

2006 Chevrolet HHR LT

2006 HVAC HVAC Systems - Manual - HHR

2006 HVAC

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SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
HVAC Actuator Retaining Screw	1.8 N.m	16 lb in
HVAC Control Assembly Screws	2.2 N.m	19 lb in

SCHEMATIC AND ROUTING DIAGRAMS

HVAC SCHEMatics

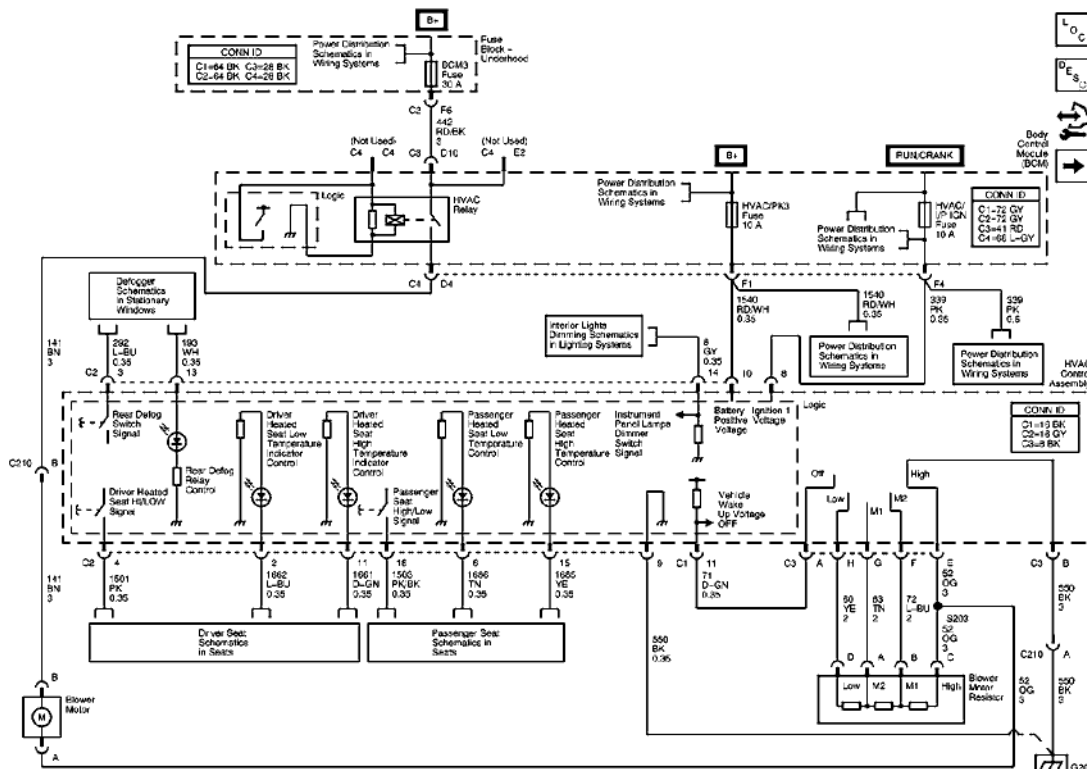


Fig. 1: Power, Ground, Blower Motor Controls, and Subsystem References
Courtesy of GENERAL MOTORS CORP.

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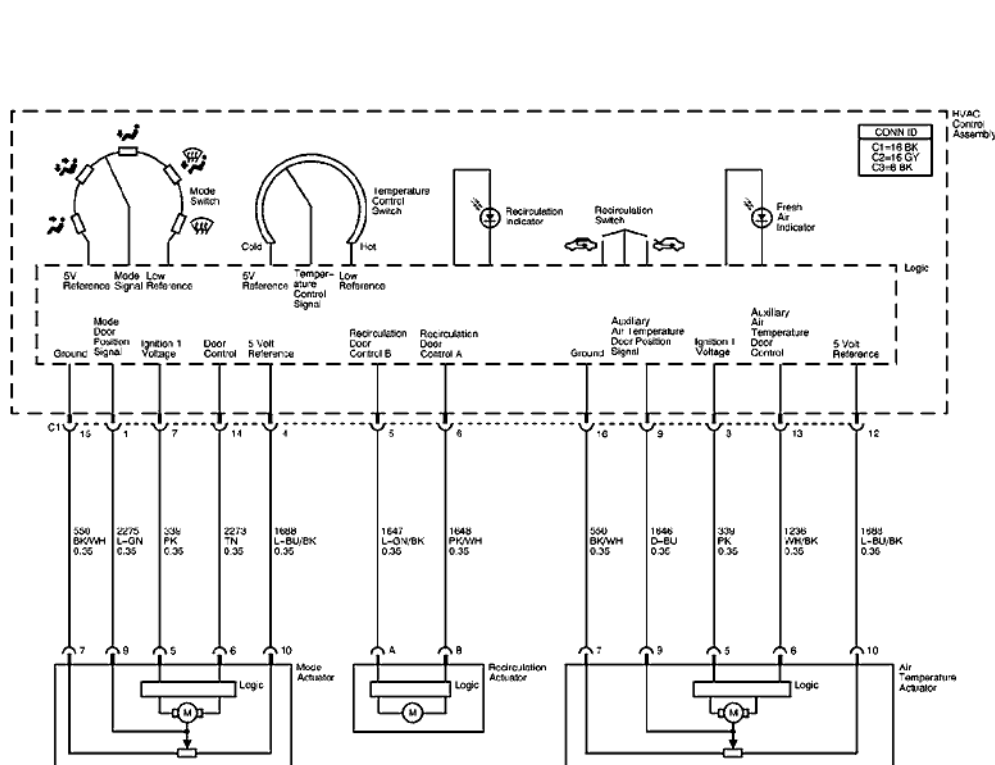


Fig. 3: Mode and Air Temperature Controls
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

HVAC COMPONENT VIEWS

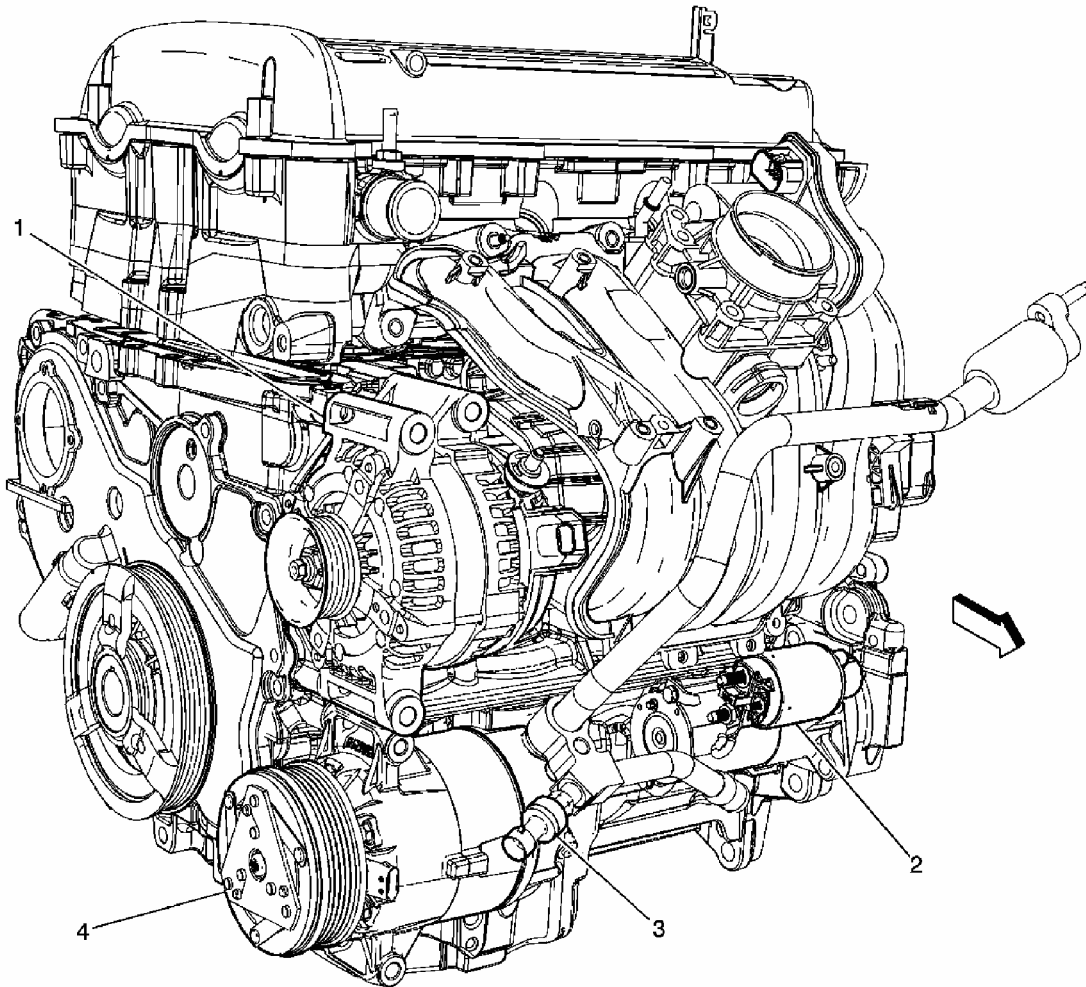


Fig. 4: Lower Front of the Engine
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Generator
2	Starter
3	A/C Refrigerant Pressure Sensor
4	A/C Compressor Clutch

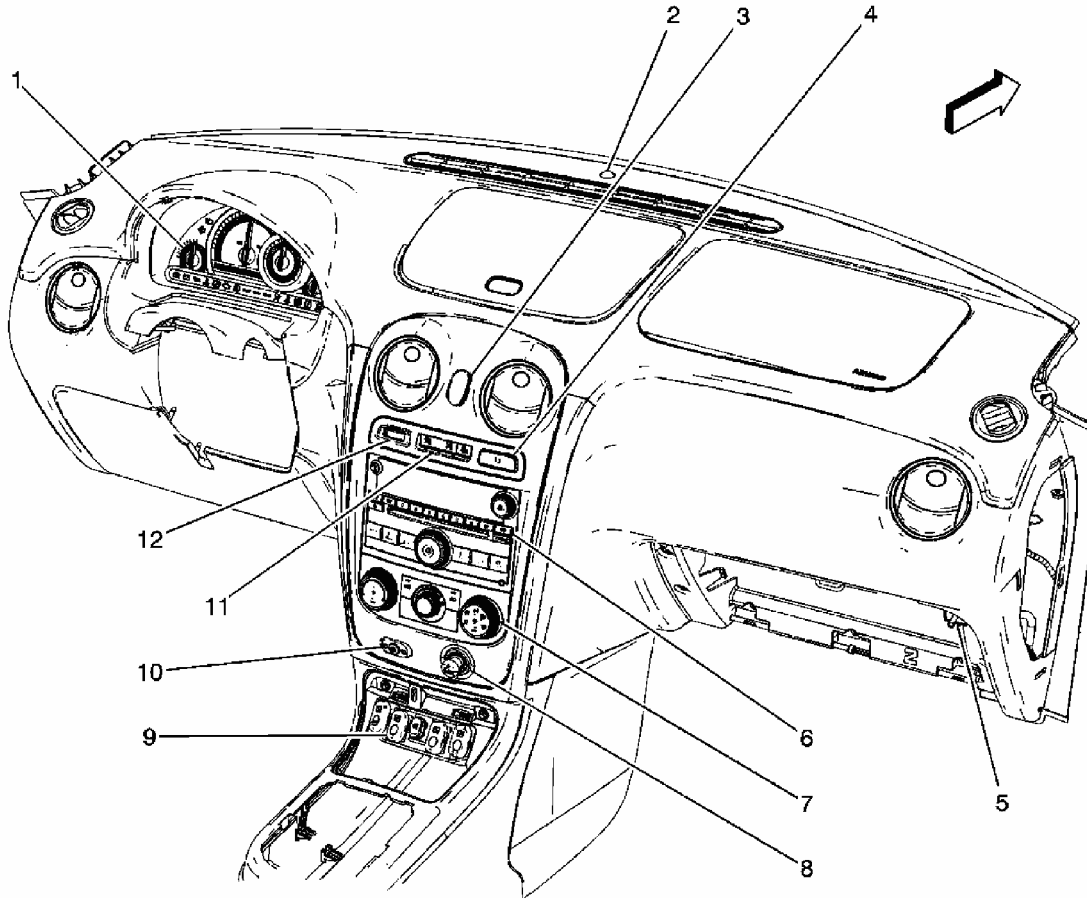


Fig. 5: I/P Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Instrument Panel Cluster (IPC)
2	Ambient Light Sensor
3	Hazard Switch
4	Fog Lamp Switch (T37)
5	I/P Compartment
6	Radio
7	HVAC Control Assembly
8	Cigar Lighter (DT4)
9	Master Window Switch
10	Rear Wiper/Washer Switch
11	Inflatable Restraint Passenger Air Bag ON/OFF Indicator
12	Instrument Panel (I/P) Dimmer Switch

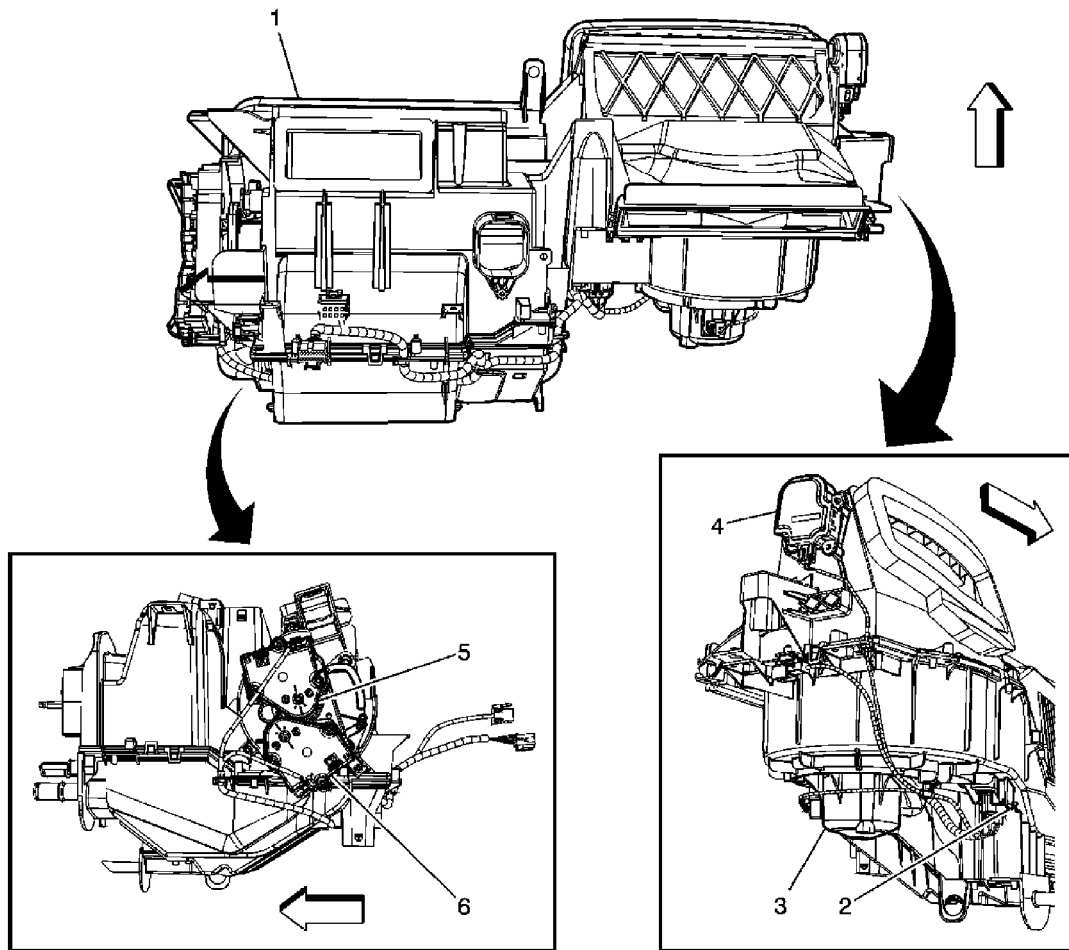


Fig. 6: Interior HVAC Components
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	HVAC Box Assembly
2	Blower Motor Resistor Assembly
3	Blower Motor
4	Recirculation Actuator
5	Air Temperature Actuator
6	Mode Actuator

HVAC CONNECTOR END VIEWS

A/C Compressor Clutch

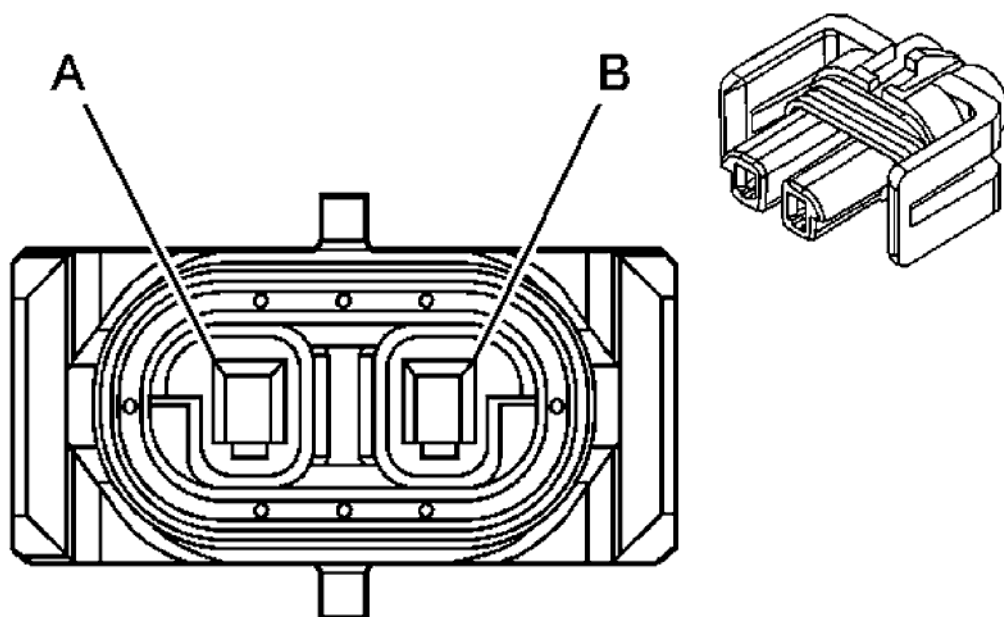


Fig. 7: A/C Compressor Clutch Connector
 Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12162017
- Service: 12101937
- Description: 2-Way F Metri-Pack 150 Series Sealed (GY)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

A/C Compressor Clutch

Pin	Wire Color	Circuit No.	Function
A	D-GN	59	A/C Compressor Clutch Supply Voltage
B	BK	150	Ground

A/C Refrigerant Pressure Sensor

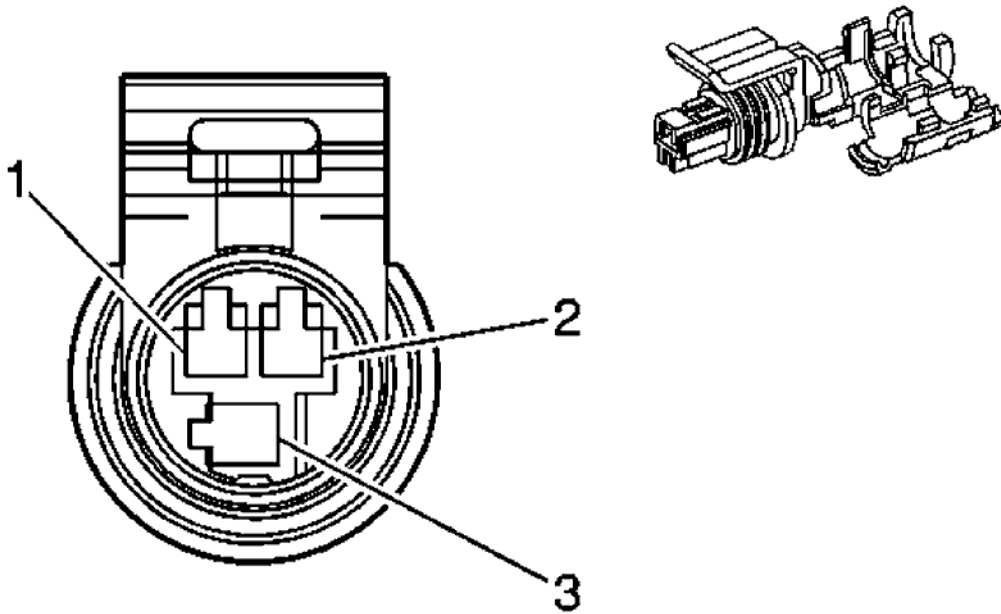


Fig. 8: A/C Refrigerant Pressure Sensor Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 15397149
- Service: 88988301
- Description: 3-Way F GT 150 Series Sealed (BK)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

A/C Refrigerant Pressure Sensor

Pin	Wire Color	Circuit No.	Function
1	BK/WH	2751	Signal Ground

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2	GY	2700	A/C Pressure Sensor 5-Volt Reference
3	OG/BK	380	A/C Refrigerant Pressure Sensor Signal

HVAC Control Assembly C1

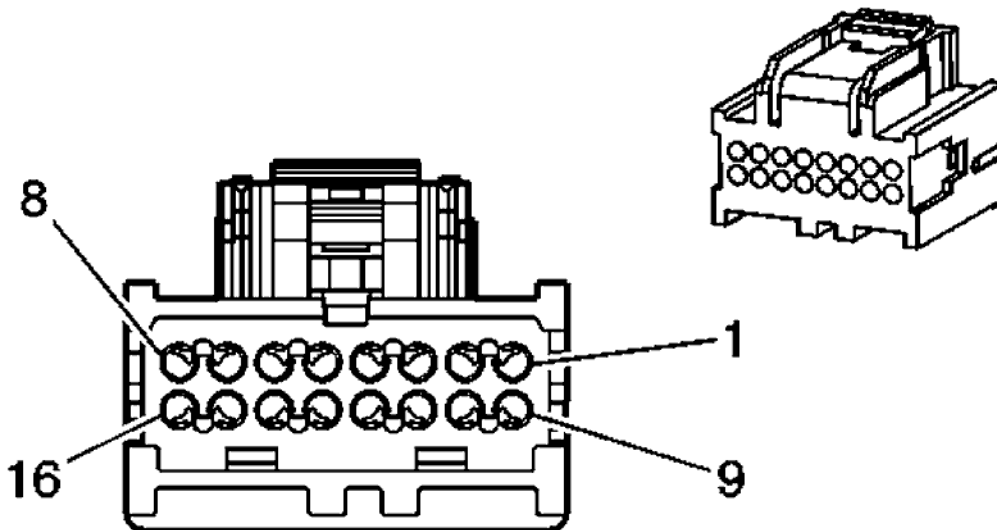


Fig. 9: HVAC Control Assembly C1 Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 15416970
- Service: 22715969
- Description: 16-Way F Micro 64 Modular (BK)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

HVAC Control Assembly C1

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Pin	Wire Color	Circuit No.	Function
1	L-GN	2275	Mode 1 Valve Position Sensor Signal
2-3	-	-	Not Used
4	L-BU/BK	1688	5-Volt Reference
5	L-GN/BK	1647	Open Recirculation Door Control
6	PK/WH	1648	Close Recirculation Door Control
7	PK	339	Run/Crank Ignition 1 Voltage
8	PK	339	Run/Crank Ignition 1 Voltage
9	D-BU	1646	Passenger Air Temperature Door Position Signal
10	-	-	Not Used
11	D-GN	71	Off Blower Motor Control
12	L-BU/BK	1688	5-Volt Reference
13	WH/BK	1236	Passenger Air Temperature Door Control
14	TN	2273	Mode 1 Valve Motor Feed
15	BK/WH	550	Ground
16	BK/WH	550	Ground

HVAC Control Assembly C2

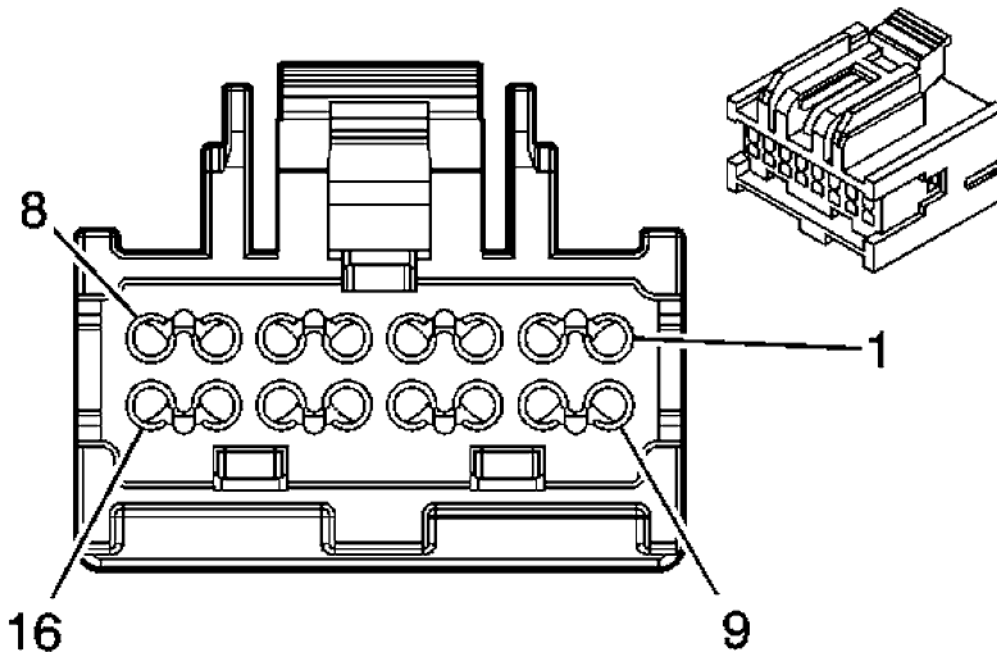


Fig. 10: HVAC Control Assembly C2 Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 7283-9077-40
- Service: 89047195
- Description: 16-Way F Micro 64 Modular (GY)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

HVAC Control Assembly C2

Pin	Wire Color	Circuit No.	Function
1	L-GN	66	A/C Request Signal
2	L-BU	1662	Driver Heated Seat Low Indicator

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			Control (KA1)
3	L-BU	292	Rear Defog Switch Signal
4	PK	1501	Driver Heated Seat High/Low Signal (KA1)
5	-	-	Not Used
6	TN	1686	Passenger Heated Seat Low Indicator Control (KA1)
7	-	-	Not Used
8	PK	339	Run/Crank Ignition 1 Voltage
9	BK	550	Ground
10	RD/WH	1540	Battery Positive Voltage
11	D-GN	1661	Driver Heated Seat High Indicator Control (KA1)
12	-	-	Not Used
13	WH	193	Rear Defog Relay Control
14	GY	8	Instrument Panel Lamp Supply Voltage (1)
15	YE	1685	Passenger Heated Seat High Indicator Control (KA1)
16	PK/BK	1503	Passenger Heated Seat High/Low Signal (KA1)

HVAC Control Assembly C3

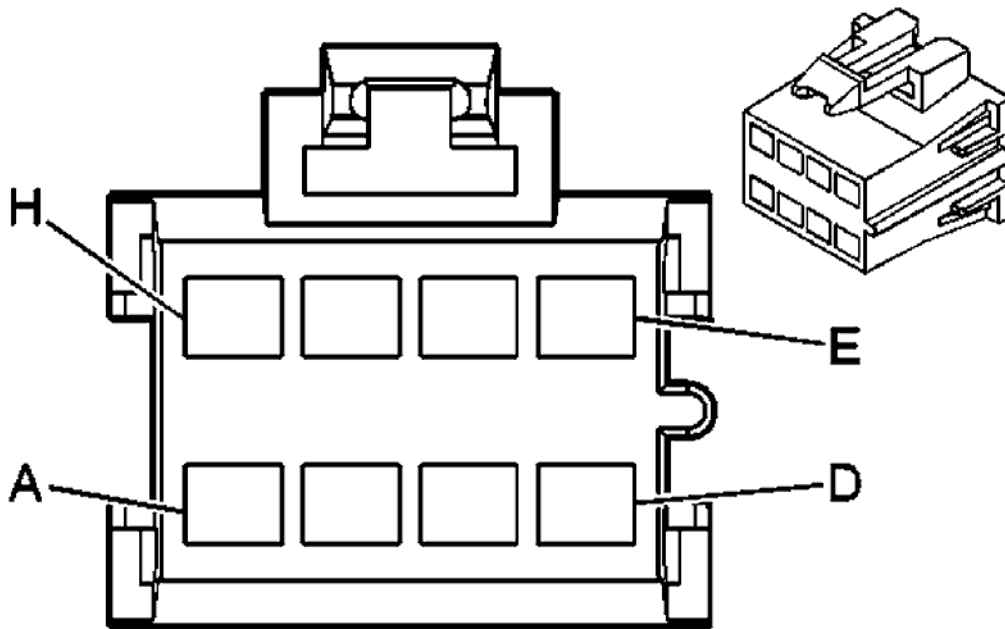


Fig. 11: HVAC Control Assembly C3 Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12064998
- Service: 15306189
- Description: 8-Way F Metri-Pack 280 Series (BK)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

HVAC Control Assembly C3

Pin	Wire Color	Circuit No.	Function
A	D-GN	71	Off Blower Motor Control
B	BK	550	Ground
C-D	-	-	Not Used

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E	OG	52	High Blower Motor Control
F	L-BU	72	Medium 2 Blower Motor Control
G	TN	63	Medium Blower Motor Control (1)
H	YE	60	Low Blower Motor Control

Recirculation Actuator

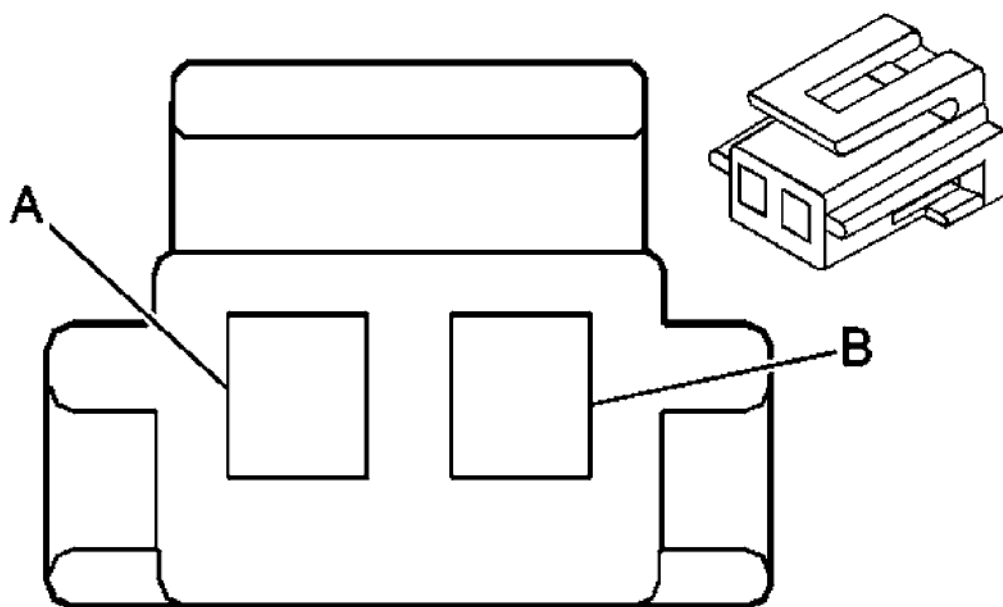


Fig. 12: Recirculation Actuator Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12059110
- Service: 88953271
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:

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- Release Tool/Test Probe:

Recirculation Actuator

Pin	Wire Color	Circuit No.	Function
A	L-GN/BK	1647	Open Recirculation Door Control
B	PK/WH	1648	Close Recirculation Door Control

Blower Motor

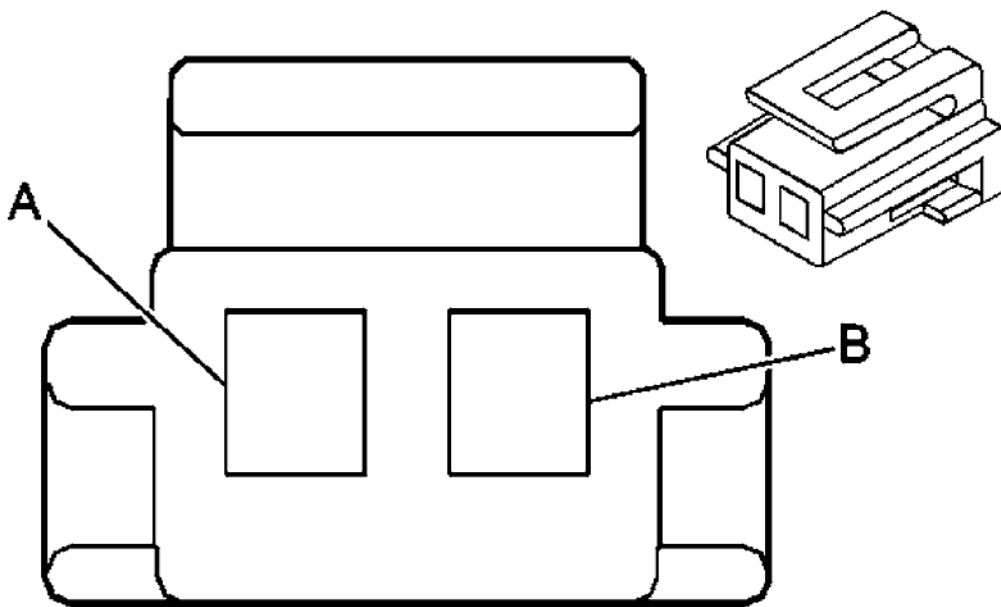


Fig. 13: Blower Motor Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12064749
- Service: 12101888
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Pins:
- Terminal:

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- Core/Insulation Crimp:
- Release Tool/Test Probe:

Blower Motor

Pin	Wire Color	Circuit No.	Function
A	OG	52	High Blower Motor Control
B	BN	141	Run Ignition 3 Voltage

Mode Actuator

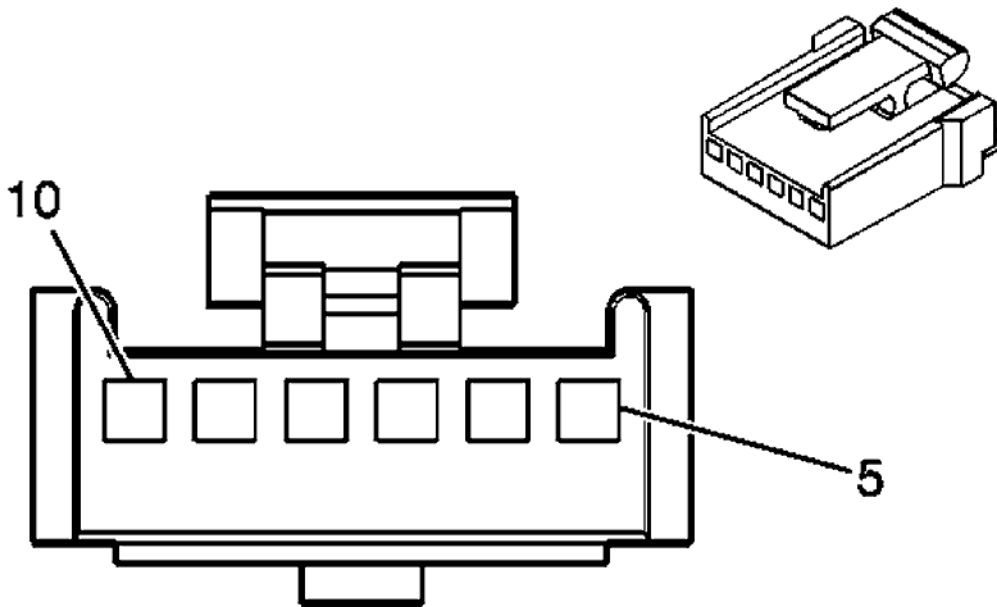


Fig. 14: Mode Actuator Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12064993
- Service: 12102485
- Description: 6-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Pins:

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- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

Mode Actuator

Pin	Wire Color	Circuit No.	Function
5	PK	339	Run/Crank Ignition 1 Voltage
6	TN	2273	Mode 1 Valve Motor Feed
7	BK/WH	550	Ground
8	-	-	Not Used
9	L-GN	2275	Mode 1 Valve Position Sensor Signal
10	L-BU/BK	1688	5-Volt Reference

Air Temperature Actuator

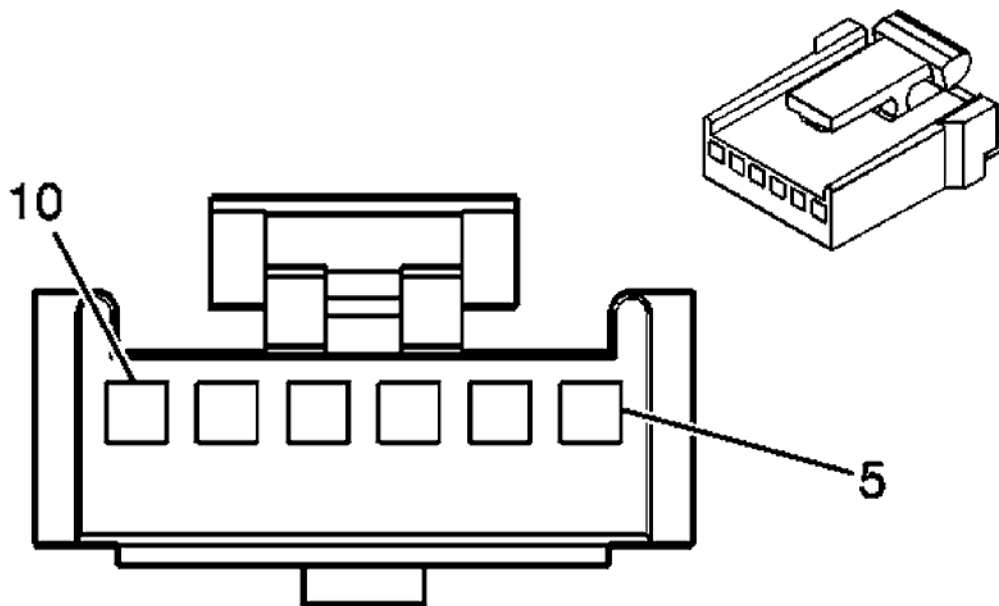


Fig. 15: Air Temperature Actuator Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

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- OEM: 12064993
- Service: 12102485
- Description: 6-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

Air Temperature Actuator

Pin	Wire Color	Circuit No.	Function
5	PK	339	Run/Crank Ignition 1 Voltage
6	WH/BK	1236	Passenger Air Temperature Door Control
7	BK/WH	550	Ground
8	-	-	Not Used
9	D-BU	1646	Passenger Air Temperature Door Position Signal
10	L-BU/BK	1688	5-Volt Reference

Blower Motor Resistor Assembly

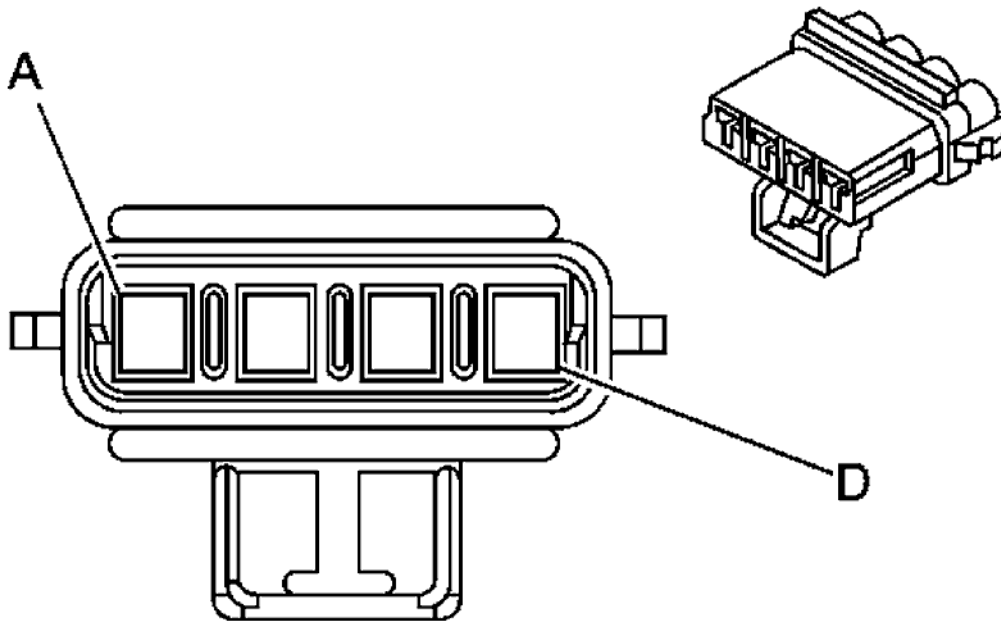


Fig. 16: Blower Motor Resistor Assembly Connector
Courtesy of GENERAL MOTORS CORP.

HVAC Connector End Views

Connector Part Information

- OEM: 12129566
- Service: 15306069
- Description: 4-Way F Metri-Pack 280 Series Sealed (GY)

Terminal Part Information

- Pins:
- Terminal:
- Core/Insulation Crimp:
- Release Tool/Test Probe:

Blower Motor Resistor Assembly

Pin	Wire Color	Circuit No.	Function
A	TN	63	Medium Blower Motor Control (1)
B	L-BU	72	Medium 2 Blower Motor Control
C	OG	52	High Blower Motor Control

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D

YE

60

Low Blower Motor Control

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B0158	** DESCRIPTION NOT COLLECTED **
DTC P0532 or P0533	** MULTIPLE VALUES **
DTC P0645	**DESCRIPTION NOT COLLECTED **

SCAN TOOL OUTPUT CONTROLS

ECM Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
A/C Relay	Engine Output Controls	The scan tool displays ON or OFF selections. This command allows you to turn the A/C relay ON or OFF for 5 seconds. When the A/C relay is commanded ON, the A/C compressor clutch should be engaged.

SCAN TOOL DATA LIST

Use the Scan Tool Data Display Values and Definitions Information in order to assist in diagnosing the HVAC Control Assembly problems. Compare the vehicles actual scan tool data with the typical data display value table information. Use the data information in order to aid in understanding the nature of the problem when the vehicle does not match with the typical data display values.

The scan tool data values were taken from a known good vehicle under the following conditions:

- The ignition switch is in the ON position.
- The engine is running at idle.
- The vehicle is in PARK.
- The doors are closed.
- The windows are closed.
- The A/C is ON.
- The ambient air temperatures are at 22-27°C (70-80°F).

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Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Body Control Module (BCM) Scan Tool Data List			
Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)			
A/C Switch	HVAC Data	On/Off	On
Battery 1	HVAC Data	Volts	Battery Voltage
Engine Control Module (ECM) Scan Tool Data List			
Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)			
A/C Disengage 1 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 2 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 3 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 4 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies

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A/C Disengage 5 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 6 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 7 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C Disengage 8 History	General Info-Inputs/Outputs	None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot	Varies
A/C High Side Pressure Sensor	General Info-Inputs/Outputs	Volts	Varies
A/C Off for WOT	General Info-Inputs/Outputs	Yes/No	No
A/C Pressure Disable	General Info-Inputs/Outputs	Yes/No	No
A/C Relay Command	General Info-Inputs/Outputs	On/Off	On
A/C Request	General Info-Inputs/Outputs	Yes/No	Yes

ECT	All	C/F	Varies
5 Volt Reference 2 Circuit Status	HVAC Data	OK/Fault	OK
5 Volt Reference 1 Circuit Status	HVAC Data	OK/Fault	OK
Start Up IAT	HVAC Data	C/F	Varies

SCAN TOOL DATA DEFINITIONS

Use the Scan Tool Data Display Values and Definitions Information in order to assist in diagnosing the body control module (BCM) problems. Compare the vehicles actual scan tool data with the typical data display value table information. Use the data information in order to aid in understanding the nature of the problem when the vehicle does not match with the typical data display values.

The scan tool data values were taken from a known good vehicle under the following conditions:

- The ignition switch is in the ON position.
- The engine is running at idle.
- The vehicle is in PARK.
- The doors are closed.
- The windows are closed.
- The A/C is ON, in UPPER mode.
- The ambient air temperatures are at 22-27°C (70-80°F).

The HVAC Scan Tool Data Definitions contains a brief description of all HVAC related parameters available on the scan tool. The list is in alphabetical order. A given parameter may appear in any one of the data lists. In some cases, the parameter may appear more than once or in more than one data list in order to group certain related parameters together.

BCM-A/C Switch

The scan tool displays On or Off. The BCM uses the A/C Switch Input in order to determine if A/C compressor operation is being requested by the HVAC control module.

5 Volt Reference 1 or 2 Circuit Status

The scan tool displays the following message stating the history status of the 5 volt reference circuit of the mode or air temp actuators. The scan tool displays OK/Fault.

ECM-A/C Disengage 1-8 History

The scan tool displays reason why the A/C compressor has disengaged.

ECM-A/C off for WOT

The scan tool displays the high throttle disable of the a/c compressor.

ECM-A/C Pressure Disable

The scan tool displays the status of the a/c high side pressure sensor. The scan tool displays Yes/No.

ECM-A/C Relay Command

The scan tool displays On or Off. On is displayed when the engine control module (ECM) has energized the A/C clutch relay.

ECM-A/C High Refrigerant Pressure

The scan tool displays 0-4000 kPa (0-580 psi). This parameter represents the A/C refrigerant pressure sensor voltage signal converted to pressure.

ECM-A/C High Side Refrigerant Pressure

The scan tool displays 0-5 volts. The output of the A/C refrigerant pressure sensor.

ECM-A/C Request

The scan tool displays Yes or No. Yes is displayed when the BCM is requesting A/C system operation.

ECM-Ignition 1 Signal

The scan tool shows available voltage at the ECM. The scan tool displays 0 to 12 volts.

ECM-ECT

The scan tool displays a range of 40-151°C (40-304°F). The ECM applies 5 volts to the engine coolant temperature (ECT) sensor circuit. The sensor is a thermistor which changes internal resistance as the engine temperature changes. When the sensor is cold, internal resistance is high, the ECM senses a high signal voltage and interprets the voltage as a cold engine. As the sensor warms, internal resistance decreases, the voltage signal decreases, and the ECM interprets the lower voltage as a warm engine.

ECM-Start Up ECT

The scan tool displays engine coolant temperature at startup. The scan tool displays °

C/°F.

ECM-Start Up IAT

The scan tool displays inside air temperature at start up. The scan tool displays °C/°F.

DTC B0158**DTC Descriptor****DTC B0158**

Ambient Air Temperature Sensor Circuit

Diagnostic Fault Information

IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

DTC B0158

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ambient Air Temperature Sensor Circuit	-	-	-	B0158 05 B0158 06

Circuit/System Description

The body control module (BCM) monitors the ambient air temperature sensor to display ambient air temperature. The temperature sensor is a 2-wire negative temperature coefficient thermistor. The BCM applies 5 volts to an internal input resistor that is connected to the signal circuits of the ambient air temperature sensor. The BCM provides the ground to the ambient air temperature sensor through the low reference circuit. The BCM monitors the voltage drop across the ambient air temperature sensor and uses the input for automatic control calculations. When the ambient air temperatures are cold, the resistance of the sensor is high and the voltage signals are high. When the ambient air temperatures are hot; the resistance of the sensors is low and the voltage signals are low. The BCM converts the voltage value to a temperature value of Celsius and Fahrenheit that will be displayed by the instrument cluster display (IPC).

Conditions for Running the DTC

The ignition is turned ON.

Conditions for Setting the DTC

- The BCM detects the sensor signal circuit is less than 0.1 volt.

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- The BCM detects the sensor signal circuit is more than 4.9 volts.

Action Taken When the DTC Sets

- The default value of 3°C (38°F) will be substituted for the ambient air temperature sensor data by the BCM.
- The instrument cluster display (IPC) will display the set temperature when ON.

Conditions for Clearing the DTC

- The DTC will become history if the BCM no longer detects a failure.
- The history DTC will clear after 40 fault-free ignition cycles.
- Using a scan tool can clear the DTC.

Reference Information

Schematic Reference

- HVAC Schematics
- Instrument Panel, Gages, and Console Schematic Icons

Connector End View Reference

- HVAC Connector End Views
- Instrument Panel, Gages, and Console Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

- Scan Tool Output Controls
- Scan Tool Data List
- Scan Tool Data Definitions

Circuit/System Verification

The ambient air temperature sensor must cool down prior to checking normal operation for the temperature display reading to be believable. With the Ignition ON, check the Ambient Air Temperature Sensor readout on the IPC. The temperature readout should be in the range

of normal outside temperature.

With the ignition OFF, disconnect the ambient air temperature sensor, Turn ON the ignition with the engine OFF, observe the Ambient Air Temperature Sensor Signal Circuit parameter in the BCM data list.

In the following tests if the fuse in the jumper opens when you perform this test, the signal circuit is shorted to voltage.

1. If more than 4.9 volts, connect a 3-amp fused jumper between the sensor signal circuit and the low reference circuit. With IGN ON and engine OFF, observe the Ambient Air Temperature parameter in the scan tool BCM data list. If the voltage reading is less than 0.1 volt, and circuit/connections test normal, replace the ambient air temperature sensor.
2. If more than 4.9 volts, connect a 3-amp fused jumper between the sensor signal circuit and the low reference circuit. With IGN ON and engine OFF, observe the Ambient Air Temperature parameter in the scan tool BCM data list. If the voltage reading is more than 0.1 volt, test the signal circuit for a short to voltage, high resistance or an open. If the circuit/connections test normal, test the low reference circuit for an open or high resistance. If the circuit/connections test normal replace the BCM.
3. If less than 4.9 volts, test the ambient air temperature sensor signal circuit for a short to ground. If the circuit/connections test normal replace the BCM.

Repair Instructions

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Ambient Air Temperature Gage Sensor Replacement
- Control Module References for BCM replacement, setup, and programming

DTC P0532 OR P0533

DTC Descriptor

DTC P0532

Air Conditioning (A/C) Pressure Sensor Circuit Low Voltage

DTC P0533

Air Conditioning (A/C) Pressure Sensor Circuit High Voltage

Diagnostic Fault Information

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IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

DTC P0532 or P0533

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
A/C Air conditioning pressure sensor circuit low voltage	P0532	P0532	-	P0532
A/C Air conditioning pressure sensor circuit high voltage	-	-	P0533	P0533

Circuit/System Description

The engine control module (ECM) monitors the high side refrigerant pressure through the A/C refrigerant pressure sensor. The ECM supplies a 5-volt reference and a low reference to the sensor. Changes in the A/C refrigerant pressure causing the A/C refrigerant pressure sensor signal to the ECM to vary. When the pressure is high, the signal voltage is high. When the pressure is low, the signal voltage is low. When pressure is high, the ECM commands the cooling fans ON. When pressure is too high or too low, the ECM will not allow the A/C compressor clutch to engage.

Conditions for Running the DTC

- The engine is running
- Any of the conditions for setting the DTC are met for 15 seconds

Conditions for Setting the DTC

P0532

The ECM detects that the A/C pressure is less than 0 psi (0.20 volts).

P0533

The ECM detects that the A/C pressure is more than 428 psi (4.92 volts).

Action Taken When the DTC Sets

- The malfunction indicator lamp (MIL) will not illuminate.
- The ECM stores the DTC in the Failure Records.
- The A/C compressor clutch is disabled.

Conditions for Clearing the DTC

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- The DTC will become history if the ECM no longer detects a failure.
- The history DTC will clear after 40 consecutive ignition cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool.

Diagnostic Aids

Test the following conditions:

- Visually inspect the sensor for contamination or damage.
- Inspect for the following that may affect the sensors accuracy:
 - A malfunction within the refrigerant system causing high pressure.
 - Visually inspect the A/C components and lines for damage.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

- Scan Tool Data Definitions
- Scan Tool Data List
- Scan Tool Output Controls

Circuit/System Verification

1. The ambient air temperature must be above 3°C (38°F).
2. The A/C refrigerant within the system must be adequately charged.

Circuit/System Testing

1. With the ignition OFF, inspect the A/C compressor for free rotation. Start the engine; place the HVAC control assembly in the OFF position.
 - If the compressor is engaged than refer to HVAC compressor clutch does not disengage.
2. Install a scan tool, turn ON the ignition, with the engine OFF. Observe the A/C Refrigerant Pressure parameter in the ECM General Info Input/Outputs data list. Expected values would be between 0.2 to 4.9 volts.
 - If the observed voltage is between the expected voltages go to Diagnostic Aids.
 - If the reading is out of the specified range, turn the ignition OFF, disconnect the A/C refrigerant pressure sensor. Turn the ignition back ON, with the engine OFF. Observe the A/C Refrigerant Pressure parameter in the ECM General Info Inputs/Outputs data list. Expected value would be less than 0.2 volts.
 - If the observed voltage is greater than the expected value than test the signal circuit of the A/C refrigerate pressure sensor for a short to voltage. If the problem is solved clear the DTC and see if the DTC resets.
3. No problem is found than inspect for poor connections at the harness connector of the ECM.
 - If a problem is found and repaired clear the DTC and see if the DTC resets.
 - If no problem is found than replace the ECM. Clear codes and retest.
 - If the observed voltage is less than the expected value than turn the IGN OFF. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the A/C refrigerant pressure sensor and the signal circuit of the A/C refrigerant pressure sensor. Turn the ignition ON, with scan tool observe the A/C Refrigerant Pressure parameter in the ECM General Info Inputs/Outputs data list. Specified value 4.9 volts.
 - If the observed voltage is less then the specified value than test the 5-volt reference circuit of the A/C refrigerant pressure sensor for a short to ground, high resistance, of an open. If a problem is found and corrected. Clear codes and retest.
 - If no problem is found than test the signal circuit of the A/C refrigerant pressure sensor for a short to ground, high resistance, or an open, if a problem is found and corrected than clear codes and retest.
 - If no problem is found than inspect for poor connection at the harness connector of the ECM, if a problem is found and corrected, clear codes and retest.
 - If no problem is found, replace the ECM. Clear codes and retest.
 - If the observed voltage is greater than the specified value than disconnect the fused jumper wire, measure the voltage between the 5-volt reference circuit of the A/C refrigerant pressure sensor and the low reference circuit of the A/C refrigerant pressure sensor. Specified value 4.9 volts.
 - If the observed voltage is greater than the specified voltage than test the 5-volt reference circuit of the A/C refrigerant pressure sensor for a short to voltage. If a

problem is found and corrected than clear codes and retest.

- If the observed voltage is less than the specified voltage. Inspect for poor connections at the harness connector of the ECM. If a problem is found and corrected. Clear codes and retest.
- If no problem is found than replace the ECM. Clear codes and retest.
- If the observed voltage is less than the specified voltage than turn OFF the ignition. Disconnect the negative battery cable, measure the resistance from the low reference circuit of the A/C refrigerant pressure sensor and ground. Specified value 5 ohms.
- If the resistance is greater than the specified value than disconnect the ECM. Test the low reference circuit of the A/C refrigerant pressure sensor for a high resistance or an open. If a problem was found and corrected, clear codes and retest.
- If no problem was found, inspect for poor connections at the harness connector of the ECM. If the problem was found and corrected, clear codes and retest.
- If no problem was found replace the ECM. Retest the system.
- If the resistance is less than the specified value than inspect for a poor connections at the harness connector of the A/C refrigerant pressure sensor. If the problem was found and corrected. Clear codes and retest.
- If no problem was found, replace the A/C refrigerant pressure sensor. Clear codes and retest.

Repair Instructions

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement
- Control Module References for ECM replacement, setup, and programming.

DTC P0645

DTC Descriptor

DTC P0645

Air Conditioning A/C Clutch Relay Control Circuit

Diagnostic Fault Information

IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

DTC P0645

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Air Conditioning A/C Clutch Relay Control Circuit	P0645	P0645	P0645	P0645	P0645

Circuit/System Description

Ignition voltage is supplied directly to the air conditioning (A/C) compressor clutch relay. The engine control module (ECM) controls the relay by grounding the A/C clutch relay control circuit via an internal solid state device called a driver. The primary function of the driver is to supply the ground for the component being controlled. The driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be near 0 volts. When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be near battery voltage. If the fault detection circuit senses a voltage other than what is expected, this DTC will set. When this DTC is set the affected driver is disabled.

Conditions for Running the DTC

- The ignition voltage is between 9 and 18 volts.
- The engine speed is more than 80 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

Conditions for Setting the DTC

The ECM detects one of the following:

- A short to ground
- A short to voltage
- An open circuit or relay
- An internally shorted or excessively low resistance relay coil

Action Taken When the DTC Sets

- The A/C is inoperative.
- The (MIL) indicator lamp will not illuminate.
- The conditions for which the DTC was set will be stored in the Failure Records data only. No information will be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The history DTC will clear after 40 fault-free ignition cycles.

- Using a scan tool can clear the DTC

Diagnostic Aids

- IMPORTANT:**
- Be sure to verify that the ECM engine grounds are secure and clean.
 - If DTC P0645 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.
 - If the condition is not present, refer to Testing for Intermittent Conditions and Poor Connections .

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

- Scan Tool Data Definitions
- Scan Tool Data List
- Scan Tool Output Controls

Circuit/System Verification

1. Install a scan tool.
2. Turn ON the ignition, with the engine OFF.
3. With the scan tool, command the A/C Relay ON and OFF in the ECM Special Functions scan tool data list.

Circuit/System Testing

1. The A/C relay turns ON and OFF inspect the system for intermittent conditions and poor connections.
2. The A/C relay does not turn ON and OFF. Turn OFF the ignition, disconnect the A/C compressor clutch relay, turn the ignition back ON, test for power on the control side battery positive circuit.
 - If the test lamp still does not illuminate repair the control side battery positive circuit.
3. If the test lamp illuminates connect the test light between the control side battery positive circuit and the ECM control circuit. Start the engine, with the scan tool turn the A/C relay ON and OFF.
4. If the test lamp illuminates inspect for a poor connection on the A/C compressor clutch circuit at the point no problem is found replace the A/C clutch relay.
5. The test lamp does not illuminate test the control circuit for poor connections or intermittent conditions.
 - If a problem is not found replace the ECM.

Repair Instructions

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for ECM replacement, setup, and programming.

SYMPTOMS - HVAC SYSTEMS - MANUAL

IMPORTANT: Review the system operation in order to learn the system functions. Refer to the following procedures:

- Air Delivery Description and Operation
- Air Temperature Description and Operation

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the HVAC System. Refer to Checking Aftermarket Accessories .
- Inspect the system components which are easily accessible or visible for obvious damage or for conditions which could cause the symptom.
- Verify the A/C compressor clutch turns freely and is not seized.
- The A/C compressor will not operate in cold, outside air temperatures. Refer to Air Temperature Description and Operation.
- The following conditions may cause window fogging:

- A wet carpet
- High humidity
- An interior water leak
- A blocked drain tube to the A/C evaporator
- Maximum passenger capacity
- Blocked body pressure relief valves
- Inspect the air distribution system for causes of reduced airflow:
 - An obstructed or dirty passenger compartment air filter
 - Blocked or damaged air vents

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to one of the following symptom diagnostic procedures:

- **HVAC Compressor Clutch Does Not Engage**
- **HVAC Compressor Clutch Does Not Disengage**
- **Blower Motor Always On**
- **Blower Motor Inoperative**
- **Blower Motor Malfunction**
- **Too Hot in Vehicle**
- **Too Cold in Vehicle**
- **Air Delivery Improper**
- **Air Recirculation Malfunction**
- **Defrosting Insufficient**
- **Noise Diagnosis - Blower Motor**
- **Noise Diagnosis - Air Conditioning (A/C) System**
- **Noise Diagnosis - HVAC Module**
- **Odor Correction**
- **Leak Testing**

HVAC COMPRESSOR CLUTCH DOES NOT ENGAGE**Test Description**

The numbers below refer to the step numbers on the diagnostic table.

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2: The A/C compressor relay output is disabled if engine coolant temperature is above 128°C (262°F). The instrument panel engine coolant indicator will indicate overheating.

3: Place the mode switch in any position except OFF, and place the air temperature control switch in a cold setting. Use the bi-level mode for consistent testing of the A/C system operation.

6: The HVAC control assembly is inoperative if the module does not respond to any operator control requests.

HVAC Compressor Clutch Does Not Engage

Step	Action	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: The A/C compressor clutch will not engage if an A/C request has been made, and a Powertrain DTC has not been set.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Observe the instrument panel coolant temperature indicator and the driver information center. Is the engine coolant temperature indicator indicating an over heat status or is the driver information center indicating low coolant?	Go to Engine Overheating	Go to Step 3
3	IMPORTANT: For A/C compressor operation, the ambient air temperature must be above 4°C (40°F). 1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the A/C request switch in the ON position. 4. Place the air temperature switch in the coldest position. Does the A/C compressor clutch engage?	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 4

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4	1. Open the window in order to ventilate the interior of the vehicle. 2. If the A/C system was operating, then wait for approximately 2 minutes. 3. Turn OFF the ignition. 4. Install the ACR 2000 Air Conditioning Service Center. Refer to <u>Special Tools</u>. 5. Record the ambient air temperature at the vehicle. 6. Record readings of the low and high side STATIC pressures. 7. Compare the low side pressure values and the high side pressure values with the allowable limits for the recorded ambient air temperature. Refer to <u>Air Conditioning (A/C) System Performance Test</u>. Are the pressure values within the allowable limits for the recorded ambient air temperature, and within 103 kPa (15 psi) of each other?	Go to Step 5	Go to <u>Leak Testing</u>
5	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, observe the A/C High Side Pressure Sensor parameter in the engine control module (ECM) data list. 3. Compare the scan tool A/C High Side Pressure parameter to the high side pressure values on the J 43600. Are the high side pressure values within 103 kPa (15 psi) of each other?	Go to Step 6	Go to Step 23
6	Is the HVAC control assembly inoperative?	Go to Step 16	Go to Step 7
	1. Start the engine. 2. With a scan tool, observe the A/C Request Signal parameter in the ECM data list.		

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7	3. Place the air temperature switch in the coldest position. 4. Place the A/C request switch in the ON position. Does the scan tool indicate that the A/C Request Signal parameter is YES?	Go to Step 10	Go to Step 8
8	1. Start the engine. 2. With a scan tool, observe the A/C Switch parameter in the body control module (BCM) data list. 3. Place the air temperature switch in the coldest position. 4. Place the A/C request switch in the ON position. Does the scan tool indicate that the A/C Switch parameter is ON?	Go to Step 9	Go to Step 18
9	1. Turn OFF the ignition. 2. Test the A/C request signal circuit for the following: • A short to voltage • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs .Did you find and correct the condition?	Go to Step 39	Go to Step 10
10	With a scan tool, command the A/C compressor clutch relay ON and OFF. Does the clutch relay turn ON and OFF with each command?	Go to Step 14	Go to Step 11
11	1. Turn OFF the ignition. 2. Disconnect the A/C compressor clutch relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side of the voltage supply circuit with a test lamp that is connected to a good ground.		

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	Does the test lamp illuminate?	Go to Step 12	Go to Step 26
12	1. Connect a test lamp between the control circuit and the coil side of the voltage supply circuit. 2. With a scan tool, command the A/C compressor clutch relay ON and OFF. Does the test lamp turn ON and OFF with each command?	Go to Step 28	Go to Step 13
13	Does the test lamp remain illuminated with each command?	Go to Step 21	Go to Step 20
14	1. Turn OFF the ignition. 2. Disconnect the A/C compressor clutch relay. 3. Probe the switch side of the voltage supply circuit with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 15	Go to Step 25
15	1. Connect a 10-amp fused jumper between the switch side voltage circuit of the clutch relay and the supply voltage circuit of the clutch. 2. Turn ON the ignition, with the engine OFF. Does the A/C compressor clutch engage?	Go to Step 28	Go to Step 22
16	Test the ignition 3 voltage circuit of the HVAC control assembly for the following: • A short to ground • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 17
17	Test the ground circuit of the HVAC control assembly for an open. Refer to Circuit Testing and to Wiring Repairs .		

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	Did you find and correct the condition?	Go to Step 39	Go to Step 30
18	1. Start the engine. 2. Place the A/C request in the ON position. 3. Measure the voltage on the request circuit at the body control module (BCM) to a good ground. Does the value measure near battery voltage?	Go to Step 31	Go to Step 19
19	Test the A/C request signal circuit for the following: • A high resistance • An open • A short to ground Refer to Circuit Testing and to Wiring Repairs . Did you complete the repair?	Go to Step 39	Go to Step 30
20	Test the control circuit of the A/C compressor clutch relay for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 32
21	Test the control circuit of the A/C compressor clutch relay for a short to ground. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 32
22	Test the supply voltage circuit at the A/C compressor clutch for the following: • A short to ground • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 24
	Test the ground circuit of the A/C		

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23	refrigerant pressure sensor for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 27
24	Test the ground circuit of the A/C compressor clutch for a high resistance or for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 29
25	Repair the switch side voltage supply circuit of the A/C compressor clutch relay. Refer to Wiring Repairs . Did you complete the repair?	Go to Step 39	-
26	Repair the coil side of the voltage supply circuit of the A/C compressor clutch relay. Refer to Wiring Repairs . Did you complete the repair?	Go to Step 39	-
27	Inspect for poor connections at the harness connector of the A/C high pressure sensor. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 33
28	Inspect for poor connections at the A/C compressor clutch relay. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 34
29	Inspect for poor connections at the harness connector of the A/C compressor clutch. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 35
30	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 36
31	Inspect for poor connections at the harness connector of the BCM. Refer to Testing for Intermittent Conditions and Poor		

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	Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 37
32	Inspect for poor connections at the harness connector of the engine control module (ECM). Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 39	Go to Step 38
33	Replace the A/C refrigerant pressure sensor. Refer to Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement . Did you complete the replacement?	Go to Step 39	-
34	Replace the A/C compressor clutch relay. Did you complete the replacement?	Go to Step 39	-
35	Replace the A/C compressor clutch assembly. Refer to Compressor Clutch Assembly Replacement . Did you complete the replacement?	Go to Step 39	-
36	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement . Did you complete the replacement?	Go to Step 39	-
37	Replace the BCM. Refer to Control Module References for replacement, setup and programming. Did you complete the replacement?	Go to Step 39	-
38	Replace the ECM. Refer to Control Module References for replacement, setup and programming. Did you complete the replacement?	Go to Step 39	-
39	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 4

HVAC COMPRESSOR CLUTCH DOES NOT DISENGAGE

HVAC Compressor Clutch Does Not Disengage

Step	Action	Value	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: The A/C compressor clutch will not disengage when an A/C request				

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has not been made and a Powertrain DTC has not been set.

1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Start the engine. 2. Turn OFF the HVAC controls. Does the A/C compressor operate?	-	Go to Step 3	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>
3	With a scan tool, observe the A/C Relay Command Parameter in the Powertrain data list. Does the scan tool indicate that the A/C Relay Command Parameter is ON?	-	Go to Step 4	Go to Step 5
4	With a scan tool, observe the A/C Request Signal parameter in the Powertrain data list. Does the scan tool indicate that the A/C Request Signal parameter is YES?	-	Go to Step 10	Go to Step 11
5	Remove the A/C compressor clutch relay. Does the A/C compressor clutch turn OFF?	-	Go to Step 6	Go to Step 8
6	Measure the resistance between the switch side A/C compressor clutch relay terminals. Does the resistance measurement equal the specified value?	infinity	Go to Step 7	Go to Step 9
7	Test the A/C clutch relay control circuit for a short to ground. Refer to <u>Circuit Testing and Wiring Repairs</u> . Did you find and correct the condition?	-	Go to Step 16	Go to Step 11
8	Test the A/C compressor clutch supply voltage circuit for a short to voltage. Refer to <u>Circuit Testing and Wiring Repairs</u> . Did you find and correct the	-	Go to Step	

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	condition?		16	Go to Step 13
9	Inspect for poor connections at the A/C compressor clutch relay. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?	-	Go to Step 16	Go to Step 12
10	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?	-	Go to Step 16	Go to Step 14
11	Inspect for poor connections at the harness connector of the engine control module (ECM). Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?	-	Go to Step 16	Go to Step 15
12	Replace the A/C compressor clutch relay. Did you complete the replacement?	-	Go to Step 16	-
13	Replace the A/C compressor. Refer to <u>Compressor Clutch Assembly Replacement</u> . Did you complete the replacement?	-	Go to Step 16	-
14	Replace the HVAC control assembly. Refer to <u>HVAC Control Assembly Replacement</u> . Did you complete the replacement?	-	Go to Step 16	-
15	Replace the ECM. Refer to <u>Control Module References</u> for replacement, setup and programming. Did you complete the replacement?	-	Go to Step 16	-
16	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 3

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BLOWER MOTOR ALWAYS ON**Test Description**

The number below refers to the step number in the diagnostic table.

6: There are 2 blower motor supply voltage circuits at the blower motor relay. Probe the circuit that is connected to the blower motor resistor assembly.

Blower Motor Always On

Step	Action	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: The blower motor is ON while the blower motor switch is in the OFF position.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	IMPORTANT: The blower motor switch must remain in the OFF position during this diagnostic procedure. 1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in the OFF position. Is the blower motor OFF?	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the blower motor relay. 3. Turn On the ignition, with the engine OFF. Does the blower motor continue to operate?	Go to Step 11	Go to Step 4
4	Probe the high blower motor control circuit of the blower motor relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 5	Go to Step 6
5	Test the high blower motor control circuit for a short to voltage. Refer to <u>Circuit Testing and Wiring Repairs</u> . Did you find and correct the condition?	Go to Step 14	Go to Step 10

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6	Probe the blower motor supply voltage circuit, from the blower motor resistor with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 7	Go to Step 9
7	Test the blower motor supply voltage circuit between the blower motor relay and the blower motor resistor for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 14	Go to Step 8
8	Test the low, medium 1, and medium 2, blower motor control circuits for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 14	Go to Step 10
9	Inspect for poor connections at the harness connector of the blower motor relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 14	Go to Step 12
10	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 14	Go to Step 13
11	Repair the short to voltage on the blower motor supply voltage circuit between the blower motor and blower motor relay. Refer to Wiring Repairs . Did you complete the repair?	Go to Step 14	-
12	Replace the blower motor relay. Did you complete the replacement?	Go to Step 14	-
13	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement . Did you complete the replacement?	Go to Step 14	-
14	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

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BLOWER MOTOR INOPERATIVE**Test Description**

The numbers below refer to the step numbers in the diagnostic table.

6: There are 2 blower motor supply voltage circuits at the blower motor relay. Probe the circuit that is connected to the blower motor resistor assembly.

7: There are 2 ignition 3 voltage circuits at the HVAC control assembly. Probe the circuit that is the supply voltage to the blower motor switch.

Blower Motor Inoperative

Step	Action	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: The blower motor is inoperative in all speed positions.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Turn ON the ignition, with the engine OFF. 2. Place the mode switch in the vent position. 3. Place the blower motor switch in each speed position. Does the blower motor operate in any speed position?	Go to <u>Blower Motor Malfunction</u>	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the blower motor. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the blower motor supply voltage circuit of the blower motor and a good ground. 5. Place the blower motor switch in the minimum speed position. Does the test lamp illuminate?	Go to Step 4	Go to Step 5
	Test the ground circuit of the blower motor for an open or high resistance. Refer to		

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4	Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 15	Go to Step 9
5	Test the blower motor supply voltage circuit between the blower motor and the blower motor relay for the following: • An open • A high resistance • A short to ground Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 15	Go to Step 6
6	1. Turn OFF the ignition. 2. Disconnect the blower motor relay. 3. Turn ON the ignition, with the engine OFF. 4. Place the blower motor switch in the minimum speed position. 5. Probe the blower motor supply voltage circuit with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 8	Go to Step 7
7	1. Turn OFF the ignition. 2. Disconnect the HVAC control assembly. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the ignition 3 voltage circuit of the HVAC control assembly and a good ground. Does the test lamp illuminate?	Go to Step 10	Go to Step 11
8	Inspect for poor connections at the harness connector of the blower motor relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 15	Go to Step 12

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9	Inspect for poor connections at the harness connector of the blower motor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 15	Go to Step 13
10	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 15	Go to Step 14
11	Repair the ignition 3 voltage circuit of the HVAC control assembly. Refer to Wiring Repairs . Did you complete the repair?	Go to Step 15	-
12	Replace the blower motor relay. Did you complete the replacement?	Go to Step 15	-
13	Replace the blower motor. Refer to Blower Motor Replacement . Did you complete the replacement?	Go to Step 15	-
14	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement Did you complete the replacement?	Go to Step 15	-
15	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

BLOWER MOTOR MALFUNCTION

Test Description

The number below refers to the step number in the diagnostic table.

9: There are 2 blower motor supply voltage circuits at the blower motor relay. Probe the circuit that is connected to the blower motor resistor assembly.

Blower Motor Malfunction

Step	Action	Yes	No
Schematic Reference: HVAC Schematics			
Connector End View Reference: HVAC Connector End Views			
DEFINITION: The blower motor operates in at least one, but not all, speed positions.			

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1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Place the mode switch in the vent position. 3. Place the blower motor switch in each speed position. Does the blower motor operate at the desired speed in each speed position?	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the blower motor. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the blower motor supply voltage circuit of the blower motor and a good ground. 5. Place the blower motor switch in each speed position. Does the test lamp illuminate in each speed position?	Go to Step 14	Go to Step 4
4	Does the test lamp illuminate in the maximum speed position?	Go to Step 9	Go to Step 5
5	1. Turn OFF the ignition. 2. Disconnect the blower motor relay. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the battery positive voltage circuit of the blower motor relay and a good ground. Does the test lamp illuminate?	Go to Step 6	Go to Step 17
	1. Place the blower motor switch in the maximum speed position. 2. Probe the high blower motor control		

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6	circuit of the blower motor relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 8	Go to Step 7
7	Test the high blower motor control circuit of the blower motor relay for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 16
8	Test the ground circuit of the blower motor relay for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 13
9	1. Turn OFF the ignition. 2. Disconnect the blower motor relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the blower motor supply voltage circuit with a test lamp that is connected to a good ground. 5. Place the blower motor switch in the low, medium 1, and medium 2, speed positions. Does the test lamp illuminate in each speed position?	Go to Step 13	Go to Step 10
10	Test the blower motor supply voltage circuit between the blower motor resistor and blower motor relay for the following: • An open • A short to ground • A high resistance Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 11
	IMPORTANT: Place the blower motor switch in the correct speed position for the control circuit that you		

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11	are testing. 1. Turn OFF the ignition. 2. Disconnect the blower motor resistor. 3. Turn ON the ignition, with the engine OFF. 4. Place the blower motor switch in the appropriate speed position for the circuit being tested. 5. Probe the low, medium 1, and medium 2 blower motor control circuits with a test lamp that is connected to good ground. Does the test lamp illuminate in each speed position?	Go to Step 15	Go to Step 12
12	Test the applicable blower motor control circuit of the blower motor resistor for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 16
13	Inspect for poor connections at the harness connector of the blower motor relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 18
14	Inspect for poor connections at the harness connector of the blower motor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 19
15	Inspect for poor connections at the harness connector of the blower motor resistor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 20
16	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent		

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	Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 22	Go to Step 21
17	Repair the battery positive voltage circuit of the blower motor relay. Refer to Wiring Repairs . Did you complete the repair?	Go to Step 22	-
18	Replace the blower motor relay. Did you complete the replacement?	Go to Step 22	-
19	Replace the blower motor. Refer to Blower Motor Replacement . Did you complete the replacement?	Go to Step 22	-
20	Replace the blower motor resistor assembly. Refer to Blower Motor Resistor Replacement . Did you complete the replacement?	Go to Step 22	-
21	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement. Did you complete the replacement?	Go to Step 22	-
22	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

TOO HOT IN VEHICLE**Test Description**

The numbers below refer to the step numbers on the diagnostic table.

4: The HVAC control assembly is inoperative when the assembly does not respond to an operator control request.

5: If the condition does not occur when an air conditioning (A/C) request has been made then you must bypass the A/C performance test procedures.

6: These actions are the enable criteria for the A/C compressor to operate. Ambient air temperature must be above 3°C (38°F) in order for this A/C compressor test to be run.

7: Performing the Air Conditioning System Performance Test ensures that the A/C system is operating properly for further testing.

9: If no condition found with all conditions listed then compare door travel to known good vehicle.

15: The voltage will vary between 0-5 volts during normal operation. Ensure to observe the air temperature actuator driveshaft and the volt meter when jumping the control

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circuit with 5-volt reference and the ground circuits. The air temperature actuator and the HVAC control assembly connectors must be connected during this step.

Too Hot in Vehicle

Step	Action	Values	Yes	No
Schematic Reference: HVAC Schematics DEFINITION: The temperature cannot be adjusted, or the cooling is insufficient during A/C operation.				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in each speed position. Does the blower motor operate at all?	-	Go to Step 3	Go to <u>Blower Motor Inoperative</u>
3	Does the blower motor operate correctly for each speed position?	-	Go to Step 4	Go to <u>Blower Motor Malfunction</u>
4	Is the HVAC control assembly inoperative?	-	Go to Step 18	Go to Step 5
5	Does the Too Hot in Vehicle concern occur when air conditioning (A/C) cooling is desired?	-	Go to Step 6	Go to Step 8
6	IMPORTANT: For A/C compressor operation, the ambient air temperature must be above 3° C (38°F). 1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the A/C request switch in the ON position. 4. Place the air temperature switch in the coldest position. Does the A/C compressor operate?	-	Go to Step 7	Go to <u>HVAC Compressor Clutch Does Not Engage</u>
	Perform the refrigerant system			

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7	performance test. Refer to <u>Air Conditioning (A/C) System Performance Test</u> . Did you find and correct the condition?	-	Go to Step 25	Go to Step 8
8	1. Observe the drive shaft of the air temperature actuator. 2. Adjust the air temperature switch. Does the drive shaft of the air temperature actuator ever rotate?	-	Go to Step 9	Go to Step 10
9	Inspect the air temperature door and the air temperature actuator for the following conditions: • A misaligned air temperature actuator-Refer to <u>Air Temperature Actuator Replacement</u>. • Broken linkages or binding linkages • A broken air temperature door or a binding air temperature door • An obstruction that prevents the air temperature door from operating within the full range of motion • Missing seals to the air temperature door • Misaligned seals to the air temperature door Did you find and correct the condition?	-	Go to Step 25	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>
10	Test the ignition 1 voltage circuit of the air temperature actuator for an open or for a high resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> . Did you find and correct the	-	Go to Step	

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	condition?		25	Go to Step 11
11	Test the ground circuit of the air temperature actuator for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 12
12	Test the 5-volt reference circuit of the air temperature actuator for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 13
13	Test the signal circuit of the air temperature door actuator for an open or a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 14
14	Test the door control circuit of the air temperature actuator an open or a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 15
15	IMPORTANT: Ensure the air temperature actuator connector and the HVAC control assembly connectors are connected during this step to avoid misdiagnosis. 1. Turn ON the ignition, with the engine OFF. 2. Backprobe and monitor the voltage from the door signal circuit of the air temperature actuator to a good ground. 3. Connect a 3-amp fused jumper between the door control circuit and the 5-volt reference circuit of the air temperature actuator. This action drives the actuator to the full COOL mode.	-		

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	4. Remove and reconnect the jumper wire between the air temperature door control and the ground circuit of the air temperature actuator. This action drives the actuator to the full HOT mode. Does the drive shaft of the air temperature actuator rotate and does the voltage change?		Go to Step 16	Go to Step 20
16	IMPORTANT: Ensure the air temperature actuator connector is connected during this step to avoid misdiagnosis. 1. Backprobe the connector terminal of the air temperature actuator in order to measure the voltage from the door control circuit to ground. 2. Adjust the air temperature switch. Is the voltage measurement near the specified value in each condition?	0 V increasing 5 V decreasing 2.5 V stationary	Go to Step 17	Go to Step 22
17	Inspect the air temperature door for a mechanical condition or for a condition that allows excessive travel of the door. Did you find and correct the condition?	-	Go to Step 25	-
18	Test the ignition 1 voltage circuit of the HVAC control assembly for the following: • An open • A high resistance • A short to ground Refer to Circuit Testing and to Wiring Repairs.	-		

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	Did you find and correct the condition?		Go to Step 25	Go to Step 19
19	Test the ground circuit of the HVAC control assembly for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 22
20	Inspect for poor connections at the harness connector of the air temperature actuator. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 21
21	Inspect the air temperature actuator, the door, and any attaching linkage for binding or for a condition that prevents drive shaft rotation. Did you find and correct the condition?	-	Go to Step 25	Go to Step 23
22	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 25	Go to Step 24
23	IMPORTANT: Perform the calibration procedure for the air temperature actuator. Replace the air temperature actuator. Refer to Air Temperature Actuator Replacement . Did you complete the replacement?	-	Go to Step 25	-
24	IMPORTANT: Perform the calibration procedure for the HVAC control assembly. Replace the HVAC control assembly. Refer to HVAC Control Assembly	-		

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	Replacement. Did you complete the replacement?		Go to Step 25	-
25	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

TOO COLD IN VEHICLE**Test Description**

The numbers below refer to the step numbers on the diagnostic table.

4: The HVAC control assembly is inoperative when the assembly does not respond to an operator control request.

8: If no condition found with all conditions listed then compare door travel to known good vehicle.

14: The voltage will vary between 0-5 volts during normal operation. Ensure to observe the air temperature actuator driveshaft and the volt meter when jumping the control circuit with 5-volt reference and the ground circuits. The air temperature actuator and the HVAC control assembly connectors must be connected during this step.

Too Cold in Vehicle

Step	Action	Values	Yes	No
Schematic Reference: HVAC Schematics				
DEFINITION: The temperature cannot be adjusted or the heating is insufficient.				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in each speed position. Does the blower operate in any of the speed positions?	-	Go to Step 3	Go to Blower Motor Inoperative
3	Does the blower motor operate correctly for each speed position?	-	Go to Step 4	Go to Blower Motor Malfunction
4	Is the HVAC control assembly inoperative?	-	Go to Step 17	Go to Step 5

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5	Inspect the cooling system for the following: • A low coolant level • A loose or worn accessory drive belt • Leaking radiator hoses or leaking heater hoses • Kinked radiator hoses or kinked heater hoses • A missing radiator cap pressure seal • A leaking radiator cap Did you find and correct the condition?	-		Go to Step 24	Go to Step 6
6	1. Start the engine. 2. Place the blower motor switch in the OFF position. 3. Place the air conditioning (A/C) request switch in the OFF position. Does the A/C compressor operate?	-		Go to HVAC Compressor Clutch Does Not Disengage	Go to Step 7
7	1. Turn ON the ignition, with the engine OFF. 2. Observe the drive shaft of the air temperature door actuator. 3. Adjust the air temperature switch. Does the drive shaft of the air temperature door actuator ever rotate?	-		Go to Step 8	Go to Step 9
	Inspect the air temperature door and the air temperature door actuator for the following conditions: • A misaligned actuator on the air temperature door				

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8	• Broken linkages or binding linkages • A broken air temperature door or a binding air temperature door • An obstruction that prevents the air temperature door from operating within the full range of motion • Missing seals to the air temperature door • Misaligned seals to the air temperature door Did you find and correct the condition?	-	-	-	Go to Heating Performance Diagnostic
9	Test the ignition 1 voltage circuit of the air temperature actuator for an open or for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	-	-	Go to Step 24 Go to Step 10
10	Test the ground circuit of the air temperature actuator for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	-	-	Go to Step 24 Go to Step 11
11	Test the 5-volt reference circuit of the air temperature actuator for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	-	-	Go to Step 24 Go to Step 12
12	Test the signal circuit of the air temperature actuator for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	-	-	Go to Step 24 Go to Step 13

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13	Test the control circuit of the air temperature actuator for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 24	Go to Step 14
14	IMPORTANT: Ensure the air temperature actuator connector and the HVAC control module connector are connected during this step in order to avoid misdiagnosis. 1. Turn ON the ignition, with the engine OFF. 2. Backprobe and monitor the voltage from the signal circuit of the air temperature door actuator to a good ground. 3. Connect a 3-ampere fused jumper between the control circuit and the 5-volt reference circuit of the air temperature door actuator. This action drives the actuator to the full COOL mode. 4. Remove and reconnect the jumper wire between the air temperature door control and the ground circuit of the air temperature actuator. This action drives the actuator to the full HOT mode. Does the drive shaft of the air temperature door actuator rotate and does the voltage change?	-	Go to Step 15	Go to Step 19
15	IMPORTANT: Ensure the air temperature actuator connector is connected during this step in order to avoid misdiagnosis. 1. Backprobe the connector terminal to the air temperature actuator in order to measure the	0 V increasing 5 V		

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	voltage from the control circuit to ground. 2. Adjust the air temperature switch. Is the voltage measurement near the specified value for each condition?	decreasing 2.5 V stationary		
			Go to Step 16	Go to Step 21
16	Inspect the air temperature door for a mechanical condition or for a condition that allows excessive travel of the door. Did you complete the repair?	-	Go to Step 24	-
17	Test the ignition 1 voltage circuit of the HVAC controller for the following: • An open • A high resistance • A short to ground Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 24	Go to Step 18
18	Test the ground circuit of the HVAC controller for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 24	Go to Step 21
19	Inspect for poor connections at the harness connector of the air temperature actuator. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 24	Go to Step 20
20	Inspect the air temperature actuator, the door, and any attaching linkage, for binding or for a condition that prevents drive shaft rotation.	-		

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	Did you find and correct the condition?		Go to Step 24	Go to Step 22
21	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 24	Go to Step 23
22	IMPORTANT: Perform the calibration procedure for the air temperature actuator. Replace the air temperature door actuator. Refer to Air Temperature Actuator Replacement . Did you complete the replacement?	-	Go to Step 24	-
23	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement . Did you complete the replacement?	-	Go to Step 24	-
24	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

AIR DELIVERY IMPROPER

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for a blower motor that does not operate regardless of the desired blower motor speed.

4: This step tests for a blower motor that operates, yet does not accurately respond to the desired blower motor speed.

5: This step verifies that there is power to the HVAC control assembly.

13: The voltage will vary between 0-5 volts during normal operation. The HVAC control assembly connector must be connected during this step.

Air Delivery Improper

Step	Action	Values	Yes	No
Schematic Reference: <u>HVAC Schematics</u>				

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Connector End View Reference: HVAC Connector End Views

DEFINITION: Air does not flow correctly from the air distribution outlets.

1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor control in the OFF position. Is the blower motor OFF?	-	Go to Step 3	Go to <u>Blower Motor Always On</u>
3	Place the blower motor control in each speed position. Does the blower motor operate at all?	-	Go to Step 4	Go to <u>Blower Motor Inoperative</u>
4	Does the blower motor operate correctly for each speed position?	-	Go to Step 5	Go to <u>Blower Motor Malfunction</u>
5	Is the HVAC control assembly inoperative in all positions?	-	Go to Step 6	Go to Step 16
6	1. Observe the drive shaft of mode actuator. 2. Place the mode control in each mode position. Does the mode actuator drive shaft rotate for each selected position?	-	Go to Step 7	Go to Step 8
7	Inspect the mode door and the mode actuator for the following conditions: • Misaligned mode actuator • Broken linkages or binding linkages • A broken mode door or a binding mode door • An obstruction that prevents the mode door from operating within the full range of motion	-		Go to <u>Testing for Intermittent Conditions</u>

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	Did you find and correct the condition?		Go to Step 23	and Poor Connections
8	Test the ignition 1 voltage circuit of the mode actuator for an open or for a high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 9
9	Test the ground circuit of the mode actuator for an open or high resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 10
10	Test the 5-volt reference circuit of the mode actuator for the following: • A short to ground • A short to voltage • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 11
11	Test the signal circuit of the mode door actuator for the following: • A short to ground • A short to voltage • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 12
	Test the mode door control circuit of the mode actuator for the following:			

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12	• A short to ground • A short to voltage • A high resistance • An open Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 13
13	IMPORTANT: Connect the mode actuator connector and the HVAC controller connector in order to correctly perform the test. 1. Turn ON the ignition, with the engine OFF. 2. Backprobe and monitor the voltage from the signal circuit of the mode door actuator with a test lamp that is connected to ground. 3. Connect a 3-ampere fused jumper between the mode door control circuit and the 5-volt reference circuit of the mode actuator. This action drives the motor to FLR mode. 4. Remove and reconnect the jumper between the mode door control circuit and the ground circuit of the mode actuator. This action drives the motor to DEF mode. Does the mode actuator drive shaft rotate and does the voltage change?	-	Go to Step 14	Go to Step 18
14	1. Backprobe the mode actuator connector terminal in order to measure the voltage from the mode door control circuit to ground.	0 V toward DEF 5 V toward		

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	2. Place the mode control in each mode position. Is the voltage measurement near the specified values for each setting?	FLR 2.5 V stationary	Go to Step 15	Go to Step 20
15	Inspect the mode door for a mechanical condition or for a condition that allows excessive travel to the door. Did you find and correct the condition?	-	Go to Step 23	-
16	Test the ignition 1 voltage circuit of the HVAC controller for an open, for a high resistance or for a short to ground. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 17
17	Test the ground circuit of the HVAC controller for an open. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 20
18	Inspect for bad connections at the harness connector of the mode actuator. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 19
19	1. Inspect the mode door and any attaching linkage for any binding. 2. Inspect the duct work for any debris that would prevent airflow through the duct work. Did you find and correct the condition?	-	Go to Step 23	Go to Step 21
	Inspect for bad connections at the			

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20	harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	-	Go to Step 23	Go to Step 22
21	Replace the mode actuator. Refer to Mode Cam Replacement . Did you complete the replacement?	-	Go to Step 23	-
22	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement . Did you complete the replacement?	-	Go to Step 23	-
23	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

AIR RECIRCULATION MALFUNCTION**Test Description**

The number below refers to the step number on the diagnostic table.

6: The HVAC control assembly is supplied by 2 voltage circuits. Test both voltage circuits.

Air Recirculation Malfunction

Step	Action	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: Air recirculation is inoperative or is always ON.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle
	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch at the maximum speed position. 3. Place the mode switch in the vent position. 4. Place the recirculation switch in the		

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2	ON position. 5. Observe the recirculation door. 6. Place the recirculation switch in the OFF position. Does the recirculation door move from the recirculation to the outside air position?	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the recirculation actuator. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between recirculation door control A and recirculation door control B of the recirculation actuator connector. 5. Place the blower motor switch in the maximum speed position. 6. Place the mode switch in the vent position. 7. Place the recirculation switch in the ON position. 8. Place the recirculation switch in the OFF position. Does the test lamp illuminate in both, recirculation and ambient air, positions?	Go to Step 5	Go to Step 4
4	Test the recirculation door control A and B circuits of the recirculation actuator for an open, for a high resistance, for a short to ground, or for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 12	Go to Step 6
	Inspect the recirculation door and the recirculation actuator for the following conditions: • A misaligned recirculation actuator- Refer to Recirculation Actuator Replacement. • Broken or binding linkages or recirculation door		

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5	• An obstruction that prevents the recirculation actuator from operating within the full range of motion • Missing seals to the recirculation door • Misaligned seals to the recirculation door Did you find and correct the condition?	Go to Step 12	Go to Step 8
6	Test the voltage supply circuits of the HVAC control assembly for an open or for a high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 12	Go to Step 7
7	Test the ground circuit of the HVAC control assembly for an open or for a high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	Go to Step 12	Go to Step 9
8	Inspect for bad connections at the harness connector of the recirculation actuator. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 12	Go to Step 10
9	Inspect for bad connections at the harness connector of the HVAC control assembly. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	Go to Step 12	Go to Step 11
10	Replace the recirculation actuator. Refer to Recirculation Actuator Replacement. Did you complete the replacement?	Go to Step 12	-
11	Replace the HVAC control assembly. Refer to HVAC Control Assembly Replacement. Did you complete the replacement?	Go to Step 12	-
12	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

HVAC CONTROL ASSEMBLY REPLACEMENT

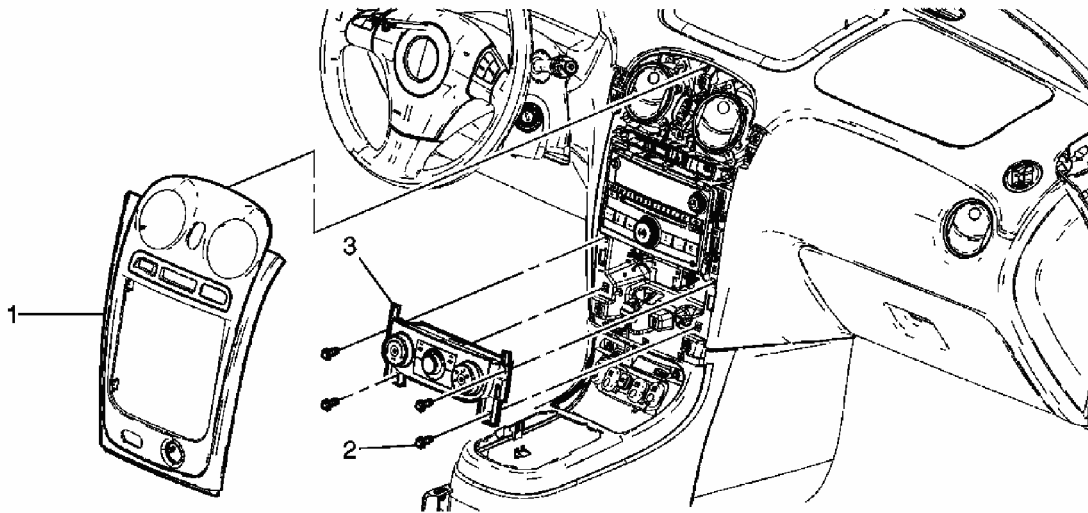


Fig. 17: HVAC Control Assembly Replacement
Courtesy of GENERAL MOTORS CORP.

HVAC Control Assembly Replacement

Callout	Component Name
NOTE: Refer to Fastener Notice .	
Fastener Tightening Specifications: Refer to Fastener Tightening Specifications . Preliminary Procedure: Remove the lower instrument panel (I/P) retainer. Refer to Instrument Panel (I/P) Retainer Replacement .	
1	I/P Accessory Trim Plate Remove the accessory trim plate. Refer to Trim Plate Replacement - Instrument Panel (I/P) Accessory .
2	Screw, HVAC Control Module (Qty: 4) Tighten: 2.5 N.m (22 lb in)
3	HVAC Control Module

AIR TEMPERATURE ACTUATOR REPLACEMENT

Removal Procedure

1. Remove the fuse labeled HVAC CTRL (BATT).
2. Remove the knee bolster reinforcement. Refer to **Knee Bolster Reinforcement**

Replacement .

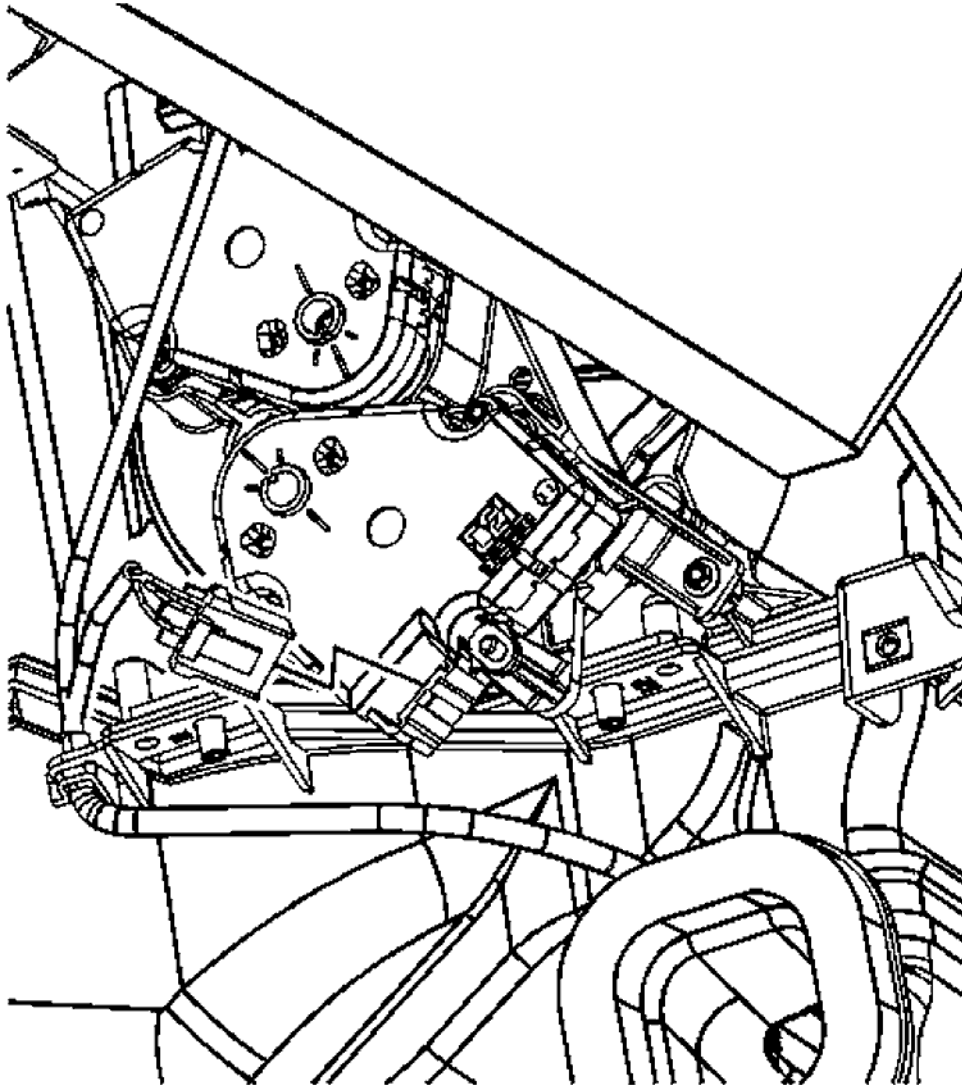


Fig. 18: Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the air temperature actuator electrical connector.

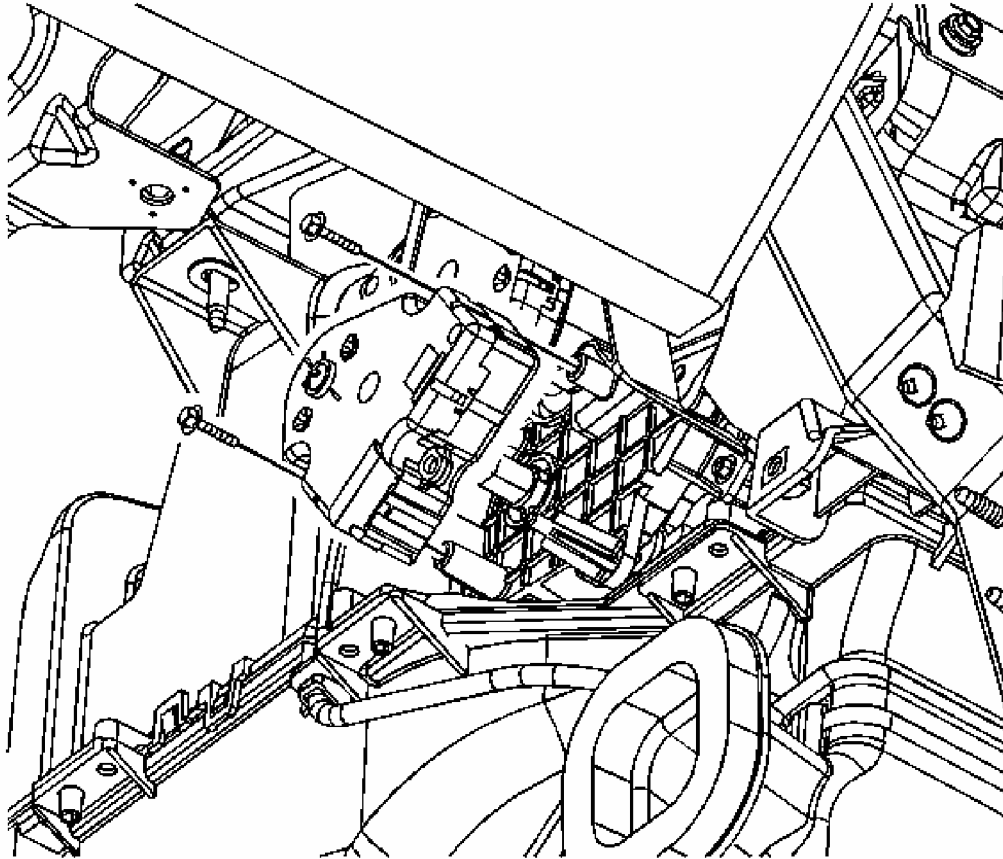


Fig. 19: Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

4. Remove the air temperature actuator screws.
5. Remove the air temperature actuator.

Installation Procedure

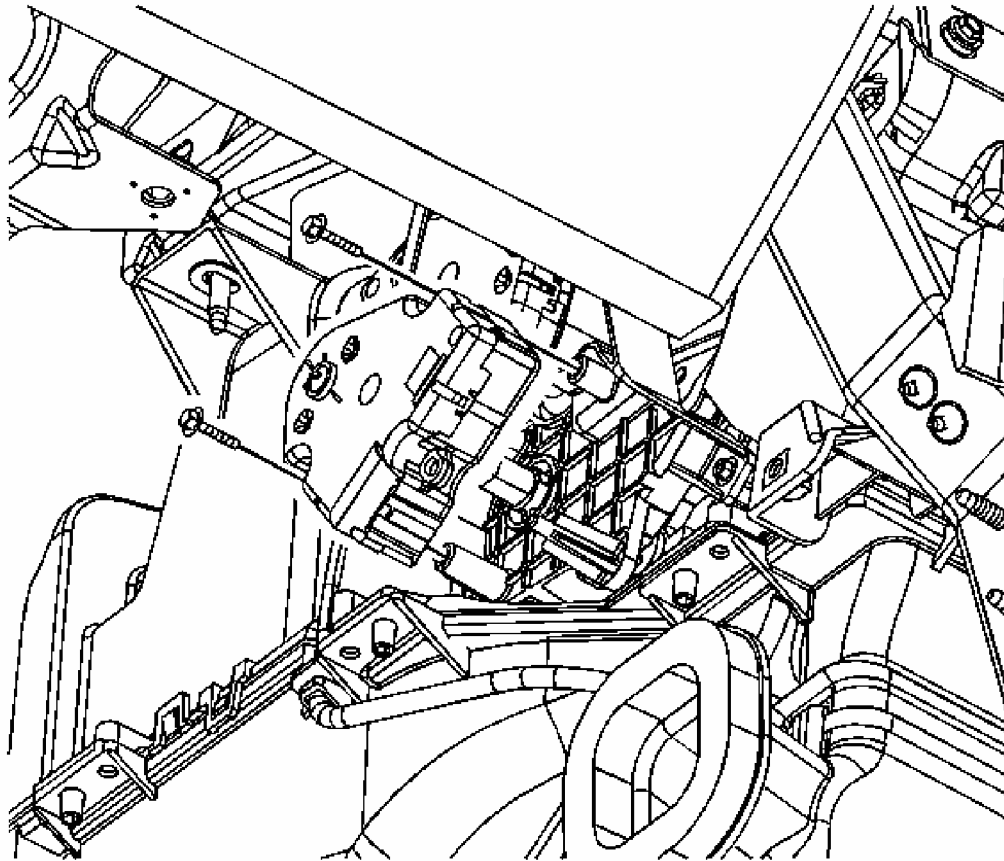


Fig. 20: Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The key should be in the OFF position when connecting the electrical connectors to ensure proper calibration.

1. Install the air temperature actuator.

NOTE: Refer to Fastener Notice .

2. Install the air temperature actuator screws.

Tighten: Tighten the screws to 2.2 N.m (19 lb in).

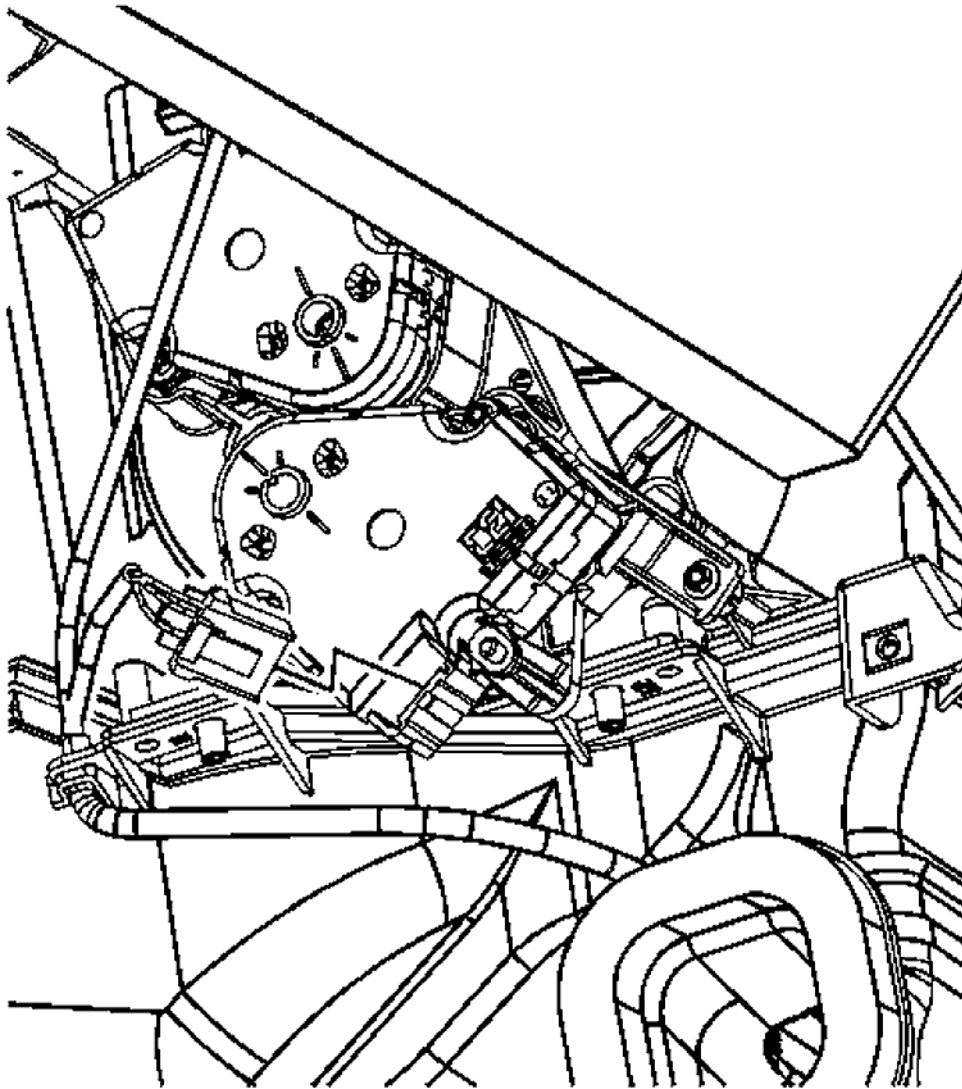


Fig. 21: Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

3. Install the air temperature actuator electrical connector.
4. Install the knee bolster reinforcement. Refer to **Knee Bolster Reinforcement Replacement**.
5. Install the fuse labeled HVAC CTRL (BATT).

IMPORTANT: Do not adjust any controls on the HVAC control assembly while the HVAC control assembly and actuators are

calibrating. If interrupted improper HVAC performance will result.

6. Start the engine and let run for one minute.

MODE CAM REPLACEMENT

Removal Procedure

1. Remove the air temperature actuator. Refer to **Air Temperature Actuator Replacement**.

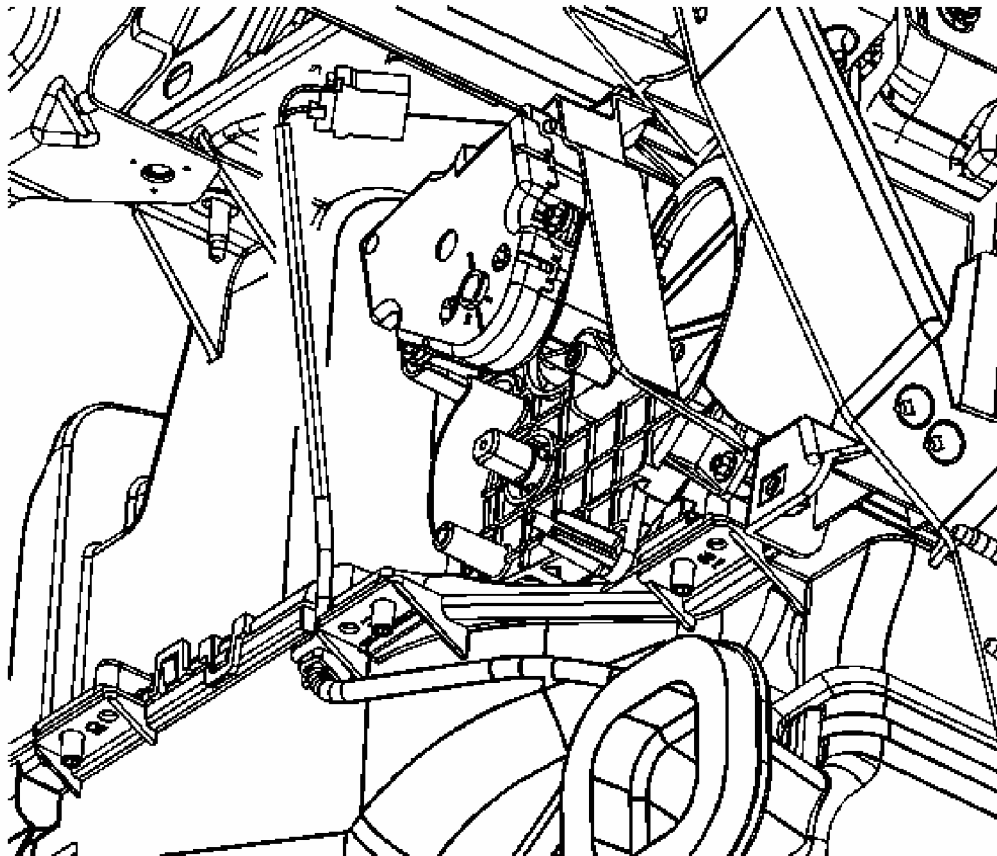


Fig. 22: Mode Actuator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the mode actuator electrical connector.

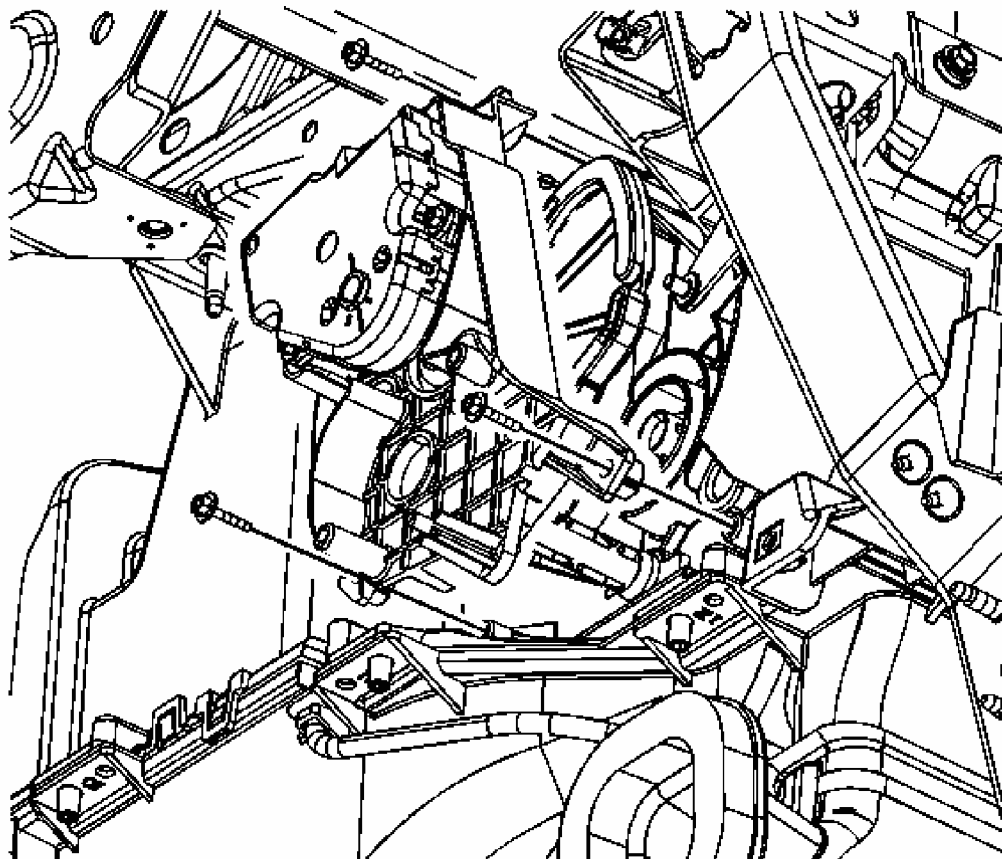


Fig. 23: Mode Actuator Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the mode actuator assembly screws.
4. Remove the mode actuator assembly.

Installation Procedure

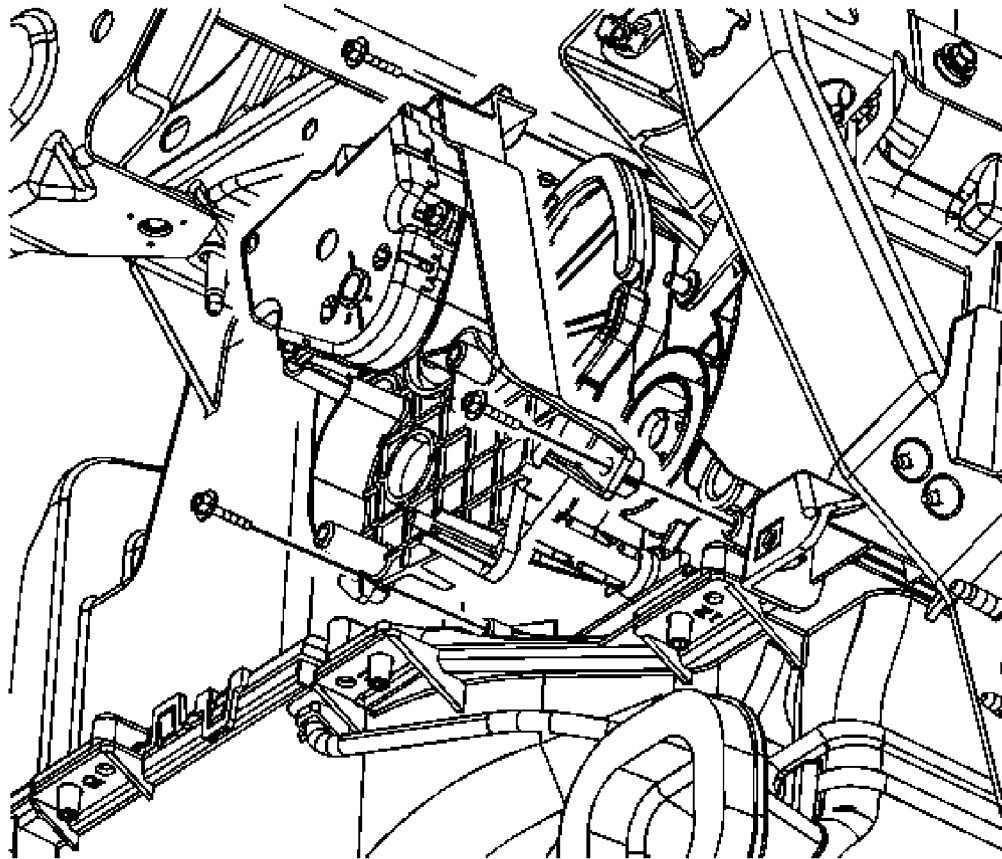


Fig. 24: Mode Actuator Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The key should be in the OFF position when connecting the electrical connectors to ensure proper calibration.

1. Install the mode actuator assembly.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the mode actuator assembly screws.

Tighten: Tighten the screws to 2.2 N.m (19 lb in).

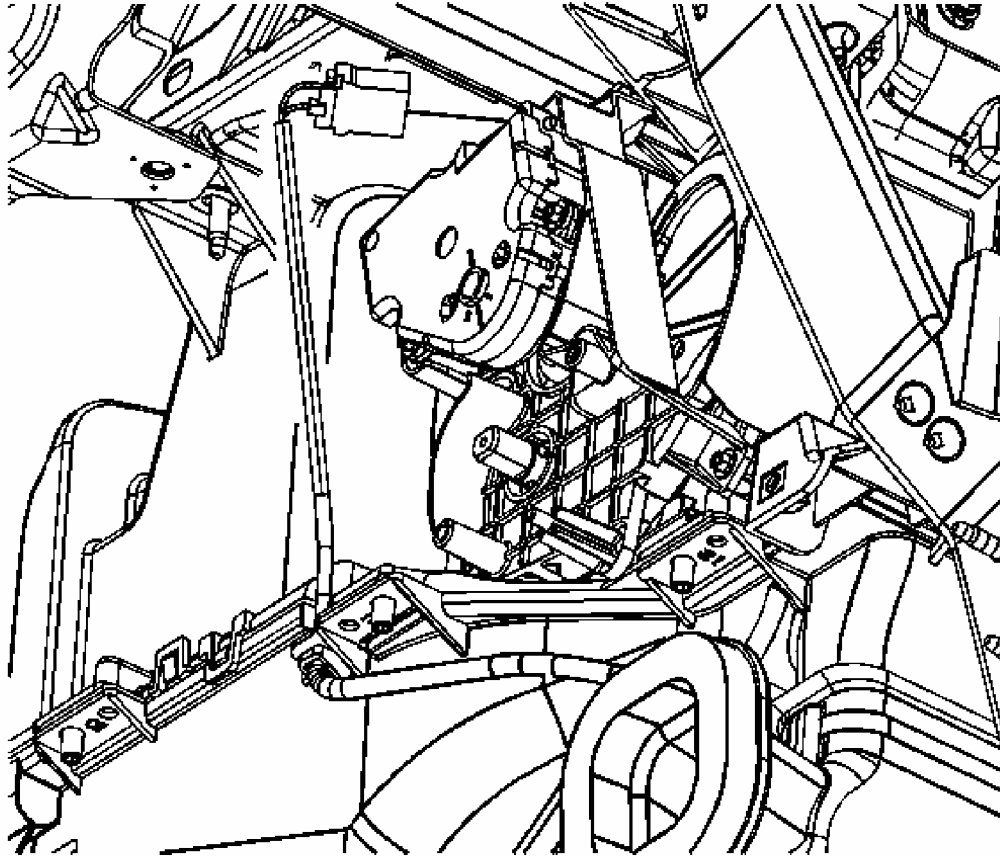


Fig. 25: Mode Actuator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Install the mode actuator electrical connector.
4. Install the air temperature actuator. Refer to **Air Temperature Actuator Replacement**.

IMPORTANT: Do not adjust any controls on the HVAC control assembly while the HVAC control assembly and actuators are calibrating. If interrupted improper HVAC performance will result.

5. Start the engine and let run for one minute.

RECIRCULATION ACTUATOR REPLACEMENT

Removal Procedure

1. Remove the fuse labeled HVAC CTRL (BATT).
2. Remove the instrument panel (I/P) retainer. Refer to **Instrument Panel (I/P) Retainer Replacement**.

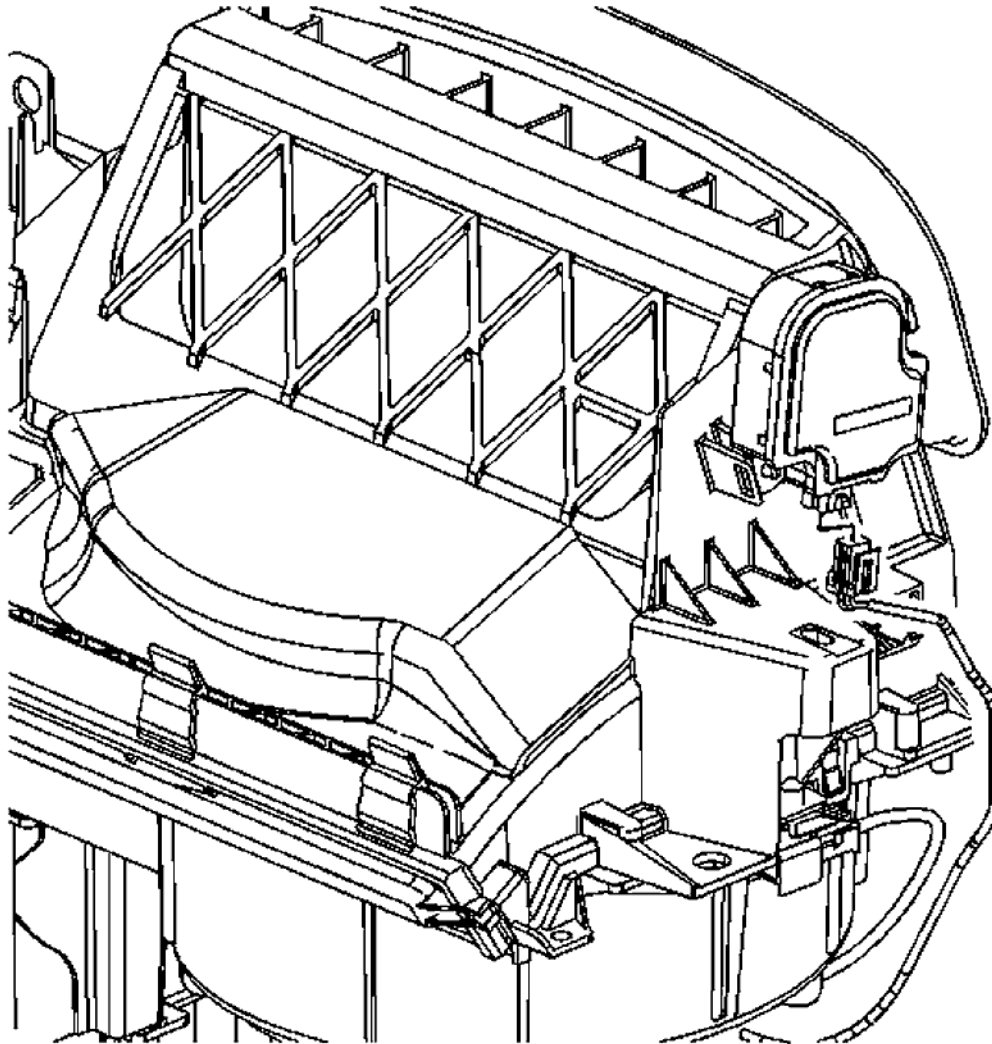


Fig. 26: Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the recirculation actuator electrical connector.

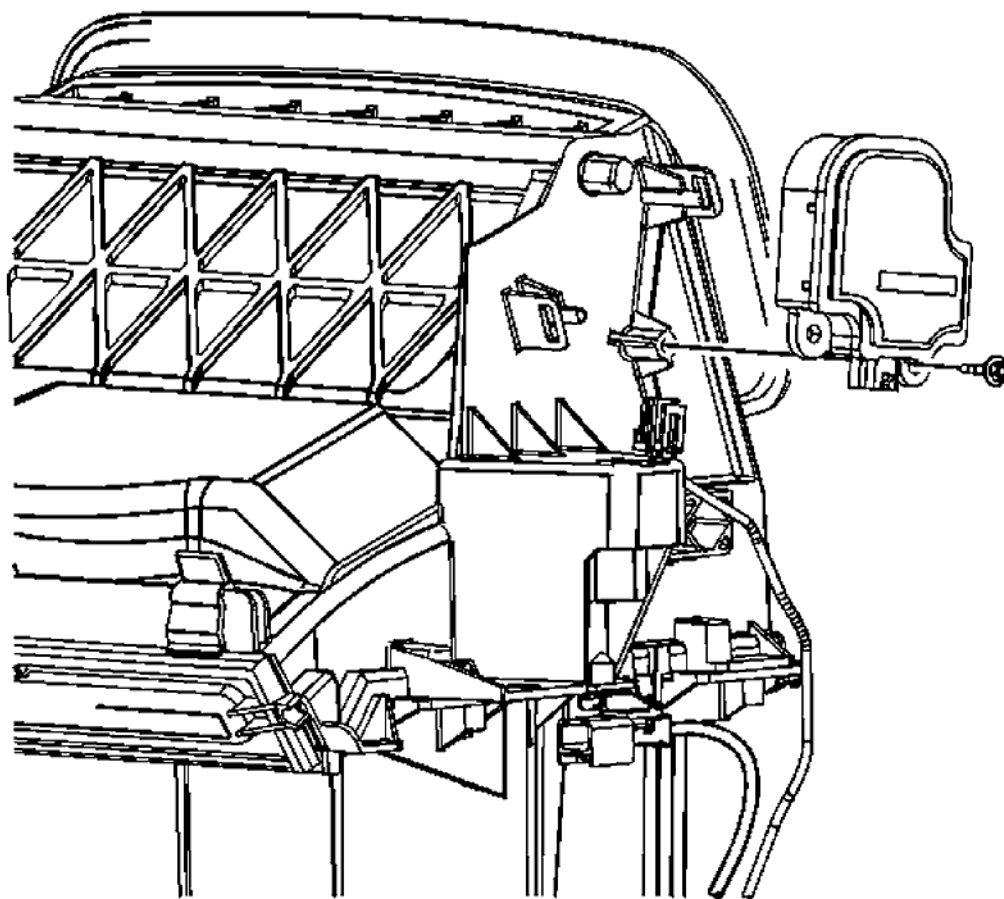


Fig. 27: Recirculation Actuator
Courtesy of GENERAL MOTORS CORP.

4. Remove the recirculation actuator screw.
5. Remove the recirculation actuator.

Installation Procedure

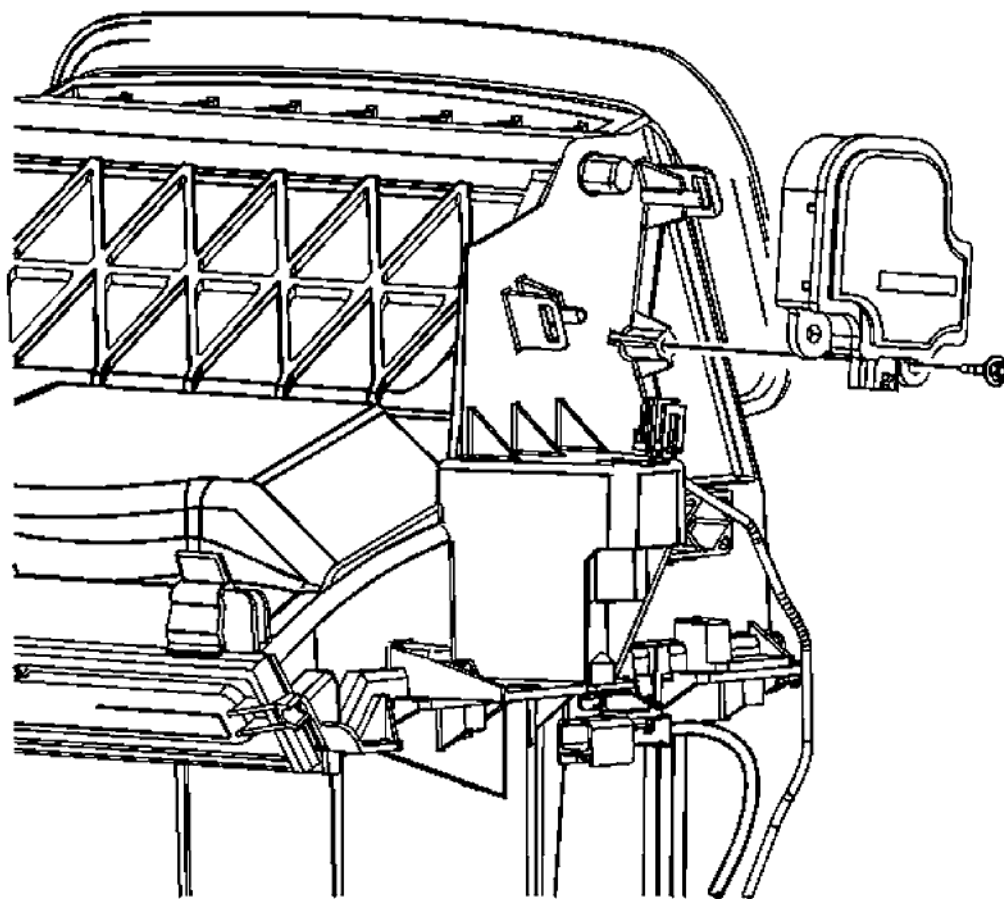


Fig. 28: Recirculation Actuator
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The key should be in the OFF position when connecting the electrical connectors to ensure proper calibration.

1. Install the recirculation actuator.

NOTE: Refer to Fastener Notice .

2. Install the recirculation actuator screw.

Tighten: Tighten the screw to 2.2 N.m (19 lb in).

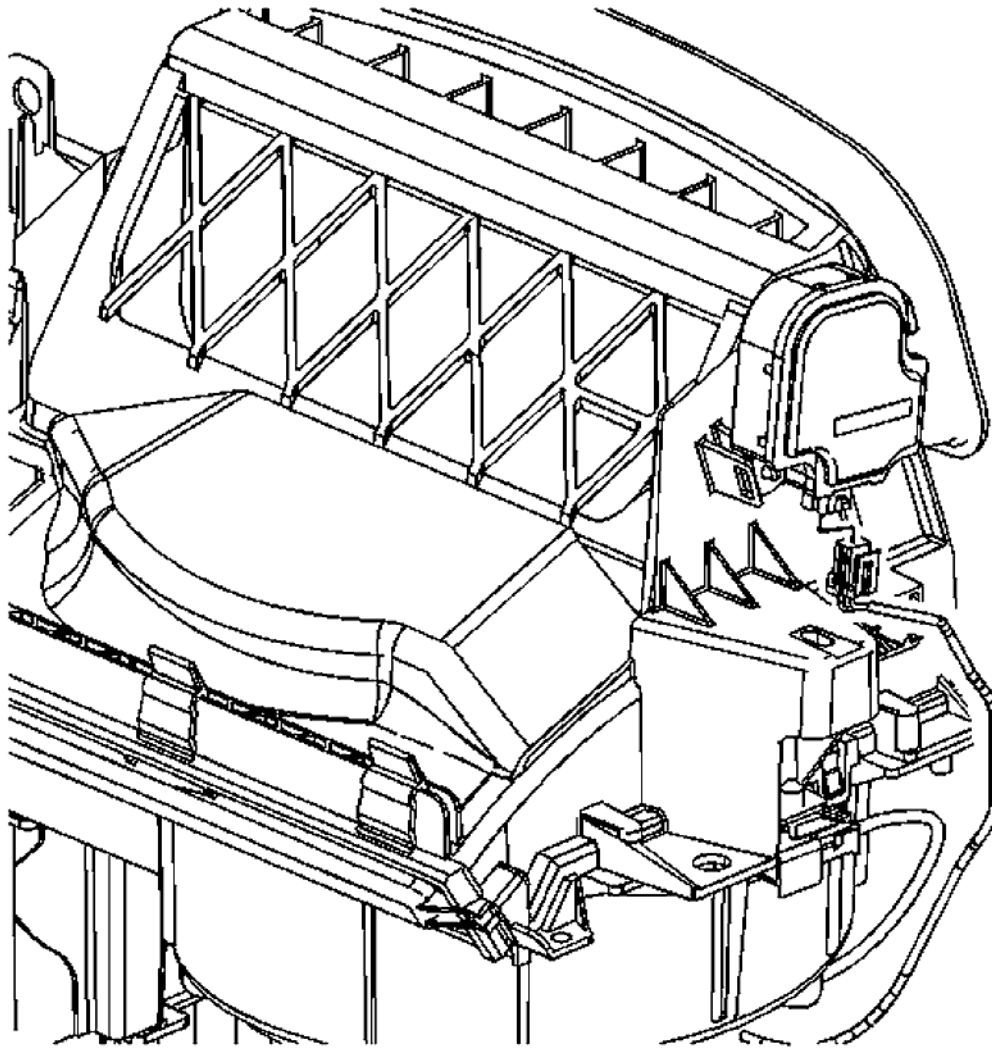


Fig. 29: Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Install the recirculation electrical connector.
4. Install the I/P retainer. Refer to Instrument Panel (I/P) Retainer Replacement .
5. Install the fuse labeled HVAC CTRL (BATT).

IMPORTANT: Do not adjust any controls on the HVAC control assembly while the HVAC control assembly and actuators are calibrating. If interrupted improper HVAC performance will result.

6. Start the engine and let run for 1 minute.

DESCRIPTION AND OPERATION

AIR DELIVERY DESCRIPTION AND OPERATION

The air delivery controls are divided into 4 areas:

- HVAC Control Components
- Air Speed
- Air Distribution
- Recirculation Operation

HVAC Control Components

HVAC Control Assembly

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. The battery positive and ignition 3 voltage circuits provide power to the control module. The HVAC control assembly during defrost mode will change the a/c compressor LED status from on to off. The control head displays recirc, outside air, a/c and rear defrost feedback status through LED indicators. The HVAC control head will display NO COMMUNICATION when checking DTCs or doing a vehicle diagnostic system check refer to **Diagnostic Trouble Code (DTC) List - Vehicle** and **Diagnostic System Check - Vehicle** . The control module supports the following features:

Air Delivery Description and Operation

Feature	Availability
Afterblow	Dealer turn on feature
Purge	Yes
Personalization	No
Actuator Calibration	Yes

Mode Actuator

The air temperature actuators are a 5-wire bi-directional electric motor that incorporates a feedback potentiometer. Ignition 3 voltage, low reference, control, 5-volt reference and position signal circuits enable the actuator to operate. The control circuit uses either a 0, 2.5, or 5-volt signal to command the actuator movement. When the actuator is at rest, the control circuit value is 2.5 volts. A 0 or 5-volt control signal commands the actuator movement in opposite directions. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

The HVAC control module uses a range of 0-255 counts to index the actuator position. The door position signal voltage is converted to a 0-255 count range. When the module sets a commanded, or targeted, value, the control signal is changed to either 0 or 5 volts depending upon the direction that the actuator needs to rotate to reach the commanded value. As the actuator shaft rotates, the changing position signal is sent to the module. Once the position signal and the commanded value are the same, the module changes the control signal to 2.5 volts.

Recirculation Actuator

The recirculation actuator is a 2-wire bi-directional electric motor. Two control circuits enable the actuator to operate. The control circuits use either a 0 or 12-volt value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 volts. In order to move the actuator, the HVAC control module grounds the appropriate control circuit for the commanded direction. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction.

The HVAC control module determines the door position by counting motor pulses on one of the control circuits. These pulses are small voltage fluctuations that occur when the brush is shorted across 2 commutator contacts as the motor rotates. As the actuator shaft rotates, the HVAC control module monitors the voltage drop across an internal resistance to detect the pulses. The HVAC control module converts the pulses to counts with a range of 0 to 255 counts. The HVAC control module uses a range of 0-255 counts to index the actuator position.

Air Speed

The HVAC control module applies voltage to the blower motor control circuit that corresponds to the selected blower speed. The resistors and the blower motor are in a series circuit. The following list represents the number of resistors in series with the blower motor per particular speed request:

- Low speed - 4 resistors
- Medium 1 speed - 3 resistors
- Medium 2 speed - 2 resistors

When the operator requests High speed, the HVAC control module applies voltage to the blower motor relay through the high blower motor control circuit. The voltage energizes the blower motor relay, connecting the blower motor to battery positive voltage.

Afterblow

The afterblow is a dealer turn on option. It is inactive in a new vehicle. The afterblow relay resides in the IBCM. The IBCM will directly turn on the hi blower fan relay to start the afterblow process.

Air Distribution

The HVAC control module controls the mode actuator in order to distribute airflow to a desired outlet. When the mode switch is moved to the bi-level through defrost positions, the A/C compressor clutch engages and the recirculation actuator will be moved to the outside air position.

Recirculation Operation

The HVAC control module controls the air intake through the recirculation actuator. Recirculation is not available when the mode is in bi-level through defrost. The operator must activate the blower for Recirculation operation. When recirculation is selected the A/C compressor will be engaged automatically.

AIR TEMPERATURE DESCRIPTION AND OPERATION

The air temperature controls are divided into 4 areas:

- HVAC Control Components
- Heating and A/C Operation
- Engine Coolant
- A/C Cycle

HVAC Control Components**HVAC Control Assembly**

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. The battery positive and ignition 3 voltage circuits provide power to the assembly. The control assembly supports the following features:

Air Temperature Description and Operation

Feature	Availability
Afterblow	No
Purge	No
Personalization	No
Actuator Calibration	No

Air Temperature Actuator

The air temperature actuators are a 5-wire bi-directional electric motor that incorporates a feedback potentiometer. Ignition 3 voltage, low reference, control, 5-volt reference and position signal circuits enable the actuator to operate. The control circuit uses either a 0, 2.5, or 5-volt signal to command the actuator movement. When the actuator is at rest, the control

circuit value is 2.5 volts. A 0 or 5-volt control signal commands the actuator movement in opposite directions. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

The HVAC control module uses a range of 0-255 counts to index the actuator position. The door position signal voltage is converted to a 0-255 count range. When the module sets a commanded, or targeted, value, the control signal is changed to either 0 or 5 volts depending upon the direction that the actuator needs to rotate to reach the commanded value. As the actuator shaft rotates, the changing position signal is sent to the module. Once the position signal and the commanded value are the same, the module changes the control signal to 2.5 volts.

A/C Refrigerant Pressure Sensor

The A/C refrigerant pressure sensor is a 3-wire piezoelectric pressure transducer. A 5-volt reference, low reference, and signal circuits enable the sensor to operate. The A/C pressure signal can be between 0-5 volts. When the A/C refrigerant pressure is low, the signal value is near 0 volts. When the A/C refrigerant pressure is high, the signal value is near 5 volts. The engine control module (ECM) converts the voltage signal to a pressure value.

The A/C refrigerant pressure sensor protects the A/C system from operating when an excessively high or low pressure condition exists. The ECM disables the compressor clutch under the following conditions:

A/C pressure is more than 2,951 kPa (428 psi). The clutch will be enabled after the pressure decreases to less than 2,068 kPa (300 psi). A/C high side pressure is less than 310 kPa (44 psi). The clutch will be enabled after the A/C high side pressure increases to more than 310 kPa (44 psi).

A/C Low Pressure Switch

The A/C low pressure switch protects the A/C system from a low pressure condition that could damage to the A/C compressor or cause evaporator icing. The HVAC control module applies 12 volts to the A/C low pressure switch signal circuit. The switch will open when the A/C low side pressure reaches 124 kPa (18 psi). This prevents the A/C compressor from operating. The switch will then close when A/C low pressure side reaches 275 kPa (40 psi). This enables the A/C compressor to turn back ON.

Heating and A/C Operation

The purpose of the heating and A/C system is to provide heated and cooled air to the interior of the vehicle. The A/C system will also remove humidity from the interior and reduce windshield fogging. The vehicle operator can determine the passenger compartment temperature by adjusting the air temperature switch. Regardless of the temperature setting, the following can effect the rate that the HVAC system can achieve the desired temperature:

- Recirculation
- Difference between inside and desired temperature
- Difference between ambient and desired temperature
- Blower motor speed setting
- Mode setting

The vehicle operator can activate the A/C system by pressing the A/C switch. The A/C system can operate regardless of the temperature setting.

The ECM will operate the A/C system automatically in FRONT DEFROST mode to help reduce moisture inside the vehicle. The A/C LED will not illuminate unless the driver presses the A/C request switch on the HVAC control assembly. The A/C system maybe running without the A/C LED indicator illuminated when in FRONT DEFROST mode. The following conditions must be met in order for the ECM to turn ON the compressor clutch:

- Body control module (BCM)
 - Battery voltage is between 9-16 volts.
 - A/C request from the HVAC control assembly
- ECM
 - Engine coolant temperature (ECT) is less than 123°C (253°F).
 - Engine speed is less than 5,300 RPM.
 - Engine speed is more than 600 RPM.
 - A/C high side pressure is between 2951-310 kPa (428-44 psi).

Once engaged, the compressor clutch will be disengaged for the following conditions:

- Throttle position is 100 percent for 10 seconds.
- A/C high side pressure is more than 2951 kPa (428 psi) and will reengage once the pressure drops below 2068 kPa (300 psi).
- A/C high side pressure is less than 310 kPa (44 psi).
- ECT is more than 123°C (253°F).
- Engine speed is less than 475 RPM.
- Engine speed is more than 6,000 RPM.
- ECM detects excessive torque load.
- ECM detects insufficient idle quality.

When the compressor clutch disengages, the compressor clutch diode protects the electrical system from a voltage spike.

Engine coolant is the key element of the heating system. The thermostat controls engine operating coolant temperature. The thermostat also creates a restriction for the cooling system that promotes a positive coolant flow and helps prevent cavitation. Coolant enters the heater core through the inlet heater hose, in a pressurized state.

The heater core is located inside the HVAC module. The heat of the coolant flowing through the heater core is absorbed by the ambient air drawn through the HVAC module. Heated air is distributed to the passenger compartment, through the HVAC module, for passenger comfort.

The amount of heat delivered to the passenger compartment is controlled by opening or closing the HVAC module air temperature door. The coolant exits the heater core through the return heater hose and is recirculated back through the engine cooling system.

A/C Cycle

Refrigerant is the key element in an air conditioning system. R-134a is presently the only EPA approved refrigerant for automotive use. R-134a is a very low temperature gas that can transfer the undesirable heat and moisture from the passenger compartment to the outside air.

The A/C compressor is belt driven and operates when the magnetic clutch is engaged. The compressor builds pressure on the vapor refrigerant. Compressing the refrigerant also adds heat to the refrigerant. The refrigerant is discharged from the compressor, through the discharge hose, and forced to flow to the condenser and then through the balance of the A/C system. The A/C system is mechanically protected with the use of a high pressure relief valve. If the high pressure switch were to fail or if the refrigerant system becomes restricted and refrigerant pressure continued to rise, the high pressure relief will pop open and release refrigerant from the system.

Compressed refrigerant enters the condenser in a high temperature, high pressure vapor state. As the refrigerant flows through the condenser, the heat of the refrigerant is transferred to the ambient air passing through the condenser. Cooling the refrigerant causes the refrigerant to condense and change from a vapor to a liquid state.

The condenser is located in front of the radiator for maximum heat transfer. The condenser is made of aluminum tubing and aluminum cooling fins, which allows rapid heat transfer for the refrigerant. The semi-cooled liquid refrigerant exits the condenser and flows through the liquid line, to the thermal expansion valve (TXV).

The TXV is located at the evaporator inlet. The TXV is the dividing point for the high and the low pressure sides of the A/C system. As the refrigerant passes through the TXV, the pressure on the refrigerant is lowered. Due to the pressure differential on the liquid refrigerant, the refrigerant will begin to boil at the TXV. The TXV also meters the amount of liquid refrigerant that can flow into the evaporator.

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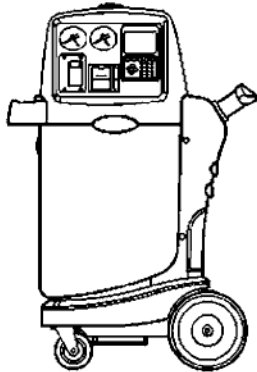
Refrigerant exiting the TXV flows into the evaporator core in a low pressure, liquid state. Ambient air is drawn through the HVAC module and passes through the evaporator core. Warm and moist air will cause the liquid refrigerant boil inside of the evaporator core. The boiling refrigerant absorbs heat from the ambient air and draws moisture onto the evaporator. The refrigerant exits the evaporator through the suction line and back to the compressor, in a vapor state, and completing the A/C cycle of heat removal. At the compressor, the refrigerant is compressed again and the cycle of heat removal is repeated.

The conditioned air is distributed through the HVAC module for passenger comfort. The heat and moisture removed from the passenger compartment will also change form, or condense, and is discharged from the HVAC module as water.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description
	J 43600 ACR2000 Air Conditioning Service Center
	J 43907 Connector Test Adapter Kit
	7000081 Tech 2 Kit

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