air mix door motor ACTIVE and motor is at 100 percent, go to next step. If scan tool does not displays left air mix door motor ACTIVE and motor is at 100 percent, go to step 3).
2. Turn left temperature knob to maximum cool. If scan tool displays left air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays left air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect left air mix door motor connector. Using an ohmmeter, check for continuity in White, Blue, Black and Gray wires between left air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 1, 2, 3, and 4. Go to next step.
4. If wires are okay, check for a short to ground in White, Blue, Black and Gray wires between left air mix door motor and A/C-heater control panel. If wires are okay, visually inspect connectors for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation. Go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 19: LEFT AIR MIX DOOR MOTOR VOLTAGE HIGH**

1. Install scan tool. Turn ignition switch to ON position. Select LEFT AIR MIX DOOR MOT. and POS. from data list. Press A/C then AUTO button on A/C-heater control panel. Turn left temperature knob to maximum heat. If scan tool displays left air mix door motor ACTIVE and motor is at zero percent, go to next step. If

scan tool does not displays interior air mix door motor ACTIVE and motor is at zero percent, go to step 3).

2. Turn temperature knob to maximum cool. If scan tool displays left air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays left air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect left air mix door motor connector. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between left air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 1, 2, 3, and 4. Go to next step.
4. Turn ignition switch to ON position. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between left air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 1, 2, 3, and 4. If wires are okay, go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 20: RIGHT AIR MIX DOOR MOTOR VOLTAGE LOW OR CIRCUIT OPEN**

1. Install scan tool. Turn ignition switch to ON position. Select RT AIR MIX DOOR MOT. and POS. from data list. Press A/C then AUTO button on A/C-heater control panel. Turn right temperature knob to maximum heat. If scan tool displays right air mix door motor ACTIVE and motor is at 100 percent, go to next step. If scan tool does not displays right air mix door motor ACTIVE and motor is at 100 percent, go to step 3).
2. Turn right temperature knob to maximum cool. If scan tool displays right air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays right air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect right air mix door motor connector. Using an ohmmeter, check for continuity in White, Blue, Black and Gray wires between right air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 5, 6, 7, and 8. Go to next step.
4. If wires are okay, check for a short to ground in White, Blue, Black and Gray wires between right air mix door motor and A/C-heater control panel. If wires are okay, visually inspect connectors for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation. Go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 21: RIGHT AIR MIX DOOR MOTOR VOLTAGE HIGH**

1. Install scan tool. Turn ignition switch to ON position. Select RT AIR MIX DOOR MOT. and POS. from data list. Press A/C then AUTO button on A/C-heater control panel. Turn right temperature knob to maximum heat. If scan tool displays right air mix door motor ACTIVE and motor is at zero percent, go to next step. If scan tool does not displays interior air mix door motor ACTIVE and motor is at zero percent, go to step 3).
2. Turn temperature knob to maximum cool. If scan tool displays right air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays right air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect right air mix door motor connector. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between right air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 5, 6, 7, and 8. Go to next step.
4. Turn ignition switch to ON position. Using a voltmeter, check for short to battery voltage in White, Blue,

Black and Gray wires between right air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 5, 6, 7, and 8. If wires are okay, go to next step.

5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 22: FLOOR AIR MIX DOOR MOTOR VOLTAGE LOW OR OPEN CIRCUIT**

1. Install scan tool. Turn ignition switch to ON position. Select FLR AIR MIX DOOR MOT. and POS. from data list. Press AUTO button on A/C-heater control panel. Set MODE to floor vents. If scan tool displays floor air mix door motor ACTIVE and motor is at 100 percent, go to next step. If scan tool does not displays floor air mix door motor ACTIVE and motor is at 100 percent, go to step 3).
2. Press defrost button. If scan tool displays floor air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays floor air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect floor air mix door motor connector. Using an ohmmeter, check for continuity in White, Blue, Black and Gray wires between floor air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 13, 14, 15, and 16. Go to next step.
4. If wires are okay, check for a short to ground in White, Blue, Black and Gray wires between floor air mix door motor and A/C-heater control panel. If wires are okay, visually inspect connectors for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation. Go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 23: FLOOR AIR MIX DOOR MOTOR VOLTAGE HIGH**

1. Install scan tool. Turn ignition switch to ON position. Select FLR AIR MIX DOOR MOT. and POS. from data list. Press AUTO button on A/C-heater control panel. Set MODE to floor vents. If scan tool displays floor air mix door motor ACTIVE and motor is at zero percent, go to next step. If scan tool does not displays interior air mix door motor ACTIVE and motor is at zero percent, go to step 3).
2. Press defrost button. If scan tool displays floor air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays floor air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect floor air mix door motor connector. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between floor air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 13, 14, 15, and 16. Go to next step.
4. Turn ignition switch to ON position. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between floor air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 13, 14, 15, and 16. Go to next step. If wires are okay, go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 24: DEFROST AIR MIX DOOR MOTOR VOLTAGE LOW OR CIRCUIT OPEN**

1. Install scan tool. Turn ignition switch to ON position. Select DEF AIR MIX DOOR MOT. and POS. from

data list. Press AUTO button on A/C-heater control panel. Set MODE to defog. If scan tool displays defrost air mix door motor ACTIVE and motor is at 30 percent, go to next step. If scan tool does not displays defrost air mix door motor ACTIVE and motor is at 30 percent, go to step 3).

2. Press defrost button. If scan tool displays defrost air mix door motor ACTIVE and motor is at zero percent, system is okay. If scan tool does not displays defrost air mix door motor ACTIVE and motor is at zero percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect defrost air mix door motor connector. Using an ohmmeter, check for continuity in White, Blue, Black and Gray wires between defrost air mix door motor harness connector, terminals No. 1, 3, 4 and 6, and A/C-heater control panel 26-pin C2 harness connector, terminals No. 17, 18, 19, and 20. Go to next step.
4. If wires are okay, check for a short to ground in White, Blue, Black and Gray wires between defrost air mix door motor and A/C-heater control panel. If wires are okay, visually inspect connectors for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation. Go to next step.
5. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 25: DEFROST AIR MIX DOOR MOTOR VOLTAGE HIGH**

1. Install scan tool. Turn ignition switch to ON position. Select DEF AIR MIX DOOR MOT. and POS. from data list. Press AUTO button on A/C-heater control panel. Set MODE to defog. If scan tool displays defrost air mix door motor ACTIVE and motor is at 30 percent, go to next step. If scan tool does not displays interior air mix door motor ACTIVE and motor is at 30 percent, go to step 3).
2. Press defrost button. If scan tool displays defrost air mix door motor ACTIVE and motor is at 100 percent, system is okay. If scan tool does not displays defrost air mix door motor ACTIVE and motor is at 100 percent, go to next step.
3. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 26-pin C2 connector. Disconnect defrost air mix door motor connector. Using a voltmeter, check for short to battery voltage in White, Blue, Black and Gray wires between defrost air mix door motor harness connector, terminals No. 1, 3, 4 and 6 and A/C-heater control panel 26-pin C2 harness connector, terminals No. 17, 18, 19, and 20. Turn ignition switch to ON position and check for short to battery voltage again. If wires are okay, go to next step.
4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 27: BLOWER MOTOR VOLTAGE LOW OR CIRCUIT OPEN**

1. Turn ignition switch to ON position. Set blower motor to position No. 3. Locate blower motor controller, behind right side of instrument panel, attached to A/C-heater control panel. Using a voltmeter, backprobe blower motor controller connector, terminal No. 4 (Brown/White wire). Measure voltage between blower motor controller and ground. If voltage is 2.7-2.8 volts, go to next step. If voltage is not 2.7-2.8 volts, replace blower motor controller.
2. Remove A/C-heater control panel. Ensure blower motor is set to position No. 3. Using a voltmeter connected to ground, backprobe A/C-heater control panel 22-pin C1 connector, terminal No. 13 (Brown/White wire). If voltage is 1.4-1.6 volts, go to next step. If voltage is not 1.4-1.6 volts, check for open or short to ground in Brown/White wire between blower motor controller harness connector, terminal No. 4 and A/C-heater control panel 22-pin C1 harness connector, terminal No. 13.
3. Check A/C-heater control panel 22-pin C1 connector, terminal No. 13 (Brown/White wire) for damage or corrosion. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Go through all 5 blower motor speeds. Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 28: AIR CIRCULATION VALVE VOLTAGE LOW OR CIRCUIT OPEN**

1. Disconnect air circulation valve connector. Turn ignition switch to ON position. Using a voltmeter, measure voltage between air circulation valve harness connector, terminal No. 2 (Yellow wire) and ground. If battery voltage exists, go to next step. If battery voltage does not exist, check for open in Yellow wire between air circulation valve harness connector, terminal No. 2 and A/C-heater control panel harness connector, terminal No. 26.
2. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, measure resistance in Blue/Black wire between A/C-heater control panel 26-pin C2 harness connector, terminal No. 22 and air circulation valve harness connector, terminal No. 1. If resistance is 0-2 ohms, go to next step. if resistance is not 0-2 ohms, check for open Blue/Black wire between A/C-heater control panel and air circulation valve.
3. Using an ohmmeter, measure resistance between air circulation valve connector terminals. If resistance is 36.4 ohms, go to next step. If resistance is not 36.4 ohms, replace air circulation valve.
4. Using an ohmmeter, check for continuity between A/C-heater control panel 26-pin C2 harness connector, terminal No. 22 (Blue/Black wire) and ground. If continuity does not exist, system is okay. If continuity exists, check for a short to ground in Blue/Black wire between A/C-heater control panel and heating cut-off valve.

**DTC 29: AIR CIRCULATION VALVE VOLTAGE HIGH**

1. Disconnect A/C-heater control panel 26-pin C2 connector. Using a voltmeter, measure voltage (with ignition off) between A/C-heater control panel 26-pin C2 harness connector, terminal No. 22 (Blue/Black wire) and ground. Turn ignition switch to ON position and measure voltage again. If voltage readings are the same, go to next step. If voltage readings are not the same, check for short to battery voltage in Blue/Black wire between A/C-heater control panel 26-pin C2 harness connector, terminal No. 22 and air circulation valve harness connector, terminal No. 1.
2. Move related harnesses and harness connectors at air recirculation valve and A/C-heater control panel. If voltage reading changes on voltmeter, repair damaged connector or wiring harness and go to next step. See **WIRING DIAGRAMS** . If voltage reading does not change on voltmeter, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation.
3. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Go through all 5 blower motor speeds. Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 30: HEATING CUT-OFF VALVE VOLTAGE LOW OR CIRCUIT OPEN**

1. Disconnect heating cut-off valve connector. Turn ignition switch to ON position. Using a voltmeter, measure voltage between heating cut-off valve harness connector, terminal No. 2 (Yellow wire) and ground. If battery voltage exists, go to next step. If battery voltage does not exist, check for open in Yellow wire between heating cut-off valve connector, terminal No. 2 and A/C-heater control panel harness connector, terminal No. 26.
2. Disconnect A/C-heater control panel 26-pin C2 connector. Using an ohmmeter, measure resistance in Blue/White wire between A/C-heater control panel 26-pin C2 harness connector, terminal No. 21 and heating cut-off valve harness connector, terminal No. 1. If resistance is 0-2 ohms, go to next step. if resistance is not 0-2 ohms, check for open Blue/White wire between A/C-heater control panel and heating cut-off valve.
3. Using an ohmmeter, measure resistance between heating cut-off valve connector terminals. If resistance is 36.4 ohms, go to next step. If resistance is not 36.4 ohms, replace heating cut-off valve.
4. Using an ohmmeter, check for continuity between A/C-heater control panel 26-pin C2 harness connector, terminal No. 21 (Blue/White wire) and ground. If continuity does not exist, system is okay. If continuity exists, check for a short to ground in Blue/Black wire between A/C-heater control panel and heating cut-off valve.

**DTC 31: HEATING CUT-OFF VALVE VOLTAGE HIGH**

1. Disconnect A/C-heater control panel 26-pin C2 connector. Using a voltmeter, measure voltage between A/C-heater control panel 26-pin C2 harness connector, terminal No. 21 (Blue/White wire) and ground. Turn ignition switch to ON position and measure voltage again. If battery voltage exists, go to next step. If battery voltage does not exist, check for short to battery voltage in Blue/White wire between A/C-heater control panel 26-pin C2 harness connector, terminal No. 21 and heating cut-off valve harness connector, terminal No. 1.
2. Move related harnesses and harness connectors at heating cut-off valve and A/C-heater control panel. If voltage reading changes on voltmeter, repair damaged connector or wiring harness and go to next step. See **WIRING DIAGRAMS** . If voltage reading does not change on voltmeter, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation.
3. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset.

**DTC 35: A/C REQUEST SIGNAL VOLTAGE CIRCUIT OPEN**

1. Remove Engine Control Module (ECM) and disconnect ECM connector. See **ENGINE CONTROL MODULE (ECM)** under REMOVAL & INSTALLATION. Ensure A/C-heater control panel is off. Using a voltmeter, measure voltage (with ignition off) between ECM harness connector, terminal No. 15 (Black/White wire) and ground. Turn ignition switch to ON position and measure voltage again. If voltage is zero volts, go to next step. If voltage is not zero volts, go to step 3).
2. Wiggle related harnesses and connectors at heating cut-off valve and A/C-heater control panel. If voltage reading changes, repair damage to connector or wiring harness and go to step 4). Refer to **WIRING DIAGRAMS** . If voltage reading does not change on voltmeter, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
3. Disconnect A/C compressor refrigerant pressure switch connector. Using a voltmeter, measure voltage between A/C compressor refrigerant pressure switch harness connector, terminal No. 2 (Black/White wire) and ground. Turn ignition switch to ON position and measure voltage again. If voltage is zero volts, check for short to voltage in Black/White wire between ECM harness connector, terminal No. 15 and A/C compressor refrigerant pressure switch harness connector, terminal No. 1. If voltage is not zero volts, check for short to voltage in Black/White wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 2 and A/C-heater control panel harness connector, terminal No. 10.
4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 36: A/C REQUEST SIGNAL VOLTAGE LOW**

1. Remove Engine Control Module (ECM) and disconnect ECM connector. See **ENGINE CONTROL MODULE (ECM)** under REMOVAL & INSTALLATION. Ensure A/C-heater panel is off. Press A/C button on A/C-harness control panel. Using a voltmeter, measure voltage between ECM harness connector, terminal No. 15 (Black/White wire)and ground. If battery voltage exists, go to next step. If battery voltage does not exist, go to step 3.
2. Move related harnesses and harness connectors at ECM, A/C compressor refrigerant pressure switch and A/C-heater control panel. If voltage reading changes on voltmeter, repair damaged connector or wiring harness and go to step 4). See WIRING DIAGRAMS. If voltage reading does not change on voltmeter, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, damaged wire insulation, and broken wire inside insulation.
3. Disconnect A/C compressor refrigerant pressure switch connector. Turn ignition switch to ON position. Press

A/C button on A/C-heater control panel. Using a voltmeter, measure voltage between A/C compressor refrigerant pressure switch harness connector, terminal No. 2 (Black/White wire) and ground. If battery voltage is present, go to step 5). If battery voltage is not present, go to step 6).

4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.
5. Using an ohmmeter, check for continuity in Black/White wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 1 and ground. If continuity does not exist, go back to step 2). If continuity exists, go to step 7).
6. Disconnect A/C-heater control panel 22-pin C1 connector. Using an ohmmeter, check for continuity in Black/White wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 2 and ground. If wire is okay, go back to step 4). If wire is not okay, go to step 8).
7. Check for short to ground in Black/White wire between A/C compressor refrigerant pressure switch harness connector terminal No. 1 and ECM harness connector terminal No. 15. Repeat step 4).
8. Check for short to ground in Black/White wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 2 and A/C-heater control panel harness connector, terminal No. 10. Go back to step 4).

**DTC 37: A/C-HEATER CONTROL PANEL SWITCH STUCK**

Install scan tool. Select DATA LIST from A/C-heater control panel menu. Select A/C SWITCH from data list. Press A/C button (on A/C-heater control panel) on and off several times. If scan tool displayed ACTIVE and INACTIVE while A/C button is being pressed, system is okay. If scan tool does not display ACTIVE and INACTIVE while A/C button is being pressed, replace and reprogram A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 38: SUNLOAD SENSOR SUPPLY VOLTAGE LOW**

1. Remove sunload sensor and disconnect sunload sensor connector. Turn ignition switch to ON position. Using a voltmeter, measure voltage at sunload sensor harness connector, terminal No. 1 (Brown wire) and ground. If voltage is 5.0-5.5 volts, check sunload sensor connector for damaged terminals and proper tension. Go to step 3). If voltage is not 5.0-5.5 volts, go to next step.
2. Disconnect A/C-heater control panel 22-pin C1 connector. Using an ohmmeter, check for continuity in Brown wire between A/C-heater control panel 22-pin C1 connector, terminal No. 7 (Brown wire) and ground. If no continuity exists, go to next step. If continuity exist, check for short to ground in Brown wire between A/C-heater control panel and sunload sensor.
3. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 39: SUNLOAD SENSOR SUPPLY VOLTAGE HIGH**

1. Remove sunload sensor and disconnect sunload sensor connector. Turn ignition switch to ON position. Using a voltmeter, measure voltage at sunload sensor harness connector, terminal No. 1 (Brown wire) and ground. If voltage is 5.0-5.5 volts, system is okay. If voltage is not 5.0-5.5 volts, go to next step.
2. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 22-pin C1 connector. Using a voltmeter, measure voltage between A/C-heater control panel 22-pin C1 connector, terminal No. 7 (Brown wire) and ground. If voltage is less than .1 volt, go to next step. If voltage is more than .1 volt, check for short to battery voltage in Brown wire between A/C-heater control panel and sunload sensor.
3. Turn ignition switch to ON position and repeat step 2). If voltage is less than .1 volt, go to next step. If voltage is more than .1 volt, check for short to battery voltage in Brown wire between A/C-heater control panel and sunload sensor.

4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 40: SUNLOAD SENSOR GROUND SHORTED TO VOLTAGE**

1. Remove sunload sensor and disconnect sunload sensor connector. Turn ignition switch to ON position. Using a voltmeter, measure voltage between sunload sensor harness connector, terminal No. 4 (Blue wire) and ground. If voltage is less than .4 volt, system is okay. If voltage is not less than .4 volt, go to next step.
2. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 22-pin C1 connector. Using a voltmeter, measure voltage between A/C-heater control panel 22-pin C1 connector, terminal No. 5 (Blue wire) and ground. If voltage is less than .1 volt, go to next step. If voltage is more than .1 volt, check for short to battery voltage in Blue wire between A/C-heater control panel and sunload sensor terminal No. 4. Also check for short to battery voltage in Blue wire between A/C-heater control panel and 22-pin C1 connector, terminal No. 5 and outside temperature sensor terminal "B".
3. Turn ignition switch to ON position and repeat step 2). If voltage is less than .1 volt, go to next step. If voltage is more than .1 volt, check for short to battery voltage in Blue wire between A/C-heater control panel and sunload sensor. Also check for short to battery voltage in Blue wire between A/C-heater control panel and 22-pin C1 connector, terminal No. 5 and outside temperature sensor terminal "B".
4. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 51: REPLACE A/C-HEATER CONTROL PANEL**

Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 52: A/C-HEATER CONTROL PANEL NOT PROGRAMMED**

Install scan tool. Select SPECIAL FUNCTIONS from HEATER and A/C CONTROL main menu. Select programming procedure. Program A/C-heater control panel. Follow instructions on display screen. If A/C-heater control panel cannot be programmed using scan tool, check all power and ground circuits to A/C-heater control panel. If power and ground circuits are okay, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 55: REPLACE A/C-HEATER CONTROL PANEL**

Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.

**DTC 169: OUTSIDE AIR TEMPERATURE SENSOR VOLTAGE LOW**

1. Install scan tool. Select OUTSIDE TEMPERATURE SENSOR and display voltage. If scan tool displays less than .2 volt, go to next step. If scan tool does not display less than .2 volt, go to step 3).
2. Disconnect outside air temperature sensor connector. If scan tool displays more than 4.5 volts, replace outside air temperature sensor. If scan tool does not display more than 4.5 volts, go to step 4).
3. Move related harnesses and harness connectors at outside air temperature sensor and A/C-heater control panel. If outside air temperature sensor reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If outside air temperature sensor reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate

terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.

4. Turn ignition switch to ON position. Using a voltmeter, measure voltage between outside air temperature sensor connector, terminal "A" (Blue/White wire) and ground. If voltage is 4.5-5 volts, go to next step. If voltage is not 4.5-5 volts, go to step 6).
5. Move related harnesses and harness connectors at outside air temperature sensor and A/C-heater control panel. If outside air temperature sensor reading changes on voltmeter, check for short to ground in Blue/White wire between A/C-heater control panel and outside air temperature sensor and go to step 7). If outside air temperature sensor reading does not change on voltmeter, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.
6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 22-pin C1 connector. Check fro short to ground in Blue/White wire between A/C-heater control panel and outside air temperature sensor. If wire is okay, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.
7. Install scan tool and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

**DTC 171: OUTSIDE AIR TEMPERATURE SENSOR CIRCUIT OPEN**

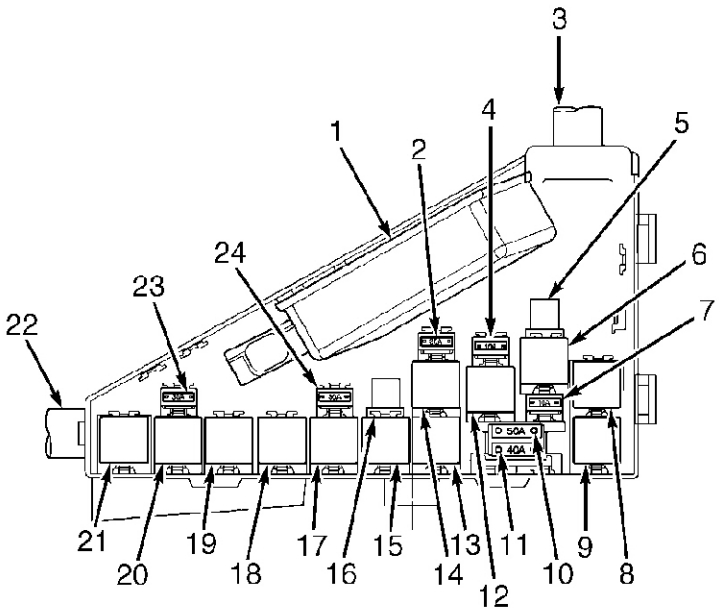
1. Install scan tool. Select OUTSIDE TEMPERATURE SENSOR and display voltage. If scan tool displays more than 4.5 volts, go to next step. If scan tool does not display more than 4.5 volts, go to step 3).
2. Disconnect outside air temperature sensor connector. Connect fused jumper wire between outside air temperature sensor connector terminals. If scan tool displays less than .2 volt, replace outside air temperature sensor. If scan tool does not display less than .2 volt, go to step 4).
3. Move related harnesses and harness connectors at outside air temperature sensor and A/C-heater control panel. If outside air temperature sensor reading changes on scan tool, repair damaged connector or wiring harness and go to step 7). See **WIRING DIAGRAMS** . If outside air temperature sensor reading does not change on scan tool, visually inspect sensor for damage, corrosion or water intrusion. Check for adequate terminal tension, misrouted harness, rubbed through wire insulation, and broken wire inside insulation.
4. Connect fused jumper wire between outside air temperature sensor harness connector, terminal "A" and ground. If outside air temperature sensor voltage is less than .2 volt, go to next step. If outside air temperature sensor voltage is not less than .2 volt, go to step 6).
5. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 22-pin C1 connector. Check for an open in Blue wire between A/C-heater control panel 22-pin C1 connector, terminal No. 5 and outside air temperature sensor connector, terminal "B". If wire is okay, replace and program A/C-heater control panel. See procedures in **CONTROL PANEL** under REMOVAL & INSTALLATION.
6. Turn ignition switch to OFF position. Disconnect A/C-heater control panel 22-pin C1 connector. Check for an open in Blue/White wire between A/C-heater control panel 22-pin C1 connector, terminal No. 12 and outside air temperature sensor connector, terminal "A". If wire is okay, replace and program A/C-heater control panel. See **CONTROL PANEL** under REMOVAL & INSTALLATION.
7. Install scan tool and clear DTCs. See procedures in **CLEARING DIAGNOSTIC TROUBLE CODES** . Ensure fault DTC does not reset. If fault DTC sets, go back to step 1).

## TROUBLE SHOOTING

WARNING: **To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in ACCESSORIES AND ELECTRICAL.**

**A/C COMPRESSOR CONTROL CIRCUIT INOPERATIVE**

1. Turn ignition switch to ON position. Using scan tool, command A/C compressor relay (K60) on and off. If A/C compressor relay turns on and off, go to next step. If A/C compressor relay does not turn on and off, go to step 4).
2. Turn ignition off. Disconnect Engine Control Module (ECM) connector. Turn ignition switch to ON position. Using ammeter, measure current draw, for 2 minutes, between ECM harness connector, terminal No. 36 (Brow/Purple wire) and ground. If current draw is .1-.75 amp, an intermittent problem exists. Intermittent problem may be caused by corrosion, misrouted harness, rubbed through wire insulation, or a broken wire inside insulation. If current draw is not .1-.75 amp, go to next step.
3. Turn ignition off. Remove A/C compressor relay (K60) from ECM housing. See **Fig. 1** . Using an ohmmeter, check for an open in Brown/Purple wire between ECM harness connector, terminal No. 36 and A/C compressor relay harness connector, terminal No. 6. If wire is okay, replace A/C compressor relay.
4. Turn ignition off. Remove A/C compressor relay (K60) from ECM housing. See **Fig. 1** . Connect a test light between A/C compressor relay harness connector, terminals No. 2 (Brown wire) and No. 6 (Yellow/Blue wire). Turn ignition switch to ON position. Using scan tool command A/C compressor relay on and off. If test light illuminates and dims with each command from scan tool, check connections at A/C compressor relay. If connections are okay, replace A/C compressor relay. If test light does not illuminate and dim with each command from scan tool, go to next step.
5. Connect test light between A/C compressor relay harness connector, terminal No. 8 (Green wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, check for open or short to ground in Green wire between A/C compressor relay and fuse No. 33 (30-amp) located in instrument panel fuse block.
6. Turn ignition off. Install A/C compressor relay (K60). Disconnect ECM connector. Turn ignition switch to ON position. Connect a fused jumper wire between ECM harness connector, terminal No. 36 (Brow/Purple wire) and ground. If A/C compressor relay turns on, go to next step. If A/C compressor relay does not turn on, check for an open in Brown/Purple wire between ECM harness connector, terminal No. 36 and A/C compressor relay harness connector, terminal No. 6.
7. Check for poor connections or poor terminal tension at ECM harness connector. If problem was found, repair connections and go to next step. If problem was not found, replace and reprogram ECM. See **PROGRAMMING ECM** under ADJUSTMENTS.
8. Turn ignition switch to ON position. Using scan tool, command A/C compressor relay on and off. If compressor relay turns on and off, system is okay. If compressor relay does not turn on and off, go back to step 1).




1. Engine Control Module (ECM)
2. Fuse No. 43
3. ECM Wiring Harness
4. Fuse No. 60
5. Coolant Fan Test Connector
6. ECM Relay K48
7. Fuse No. 50
8. Fuel Pump Relay K44
9. Engine Controls Power Relay K43
10. Fuse No. 49
11. Fuse No. 42
12. Fan Control Relay K28
13. Fan Control Relay K26
14. Fan Control Relay K52
15. Fan Control Relay K87
16. In-line Connector C110
17. A/C Compressor Relay K60
18. Windshield Wiper Motor Relay K8
19. Auxiliary Water Pump Relay K22
20. Fan Control Relay K60
21. Secondary Air Injection Pump Relay K12
22. A/C Control Wiring Harness
23. Fuse No. 40
24. Fuse No. 52

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**Fig. 1: Identifying Housing Components**
**Courtesy of GENERAL MOTORS CORP.**

**A/C LOAD SWITCH SIGNAL CIRCUIT INOPERATIVE**

1. Install scan tool. Start engine. Turn A/C off wile observing A/C load signal on scan tool. If scan tool displays HEAVY, go to next step. If scan tool does not display HEAVY, go to step 3).
2. Disconnect A/C load control switch connector. If scan tool displays NORMAL, replace A/C load control switch. If scan tool does not display, NORMAL, go to step 7).
3. Turn ignition switch to ON position. Disconnect A/C load control switch connector. Connect test light between A/C load control switch harness connector, terminal "B" (Brown wire) and ground. If test light illuminates, go to next step. If test light does not illuminate, check for open or high resistance in Brown wire between fuse No. 13 (10-amp) and A/C load control switch harness connector, terminal "B". Fuse No. 13 (10-amp) is located in instrument panel fuse block.
4. Connect a fused jumper wire between A/C load control switch harness connector terminals. If scan tool displays HEAVY, go to next step. If scan tool does not display HEAVY, go to step 7).

5. Check for any poor connections of poor terminal tension at A/C load control switch harness connector. If a problem was found, repair as necessary and go to step 9). if problem was not found, go to next step.
6. Reconnect A/C load control switch connector. Connect manifold gauge set. High pressure service valve is located on A/C compressor-to-condenser hose. Low pressure service valve is located on accumulator. Start engine and turn A/C on. Set A/C to maximum cooling. Raise idle speed to 2,000 RPM. If scan tool displays HEAVY when high side pressure reaches 174 psi (12.2 $kg/cm^2$ ), system is okay. If scan tool does not display HEAVY when high side pressure reaches 174 psi (12.2 $kg/cm^2$ ), replace A/C load control switch.
7. Turn ignition off. Disconnect Engine Control Module (ECM) connector. Turn ignition switch to ON position. Check for open, short to ground or short to power in Black/Blue wire between A/C load control switch harness connector, terminal "A" and ECM harness connector, terminal No. 12. If problem was found, repair as necessary and go to step 9). If problem was not found, go to next step.
8. Check for any poor connections or poor terminal tension at ECM harness connector. If problem was found, repair as necessary and go to next step. If problem was not found, replace and reprogram ECM. See **ENGINE CONTROL MODULE (ECM)** under REMOVAL & INSTALLATION.

**A/C REQUEST CIRCUIT INOPERATIVE**

1. Install scan tool. Start engine. Turn A/C on and off while observing A/C request on scan tool. If scan tool parameter toggles between YES and NO, problem could be intermittent. This may be caused by corrosion, misrouted wire harness, rubbed through wire insulation or broken wire inside insulation. If scan tool parameter does not toggle between YES and NO, go to next step.
2. If scan tool always indicates YES, go to next step. If scan tool does not always indicated YES, go to step 4).
3. Disconnect A/C compressor refrigerant pressure switch connector. If scan tool display changes to NO, check A/C system performance. See **A/C SYSTEM PERFORMANCE** under TESTING. If scan tool display does not change to NO, go to step 5).
4. Disconnect A/C compressor refrigerant pressure switch connector. Turn ignition switch to ON position. Connect a fused jumper wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 1 (Black/White wire) and battery voltage. If scan tool indicates YES when circuit is jumpered to battery voltage, check A/C system performance. See **A/C SYSTEM PERFORMANCE** under TESTING. If scan tool does not indicate YES when circuitry is jumpered to battery voltage, go to next step.
5. Turn ignition off. Disconnect ECM connector. Turn ignition switch to ON position. Check for open, short to ground or short to power in Black/White wire between A/C compressor refrigerant pressure switch harness connector, terminal No. 1 and ECM harness connector, terminal No. 15.
6. Check for a poor connection of poor terminal tension at ECM harness connector. If connection and terminal tension are okay, replace and reprogram ECM. See **ENGINE CONTROL MODULE (ECM)** under REMOVAL & INSTALLATION. If connection and terminal tension is not okay, repair problem, reconnect wiring and components. Verify system operates properly.

**AUXILIARY COOLING FAN NO. 1 INOPERATIVE**

1. Locate test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 1 (Brown/Blue wire) of test connector to a known-good ground. Disconnect auxiliary cooling fan No. 1. Using a voltmeter, measure voltage between ground and Red/White wire terminal at auxiliary cooling fan wiring harness. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.
2. Disconnect fan control relay (K26) from ECM housing. See **Fig. 1** . Measure voltage between ground and terminal No. 3 (Red wire) at fan control relay (K26) wiring harness connector. If battery voltage is present, go to step 4). If battery voltage is not present, go to next step.
3. Check fuse No. 50 (10-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. If fuse and circuits are okay, go to step 10).

4. Measure voltage between ground and terminal No. 2 (Red wire) at fan control relay (K26). If battery voltage is present, go to step 6). If battery voltage is not present, go to next step.
5. Check fuse No. 52 (30-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. If fuse and circuits are okay, go to step 10).
6. Connect a fused jumper wire between terminal No. 2 (Red wire) and terminal No. 8 (Red/White wire) of fan control relay (K26) wiring harness connector. Measure voltage between ground and Red/White wire terminal of auxiliary cooling fan No. 1. If battery voltage is present, go to step 8). If battery voltage is not present, go to next step.
7. Repair open circuit or high resistance in Red/White wire between auxiliary cooling fan and fan control relay. After repairing wire, go to step 10).
8. Replace fan control relay (K26). After replacing relay, go to step 10).
9. Check for open circuit or high resistance in Brown/White wire and Black wire to temperature switch No. 1. Repair if necessary. If wires are okay, replace temperature switch No. 1. After repairing wire(s) or replacing switch, go to next step.
10. Locate test connector within the Engine Control Module (ECM) housing. Using a fused jumper wire, connect terminal No. 5 (Brown/White wire) of test connector to a known-good ground. Disconnect auxiliary cooling fan No. 1. Using an ohmmeter, measure resistance between ground and Brown/Green wire terminal at auxiliary cooling fan wiring harness. If resistance is less than 2 ohms, go to next step. If resistance is not as specified, go to step 12).
11. Replace auxiliary cooling fan No. 1. After replacing fan, reconnect wiring and components. Verify cooling fan No. 1 operates properly.
12. Disconnect fan control relay (K52) from ECM housing. See **Fig. 1** . Measure voltage between ground and terminal No. 4 (Brown wire) at fan control relay. If battery voltage is present, go to step 14). If battery voltage is not present, go to next step.
13. Repair open circuit or high resistance in Brown wire to fan control relay. After repairing wire, reconnect wiring and components. Verify cooling fan No. 1 operates properly.
14. Measure resistance between ground and terminal No. 8 (Black wire) at fan control relay harness connector. If resistance is less than 2 ohms, go to step 16). If resistance is not as specified, go to next step.
15. Repair open circuit or high resistance in Black (ground) wire to fan control relay. After repairing wire, reconnect wiring and components. Verify cooling fan No. 1 operates properly.
16. Measure resistance between terminal No. 2 (Brown/Green wire) of fan control relay (K52) and auxiliary cooling fan No. 1. If resistance is less than 2 ohms, go to step 18). If resistance is not as specified, go to next step.
17. Repair open circuit or high resistance in Brown/Green wire between fan control relay and auxiliary cooling fan No. 1. After repairing wire, reconnect wiring and components. Verify cooling fan No. 1 operates properly.
18. Check for open circuit or high resistance in Brown/White wires and Black wire to temperature switch No. 2. Repair if necessary. If wires are okay, replace temperature switch No. 2. After repairs, reconnect wiring and components. Verify cooling fan No. 1 operates properly.

**AUXILIARY COOLING FAN NO. 2 INOPERATIVE**

1. Locate test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 5 (Brown/White wire) of test connector to a known-good ground. If auxiliary cooling fan No. 2 comes on, go to next step. If auxiliary cooling fan No. 2 does not come on, go to step 3).
2. Repair open circuit or high resistance in Brown/White wire and Black wire to temperature switch No. 2. Repair if necessary. If wires are okay, replace temperature switch No. 2. After repairs, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
3. Disconnect fan control relay (K28) from ECM housing. See **Fig. 1** . Using an ohmmeter, measure resistance between test terminal No. 5 and Brown/White wire at fan control relay. If resistance is less than 2 ohms, go to

step 5). If resistance is not as specified, go to next step.

4. Repair open circuit or high resistance in Brown/White wire between terminal No. 5 of test connector and fan control relay. After repairing wire, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
5. Using a voltmeter, measure voltage between ground and terminal No. 2 (Brown wire) of fan control relay. If battery voltage is present, go to step 7). If battery voltage is not present, go to next step.
6. Repair open circuit or high resistance in Brown wire to fan control relay. After repairing wire, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
7. Measure voltage between ground and terminal No. 4 (Red wire) of fan control relay. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.
8. Check fuse No. 40 (30-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. After repairs, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
9. Connect a fused jumper wire between terminal No. 4 (Red wire) and terminal No. 8 (Red/White wire) of fan control relay (K28) wiring harness connector. If auxiliary cooling fan No. 2 comes on, go to next step. If auxiliary cooling fan No. 2 does not come on, go to step 11).
10. Replace fan control relay (K28). After replacing relay, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
11. Disconnect auxiliary cooling fan No. 2. Measure voltage between ground and Red/White wire terminal of auxiliary cooling fan No. 2 wiring harness connector. If battery voltage is present, go to step 13). If battery voltage is not present, go to next step.
12. Repair open circuit, high resistance, or short to ground in Red/White wire to auxiliary cooling fan No. 2. After repairing wire, reconnect wiring and components. Verify cooling fan No. 2 operates properly.
13. Replace auxiliary cooling fan No. 2. After replacing fan, reconnect wiring and components. Verify cooling fan No. 2 operates properly.

**AUXILIARY WATER PUMP INOPERATIVE**

1. Remove auxiliary water pump relay (K22) from ECM housing. See **Fig. 1** . Turn ignition on. Using a voltmeter, measure voltage between auxiliary water pump relay harness connector, terminal No. 4 (Brown wire) and ground. If battery voltage exists, go to next step. If battery voltage does not exist, check for an open or high resistance in Brown wire between auxiliary water pump relay and in-line harness connector located at front of ECM housing.
2. Using an ohmmeter, measure resistance between auxiliary water pump relay harness connector, terminal No. 6 (Black wire) and ground. If resistance is less than 5 ohms, go to next step. If resistance is more than 5 ohms, check for an open or high resistance in Black wire between auxiliary water pump relay and in-line harness connector located at front of ECM housing.
3. Locate coolant fan test connector in ECM housing. See **Fig. 1** . Connect a fused jumper wire between coolant fan test connector, terminal No. 1 and ground. If cooling fan turns on at low speed, go to next step. If cooling fan does not turn on at low speed, go to COOLING FAN DOES NOT OPERATE IN LOW SPEED.
4. Using a voltmeter, measure voltage between auxiliary water pump relay harness connector, terminal No. 2 (Red/Blue wire) and ground. If battery voltage exists, go to next step. If battery voltage does not exist, check for an open or high resistance in Red/Blue wire between auxiliary water pump relay and splice S114.
5. Remove fused jumper wire. Install auxiliary water pump relay. Disconnect auxiliary water pump connector. Reconnect fused jumper wire. Using voltmeter, measure voltage between auxiliary water pump harness connector, terminal No. 2 (Brown wire) and ground. If battery voltage exists, go to step 7). If battery voltage does not exist, go to next step.
6. Check for open or high resistance in Brown wire between auxiliary water pump and auxiliary water pump relay. If Brown wire is okay, replace auxiliary water pump relay.
7. Using an ohmmeter, measure resistance between auxiliary water pump harness connector, terminal No. 1

(Black wire) and ground. If resistance is less than 5 ohms, replace auxiliary water pump. If resistance is more than 5 ohms, check for open or high resistance in Black wire between auxiliary water pump and slice S109.

**BLOWER MOTOR INOPERATIVE**

1. Disconnect blower controller connector. Using a voltmeter, connect positive lead to blower motor harness connector, terminal No. 1 (Red wire) and negative lead to terminal No. 3 (Black wire). If battery voltage exists, go to next step. If battery voltage does not exist, go to step 3)
2. Turn ignition switch to ON position. Move voltmeter positive lead to blower motor harness connector, terminal No. 6 (Red wire). Using A/C-heater control panel, cycle through all 5 blower motor speeds from low to high. If voltage changes from 3.5 volts to 9.0 volts, check for open in Brown wire between blower controller harness connector, terminal No. 7 and blower motor. If voltage does not change from 3.5 volts to 9.0 volts, replace blower controller.
3. Move voltmeter negative lead to chassis ground. If battery voltage exists, check for open in Black wire between blower controller and splice S205. If battery voltage does not exist, check for open in Red wire between blower controller and fuse No. 33 (30-amp).

**BLOWER MOTOR RUNS CONTINUOUSLY**

1. Turn ignition switch to OFF position. Using a voltmeter connected to ground, backprobe blower controller connector terminal No. 6 (Red wire). If voltage exists, go to next step. If voltage does not exist, problem is intermittent, go to step 3)
2. Using a voltmeter connected to ground, backprobe controller connector terminal No. 2 (Black/Blue wire). If voltage exists, go to step 4). If voltage does not exist, replace blower controller.
3. Using A/C-heater control panel, cycle through all 5 blower motor speeds several times. If problem still exists, go back to step 1).
4. Remove A/C-heater control panel and disconnect 22-pin C1 connector. See **CONTROL PANEL** under REMOVAL & INSTALLATION. Ensure all A/C-heater control panel functions are off. Using a voltmeter, measure voltage between A/C-heater control panel and disconnect 22-pin C1 connector, terminal No. 11 and ground. If voltage exists, replace and reprogram A/C-heater control panel. If voltage does not exist, check for short to battery voltage Black/Blue wire between A/C-heater control panel and blower controller.

**ECM COOLING FAN INOPERATIVE**

1. Locate cooling fan test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 1 (Brown/Blue wire) of cooling fan test connector to a known-good ground. If ECM cooling fan comes on, go to next step. If ECM cooling fan does not come on, go to step 3).
2. Check for open circuit or high resistance in Brown/Blue wire between temperature switch No. 1 and splice S116. See WIRING DIAGRAMS. Also repair open circuit or high resistance in Black wire between temperature switch No. 1 and splice S109. If wires are okay, replace temperature switch No. 1. After repairs, reconnect wiring and components. Verify ECM cooling fan operates properly.
3. Remove ECM relay (K48) from ECM housing. See **Fig. 1** . Using a voltmeter, measure voltage between ground and terminal No. 2 (Red wire) of ECM relay harness connector. If battery voltage is present, go to step 5). If battery voltage is not present, go to next step.
4. Repair open circuit or high resistance in Red wire between ECM relay and fan control relay (K26). After repairing wire, reconnect wiring and components. Verify ECM cooling fan operates properly.
5. Measure voltage between ground and terminal No. 4 (Brown wire) of ECM relay. If battery voltage is present, go to step 7). If battery voltage is not present, go to next step.
6. Repair open circuit or high resistance in Brown wire between ECM relay and splice S115. See **WIRING DIAGRAMS** . After repairing wire, reconnect wiring and components. Verify ECM cooling fan operates properly.
7. Connect a fused jumper wire between terminal No. 4 (Brown wire) and terminal No. 8 (Black/White wire) of

ECM relay harness connector. If ECM cooling fan comes on, go to next step. If ECM cooling fan does not comes on, go to step 9).

8. Replace ECM relay. After replacing relay, reconnect wiring and components. Verify ECM cooling fan operates properly.
9. Disconnect ECM cooling fan. Measure voltage between ECM cooling fan harness connector, terminal No. 1 (Black/White) and ground. If battery voltage is present, go to step 11). If battery voltage is not present, go to next step.
10. Repair open circuit or high resistance in Black/White wire between ECM relay and cooling fan. After repairing wire, reconnect wiring and components. Verify ECM cooling fan operates properly.
11. Measure resistance between ECM cooling fan wiring harness connector, terminal No. 2 (Black) and ground. If resistance is less than 5 ohms, go to step 13). If resistance is not less than 5 ohms, go to next step.
12. Repair open circuit or high resistance in Black wire between ECM cooling fan and splice S109. See **WIRING DIAGRAMS** . After repairing wire, reconnect wiring and components. Verify ECM cooling fan operates properly.
13. Replace ECM cooling fan. After replacing fan, reconnect wiring and components. Verify ECM cooling fan operates properly.

**ENGINE COOLING FAN INOPERATIVE**

1. Locate test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 4 (Brown/White wire) of test connector to a known-good ground. If engine cooling fan comes on, go to next step. If engine cooling fan does not come on, go to step 3).
2. Check for open or high resistance if Brown/White wire or Black (ground) wire to temperature switch No. 1. Repair if necessary. If wires are okay, replace temperature switch No. 1. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly.
3. Remove fan control relay (K67) from ECM housing. See **Fig. 1** . Using an ohmmeter, measure resistance between terminal No. 4 of test connector and Brown/White wire terminal of fan control relay harness connector. If resistance is less than 2 ohms, go to step 5). If resistance is not as specified, go to next step.
4. Repair open circuit or high resistance in Brown/White wire between fan control relay and test connector. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
5. Using a voltmeter, measure voltage between ground and terminal No. 2 (Red wire) at fan control relay (K67). If battery voltage is present, go to step 7). If battery voltage is not present, go to next step.
6. Repair open circuit or high resistance in Red wire to fan control relay. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
7. Measure voltage between ground and terminal No. 4 (Red wire) at fan control relay (K67). If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.
8. Check fuse No. 42 (40-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly.
9. Connect a fused jumper wire between terminal No. 4 (Red wire) and Red/White wire terminal of fan control relay (K67) wiring harness connector. If cooling fan comes on, go to next step. If cooling fan does not come on, go to step 11).
10. Replace fan control relay (K67). After replacing relay, reconnect wiring and components. Verify engine cooling fan operates properly.
11. Disconnect engine cooling fan. Measure voltage between ground and Red/White wire terminal of cooling fan wiring harness connector. If battery voltage is present, go to step 13). If battery voltage is not present, go to next step.
12. Repair open circuit, high resistance, or short to ground in Red/White wire between fan control relay and cooling fan. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.

13. Measure resistance between ground and Black wire terminal of cooling fan wiring harness connector. If resistance is less than 2 ohms, go to step 15). If resistance is not as specified, go to next step.
14. Repair open circuit or high resistance in Black (ground) wire to cooling fan. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
15. Replace engine cooling fan. After replacing fan, reconnect wiring and components. Verify engine cooling fan operates properly.

**ENGINE COOLING FAN INOPERATIVE AT HALF SPEED**

1. Locate test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 1 (Brown/Blue wire) of test connector to a known-good ground. If cooling fan comes on at half speed, go to next step. If cooling fan does not come on at half speed, go to step 3).
2. Repair open circuit or high resistance in Brown/Blue wire and Black wire to temperature switch No. 1. Repair if necessary. If wires are okay, replace temperature switch No. 1. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly (at half speed).
3. Remove fan control relay (K26) from ECM housing. See **Fig. 1** . Using an ohmmeter, measure resistance between test terminal No. 1 and Brown/Blue wire at fan control relay. If resistance is less than 2 ohms, go to step 5). If resistance is not as specified, go to next step.
4. Repair open circuit or high resistance in Brown/Blue wire between terminal No. 1 of test connector and fan control relay. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
5. Using a voltmeter, measure voltage between ground and terminal No. 3 (Red wire) of fan control relay. If battery voltage is present, go to step 7). If battery voltage is not present, go to next step.
6. Check fuse No. 50 (10-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly.
7. Measure voltage between ground and terminal No. 4 (Red wire) of fan control relay. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.
8. Check fuse No. 52 (30-amp). If fuse is okay, repair open circuit or high resistance in Red wire between fan control relay and fuse. Also check Red wire circuit to battery. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly.
9. Connect a fused jumper wire between terminal No. 4 (Red wire) and terminal No. 5 (Red/Blue wire) of fan control relay (K26) wiring harness connector. If cooling fan comes on at half speed, go to next step. If cooling fan does not come on at half speed, go to step 11).
10. Replace fan control relay (K26). After replacing relay, reconnect wiring and components. Verify engine cooling fan operates properly.
11. Disconnect engine cooling fan resistor. Measure voltage between ground and Red/Blue wire terminal of cooling fan resistor wiring harness connector. If battery voltage is present, go to step 13). If battery voltage is not present, go to next step.
12. Repair open circuit, high resistance, or short to ground in Red/Blue wire to cooling fan resistor. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
13. Disconnect engine cooling fan. Measure resistance between ground and Red/White wire terminal of cooling fan resistor wiring harness connector. If resistance is less than 2 ohms, go to step 15). If resistance is not as specified, go to next step.
14. Repair open circuit or high resistance in Red/White wire to cooling fan resistor. After repairing wire, reconnect wiring and components. Verify engine cooling fan operates properly.
15. Measure resistance between ground and Black (ground) wire of cooling fan wiring harness connector. If resistance is less than 2 ohms, go to step 17). If resistance is not as specified, go to next step.
16. Repair open circuit or high resistance in Black (ground) wire of cooling fan wiring harness. After repairing

wire, reconnect wiring and components. Verify engine cooling fan operates properly.

17. Check cooling fan resistor. Replace resistor if necessary. If resistor is okay, replace engine cooling fan. After repairs, reconnect wiring and components. Verify engine cooling fan operates properly.

**ENGINE IDLE SPEED DOES NOT INCREASE WHEN A/C COMPRESSOR ENERGIZES**

1. Disconnect A/C control switch. Connect a test light between ground and Brown wire terminal of A/C control switch wiring harness connector. Turn ignition on. Press A/C button on A/C-heater control panel. If test light comes on, go to step 3). If test light does not come on, go to next step.
2. Repair open circuit or high resistance in Brown wire between A/C control switch and A/C compressor relay (K60). After repairing wire, go to next step.
3. Connect a test light between A/C control switch wiring harness connector terminals. Turn ignition on. Press A/C button on A/C-heater control panel. If test light comes on, go to step 5). If test light does not come on, go to next step.
4. Replace A/C control switch. After replacing A/C control switch, go to next step.
5. Disconnect Engine Control Module (ECM). Reconnect A/C control switch. Connect a test light between ground and terminal No. 12 (Black/Blue wire) of ECM wiring harness connector. Turn ignition on. Press A/C button on A/C-heater control panel. If test light does not come on, go to next step. If test light comes on, reconnect wiring and components. Verify idle speed increase and A/C compressor operate properly.
6. Repair open circuit or high resistance in Black/Blue wire between A/C control switch and ECM. After repairing wire, reconnect wiring and components. Verify idle speed increase and A/C compressor operate properly.

**HEADLIGHT AUTOMATIC CONTROL AMBIENT LIGHT SENSOR IS INOPERATIVE**

1. Disconnect headlight automatic control ambient light sensor. Turn ignition on. Using a voltmeter, measure voltage between ground and terminal No. 1 (Brown wire) of ambient light sensor. If 5 volts are present, go to step 3). If 5 volts are not present, go to next step.
2. Repair open circuit or high resistance in Brown wire. After repairing wire, go to next step.
3. Measure resistance of Black wire, Black/White wire, and Blue wire to sensor. If resistance for each wire is 5 ohms or less, go to step 5). If resistance is not as specified, go to next step.
4. Repair open circuit or high resistance in Black wire, Black/White wire, or Blue wire. After repairing wire(s), go to next step.
5. Turn ignition off. Disconnect A/C-heater control panel. Connect a fused jumper wire between terminal No. 7 (Brown wire) of A/C-heater control panel and terminal No. 1 of headlight automatic control ambient light sensor. Connect another jumper wire between ground and terminal No. 4 (Blue wire) of headlight automatic control ambient light sensor. Go to next step.
6. Turn ignition on. Using a voltmeter, measure voltage between ground and terminal No. 2 (Black wire) of headlight automatic control ambient light sensor. Alternately shade and shine a bright light on sensor. If voltage increases when light is blocked and decreases when light is shined, go to step 8). If voltage does not vary as specified, go to next step.
7. Replace headlight automatic control ambient light sensor. After replacing sensor, reconnect wiring and components. Verify headlight automatic control ambient light sensor circuit operates properly.
8. Repair or replace A/C-heater control panel. After repairing/replacing A/C-heater control panel, reconnect wiring and components. Verify headlight automatic control ambient light sensor circuit operates properly.

**OUTSIDE AIR TEMPERATURE SENSOR IS INOPERATIVE**

Disconnect outside air temperature sensor. Using an ohmmeter, measure resistance between outside air temperature sensor terminals. Measure outside air temperature. Compare resistance readings to **OUTSIDE AIR TEMPERATURE SENSOR RESISTANCE** table. If resistance is not correct at specified temperature, replace

outside air temperature sensor.

**OUTSIDE AIR TEMPERATURE SENSOR RESISTANCE**

| F° (C°) | Ohms |
|---|---|
| -40 (-40) | 169,400 |
| -22 (-30) | 88,740 |
| -4 (-20) | 48,580 |
| 14 (-10) | 27,670 |
| 32 (0) | 16,330 |
| 50 (10) | 9,951 |
| 68 (20) | 6,246 |
| 86 (30) | 4,028 |
| 104 (40) | 2,663 |
| 122 (50) | 1,801 |
| 140 (60) | 1,245 |

**TIMING CONTROL PUMP INOPERATIVE**

1. Remove auxiliary water pump relay (K22) from ECM housing. See **Fig. 1** . Turn ignition on. Using a voltmeter, measure voltage between ground and terminal No. 4 (Brown wire) of auxiliary water pump relay. If battery voltage is present, go to step 3). If battery voltage is not present, go to next step.
2. Repair open circuit or high resistance in Brown wire to auxiliary water pump relay. After repairing wire, reconnect wiring and components. Verify timing control pump operates properly.
3. Measure resistance between ground and terminal No. 6 (Black wire) of auxiliary water pump relay harness connector. If resistance is less than 2 ohms, go to step 5). If resistance is not as specified, go to next step.
4. Repair open circuit or high resistance in Black (ground) wire to auxiliary water pump relay. After repairing wire, reconnect wiring and components. Verify timing control pump operates properly.
5. Locate test connector within the Engine Control Module (ECM) housing. See **Fig. 1** . Using a fused jumper wire, connect terminal No. 1 (Brown/Blue wire) of test connector to a known-good ground. If engine cooling fan comes on at half speed, go to step 7). If engine cooling fan does not come on at half speed, go to next step.
6. Perform ENGINE COOLING FAN DOES NOT OPERATE AT HALF SPEED symptom test.
7. Measure voltage between ground and terminal No. 2 (Red/Blue wire) of auxiliary water pump relay (K22) wiring harness connector. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.
8. Repair open circuit or high resistance in Red/Blue wire to auxiliary water pump relay. After repairing wire, reconnect wiring and components. Verify timing control pump operates properly.
9. Remove fused jumper wire (at test connector). Install auxiliary water pump relay. Disconnect timing control pump. Connect fused jumper wire, as in step 5), again. Measure voltage between ground and Brown/Green wire at timing control pump wiring harness connector. If battery voltage is present, go to step 11). If battery voltage is not present, go to next step.
10. Check for open circuit or high resistance in Brown/Green wire between auxiliary water pump relay and timing control pump. If wire is okay, replace auxiliary water pump relay. After repairs, reconnect wiring and components. Verify timing control pump operates properly.
11. Measure resistance between ground and Black (ground) wire terminal of timing control pump wiring harness connector. If resistance is less than 2 ohms, go to step 13). If resistance is not as specified, go to next step.
12. Repair open circuit or high resistance in Black wire to timing control pump. After repairing wire, reconnect wiring and components. Verify timing control pump operates properly.
13. Replace timing control pump. After replacing pump, reconnect wiring and components. Verify timing control pump operates properly.

## TESTING

### A/C SYSTEM PERFORMANCE

1. Connect manifold gauge set. High pressure service valve is located on A/C compressor-to-condenser hose. Low pressure service valve is located on accumulator. Place a high-volume fan in front of radiator grille.
2. Open hood and close all doors and windows. Set A/C-heater control panel to 60°F (16°C), AUTO mode and high blower motor speed. Start engine and allow it to idle for 5 minutes.
3. Increase engine speed to 2000 RPM and perform test. Measure ambient air temperature and the temperature of the air being discharged from center vent on instrument panel. Measure and record system pressures.
4. If discharged air temperature is at least 20°F (11°C) less than ambient temperature and pressures fall within normal range, system is operating properly.

## REMOVAL & INSTALLATION

**WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in ACCESSORIES AND ELECTRICAL.**

### CONTROL PANEL

#### Removal & Installation

1. Disconnect negative battery cable. Set parking brake. Place shift lever in 1st gear (rear position). Remove instrument panel center bezel. Remove radio mounting screws. Remove radio from A/C-heater control panel mounting bracket. Disconnect antenna and wiring harness from radio.
2. Remove 6 A/C-heater control panel screws. Disconnect wiring harness to A/C-heater control panel and remove A/C-heater control panel from vehicle.
3. If necessary, press release tabs on side of A/C-heater control panel to gain access to bulbs and printed circuit. See **Fig. 2** . To install, reverse removal procedure.

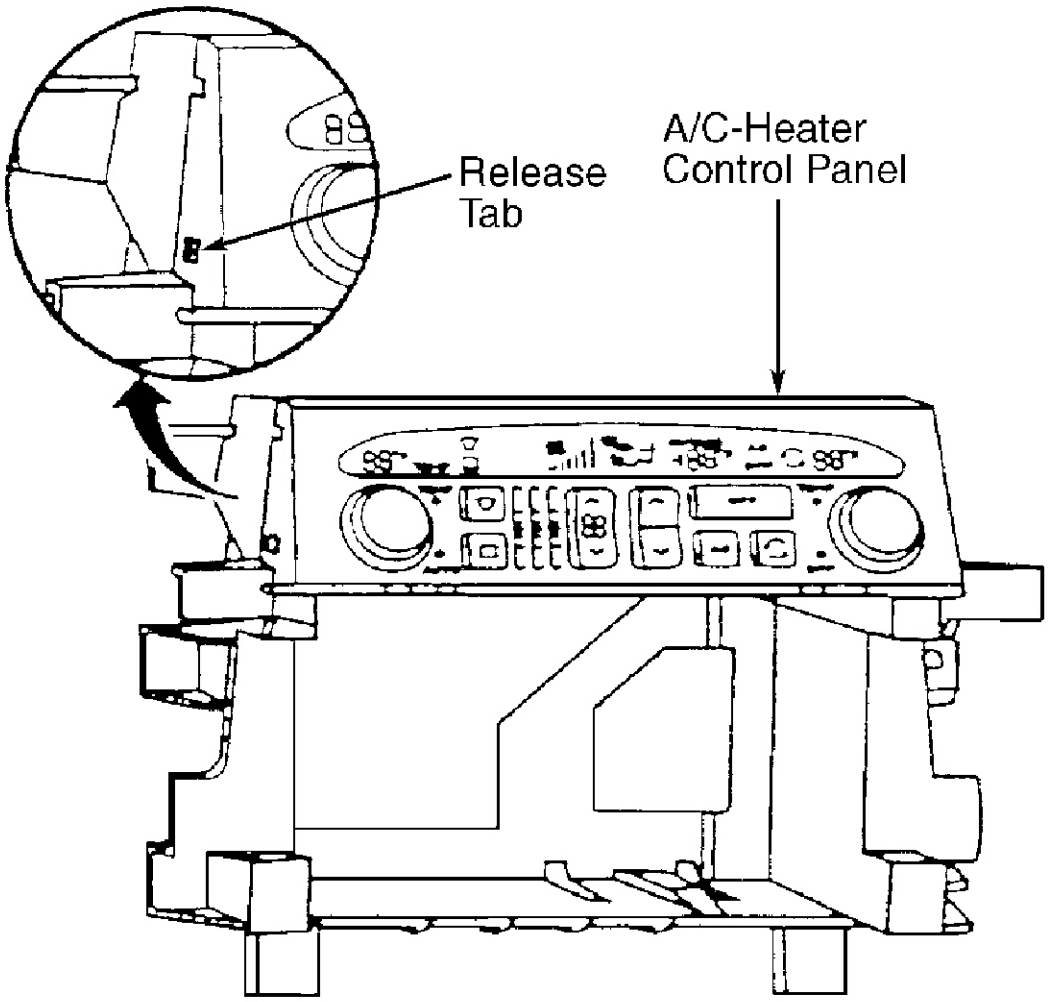


**Fig. 2: Removing A/C-Heater Control Panel**
**Courtesy of GENERAL MOTORS CORP.**

**A/C-HEATER ASSEMBLY**

**Removal & Installation**

1. Disconnect negative battery cable. Drain cooling system. Discharge A/C system, using approved refrigerant recovery/recycling equipment.
2. Disconnect heater hose at quick-connect fittings. Use caution as tabs on quick-connect fittings break easily. Remove evaporator line extension bolt from cowl. Remove steering column and instrument panel carrier. See **INSTRUMENT PANEL** .
3. Disconnect vacuum hose connection at cowl. Disconnect wiring harness from electrically operated actuators. Remove heater core pipe bracket screws and bracket. Remove heater core pipe bracket screws and pipes. Remove instrument panel support brace.
4. Disconnect wiring harness and vacuum hoses from vacuum actuators. Remove 2 screws, at cowl, from engine compartment side of air distribution module. See **Fig. 3** . From inside passenger compartment, remove air distribution module nut.
5. Remove right/left side floor supply duct screws and remove ducts from air distribution module. Set wiring harness aside to allow for air distribution module removal.
6. Carefully pry upper vents from under rubber seal, and angle air distribution module out. Remove air distribution module from vehicle. To install, reverse removal procedure. Ensure wiring harness and vacuum hoses are not pinched during installation.

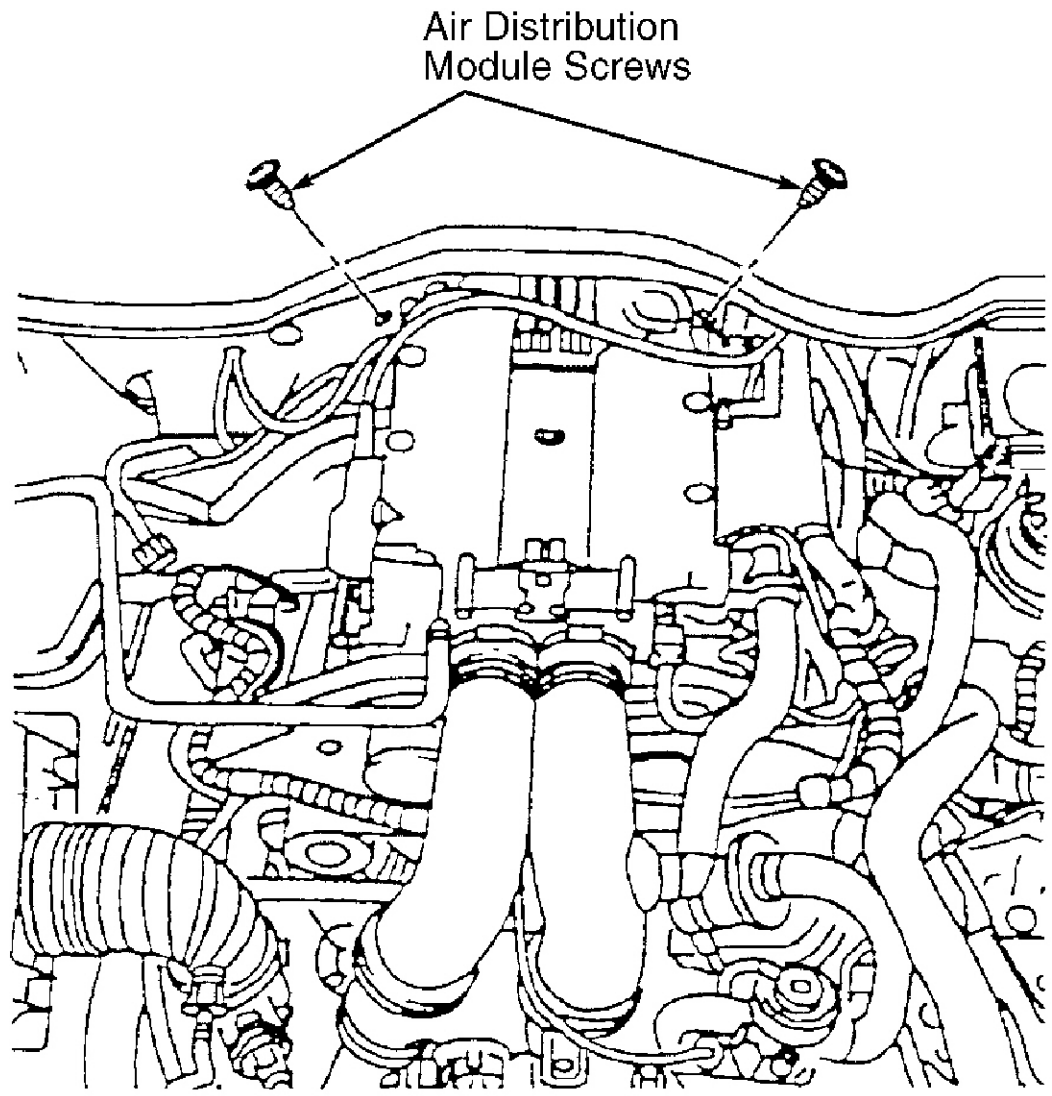


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**Fig. 3: Removing Air Distribution Module**
**Courtesy of GENERAL MOTORS CORP.**

**AMBIENT AIR TEMPERATURE SENSOR**

Raise and support vehicle. Locate ambient air temperature sensor on left side of front fascia. Remove sensor and disconnect wiring harness. To install, reverse removal procedure.

**A/C COMPRESSOR**

**Removal & Installation**

1. Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Detach refrigerant hoses from top of compressor using an extension and swivel socket.
2. Disconnect mass airflow sensor and air intake temperature sensor. Disconnect air hoses from resonance chamber. See **Fig. 4** . Remove switchover valve and disconnect vacuum hoses. Remove resonance chamber.
3. Raise and support vehicle. Remove engine splash shield. Remove "O" rings from A/C compressor hoses. Remove bolt from compressor hose clamp to air pipe bracket.
4. Remove A/C compressor hose-to-oil pan bolt. Remove air injection crossover pipe bracket nut from generator bolt. Remove air injection bushing nut from bracket (located on left side of engine). Remove air injection crossover pipe from rubber hose connections. Remove serpentine belt. See **Fig. 5** .
5. Remove A/C compressor mounting bolts (3 at front and 2 at rear). Disconnect A/C compressor from wiring

harness. Lower vehicle. Remove A/C compressor through top of engine compartment.

6. To install, reverse removal procedure. Use a 15-mm wrench to rotate tensioner clockwise, and install belt on water pump pulley last. Evacuate and charge A/C system.

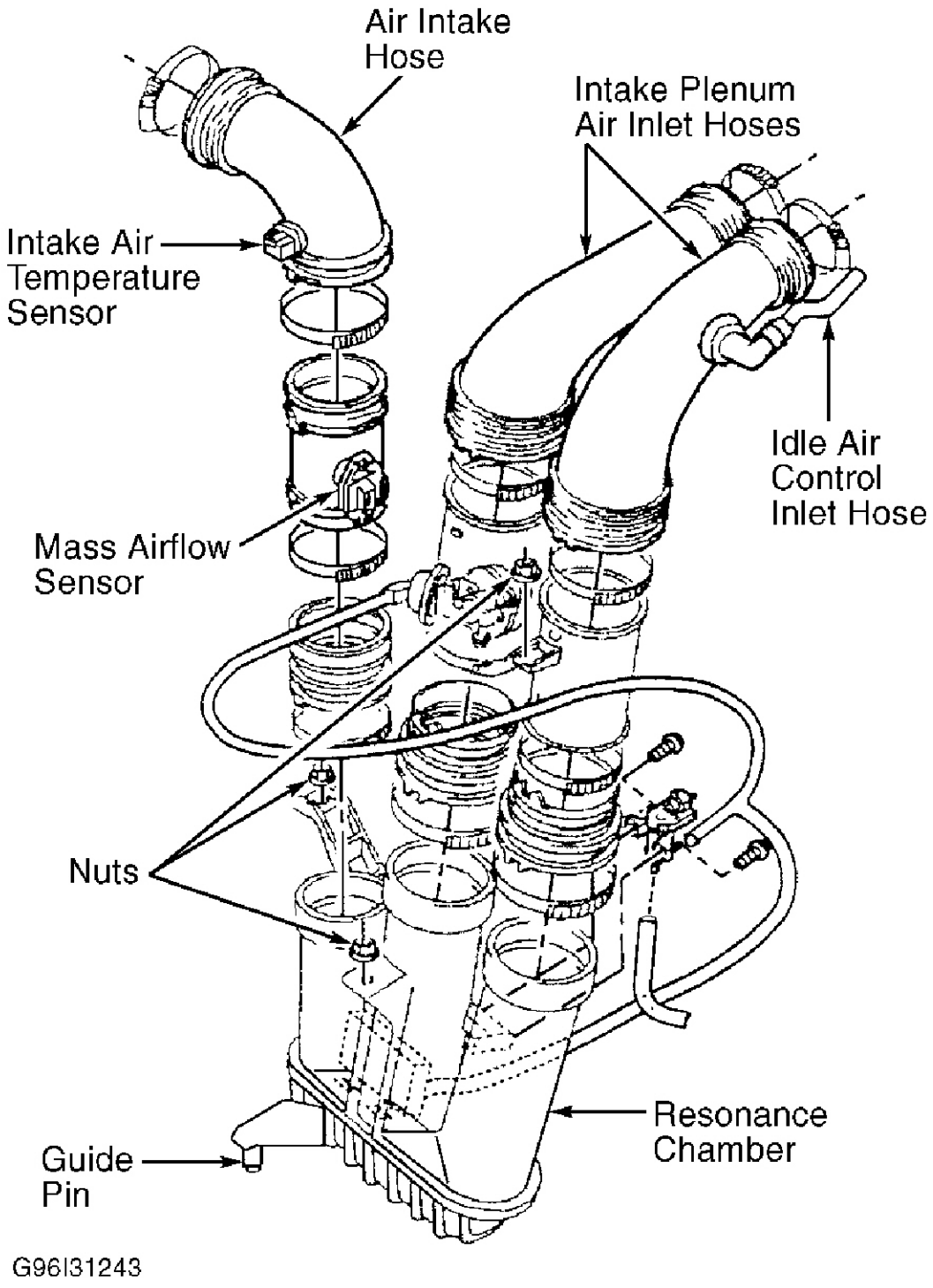


**Fig. 4: Removing Resonance Chamber**
**Courtesy of GENERAL MOTORS CORP.**

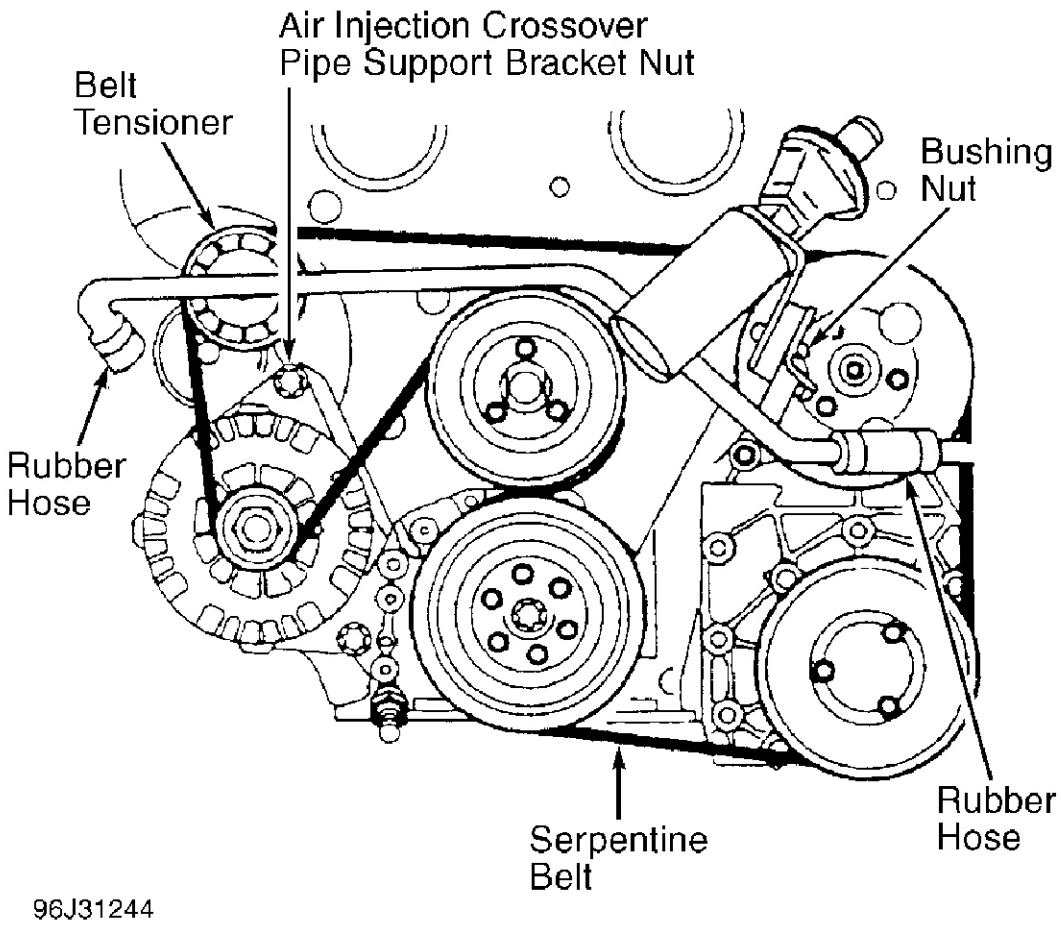


**Fig. 5: Serpentine Belt Routing**
**Courtesy of GENERAL MOTORS CORP.**

### A/C-HEATER VACUUM SOLENOIDS

#### Removal & Installation

Detach sound insulator locking tabs and remove sound insulator from driver's side. Detach clip for driver's side front floor air outlet. Remove front floor air outlet. Disconnect wiring harness and vacuum hoses from solenoids. Remove screws and vacuum solenoids. To install, reverse removal procedure.

### BLOWER MOTOR

#### Removal & Installation

1. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from passenger's side. Detach clip for passenger's side front floor air outlet. Remove front floor air outlet.
2. Remove instrument panel compartment (glove box). Bend down accordion section of side air vent supply duct and remove. Remove blower motor housing. Remove blower motor from housing. To install, reverse removal procedure.

### CONDENSER

#### Removal & Installation

1. Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove resonance chamber. Drain cooling system.
2. Remove radiator. Remove bolt from condenser line connection (at condenser). Detach refrigerant line from condenser. Remove condenser from vehicle.

3. To install, reverse removal procedure. Transfer receiver-drier and brackets to replacement condenser. Use NEW "O" rings lubricated with mineral oil. Evacuate and charge A/C system. Fill cooling system.

## DUCT TEMPERATURE SENSORS

### Removal & Installation (Driver's Side)

1. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from driver's side.
2. Detach clip for driver's side front floor air outlet. Remove front floor air outlet. Remove duct temperature sensor from air distribution module by rotating sensor 180 degrees. Disconnect wiring harness from sensor. To install, reverse removal procedure.

### Removal & Installation (Passenger's Side)

1. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from passenger's side.
2. Detach clip for passenger's side front floor air outlet. Remove front floor air outlet. Remove mode valve (floor) actuator. See **DEFROSTER VALVE ACTUATOR & MODE VALVE (FLOOR) ACTUATOR** .
3. Remove duct temperature sensor from air distribution module by rotating sensor 180 degrees. See **Fig. 6** . Disconnect wiring harness from sensor.
4. To install, reverse removal procedure. Turn ignition on. Simultaneously press and hold AUTO and OFF buttons on the A/C-heater control panel for at least 5 seconds to synchronize actuators.

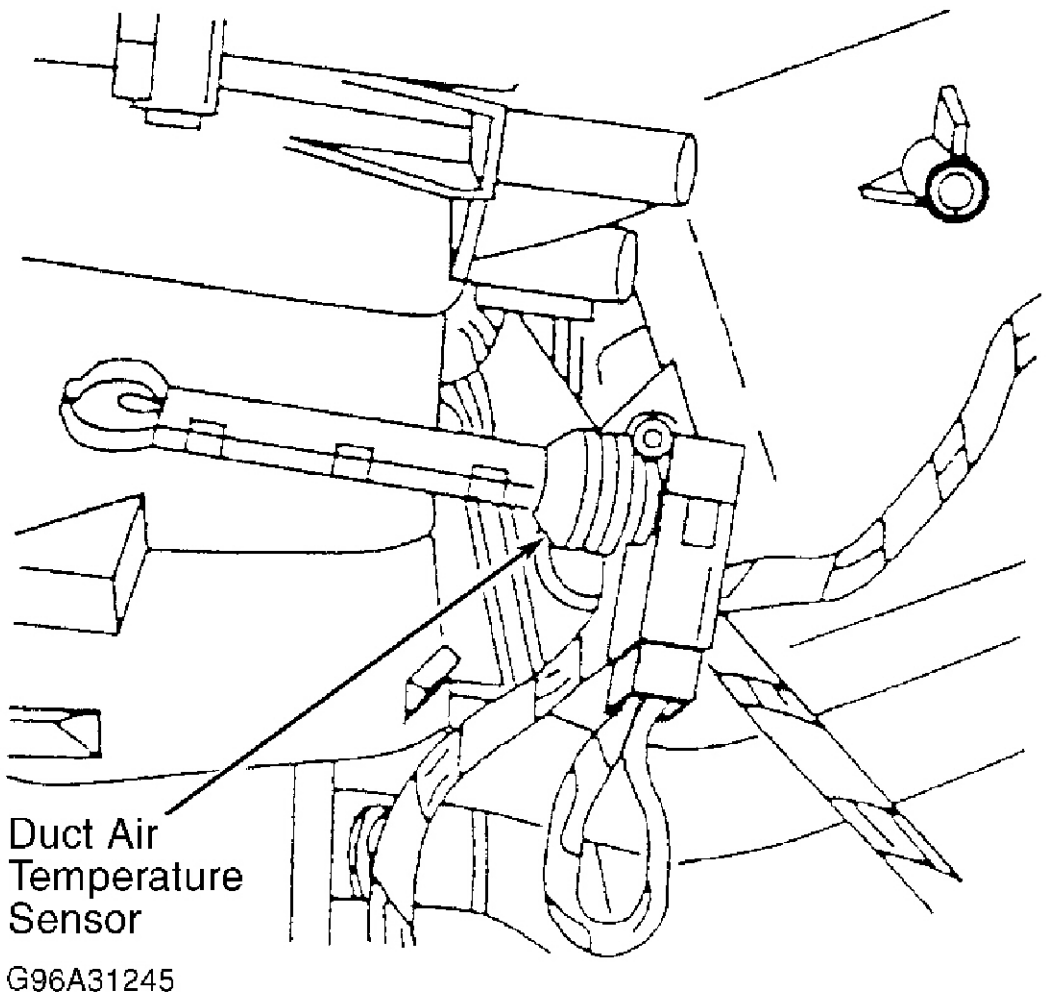


**Fig. 6: Removing Duct Air Temperature Sensor**

**Courtesy of GENERAL MOTORS CORP.**

### ENGINE CONTROL MODULE (ECM)

Turn ignition off. Slide ECM straight up and out of relay center. See **Fig. 1** . Flip release lever and disconnect ECM connector. Ensure not to touch connector pins or soldered components. Transfer broadcast code and production ECM number to new ECM label. **DO NOT** record this information on ECM cover. To install, reverse removal procedure. Program new ECM with frequency code of theft deterrent module currently on vehicle.

### EVAPORATOR

#### Removal & Installation

1. Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove evaporator line extension valve bolt.
2. Detach sound insulator locking tabs and remove sound insulator. Detach driver's side front floor air outlet clip. Remove air outlet. Disconnect wiring harness from vacuum solenoid/cut-off valve actuator. Remove screws and position vacuum solenoid/cut-off valve actuator out of way.
3. Remove evaporator access panel screws and panel. Remove evaporator line screw. Remove thermostatic expansion valve screws and valve. Remove steering column and brake pedal bracket with brake pedal attached.
4. Plug evaporator openings to prevent oil from dripping on interior. Carefully pull evaporator out. To install, reverse removal procedure. Use NEW "O" rings lubricated with mineral oil. Evacuate and charge A/C system.

### HEATER CORE

#### Removal & Installation

1. Disconnect negative battery cable. Drain cooling system. Disconnect heater hose at quick-connect fittings. Use caution as tabs on quick-connect fittings break easily.
2. Remove steering column and instrument panel carrier. See **INSTRUMENT PANEL** . Remove blower motor housing and blower motor. Remove heater core pipe bracket screws and bracket.
3. Remove heater core pipe bracket screws and pipes. Remove instrument panel support brace and bracket. Remove heater core retaining screw. Remove heater core and rubber seal. To install, reverse removal procedure.

### HEATER CONTROL VALVE

#### Removal & Installation

1. Drain cooling system. Remove windshield wiper motor. Remove access panel nut, near pollen filter, and remove access panel.
2. Disconnect vacuum hose from heater control valve. Clamp shut heater hoses and detach hoses from heater control valve. Remove heater control valve. To install, reverse removal procedure.

### INSTRUMENT PANEL

#### Removal & Installation

1. Disable air bag system. See AIR BAG RESTRAINT SYSTEM article in ACCESSORIES AND ELECTRICAL. Ensure front wheels are in straight-ahead position.
2. Remove Torx screws from back of steering wheel. Remove air bag module and disconnect wiring harness. Reposition locking tab on steering wheel nut. Remove steering wheel nut and locking tab. Using puller, remove steering wheel.

3. Remove upper and lower steering column covers. Remove driver's side knee bolster and sound insulator. Remove bolt from steering column shaft coupler. Using a chisel, rotate front support bracket shear bolt. See **Fig. 7** .
4. Remove front support bracket nut and rear support bracket nut. Disconnect wiring harness as necessary. Remove steering column, being careful not to damage adjacent wiring harness.
5. Remove assist handles above front doors. Remove windshield garnish moldings. Remove access panel from ends of instrument panel. Remove outer air deflector screws. Remove outer air deflectors.
6. Remove instrument panel compartment (glove box). Remove right side air ducts. Remove passenger's side air bag module trim cover. Disconnect air bag module 2-pin wiring harness connector. Remove passenger's side air bag module.
7. Remove center console and center console air duct. Remove radio and A/C-heater control panel. See **CONTROL PANEL** . Turn center air deflector completely downward. Carefully pry out center air deflector from its side.
8. Remove headlight switch by carefully prying switch from its left side. Remove driver's side vent bracket. Remove screw from right side of instrument cluster. Remove screw from upper column cover collar (screw also retains bottom of instrument panel).
9. Pull out right side of instrument cluster and disconnect wiring harness. Slide cluster to right, just enough to left side of cluster to clear left vent housing. Carefully remove instrument cluster.
10. Remove fuse/relay panel. Carefully pry out headlight automatic control ambient light sensor. Remove instrument panel bolts. Disconnect wiring harness as necessary. With the aid of an assistant, remove instrument panel.
11. To install, reverse removal procedure. Ensure wiring harnesses are not pinched during installation.

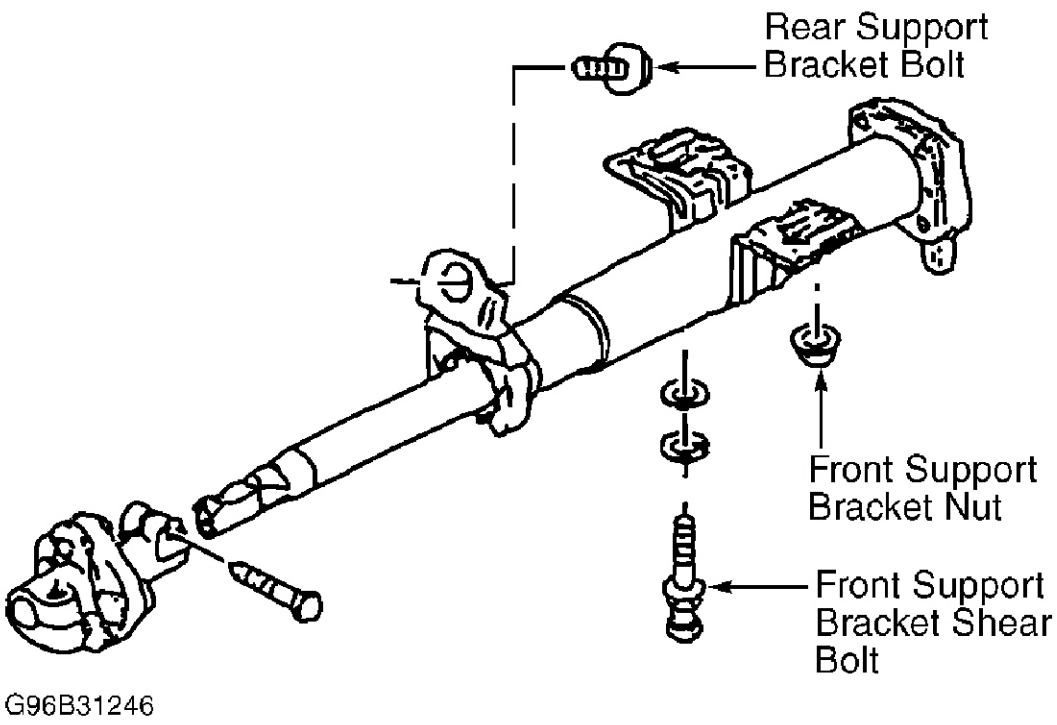


**Fig. 7: Removing Steering Column**
**Courtesy of GENERAL MOTORS CORP.**

### INSTRUMENT PANEL AIR VALVE ACTUATOR

#### Removal & Installation

1. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from

passenger's side. Detach clip for passenger's side front floor air outlet. Remove front floor air outlet. Remove instrument panel compartment (glove box).

2. Bend down accordion section of side air vent supply duct and remove. Disconnect wiring harness from actuator. Remove 3 screw and detach actuator from linkage. It may be necessary to rotate actuator linkage to access screws. Remove actuator from vehicle.
3. To install, reverse removal procedure. Recalibrate actuator. See **CALIBRATING ACTUATORS** under ADJUSTMENTS.

## DEFROSTER VALVE ACTUATOR & MODE VALVE (FLOOR) ACTUATOR

### Removal & Installation

1. Disconnect negative battery cable. Remove right floor air outlet. Disable air bag system. See AIR BAG RESTRAINT SYSTEM article in ACCESSORIES AND ELECTRICAL. Open glove box. Remove right end panel from instrument panel. Remove right outlet vent.
2. Remove air bag cover screws and cover. Remove screws from front of glove box and right side of instrument panel. Disconnect glove box light switch and light connector. Remove cool air hose from rear of glove box and remove glove box.
3. Disconnect defroster valve actuator connector. If necessary, rotate defroster valve actuator linkage to access screws. Remove screw and detach defroster valve actuator from linkage.
4. Disconnect mode valve actuator connector. If necessary, rotate mode valve actuator linkage to access screws. Remove screw and detach mode valve actuator from linkage.
5. To install, reverse removal procedure. Recalibrate actuators. See **CALIBRATING ACTUATORS** under ADJUSTMENTS.

## POLLEN FILTER

### Removal & Installation

Open hood. Pull back sealing strip on passenger's side of air inlet grille. Open air inlet grille flap. Release clips and pull pollen filter straight up. To install, reverse removal procedure.

## RECEIVER-DRIER

### Removal & Installation

1. Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove front grille.
2. Pull windshield washer reservoir fill tube straight up to remove. Remove receiver-drier connection bolt through front grille opening. Remove receiver-drier bracket bolts and receiver-drier.
3. To install, reverse removal procedure. Use NEW "O" rings lubricated with mineral oil. Evacuate and charge A/C system.

## SUNLOAD SENSOR

### Removal & Installation

Locate sunload sensor on top of instrument panel. Carefully pry sunload sensor out of instrument panel. Disconnect wiring harness from sensor. To install, reverse removal procedure.

## TEMPERATURE VALVE ACTUATORS

### Removal & Installation (Driver's Side)

1. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from

driver's side.

2. Detach clip for driver's side front floor air outlet. Remove front floor air outlet. Remove actuator cover. Disconnect wiring harness from actuator. Remove screw and detach actuator from linkage. Remove actuator from vehicle.
3. To install, reverse removal procedure. Recalibrate actuator. See **CALIBRATING ACTUATORS** under ADJUSTMENTS. Removal & Installation (Passenger's Side)
4. Disconnect negative battery cable. Detach sound insulator locking tabs and remove sound insulator from passenger's side.
5. Detach clip for passenger's side front floor air outlet. Remove front floor air outlet. Disconnect wiring harness from actuator. Remove screw and detach actuator from linkage. Remove actuator from vehicle.
6. To install, reverse removal procedure. Recalibrate actuator. See **CALIBRATING ACTUATORS** under ADJUSTMENTS.

### THERMOSTATIC EXPANSION VALVE

#### Removal & Installation

1. Disconnect negative battery cable. Discharge A/C system, using approved refrigerant recovery/recycling equipment. Remove evaporator line extension bolt from cowl.
2. Detach sound insulator locking tabs and remove sound insulator. Detach driver's side front floor air outlet clip. Remove air outlet. Disconnect wiring harness from vacuum solenoid/cut-off valve actuator. Remove screws and position vacuum solenoid/cut-off valve actuator out of way.
3. Remove evaporator access panel screws and panel. Remove evaporator line screw. Remove thermostatic expansion valve screws and valve. To install, reverse removal procedure. Use NEW "O" rings lubricated with mineral oil. Evacuate and charge A/C system.

### VACUUM TANK

#### Removal & Installation

Open hood. Remove air inlet grille. Remove vacuum tank nuts. Disconnect vacuum hoses from tank. Remove vacuum tank from vehicle. To install, reverse removal procedure.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

| Application | Ft. Lbs. (N.m) |
|---|---|
| A/C Compressor Hose Bolt | 24 (33) |
| A/C Compressor Mounting Bolts | 30 (41) |
| Air Injection Crossover Support Bracket Nut (Generator Bolt) | 30 (41) |
| Condenser Line Bolt | 20 (27) |
| Evaporator Line Extension Bolt | 15 (20) |
| Instrument Panel Support Brace Bolts | 16 (22) |
| Receiver-Drier Connection Bolt | 11 (15) |
| Steering Column Support Bracket Bolts/Nut | (1) 16 (22) |
| | **INCH Lbs. (N.m)** |
| A/C Compressor Hose-To-Oil Pan Bolt | 71 (8) |
| Air Distribution Module Nut/Screws | 35 (4) |
| Driver's Side Air Bag Module Bolts | 25 (2.8) |
| Passenger's Side Air Bag Module Bolts | 89 (10) |

| | |
|---|---|
| Resonance Chamber Nuts | 27 (3) |
| Receiver-Drier Bracket Bolts | 35 (4) |
| Thermostatic Expansion Valve Screws | 71 (8) |
| (1) Tighten support bracket shear bolt until head breaks off. | |

## WIRING DIAGRAMS

**Fig. 8: Automatic A/C-Heater System Wiring Diagram (1 Of 2)**

**Fig. 9: Automatic A/C-Heater System Wiring Diagram (2 Of 2)**

# 1998 Cadillac Catera

A/C-HEATER SYSTEM 1998 AIR CONDITIONING & HEAT General Motors Corp. - A/C-Heater System

# 1998 Cadillac Catera

A/C-HEATER SYSTEM 1998 AIR CONDITIONING & HEAT General Motors Corp. - A/C-Heater System

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