

2006 HVAC

HVAC Systems - Manual - Equinox & Torrent

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Air Temperature Actuator to Evaporator Case Screws	1.5 N.m	13 lb in
HVAC Control to Center Trim Bezel Screws	1.5 N.m	13 lb in
Mode Actuator to Evaporator Case Screws	1.5 N.m	13 lb in
Mode Cam Bracket to Evaporator Case Screws	1.5 N.m	13 lb in
Recirc Actuator to Air Inlet Screws	1.5 N.m	13 lb in

SCHEMATIC AND ROUTING DIAGRAMS

HVAC SCHEMATICS

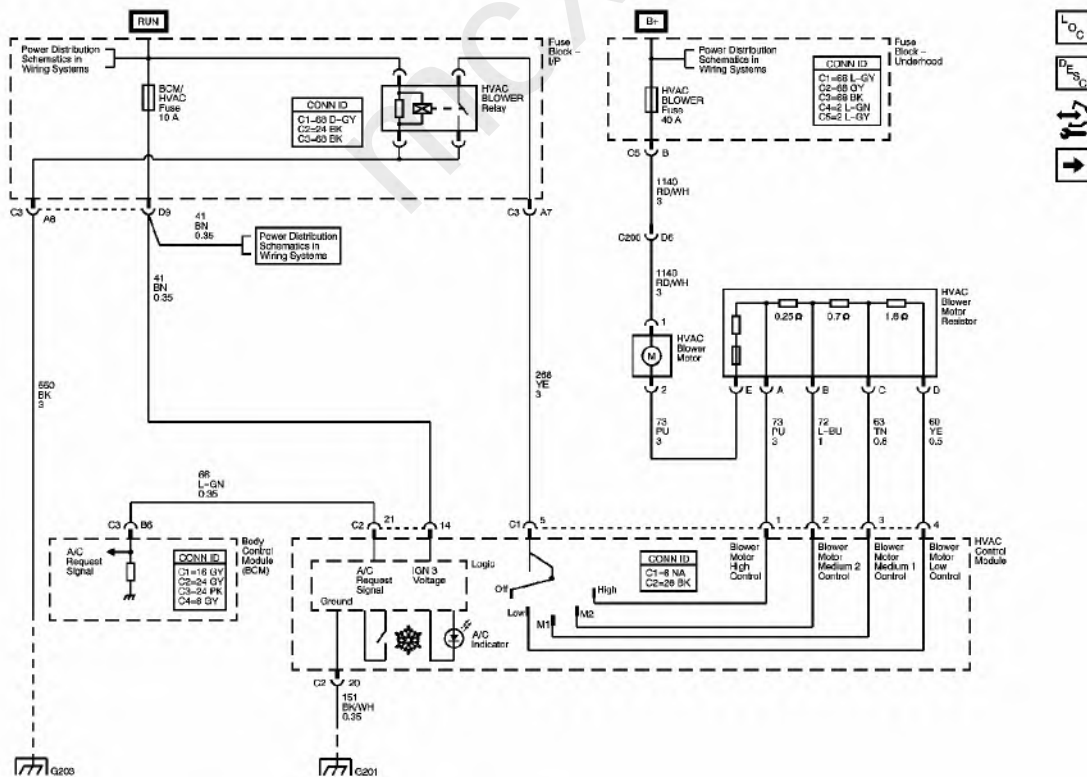


Fig. 1: Blower Controls Schematics

Courtesy of GENERAL MOTORS CORP.

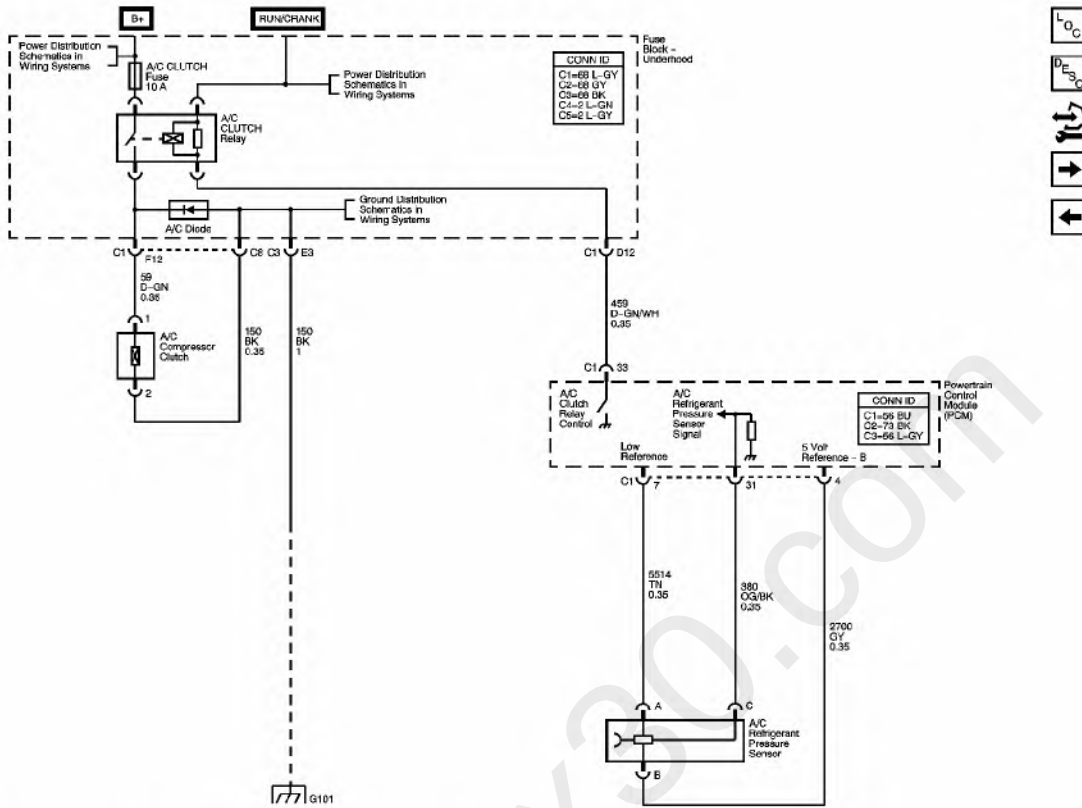


Fig. 2: A/C Compressor and Pressure Sensor Signals Schematics
Courtesy of GENERAL MOTORS CORP.

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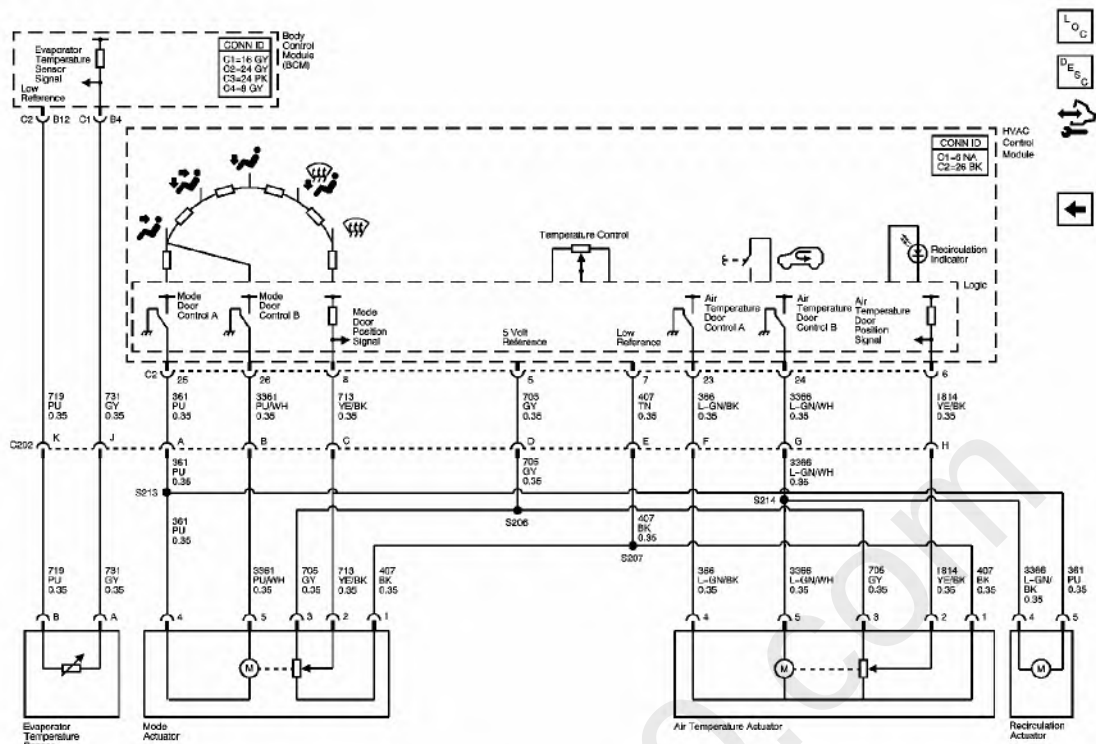


Fig. 3: Actuators, Evaporator Temperature Sensor Schematics
 Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

HVAC COMPONENT VIEWS

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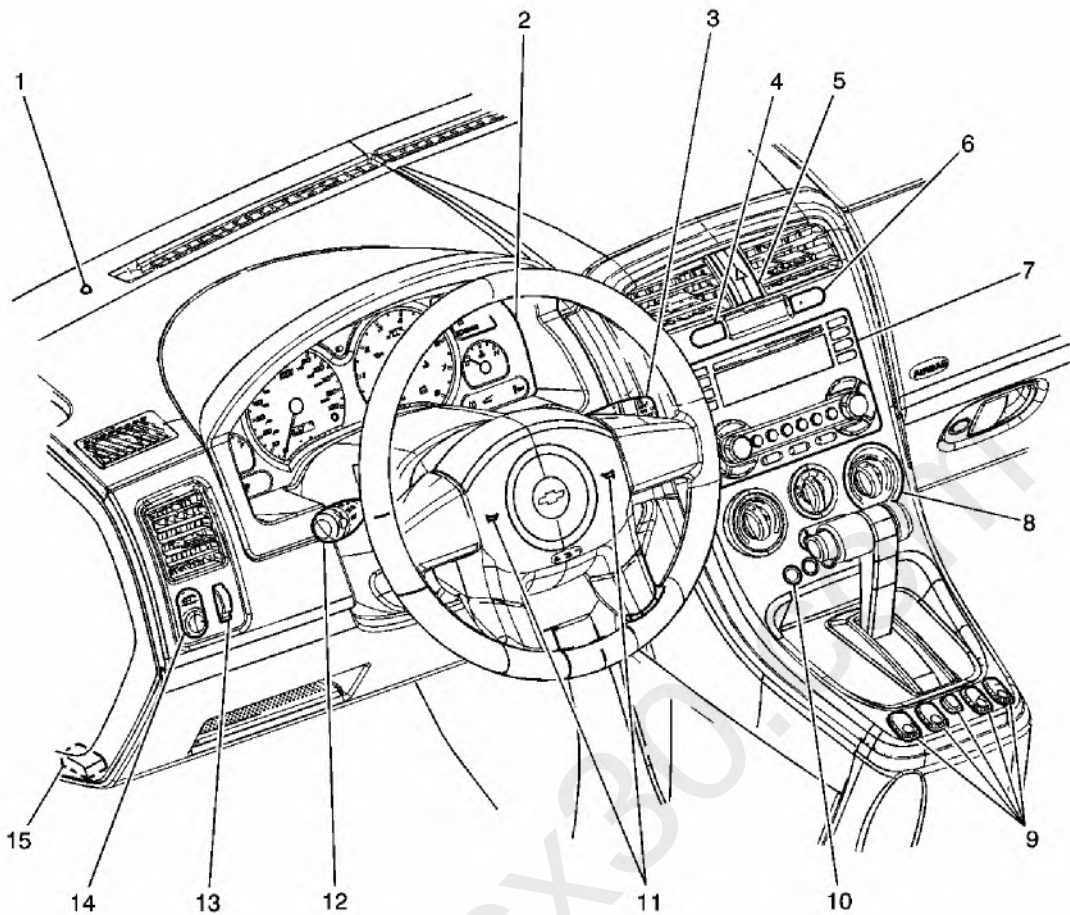


Fig. 4: Left Side of the I/P
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Ambient Light Sensor
2	Instrument Panel Cluster (IPC)
3	Windshield Wiper/Washer Switch
4	Traction Control (TC) Switch (JM4)
5	Hazard Switch
6	Fog Lamp Switch (T96)
7	Radio
8	HVAC Control Module
9	Power Window Switch - Main
10	Transmission Range Indicator
11	Horn Switch/Pad - Part of the Inflatable Restraint Steering Wheel Module

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12	Headlamp Switch
13	Dimmer Switch
14	Outside Rearview Mirror Switch
15	Data Link Connector (DLC)

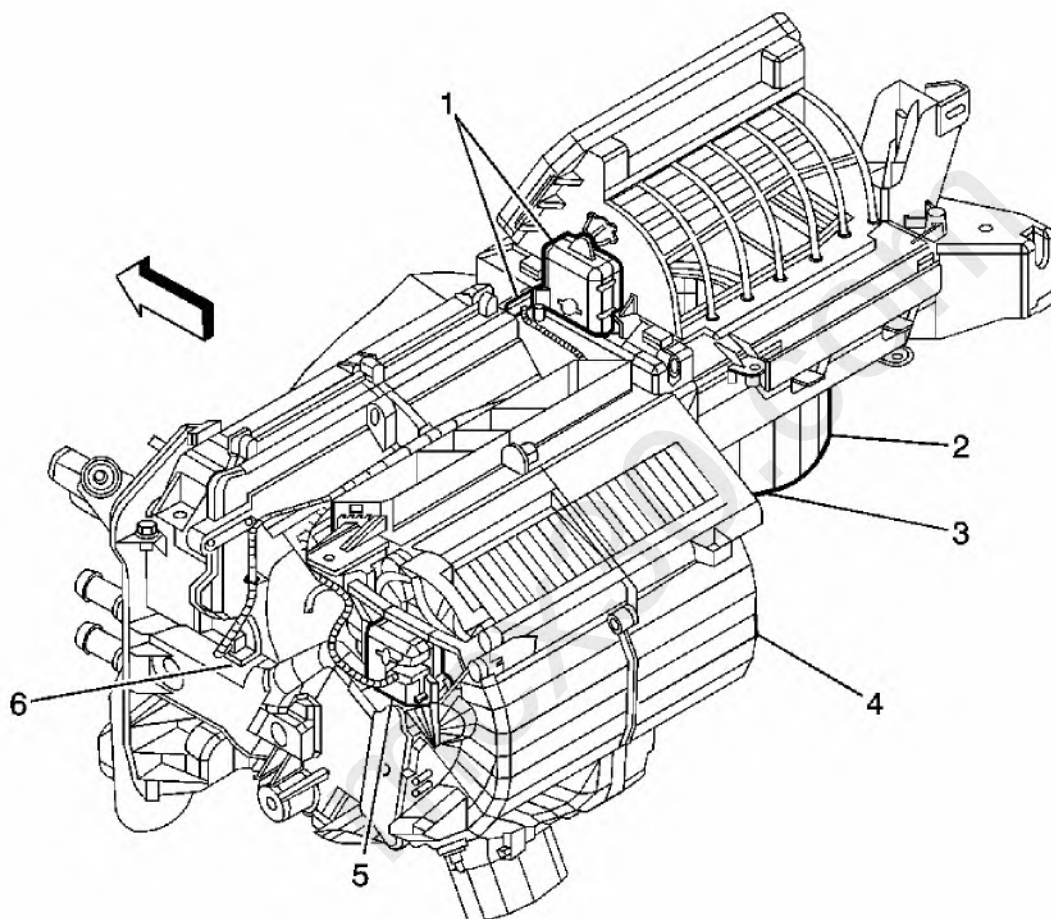
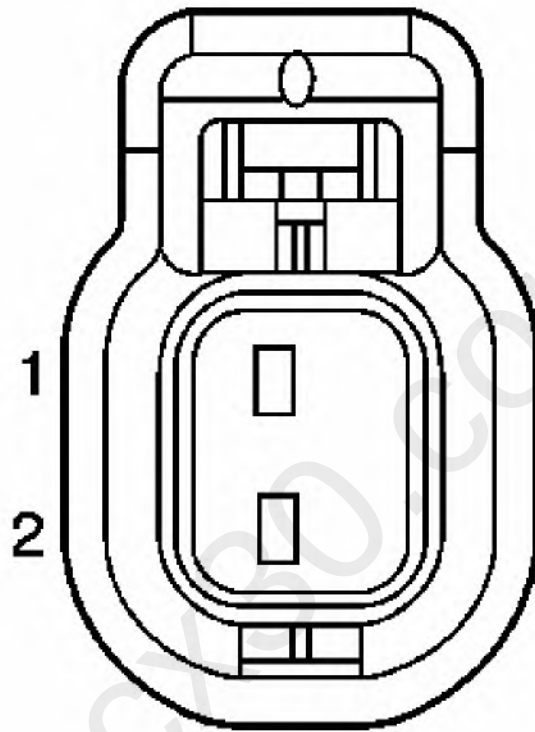


Fig. 5: HVAC Module Assembly Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Recirculation Actuator
2	HVAC Blower Motor
3	HVAC Blower Motor Resistor (Hidden)
4	Air Temperature Actuator
5	Mode Actuator
6	Evaporator Temperature Sensor

HVAC CONNECTOR END VIEWS**A/C Compressor Clutch****Connector Part Information**

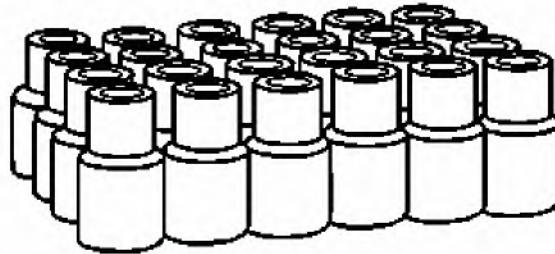
- **OEM: 7283-5448**
- **Service: See Catalog**
- **2-Way F (BK)**

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

A/C Refrigerant Pressure Sensor

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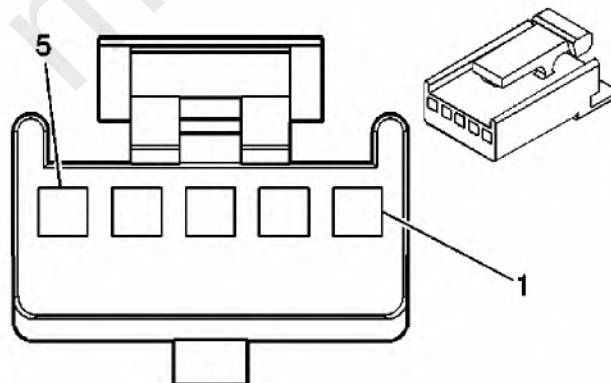


Connector Part Information

- OEM: 12110192
- Service: 12102748
- 3-Way F Metri-Pack 150 Series (BK)

Pin	Wire Color	Circuit No.	Function
A	TN	5514	Low Reference
B	GY	2700	5-Volt Reference
C	OG/BK	380	A/C Refrigerant Pressure Sensor Signal

Air Temperature Actuator



Connector Part Information

- OEM: 12064982
- Service: See Catalog
- 5-Way F Micro-Pack 100 Series (BK)

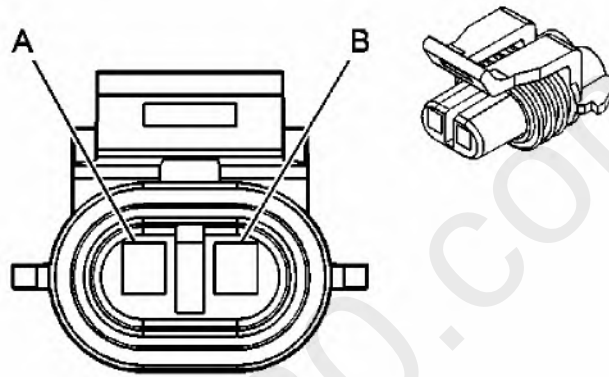
Pin	Wire Color	Circuit No.	Function
1	BK	407	Low Reference

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2	YE/BK	1814	Lower Mode Door Position Signal
3	GY	705	5-Volt Reference
4	L-GN/BK	3366	Lower Mode Valve Solenoid Control B
5	L-GN/WH	366	Lower Mode Valve Solenoid Control A

Evaporator Temperature Sensor



Connector Part Information

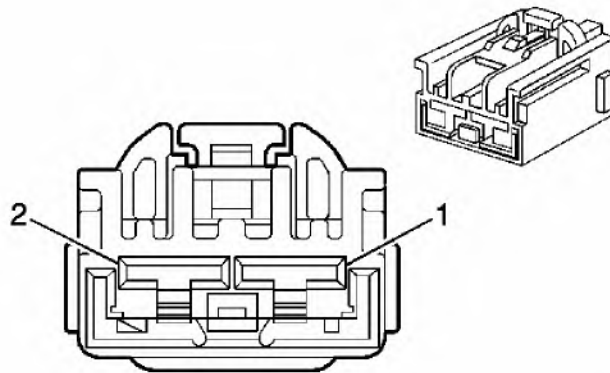
- OEM: 12052641
- Service: 12102747
- 2-Way F Metri-Pack 150 Series (BK)

Pin	Wire Color	Circuit No.	Function
A	GY	731	Evaporator Temperature Sensor Signal
B	PU	719	Low Reference

HVAC Blower Motor

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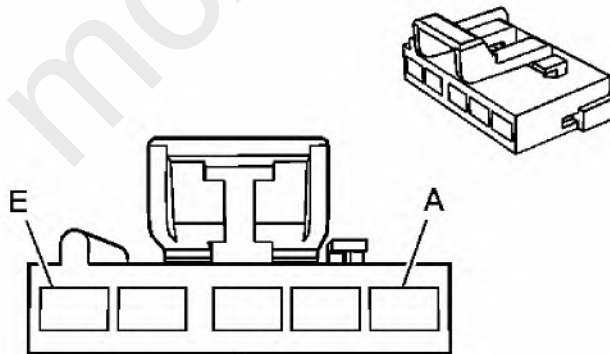


Connector Part Information

- OEM: 7283-5590-40
- Service: See Catalog
- 2-Way F (BK)

Pin	Wire Color	Circuit No.	Function
1	RD/WH	1140	Battery Positive Voltage
2	PU	73	Blower Motor High Control

HVAC Blower Motor Resistor



Connector Part Information

- OEM: 12059296
- Service: 15306069
- 5-Way F Metri-Pack 280 Series Sealed (RD)

Pin	Wire Color	Circuit No.	Function
A	PU	73	Blower Motor High Control
B	L-BU	72	Blower Motor Medium 2 Control
C	TN	63	Blower Motor Medium 1 Control
D	YE	60	Blower Motor Low Control

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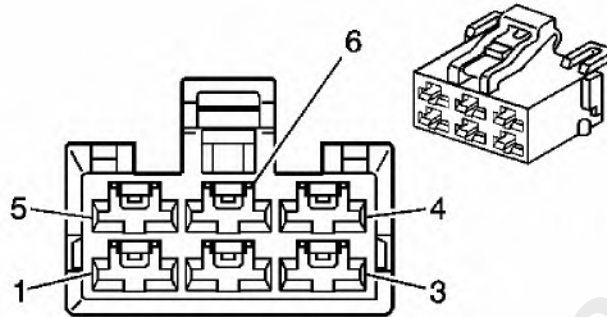
E

PU

73

Blower Motor High Control

HVAC Control Module C1



Connector Part Information

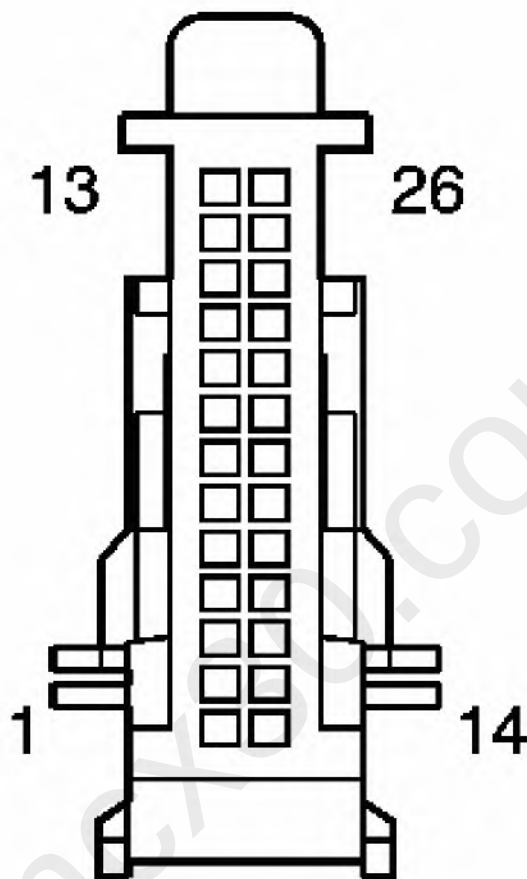
- OEM: 7123-6060
- Service: See Catalog
- 6-Way F 58 M-Type Series (NA)

Pin	Wire Color	Circuit No.	Function
1	PU	73	Medium 3 Blower Motor Control
2	L-BU	72	Blower Motor Medium 1 Control
3	TN	63	Blower Motor Medium 1 Control
4	YE	60	Blower Motor Low Control
5	YE	268	Blower Motor Relay Common
6	-	-	Not Used

HVAC Control Module C2

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Connector Part Information

- **OEM: 1326362-1**
- **Service: See Catalog**
- **26-Way F 0.64 mm Lever Assisted Series (BK)**

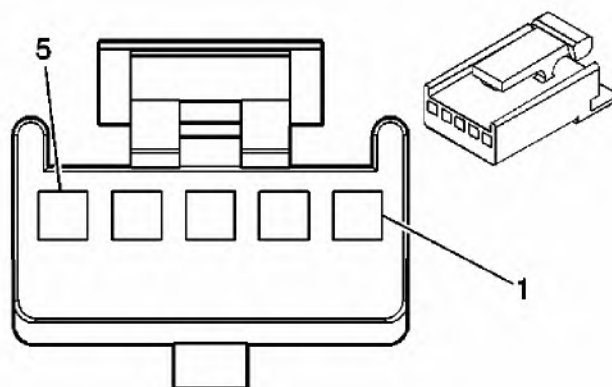
Pin	Wire Color	Circuit No.	Function
1-2	-	-	Not Used
3	WH	193	Rear Defogger Relay Control
4	-	-	Not Used
5	GY	705	5-Volt Reference
6	YE/BK	1814	Lower Mode Door Position Sensor Signal
7	TN	407	Low Reference

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8	YE/BK	713	Defrost Mode Valve Position Sensor Signal
9	GY	8	Instrument Panel Lamp Supply Voltage
10-11	-	-	Not Used
12	PK	1501	Driver Heated Seat High/Low Signal
13	PK/BK	1503	Front Passenger Heated Seat High/Low Signal
14	BN	41	Ignition 3 Voltage
15	-	-	Not Used
16	RD/WH	2140	Battery Positive Voltage
17-19	-	-	Not Used
20	BK/WH	151	Ground
21	L-GN	66	A/C Request Signal
22	L-BU	292	Rear Defogger Switch Signal
23	L-GN/WH	366	Lower Mode Valve Solenoid Control A
24	L-GN/BK	3366	Lower Mode Valve Solenoid Control B
25	PU	361	Defrost Mode Valve Solenoid Control A
26	PU/WH	3361	Defrost Mode Valve Solenoid Control B

Mode Actuator



Connector Part Information

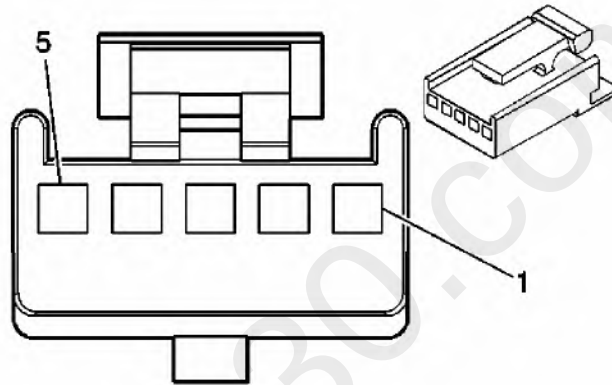
- OEM: 12064982
- Service: See Catalog
- 5-Way F Micro-Pack 100 Series (BK)

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Pin	Wire Color	Circuit No.	Function
1	BK	407	Low Reference
2	YE/BK	713	Heater Mode Valve Position Sensor Signal
3	GY	705	5-Volt Reference
4	PU	361	Mode Valve Solenoid Control A
5	PU/WH	3361	Mode Valve Solenoid Control B

Recirculation Actuator



Connector Part Information

- OEM: 12064982
- Service: See Catalog
- 5-Way F Micro-Pack 100 Series (BK)

Pin	Wire Color	Circuit No.	Function
1-3	-	-	Not Used
4	L-GN/BK	3366	Lower Mode Valve Solenoid Control B
5	PU	361	Mode Valve Solenoid Control A

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC P0532 or P0533	** MULTIPLE VALUES **
DTC P0645	Air Conditioning (A/C) Clutch Relay Control Circuit

SCAN TOOL OUTPUT CONTROLS

PCM 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. 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 Module 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).

Body Control Module (BCM) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)			
A/C Request	Switch Inputs	Yes/No	Yes
A/C Sensor	Accessory	Volts	Varies
Battery 1	Accessory	Volts	Varies

Powertrain Control Module (PCM) Scan Tool Data List (LNJ/3.4L)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions: Engine idling, A/C ON, ambient air temperature between			

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22-27°C (70-80°F)			
A/C Off for WOT	Engine Data 2	Yes/No	Varies
A/C Off Due to Pressure	Engine Data 2	Active/Inactive	Varies
A/C Pressure Sensor	Engine Data 1,2,3	0 to 5 Volts	Varies
A/C High Side Pressure Sensor	Engine Data 1,2,3	psi/kPa	psi
A/C Relay Command	Engine Data 1,2,3	On/Off	On
A/C Request Signal	Engine Data 2	Yes/No	Yes
ECT	Engine Data 1,2,3	C/F	Varies
Ignition 1 Signal	Engine Data 1,2,3	Volts	Varies

SCAN TOOL DATA DEFINITIONS

Use the Scan Tool Data Display Values and Definitions Information in order to assist in diagnosing control module 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-Battery 1

The scan tool displays the level of battery voltage at the BCM.

BCM-Switch Inputs-A/C Request

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.

PCM-A/C Off for WOT

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

PCM-A/C Off Due to Pressure

The scan tool displays the status of the a/c high side pressure sensor. The scan tool displays Active/Inactive.

PCM-A/C Relay Command

The scan tool displays On or Off. On is displayed when the PCM has energized the A/C clutch relay.

PCM-A/C 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.

PCM-A/C Refrigerant Pressure

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

PCM-A/C Request

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

PCM-ECT

The scan tool displays a range of 40-151°C (40-304°F). The PCM applies 5 volts to the 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 PCM 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 PCM interprets the lower voltage as a warm engine.

PCM-Ignition 1 Signal

The scan tool shows available voltage at the PCM.

DTC P0532 OR P0533**Circuit Description**

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

DTC Descriptor

This diagnostic procedure supports the following DTCs:

- DTC P0532 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit Low Voltage
- DTC P0533 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit High Voltage

Conditions for Running the DTC

- The engine is running.
- The battery voltage is between 11-18 volts.

Conditions for Setting the DTC

- The PCM detects that the A/C pressure is less than 0 psi (0.01 volts).
- The PCM detects that the A/C pressure is more than 497 psi (4.94 volts).

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- 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.
- The DTC will become history if the PCM no longer detects a failure.

Diagnostic Aids

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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.
- Refer to **Testing for Intermittent Conditions and Poor Connections**.

Test Description

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

4: Tests for the proper operation of the circuit in the low voltage range.

5: Tests for the proper operation of the circuit in the high voltage range. If the fuse in the jumper opens when you perform this test, the signal circuit is shorted to ground.

6: Tests for a short to voltage in the 5-volt reference circuit.

7: Tests for a high resistance or an open in the low reference circuit.

DTC P0532 or P0533

Step	Action	Values	Yes	No
Schematic Reference: HVAC Schematics				
Connector End View Reference: HVAC Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	IMPORTANT: The ambient air temperature must be above 5°C (40°F). 1. Turn OFF the ignition. 2. Inspect the A/C compressor for free rotation operation. 3. Start the engine. 4. Place the HVAC control module in the OFF position. Does the A/C compressor operate?	-	Go to <u>HVAC Compressor Clutch Does Not Disengage</u>	Go to Step 3
	1. Install a scan tool. 2. Turn ON the ignition, with the			

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3	engine OFF. 3. With a scan tool, observe the A/C High Side Pressure parameter in the powertrain control module (PCM). Does the scan tool indicate that the A/C Refrigerant Pressure parameter is within the specified range?	0.1-4.9 V	Go to Diagnostic Aids	Go to Step 4
4	1. Turn OFF the ignition. 2. Disconnect the A/C refrigerant pressure sensor. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, observe the A/C High Side Pressure parameter in the PCM. Does the scan tool indicate that the A/C Refrigerant Pressure parameter is less than the specified value?	0.1 V	Go to Step 5	Go to Step 11
5	1. Turn OFF the ignition. 2. 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. 3. Turn ON the ignition, with the engine OFF. 4. With a scan tool, observe the A/C High Side Pressure parameter in the PCM. Does the scan tool indicate that the A/C Refrigerant Pressure parameter is greater than the specified value?	4.9 V	Go to Step 6	Go to Step 9
	1. Disconnect the fused jumper wire. 2. Measure the voltage between the 5-volt reference circuit of the			

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6	A/C refrigerant pressure sensor and the low reference circuit of the A/C refrigerant pressure sensor. Does the voltage measure less than the specified value?	4.9 V	Go to Step 7	Go to Step 8
7	1. Turn OFF the ignition. 2. Disconnect the negative battery cable. 3. Measure the resistance from the low reference circuit of the A/C refrigerant pressure sensor to a good ground. Does the resistance measure less than the specified value?	5 ohm	Go to Step 13	Go to Step 12
8	Test the 5-volt reference circuit of the A/C refrigerant pressure sensor for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 14
9	Test the 5-volt reference circuit of the A/C refrigerant pressure sensor for a short to ground, a high resistance, or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 10
10	Test the signal circuit of the A/C refrigerant pressure sensor for a short to ground, a high resistance, or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 14
11	Test the signal circuit of the A/C refrigerant pressure sensor for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the	-		Go to Step

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	condition?		Go to Step 17	14
12	1. Disconnect the powertrain control module. 2. Test the low reference circuit of the A/C refrigerant pressure sensor for a high resistance or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 14
13	Inspect for poor connections at the harness connector of the A/C refrigerant pressure sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 15
14	Inspect for poor connections at the harness connector of the engine control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	-	Go to Step 17	Go to Step 16
15	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 17	-
16	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	-	Go to Step 17	-
17	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text.	-		

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Does the DTC reset?		Go to Step 2	System OK
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DTC P0645

Circuit Description

Ignition voltage is supplied directly to the A/C compressor clutch relay. The powertrain control module (PCM) 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 PCM. When the PCM is commanding a component ON, the voltage of the control circuit should be near 0 volts. When the PCM 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, a DTC will set.

The PCM will monitor the control circuit for the following:

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

When the PCM detects any of the above malfunctions, a DTC is set and the affected driver is disabled.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit

Conditions for Running the DTC

- The ignition voltage is between 11.0-18.0 volts.
- The engine speed is less than 600 RPM.
- The PCM driver transitions from ON to OFF or from OFF to ON.

Conditions for Setting the DTC

The PCM detects an open on the control circuit of the A/C compressor clutch relay when commanded off with the engine in crank or run status.

Action Taken When the DTC Sets

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- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A History DTC clears after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.
- The DTC will become history if the PCM no longer detects a failure.

Diagnostic Aids

IMPORTANT: Be sure to verify that the PCM engine grounds are secure and clean.

If DTC P0645 cannot be duplicated, reviewing the Failure Records vehicle millage 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** in Wiring Systems.

Test Description

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

2: Listen for an audible click when the A/C compressor clutch relay operates. Command both the ON and OFF states. Repeat the commands as necessary.

3: Tests for voltage at the coil side of the A/C compressor clutch relay. The 10-amp fuse supplies power to the coil side of the A/C compressor clutch relay.

4: Verifies that the engine control module is providing ground to the A/C compressor clutch relay.

DTC P0645

Step	Action	Yes	No
Schematic Reference: HVAC Schematics			
Connector End View Reference: HVAC Connector End Views			
1	Did you perform the Diagnostic System Check - Vehicle?		Go to <u>Diagnostic System Check - Vehicle</u> in Vehicle DTC

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		Go to Step 2	Information
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the A/C Relay ON and OFF in the powertrain control module (PCM). Does the A/C compressor clutch relay turn ON and OFF with each command?	Go to Diagnostic Aids	Go to Step 3
3	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 battery positive voltage circuit of the A/C compressor clutch relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to Step 4	Go to Step 6
4	1. Connect a test lamp between the control circuit and the battery positive voltage circuit of the A/C compressor clutch relay. 2. With a scan tool, command the A/C relay ON and OFF. Does the test lamp turn ON and OFF with each command?	Go to Step 7	Go to Step 5
5	Test the control circuit of the A/C compressor clutch relay for a short to voltage, an open, or a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 8
6	Repair the battery positive voltage circuit of the A/C compressor clutch relay. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	Go to Step 11	-
	Inspect for poor connections at the A/C		

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7	compressor clutch relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 09
8	Inspect for poor connections at the harness connector of the powertrain control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 10
9	Replace the A/C compressor clutch relay. Did you complete the replacement?	Go to Step 11	-
10	Replace the PCM. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	Go to Step 11	-
11	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

SYMPTOMS - HVAC SYSTEMS - MANUAL

IMPORTANT: Review the system operation in order to familiarize yourself with 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** in Wiring Systems.
- Inspect the easily accessible or visible system components for obvious damage or 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 could cause window fogging:
 - Wet carpet or mats
 - High humidity
 - Interior water leak
 - Blocked A/C evaporator drain tube
 - Maximum passenger capacity
 - Blocked body pressure relief valves
- Inspect the air distribution system for causes of reduced air flow:
 - Obstructed or dirty passenger compartment air filter, if equipped
 - Blocked or damaged air inlet or outlet vents

Intermittent

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

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **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**
- **Leak Testing** in Heating, Ventilation and Air Conditioning
- **Noise Diagnosis - HVAC Module** in Heating, Ventilation and Air Conditioning
- **Noise Diagnosis - Air Conditioning (A/C) System** in Heating, Ventilation and Air Conditioning
- **Noise Diagnosis - Blower Motor** in Heating, Ventilation and Air Conditioning
- **Odor Diagnosis** in Heating, Ventilation and Air Conditioning

HVAC COMPRESSOR CLUTCH DOES NOT ENGAGE**Diagnostic Aids**

The refrigerant temperature at the temperature sensor in the thermal expansion valve (TXV) controls cycling of the compressor clutch to prevent freezing of the evaporator core. The compressor is disabled when the temperature goes below 3°C (37°F) and vehicle speed is greater than 5 mph (8 km/h). The compressor is enabled when the temperature exceeds 4°C (40°F). The minimum cycling time OFF is 4 seconds. Refer to **Air Temperature Description and Operation** for a voltage temperature value table of the evaporator temperature sensor.

Test Description

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

- 2:** The A/C compressor relay output is disabled if the engine coolant temperature is above 96°C (205°F).
- 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 module is inoperative if the module does not respond to any operator control requests.
- 23:** The compressor is disabled when the evaporator temperature goes below 3°C (38°F).
- 34:** Check the connection by removing and securely reinstalling before replacement of the HVAC control is considered.

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 in Vehicle DTC Information
2	1. Install a scan tool. 2. Start the engine. 3. Observe the Electronic Temperature Control (ETC) parameter in the Engine Control Data General Info-Inputs data list.		

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	Does the scan tool indicate that the ECT parameter is above 96°C (205°F)?	Go to Engine Overheating in Engine Cooling	Go to Step 3
3	IMPORTANT: For A/C compressor operation, the evaporator 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 clutch operate?	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems	Go to Step 4
4	1. Park the vehicle inside or out of direct sunlight. 2. Open the window in order to ventilate the interior of the vehicle. 3. If the A/C system was operating, then wait for approximately 2 minutes. 4. Turn OFF the ignition. 5. Install the J 43600 ACR 2000 Air Conditioning Service Center. 6. Record the ambient air temperature at the vehicle. 7. Record readings of the low and high side STATIC pressures. 8. Compare the low and the high side pressure values with the allowable limits for the recorded ambient air temperature. Refer to Air Conditioning (A/C) System Performance Test in Heating, Ventilation and Air Conditioning. Are the low and high side 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 Leak Testing in Heating, Ventilation and Air Conditioning

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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 powertrain control module (PCM) data list 3. Compare the scan tool A/C High Side Pressure parameter to the high side pressure values on the ACR 2000. Are the high side pressure values within 103 kPa (15 psi) of each other?	Go to Step 6	Go to Step 24
6	Is the HVAC control module inoperative?	Go to Step 16	Go to Step 7
7	1. Start the engine. 2. With a scan tool, observe the A/C Request Signal parameter in the powertrain control module (PCM) 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 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 Request 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 Request parameter is ON?	Go to Step 9	Go to Step 18
	1. Turn OFF the ignition. 2. Test the A/C request signal circuit for the following: • A short to voltage		

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9	• A high resistance • An open Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 23
10	With a scan tool, command the A/C compressor clutch relay ON and OFF. Does the A/C compressor 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. Does the test lamp illuminate?	Go to Step 12	Go to Step 27
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 in scan tool special functions. Does the test lamp turn ON and OFF with each command?	Go to Step 29	Go to Step 13
13	Does the test lamp remain illuminated with each command?	Go to Step 21	Go to Step 19
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 26
	1. Connect a 10-amp fused jumper		

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15	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 29	Go to Step 22
16	Test the ignition 3 voltage circuit of the HVAC control module for the following: • A short to ground • A high resistance • An open Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 17
17	Test the ground circuit of the HVAC control module for an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 34
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 BCM to a good ground. Does the value measure near battery voltage?	Go to Step 31	Go to Step 20
19	Test the control circuit of the A/C compressor clutch relay for an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 35
20	Test the A/C request signal circuit for the following: • A short to ground • A high resistance • An open		

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	Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 23
21	Test the control circuit of the A/C compressor clutch relay for a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 35
22	Test the supply voltage circuit at the A/C compressor clutch relay for the following: • A short to ground • A high resistance • An open Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 25
23	View the evaporator voltage in the BCM scan tool data list under A/C sensor. Refer to Air Temperature Description and Operation for the evaporator sensor temperature to voltage conversion chart. Is the Evaporator Voltage parameter greater than the voltage range of 2.45-2.55 volts which equals a temperature range of 36-38° F?	Go to Step 24	Go to Step 32
24	Test the ground circuit of the A/C refrigerant pressure sensor for a high resistance or for an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 28
25	Test the ground circuit of the A/C compressor clutch for a high resistance or for an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 30
	Repair the switch side voltage supply circuit of the relay. Refer to Wiring		

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26	Repairs in Wiring Systems. Did you complete the repair?	Go to Step 43	-
27	Repair the coil side of the voltage supply circuit of the relay. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	Go to Step 43	-
28	Inspect for poor connections at the harness connector of the A/C refrigerant pressure sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 36
29	Inspect for poor connections at the relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 38
30	Inspect for poor connections at the harness connector of the A/C compressor clutch. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 39
31	Inspect for poor connections at the harness connector of the BCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 41
32	Test the evaporator temperature sensor circuits for the following: • A short to ground • A high resistance • An open Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 33
	Inspect for poor connections at the harness connector of the evaporator low		

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33	temperature sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 34
34	Inspect for poor connections at the harness connector of the HVAC control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 37
35	Inspect for poor connections at the harness connector of the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 43	Go to Step 42
36	Replace the A/C refrigerant pressure sensor. Refer to Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	Go to Step 43	-
37	Replace the evaporator low temperature sensor. Refer to Air Conditioning (A/C) Refrigerant Low Temperature Sensor Replacement in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	Go to Step 43	-
38	Replace the relay. Did you complete the replacement?	Go to Step 43	-
39	Replace the A/C compressor clutch. Refer to Compressor Clutch Assembly Replacement in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	Go to Step 43	-
40	Replace the HVAC control module. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	Go to Step 43	-
	Replace the BCM. Refer to Control Module References in		

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41	Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	Go to Step 43	-
42	Replace the PCM. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	Go to Step 43	-
43	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	Values	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 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 Diagnostic System Check - Vehicle in Vehicle DTC Information
2	1. Start the engine. 2. Place the blower motor switch in the OFF position. 3. Place the A/C request switch in the OFF position. Does the A/C compressor operate?	-	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
3	With a scan tool, observe the A/C Request Signal parameter in the powertrain control module PCM, Engine Data list. Does the scan tool indicate that the A/C Request Signal parameter is YES?	-	Go to Step 4	Go to Step 6
	Test the A/C request signal circuit for a short to voltage. Refer to Circuit			

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4	Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 5
5	1. Turn OFF the ignition. 2. Disconnect the A/C Refrigerant pressure sensor. 3. Start the engine. 4. With a scan tool, observe the A/C Request Signal parameter. Does the scan tool indicate that the A/C Request Signal parameter is YES?	-	Go to Step 13	Go to Step 12
6	With a scan tool, command the A/C compressor clutch relay ON and OFF. Does the A/C compressor clutch relay turn ON and OFF with each command?	-	Go to Step 7	Go to Step 9
7	Remove the A/C compressor clutch relay. Is the A/C compressor ON?	-	Go to Step 10	Go to Step 8
8	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 9	Go to Step 11
9	Test the A/C clutch relay control circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 13
10	Test the A/C compressor clutch supply voltage circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 15
11	Inspect for poor connections at the A/C compressor clutch relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 14
	Inspect for poor connections at the			

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12	harness connector of the HVAC control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 16
13	Inspect for poor connections at the harness connector of the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 18	Go to Step 17
14	Replace the A/C compressor clutch relay. Did you complete the replacement?	-	Go to Step 18	-
15	Replace the A/C compressor clutch. Refer to Compressor Clutch Assembly Replacement in Heating, Ventilation, and Air Conditioning. Did you complete the replacement?	-	Go to Step 18	-
16	Replace the HVAC control module. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	-	Go to Step 18	-
17	Replace the PCM. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	-	Go to Step 18	-
18	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 3

BLOWER MOTOR ALWAYS ON

Test Description

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

4: Test the Low, Med 1, Med 2 and High blower motor control circuits for an short to ground. The High speed blower motor control circuit is spliced to the Blower motor resistor circuit. This circuit should be checked for a short to ground also.

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 Diagnostic System Check - Vehicle in Vehicle DTC Information
2	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 Testing for Intermittent Conditions and Poor Connections in Wiring Systems	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the HVAC control assembly connector. 3. Turn ON the ignition, with the engine OFF. Is the blower motor OFF?	Go to Step 5	Go to Step 4
4	Repair the applicable blower motor control circuit for an short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you complete the repair?	Go to Step 7	-
5	Inspect for poor connections at the harness connector of the HVAC control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 7	Go to Step 6
6	Replace the HVAC control module. Refer to Control Module References in Computer/Integrating Systems for Replacement, Setup and Programming. Did you complete the replacement?	Go to Step 7	-
	Operate the system in order to verify the		

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7	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 on the diagnostic table.

4: The High speed blower motor control circuit is spliced to the Blower motor resistor circuit. A short to voltage on the control circuits will open the HVAC Blower fuse. Be sure to check all the blower motor control circuits for a short to ground.

6: The ground circuit to be tested comes from the HVAC blower relay.

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 Diagnostic System Check - Vehicle in Vehicle DTC Information
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 in any speed position?	Go to Blower Motor Malfunction	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. Turn ON the blower motor. 5. Connect a test lamp between the blower motor supply voltage circuit and the blower motor ground circuit. 6. Place the blower switch in the		

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	maximum speed position.		
	Does the test lamp illuminate?	Go to Step 7	Go to Step 4
4	Test the blower motor supply voltage circuit for an open, short to ground or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 5
5	Test the High blower motor control circuit for an open, or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 6
6	Test the ground circuit of the HVAC control assembly for an open, short to voltage or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 8
7	Inspect for poor connections at the blower motor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 9
8	Inspect for poor connections at the HVAC control Module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 10
9	Replace the blower motor. Refer to Blower Motor Replacement in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	Go to Step 11	-
10	Replace the HVAC control module. Refer to Control Module References in Computer/Integrating Systems for Replacement, Setup and Programming. Did you complete the replacement?	Go to Step 11	-
11	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

BLOWER MOTOR MALFUNCTION

Test Description

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

3: Test the Low, Med 1, Med 2 and High blower motor control circuits for an open, short to voltage, short to ground or high resistance. The High speed blower motor control circuit is spliced to the Blower motor resistor circuit. This circuit should be checked also.

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.			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to Diagnostic System Check - Vehicle in Vehicle DTC Information
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 the desired speeds?	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the blower motor resistor assembly. 3. Turn ON the ignition, with the engine OFF. 4. Probe the LOW, MED 1, MED 2 and HIGH blower motor control circuits at the blower motor resistor assembly and HVAC control assembly, with a test lamp that is connected to voltage. At the same time, place the blower motor switch in the appropriate speed position for the circuit being tested. Does the test lamp illuminate on all blower		

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	motor control circuits?	Go to Step 5	Go to Step 4
4	Test the applicable blower motor control circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 7
5	Test each blower motor control circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 6
6	Inspect for poor connections at the harness connector of the blower motor resistor assembly. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 8
7	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 in Wiring Systems. Did you find and correct the condition?	Go to Step 10	Go to Step 9
8	Replace the blower motor resistor. Refer to Blower Motor Resistor Replacement in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	Go to Step 10	-
9	Replace the HVAC control module. Refer to Control Module References in Computer/Integrating Systems for Replacement, Setup and Programming. Did you complete the replacement?	Go to Step 10	-
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 2

TOO HOT IN VEHICLE

Too Hot in Vehicle

Step	Action	Values	Yes	No
Schematic Reference: HVAC Schematics Connector End View Reference: HVAC Connector End Views DEFINITION: The temperature cannot be adjusted, or the cooling is insufficient				

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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 in any of the speed positions?	-	Go to Step 3	Go to <u>Blower Motor Inoperative</u>
3	Does the blower motor operate at the desired speeds?	-	Go to Step 4	Go to <u>Blower Motor Malfunction</u>
4	When the A/C is ON, does the customer concern occur?	-	Go to Step 5	Go to Step 7
5	1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the recirculation switch in the ON position. Does the recirculation door move to the recirculation position?	-	Go to Step 6	Go to <u>Air Delivery Improper</u>
6	1. Place the blower motor switch in the maximum speed position. 2. Place the A/C switch in the ON position. 3. Place the 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>
7	Perform the refrigerant system performance test. Refer to <u>Air Conditioning (A/C) System Performance Test</u>. Did you find and correct the condition?	-	Go to Step 18	Go to Step 8
	1. Observe the drive shaft of the air temperature actuator.			

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8	2. Place the air temperature switch from the coldest position to the warmest position. Does the air temperature actuator drive shaft rotate at all?	-	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 or binding linkages or air temperature door • An obstruction that prevents the air temperature door from operating within its 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 18	Go to Step 10
10	Test the control A and control B circuits of the air temperature actuator for an open or a high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u>. Did you find and correct the condition?	-	Go to Step 18	Go to Step 11
11	1. Connect a test lamp between the air temperature actuator control A circuit and the control B circuit 2. Move the air temperature control from hot to cold Does the test lamp illuminate with each command?	-	Go to Step 14	Go to Step 12
	Test the ignition 3 voltage circuit of			

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12	the HVAC control module 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 18	Go to Step 13
13	Test the ground circuit of the HVAC control module for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 18	Go to Step 15
14	Inspect for poor connections at the harness connector of the air temperature actuator. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	-	Go to Step 18	Go to Step 16
15	Inspect for poor connections at the harness connector of the HVAC control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	-	Go to Step 18	Go to Step 17
16	Replace the air temperature actuator. Refer to Air Temperature Actuator Replacement. Did you complete the replacement?	-	Go to Step 18	-
17	Replace the HVAC control module. Refer to Control Module References for replacement, setup and programming. Did you complete the replacement?	-	Go to Step 18	-
18	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

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TOO COLD IN VEHICLE

Too Cold in Vehicle

Step	Action	Values	Yes	No
Schematic Reference: <u>HVAC Schematics</u> Connector End View Reference: <u>HVAC Connector End Views</u> 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 <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 in any of the speed positions?	-	Go to Step 3	Go to <u>Blower Motor Inoperative</u>
3	Does the blower motor operate at the desired speeds?	-	Go to Step 4	Go to <u>Blower Motor Malfunction</u>
4	Inspect the cooling system for the following conditions: • A low coolant level • A loose or worn accessory drive belt • A leaking radiator hose or heater hose • A kinked radiator hose or heater hose • A missing radiator cap pressure seal • A leaking radiator cap Refer to <u>Heating Performance Diagnostic</u> . Did you find and correct the condition?	-	Go to Step 18	Go to Step 5

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5	1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the mode switch in the Vent position. 4. Place the recirculation switch in the ON position. 5. Place the A/C switch in the ON position. Does the recirculation door move to the recirculation position?	-	Go to Step 6	Go to Air Delivery Improper
6	Place the HVAC control module in the OFF position. Does the A/C compressor operate?	-	Go to HVAC Compressor Clutch Does Not Disengage	Go to Step 7
7	1. Observe the drive shaft of the air temperature actuator. 2. Place the air temperature switch from the coldest position to the warmest position. Does the air temperature actuator drive shaft rotate at all?	-	Go to Step 8	Go to Step 10
8	Inspect the air temperature door and the air temperature actuator for the following conditions: • A misaligned air temperature actuator. Refer to Air Temperature Actuator Replacement. • Broken or binding linkages or air temperature door • An obstruction that prevents the air temperature door from operating within its full range of motion • Missing seals to the air temperature door	-		

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	• Misaligned seals to the air temperature door Did you find and correct the condition?		Go to Step 18	Go to Step 9
9	Test the air temperature actuator control A and control B circuits of the air temperature actuator for an open or a high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 18	Go to Step 10
10	1. Connect a test lamp between the air temperature actuator control A circuit and the control B circuit 2. Move the air temperature control from hot to cold Does the test lamp illuminate with each command?	-	Go to Step 13	Go to Step 11
11	Test the ignition 3 voltage circuit of the HVAC control module 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 18	Go to Step 12
12	Test the ground circuit of the HVAC control module for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	-	Go to Step 18	Go to Step 15
	Inspect for poor connections at the			

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13	harness connector of the air temperature actuator. 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 18	Go to Step 14
14	Inspect the air temperature actuator, door and any attaching linkage for binding or a condition that prevents drive shaft rotation. Did you find and correct the condition?	-	Go to Step 18	Go to Step 16
15	Inspect for poor connections at the harness connector of the HVAC control module. 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 18	Go to Step 17
16	Replace the air temperature actuator. Refer to <u>Air Temperature Actuator Replacement</u> . Did you complete the replacement?	-	Go to Step 18	-
17	Replace the HVAC control module. Refer to <u>Control Module References</u> for replacement, setup and programming. Did you complete the replacement?	-	Go to Step 18	-
18	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.

13: The test lamp should illuminate while trying to command the appropriate mode door in both directions.

15: Two ignition 3 voltage circuits supply the HVAC control module. Test the ignition

3 voltage circuit that does not supply the blower motor switch.

Air Delivery Improper

Step	Action	Yes	No
Schematic Reference: HVAC Schematics 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 switch 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 switch in each speed position. Does the blower motor operate in any speed position?	Go to Step 4	Go to <u>Blower Motor Inoperative</u>
4	Does the blower motor operate in each speed position?	Go to Step 5	Go to <u>Blower Motor Malfunction</u>
5	Are all of the HVAC control module controls except for the blower motor inoperative?	Go to Step 15	Go to Step 6
6	1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in the vent position. 3. Place the recirculation switch in the ON position. 4. Observe the recirculation door. 5. Place the outside air switch in the ON position. Does the recirculation door move from the recirculation to the outside air position?	Go to Step 7	Go to <u>Air Recirculation Malfunction</u>
	1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in each mode		

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	position.	Go to Testing for Intermittent Conditions and Poor Connections	
7	Does air flow sufficiently from the proper air distribution outlets for each selected mode position?		Go to Step 8
8	Inspect the air delivery system for the following conditions: • A dirty HVAC air filter, if applicable • An obstruction to the airflow • Air leaks • Misaligned air ducts Did you find and correct the condition?		
9	Inspect mode door and the mode actuator for the following conditions: • A misaligned mode actuator Refer to Mode Actuator Replacement. • Broken or binding linkages or mode door • An obstruction that prevents the mode actuator from operating within the full range of motion • Missing seals to the mode door • Misaligned seals to the mode door Did you find and correct the condition?	Go to Step 21	Go to Step 9
10	Test the position signal 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 21	Go to Step 10
11	Test the low reference 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 21	Go to Step 11
	Test the 5-volt reference circuit of the mode actuator for an open or for a high		

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12	resistance. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 21	Go to Step 13
13	1. Turn OFF the ignition. 2. Reconnect the mode actuator. 3. Turn ON the ignition with the engine OFF. 4. Connect a test lamp between mode door control A and mode door control B circuits of the mode actuator connector. 5. Place the mode switch in the Defrost position. 6. Place the mode switch in the Panel position. Does the test lamp illuminate in both positions?	Go to Step 17	Go to Step 14
14	Test the mode door control A and mode door control B circuits of the mode actuator for an open, a high resistance, a short to ground, or a short to voltage. Refer to Circuit Testing and to Wiring Repairs . Did you find and correct the condition?	Go to Step 21	Go to Step 18
15	Test the ignition 3 voltage circuit of the HVAC control module 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 21	Go to Step 16
16	Test the ground circuit of the HVAC control module 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 21	Go to Step 18
17	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 21	Go to Step 19
	Inspect for bad connections at the harness connector of the HVAC control module.		

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18	Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs . Did you find and correct the condition?	Go to Step 21	Go to Step 20
19	Replace the mode actuator. Refer to Mode Actuator Replacement . Did you complete the replacement?	Go to Step 21	-
20	Replace the HVAC control module. Refer to Control Module References for Replacement, Setup and Programming. Did you complete the replacement?	Go to Step 21	-
21	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 8

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 ignition 3 voltage circuits. Test both ignition 3 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 in Vehicle DTC Information
2	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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	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 in Wiring Systems	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 to Wiring Repairs in Wiring Systems. 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.		

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5	• Broken or binding linkages or recirculation door • 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 ignition 3 voltage circuits of the HVAC control assembly for an open or for a high resistance. Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. 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 to Wiring Repairs in Wiring Systems. 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 to Connector Repairs in Wiring Systems. 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 to Connector Repairs in Wiring Systems. 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 module. Refer to Control Module References in Computer/Integrating Systems for Replacement, Setup and Programming. Did you complete the replacement?	Go to Step 12	-
	Operate the system in order to verify the		

12

repair.
Did you correct the condition?

System OK

Go to **Step 3**

RE-CALIBRATING ACTUATORS

When replacing the HVAC control module it will be necessary to allow the HVAC control module to perform a calibration process. When installing the HVAC control module be sure to perform the following:

IMPORTANT: Do not adjust any controls on the HVAC control module while the HVAC control module is self-calibrating. If interrupted, improper HVAC performance will result.

Use the following steps to perform the calibration update:

1. Ignition in ON position or engine running.
2. Simultaneously press the A/C and recirculation buttons on control head 3 times in less than 2 seconds.
3. The Mode setting lights will flash during calibration and will quit flashing once calibration is completed.
4. This calibration process can take up to 30 seconds.

REPAIR INSTRUCTIONS

HVAC CONTROL MODULE REPLACEMENT

Removal Procedure

1. Remove the center trim bezel from the instrument panel. Refer to **Trim Bezel Replacement - Center** .

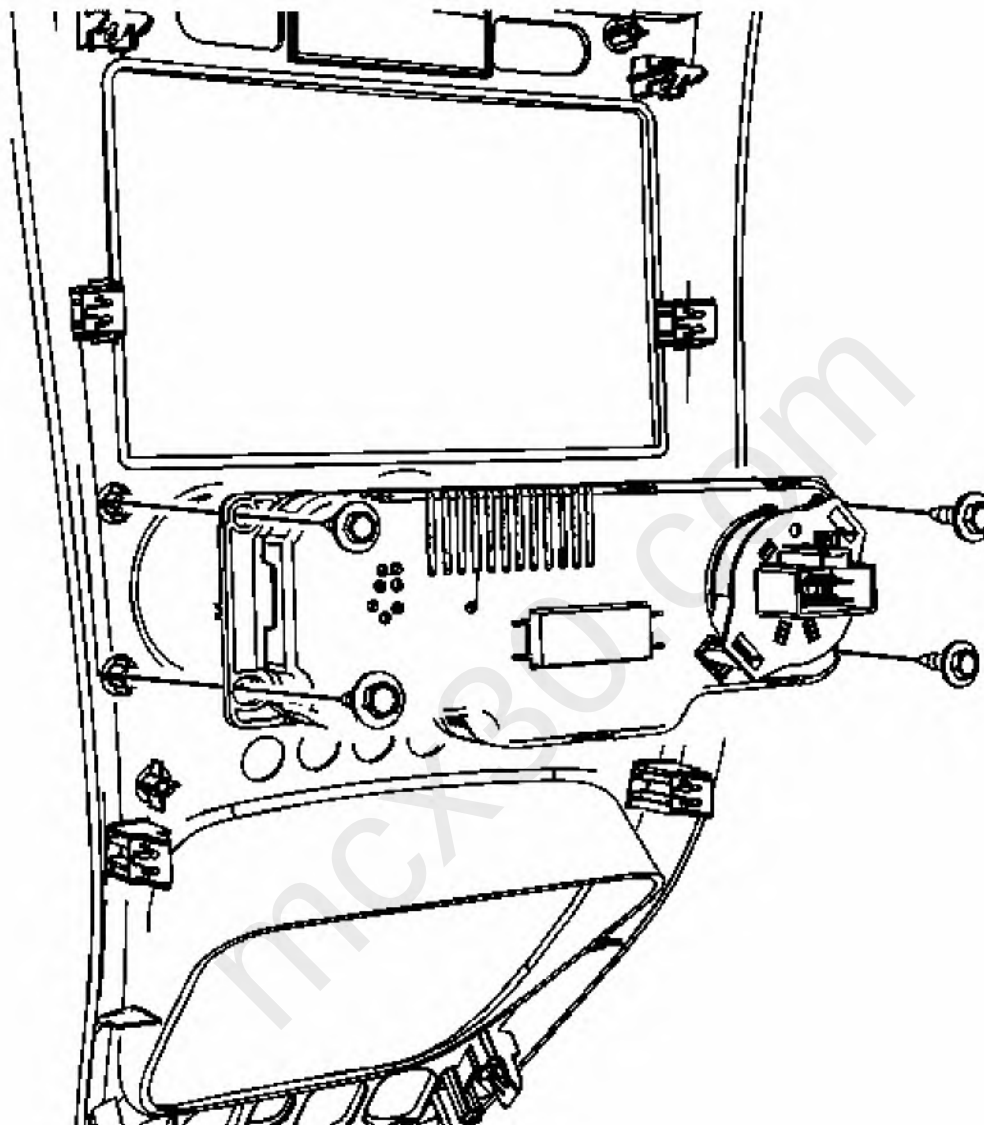


Fig. 6: View Of HVAC Control Module
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the electrical connectors from the HVAC control module.
3. Remove the HVAC control module screws from the center trim bezel.
4. Remove the HVAC control module from the center trim bezel.

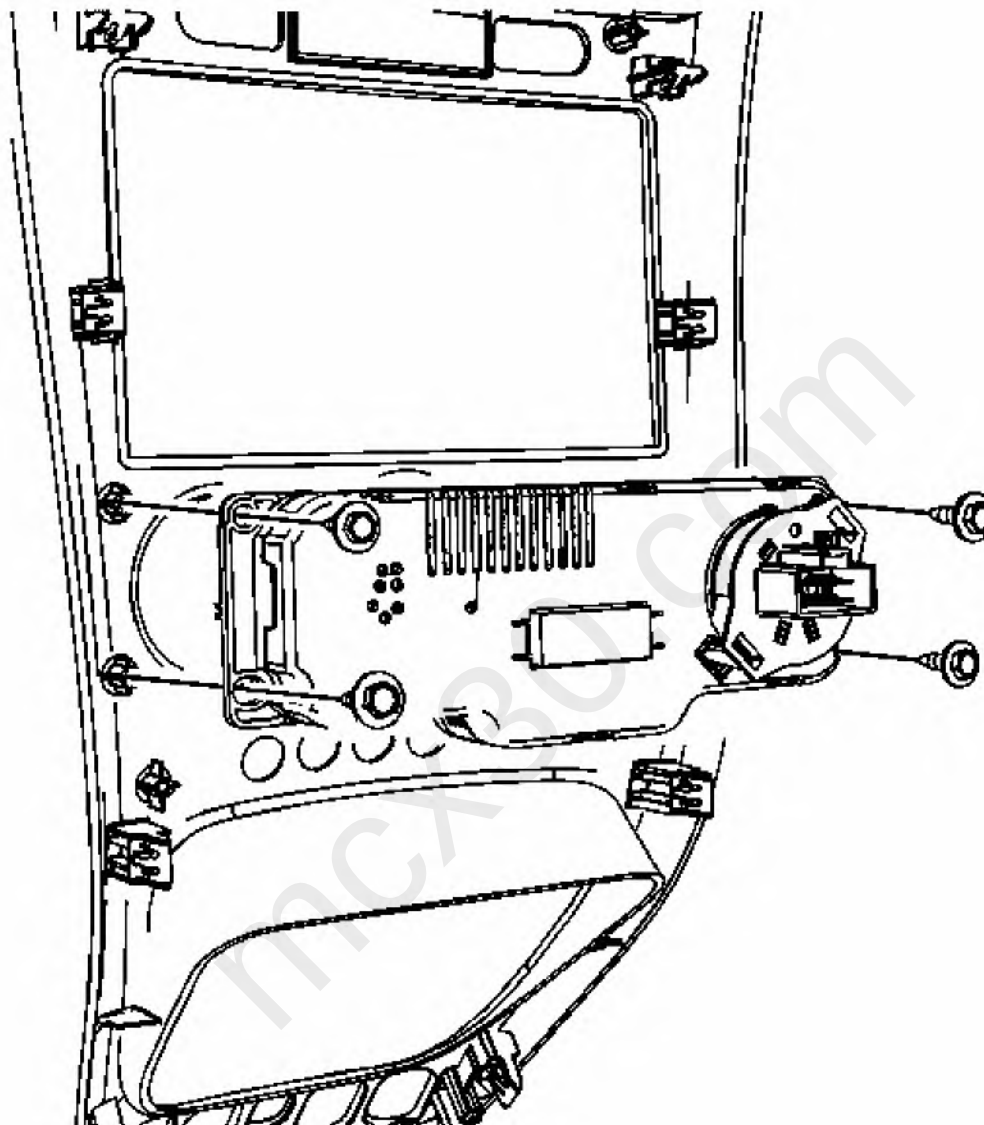


Fig. 7: View Of HVAC Control Module
Courtesy of GENERAL MOTORS CORP.

1. Install the HVAC control module to the center trim bezel.

NOTE: Refer to Fastener Notice .

2. Install the HVAC control module screws to the center trim bezel.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

3. Connect the electrical connectors to the HVAC control module.
4. Install the center trim bezel to the instrument panel. Refer to **Trim Bezel Replacement - Center**.

IMPORTANT: Any time a mode actuator or the HVAC control module is replaced, the HVAC control module must be calibrated to ensure proper air distribution.

5. Calibrate the mode actuators by simultaneously pushing the A/C and RECIRC buttons on the HVAC control module 3 times each, within 2 seconds of initial push.
6. Calibrate the mode actuators by simultaneously pushing the A/C and RECIRC buttons on the HVAC control module 3 times each, within 2 seconds of initial push.
 - The A/C and RECIRC button LED's will flash while this calibration is taking place.
 - The calibration will take anywhere between 10-30 seconds depending on battery voltage.
 - The LED's will quit flashing when the calibration is complete.
7. Cycle the ignition and verify proper operation.

AIR TEMPERATURE ACTUATOR REPLACEMENT

Removal Procedure

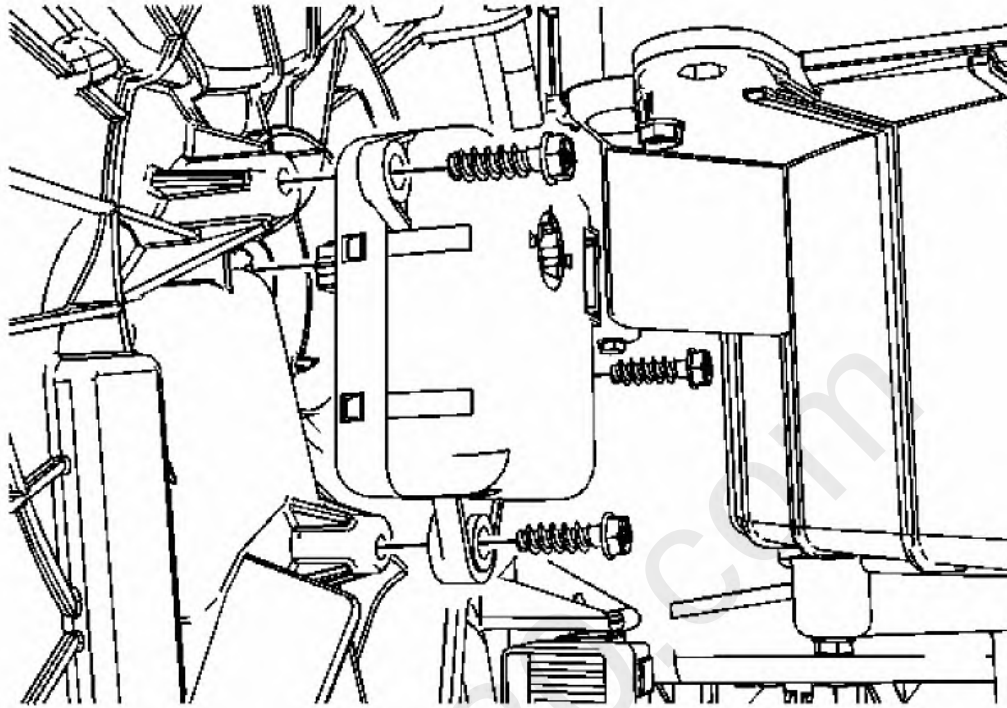


Fig. 8: View Of Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

1. Remove the instrument panel compartment. Refer to **Compartment Replacement - Instrument Panel (I/P)** .
2. Disconnect the electrical connector from the air temperature actuator.
3. Remove the air temperature actuator screws from the HVAC module.
4. Remove the air temperature actuator from the HVAC module.

Installation Procedure

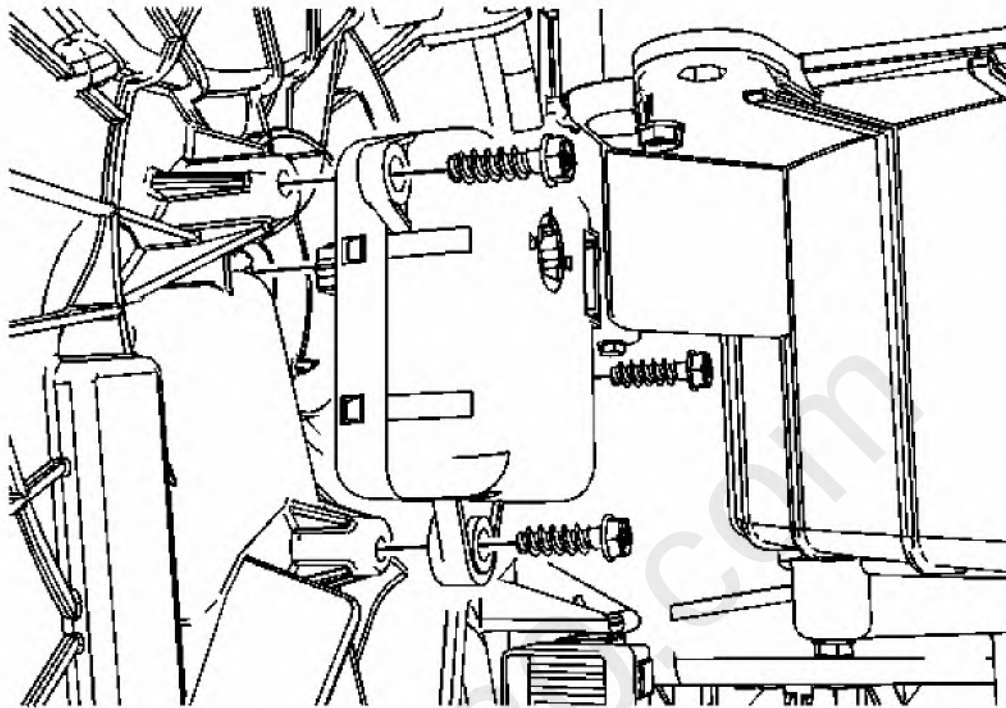


Fig. 9: View Of Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

1. Align the air temperature actuator with the door shaft and rotate into position.

NOTE: Refer to Fastener Notice .

2. Install the air temperature actuator screws to the HVAC module.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

3. Connect the electrical connector to the air temperature actuator.

IMPORTANT: Any time an actuator or the HVAC control module is replaced, the HVAC control module must be calibrated to ensure proper air distribution.

4. Calibrate the actuators by simultaneously pushing the A/C and RECIRC buttons on the HVAC control module three times each, within two seconds of initial push.
 - The A/C and RECIRC button LED's will flash while this calibration is taking place.

- The calibration will take anywhere between 10 to 30 seconds depending on battery voltage.
 - The LEDs will quit flashing when the calibration is complete.
5. Cycle the ignition and verify proper operation.
 6. Install the instrument panel compartment. Refer to **Compartment Replacement - Instrument Panel (I/P)**.

MODE ACTUATOR REPLACEMENT

Removal Procedure

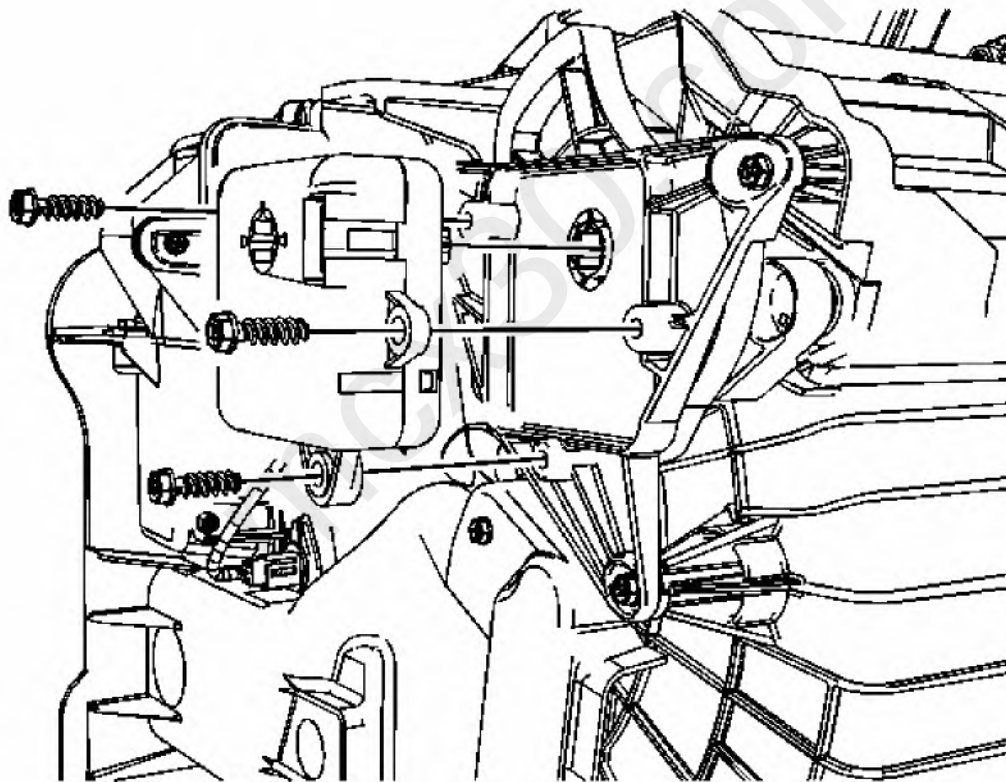


Fig. 10: View Of Mode Actuator
Courtesy of GENERAL MOTORS CORP.

1. Remove the left side insulator/closeout panel. Refer to **Closeout/Insulator Panel Replacement - Left**.
2. Remove the communication interface module, if equipped. Refer to **Communication Interface Module Replacement**.

3. Disconnect the electrical connector from the mode actuator.
4. Remove the mode actuator screws from the evaporator case assembly.
5. Remove the mode actuator from the evaporator case assembly.

Installation Procedure

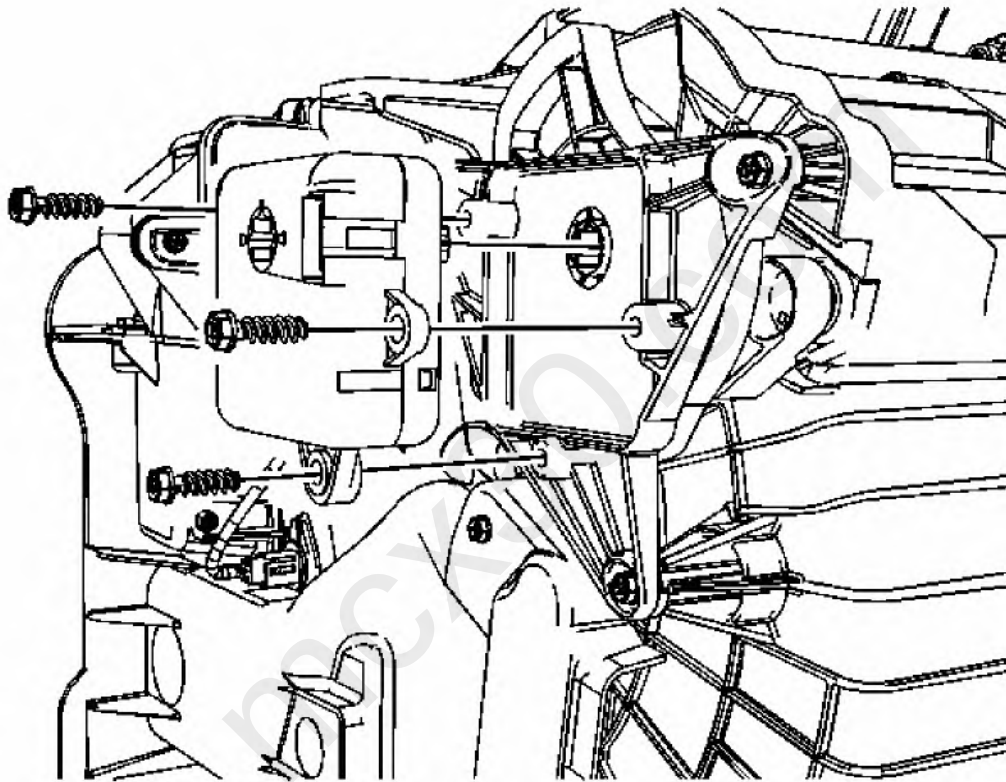


Fig. 11: View Of Mode Actuator
Courtesy of GENERAL MOTORS CORP.

1. Install the mode actuator to the evaporator case assembly.

NOTE: Refer to Fastener Notice .

2. Install the mode actuator screws to the evaporator case assembly.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

3. Connect the electrical connector to the mode actuator.
4. Install the communication interface module, if equipped. Refer to **Communication**

Interface Module Replacement .

5. Install the left side insulator/closeout panel. Refer to **Closeout/Insulator Panel Replacement - Left .**

IMPORTANT: Any time a mode actuator or the HVAC control module is replaced, the HVAC control module must be calibrated to ensure proper air distribution.

6. Calibrate the mode actuators by simultaneously pushing the A/C and RECIRC buttons on the HVAC control module 3 times each, within 2 seconds of initial push.
 - The A/C and RECIRC button LED's will flash while this calibration is taking place.
 - The calibration will take anywhere between 10-30 seconds depending on battery voltage.
 - The LED's will quit flashing when the calibration is complete.
7. Cycle the ignition and verify proper operation.

MODE CAM REPLACEMENT

Removal Procedure

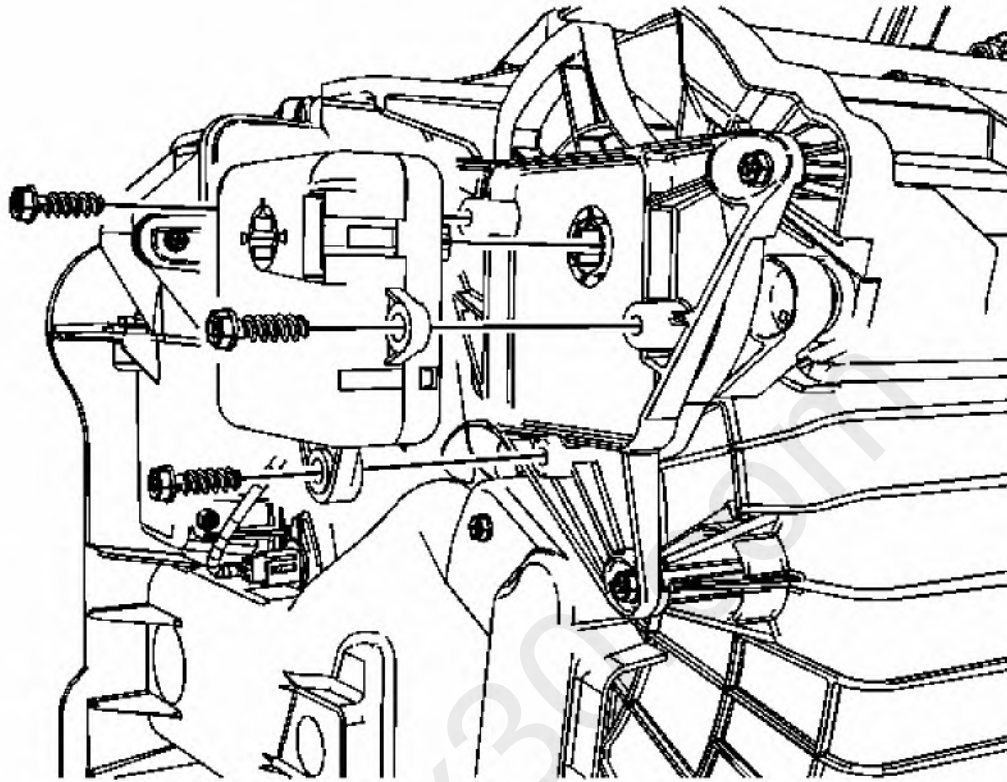


Fig. 12: View Of Mode Actuator
Courtesy of GENERAL MOTORS CORP.

1. Remove the left side insulator/closeout panel. Refer to **Closeout/Insulator Panel Replacement - Left**.
2. Remove the communication interface module, if equipped. Refer to **Communication Interface Module Replacement**.
3. Disconnect the electrical connector from the mode actuator.
4. Remove the mode actuator screws from the evaporator case assembly.
5. Remove the mode actuator from the evaporator case assembly.

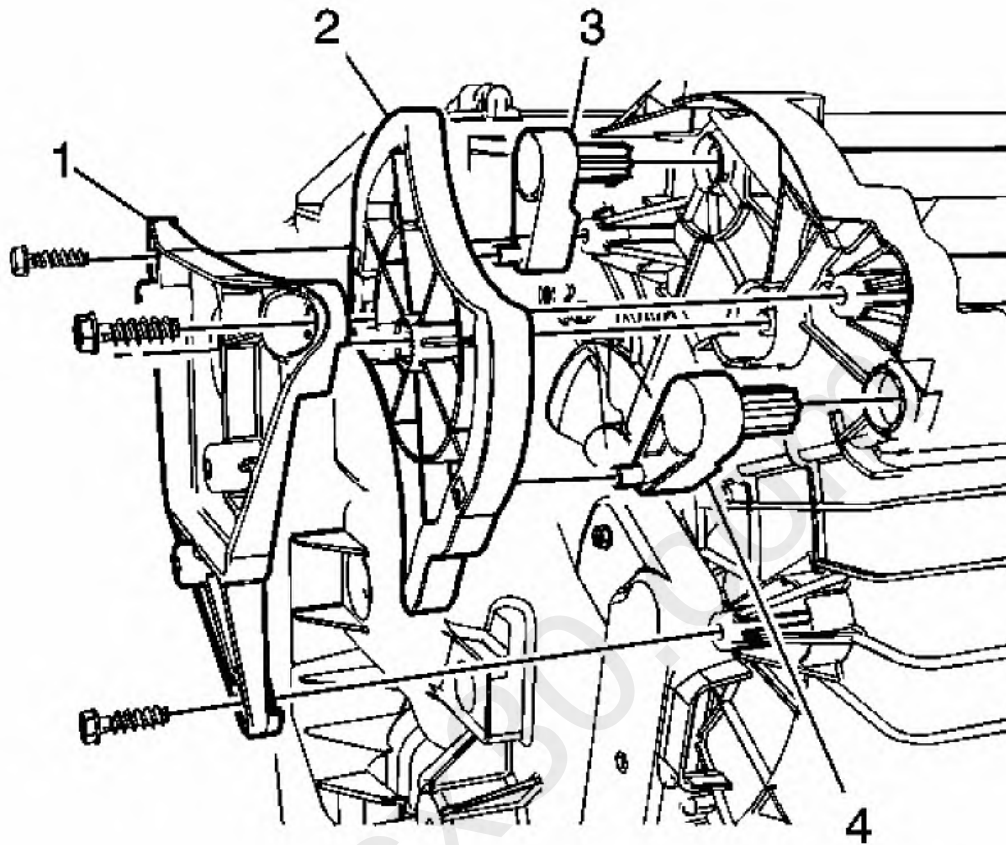


Fig. 13: View Of Mode Cam Bracket , Mode Cam And Mode Cam Levers
Courtesy of GENERAL MOTORS CORP.

6. Remove the screws retaining the mode cam bracket (1) to the evaporator case assembly.
7. Remove the mode cam bracket (1) from the evaporator case assembly.
8. Remove the mode cam (2) and the mode cam levers (3) from the evaporator case assembly.

Installation Procedure

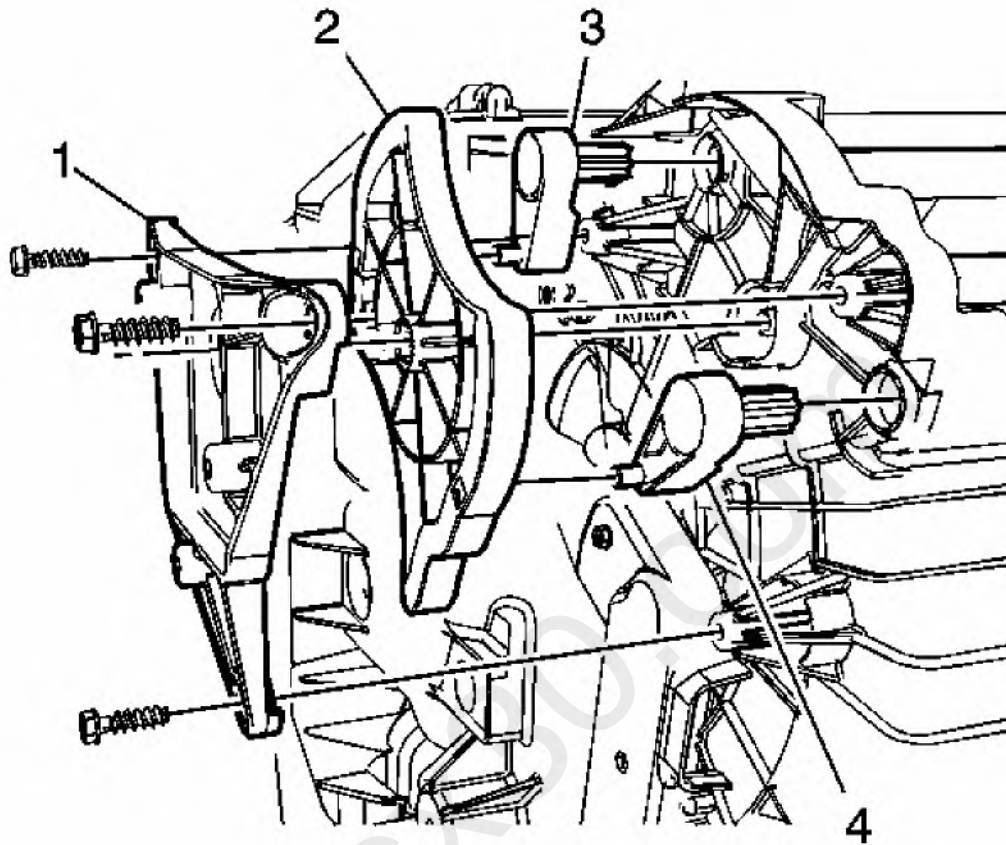


Fig. 14: View Of Mode Cam Bracket , Mode Cam And Mode Cam Levers
Courtesy of GENERAL MOTORS CORP.

1. Install the mode cam levers (3) to the evaporator case assembly.
2. Align and install the mode cam (2) to the mode cam levers (3). Rotate the mode cam (2) to verify mode door operation.
3. Install the mode cam bracket (1) to the evaporator case assembly.

NOTE: Refer to Fastener Notice .

4. Install the mode cam bracket screws to the evaporator case assembly.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

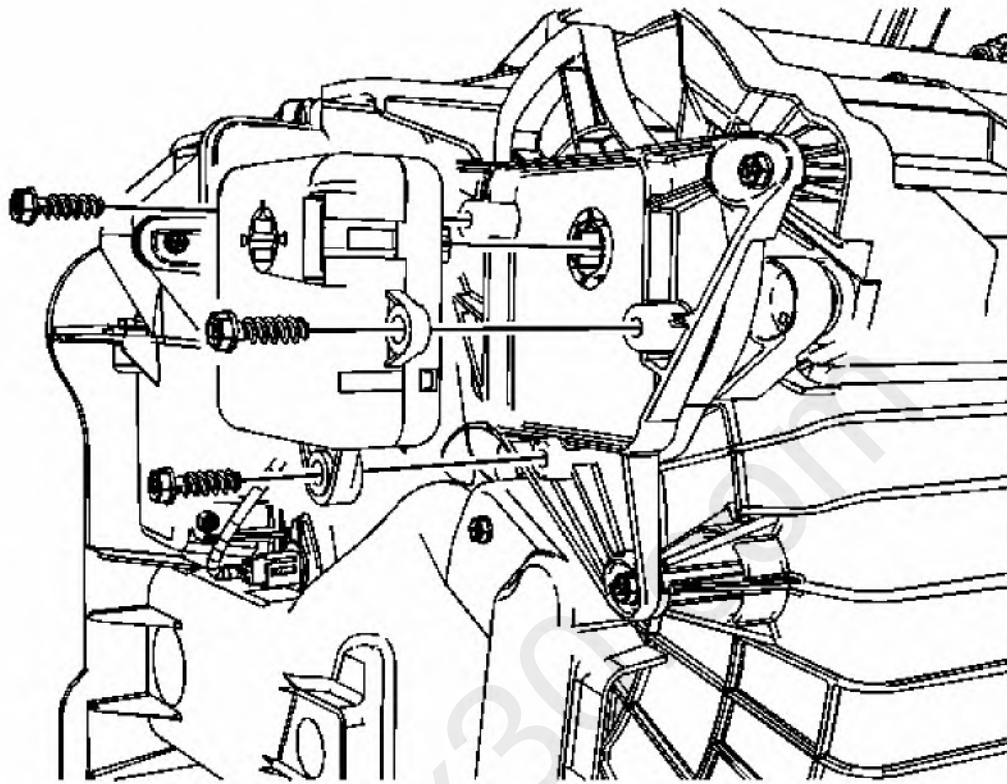


Fig. 15: View Of Mode Actuator
Courtesy of GENERAL MOTORS CORP.

5. Install the mode actuator to the evaporator case assembly.
6. Install the mode actuator screws to the evaporator case assembly.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

7. Connect the electrical connector to the mode actuator.
8. Install the communication interface module, if equipped. Refer to **Communication Interface Module Replacement** .
9. Install the left side insulator/closeout panel. Refer to **Closeout/Insulator Panel Replacement - Left** .

IMPORTANT: Any time a mode actuator or the HVAC control module is replaced, the HVAC control module must be calibrated to ensure proper air distribution.

10. Calibrate the mode actuators by simultaneously pushing the A/C and RECIRC buttons on the HVAC control module 3 times each, within 2 seconds of initial push.
 - The A/C and RECIRC button LED's will flash while this calibration is taking place.
 - The calibration will take anywhere between 10-30 seconds depending on battery voltage.
 - The LED's will quit flashing when the calibration is complete.
11. Cycle the ignition and verify proper operation.

RECIRCULATION ACTUATOR REPLACEMENT

Removal Procedure

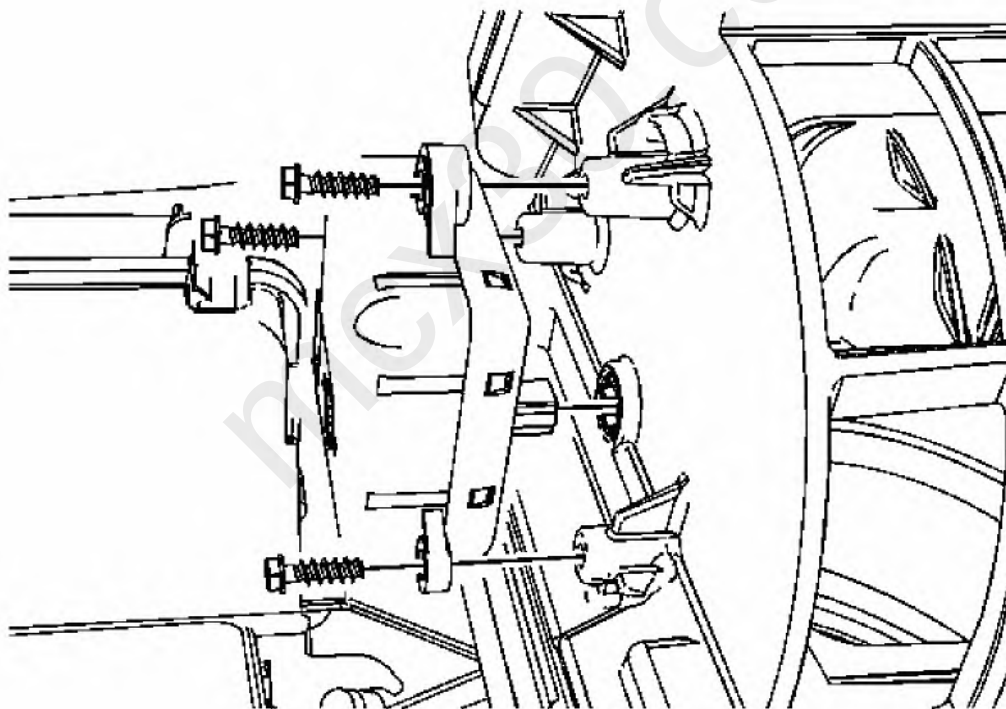


Fig. 16: View Of Recirculation Actuator
Courtesy of GENERAL MOTORS CORP.

1. Remove the instrument panel upper trim panel. Refer to **Trim Panel Replacement - Instrument Panel (I/P) Upper**.
2. Disconnect the electrical connector from the recirculation actuator.
3. Remove the recirculation actuator screws from the HVAC module.

4. Remove the recirculation actuator from the HVAC module.

Installation Procedure

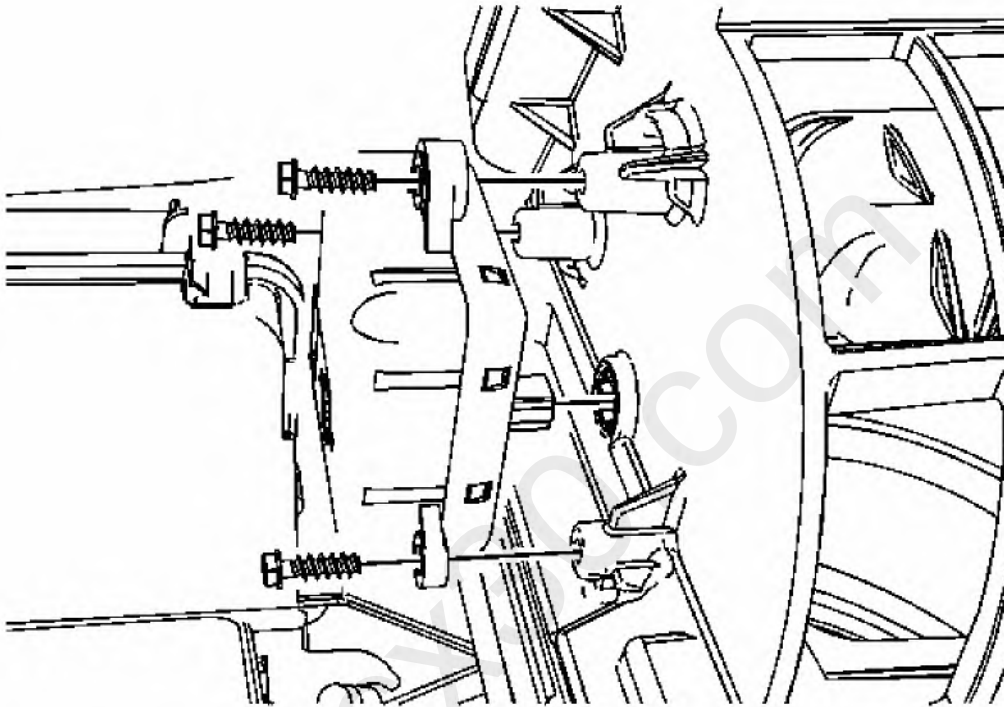


Fig. 17: View Of Recirculation Actuator
Courtesy of GENERAL MOTORS CORP.

1. Align the recirculation actuator with the door shaft and rotate into position.

NOTE: Refer to Fastener Notice .

2. Install the recirculation actuator screws to the HVAC module.

Tighten: Tighten the screws to 1.5 N.m (13 lb in).

3. Connect the electrical connector to the recirculation actuator.
4. Cycle the ignition and verify proper operation.
5. Install the instrument panel upper trim panel. Refer to Trim Panel Replacement - Instrument Panel (I/P) Upper .

DESCRIPTION AND OPERATION

AIR DELIVERY DESCRIPTION AND OPERATION

The air delivery description and operation is divided into 4 areas:

- HVAC control components
- Air speed
- Air delivery
- Recirculation operation

HVAC Control Components**HVAC Control Module**

The HVAC control module 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 control module supports the following features:

Air Delivery Description and Operation

Feature	Availability
After Blow	No
Purge	No
Personalization	No
Actuator Calibration	Yes

Mode Actuators - Defrost, Panel and Floor

The mode actuators are 5-wire bi-directional electric motors that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal, and 2 control circuits enable the actuators 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 one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. 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, one of the control circuits is grounded. 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 removes power from both control circuits.

Air Speed

The HVAC control assembly applies ground 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-3 resistors
- Medium 1 speed-2 resistors
- Medium 2 speed-1 resistor

When the operator requests High speed, the HVAC control assembly applies ground directly to the blower motor through the high blower motor control circuit. The resistor card has a fusible link which, if blown, will require that the card be replaced.

Air Delivery

The defrost, panel and floor actuators control air delivery. The HVAC control module controls these actuators in order to distribute airflow to a desired outlet. When the vehicle operator selects the defrost, mix-blend or floor positions, the A/C compressor clutch engages and the recirculation actuator will be moved to the outside air position. The flow of air during the various modes of operation is as follows:

- Panel-Instrument panel (I/P) outlets
- Bi-Level-I/P and floor outlets
- Floor-Floor outlets only
- Mix-Blend-Floor and defroster outlets with a slight bleed to the I/P outlets
- Defrost-Defrost outlets with a small amount of air to the side window defoggers

Recirculation Operation

The recirculation actuator is a 2-wire bi-directional electric motor. Two control circuits enable the actuator to operate. The control circuits use either ground or a 12-volt value to coordinate the actuator movement. The HVAC control assembly reverses the polarity of the control circuits to move the actuator in the opposite direction. The recirculation operation can function with blower motor in either the ON or OFF position. The A/C compressor automatically comes on when recirculation is selected. recirculation is not available in defrost, mix-blend or floor mode. The recirculation LED may still be ON while the air inlet door is in the outside air position.

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 Module

The HVAC control module 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 control module supports the following features:

Air Temperature Description and Operation

Feature	Availability
After Blow	No
Purge	No
Personalization	No
Actuator Calibration	Yes

Air Temperature Actuator

The air temperature actuator are 5-wire bi-directional electric motors that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal, and 2 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 one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. 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, one of the control circuits is grounded. 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 removes power from both control circuits.

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 A/C refrigerant pressure sensor protects the A/C system from operating when an

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excessively high or low pressure condition exists. The powertrain control module (PCM) or engine control module (ECM) disables the compressor clutch under the following conditions:

- The A/C high side pressure is more than 2 929 kPa (425 psi).
- The clutch will be enabled after the high side pressure decreases to less than 1 376 kPa (200 psi).
- A/C low side pressure is less than 269 kPa (39 psi).
- The clutch will be enabled or will allow engagement again after the low side pressure increases to more than 296 kPa (43 psi).

Evaporator Low Ambient Protection

The refrigerant temperature at the temperature sensor in the thermal expansion valve (TXV) controls cycling of the compressor clutch to prevent freezing of the evaporator core. The compressor is disabled when the temperature goes below 3°C (37°F) and vehicle speed is greater than 8 km/h (5 mph). The compressor is enabled when the temperature exceeds 4°C (40°F). The minimum cycling time off is 4 seconds. For purposes of converting a voltage to a temperature value in the diagnosis of the temperature sensor located within the TXV at the inlet outlet of the evaporator the following conversion chart has been inputted. The evaporator temperature sensor is an input to the body control module (BCM).

Air Temperature Description and Operation

TEMP (°C/°F)	MIN/MAX (BCM) Voltage
-2/28	2.80/2.90
-1/30	2.73/2.83
0/32	2.66/2.76
1/34	2.59/2.69
2/36	2.52/2.62
3/38	2.45/2.55
4/40	2.38/2.48
6/42	2.31/2.41
7/44	2.25/2.35
24/75	1.34/1.37
SET POINT	
-40/-40	OPEN (4.85)
81/178	SHORT (0.122)

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 control. 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 powertrain control module (PCM) or engine control module (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 module. The A/C system maybe running without the A/C LED indicator illuminated when in FRONT DEFROST mode. The HVAC system uses a compressor that incorporates a thermal switch that opens once the compressor temperature exceeds 211-217° C (380-454°F) creating an open circuit. The following conditions must be met in order for the PCM/ECM to turn on the compressor clutch:

- BCM
 - Battery voltage between 11-16 volts
 - A/C request from the HVAC control module
- PCM/ECM
 - Engine coolant temperature (ECT) is greater than 117°C (243°F).
 - Engine speed is less than 4,760 RPM.
 - A/C pressure is between 2,929-2,706 kPa (425-39 psi).

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

- Throttle position is 100 percent
- A/C pressure is more than 2,929 kPa (425 psi).
- A/C pressure is less than 269 kPa (39 psi).
- ECT is more than 120°C (248°F).
- Engine speed is more than 6240 RPM.
- Transmission shift
- PCM/ECM detects excessive torque load.
- PCM/ECM detects insufficient idle quality.

- PCM/ECM detects a hard launch condition.

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

Engine Coolant

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 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 compressor is a variable displacement scroll type pump. The compressor uses a control valve to vary its displacement from 6.5 percent (9cc) to 100 percent (105cc). The A/C compressor is belt driven and operates when the magnetic clutch is engaged. A thermal protection switch is incorporated into the compressor. If the temperature exceeds 211-217°C (380-454°F), the switch will open creating an open circuit. 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 located in the compressor hose assembly block. This valve will open at 3965-3375 kPa (575-490 psi), and reset at 2930 kPa (425 psi). If this valve ever opens the a/c system must be serviced and the valve must be replaced.

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 thermal expansion valve (TXV) is located at the evaporator inlet and outlet pipes. 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.

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 to 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

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