2007 HVAC

HVAC - Manual - H3

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Actuator Retaining Screws, ALL	1.9 N.m	17 lb in
HVAC Control Module Retaining Screws	1.9 N.m	17 lb in

SCHEMATIC AND ROUTING DIAGRAMS

HVAC SCHEMATICS

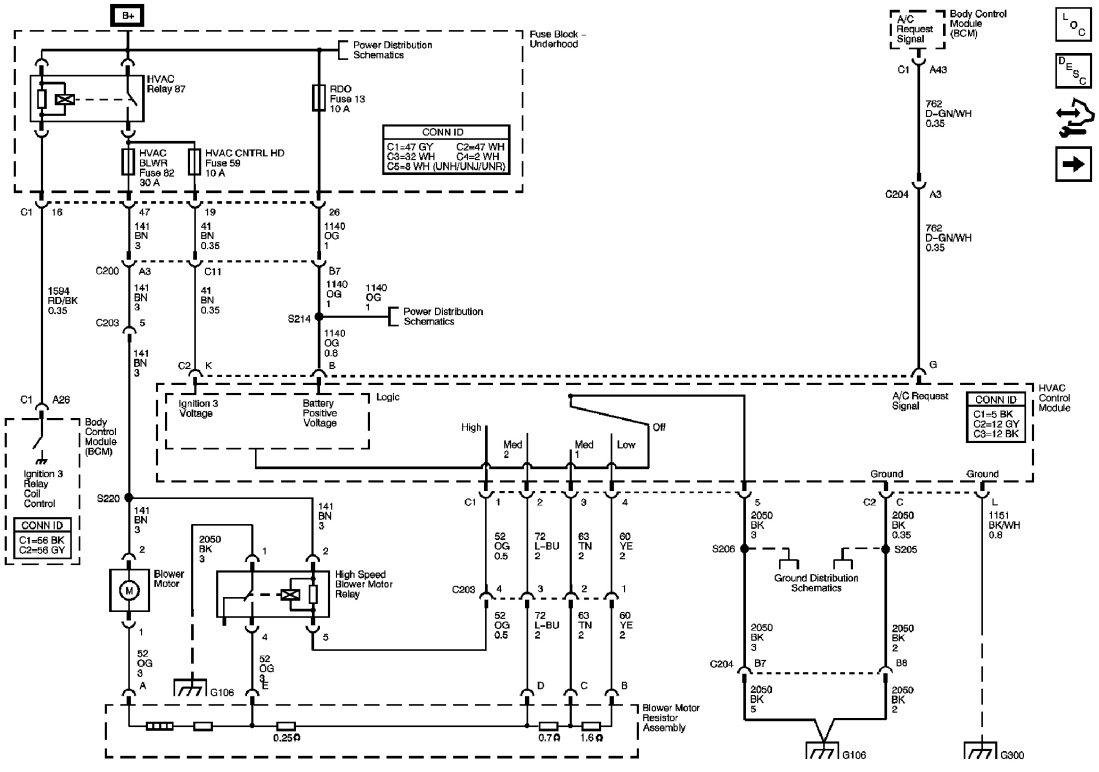


Fig. 1: Module Power, Ground and Blower Motor Schematic
Courtesy of GENERAL MOTORS CORP.

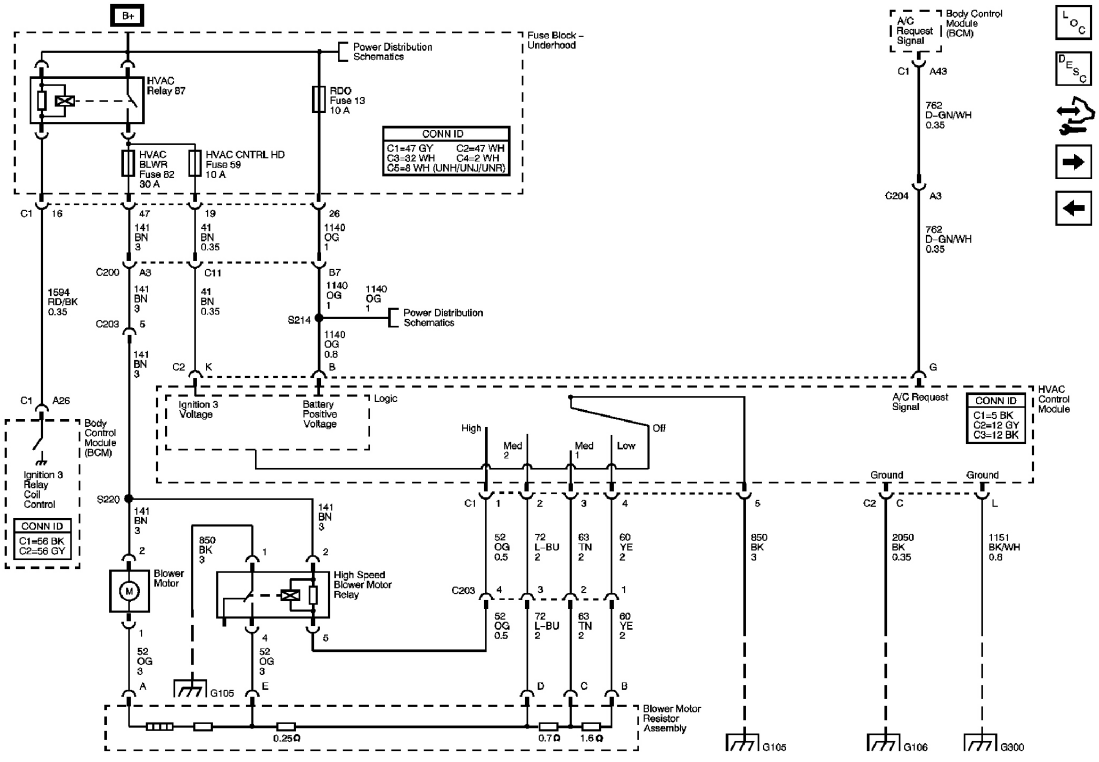


Fig. 2: Module Power, Ground and Blower Motor Schematic - RHD
Courtesy of GENERAL MOTORS CORP.

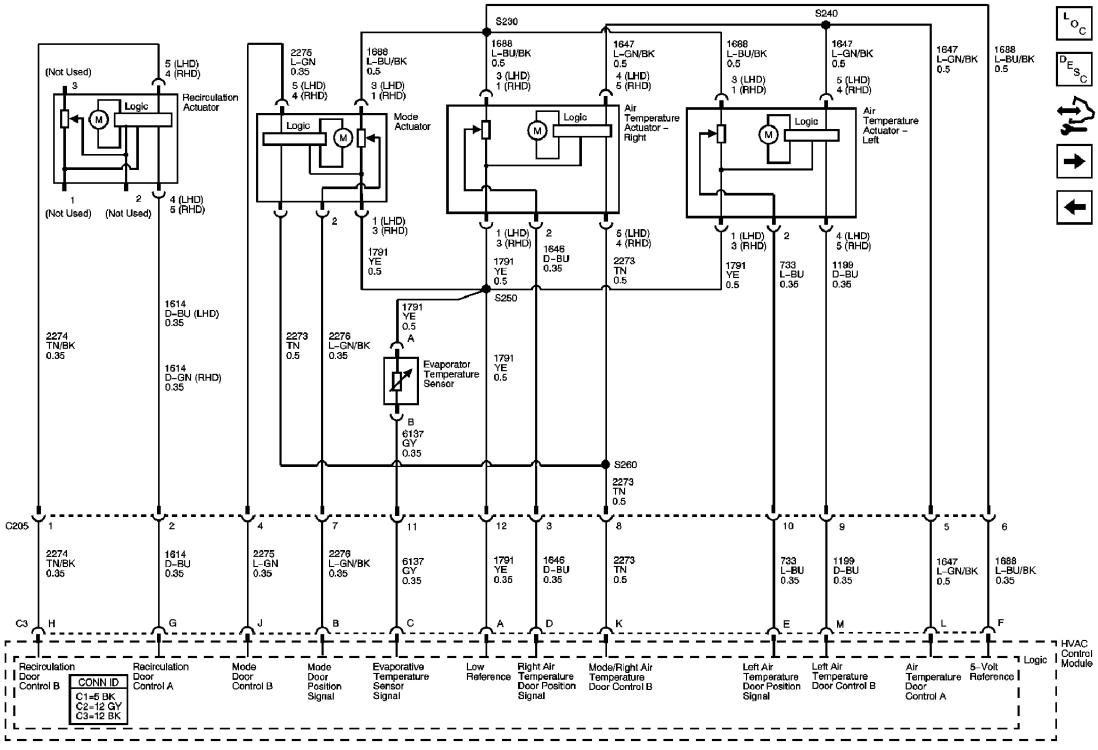


Fig. 3: Mode, Recirculation and Temperature Controls Schematic
Courtesy of GENERAL MOTORS CORP.

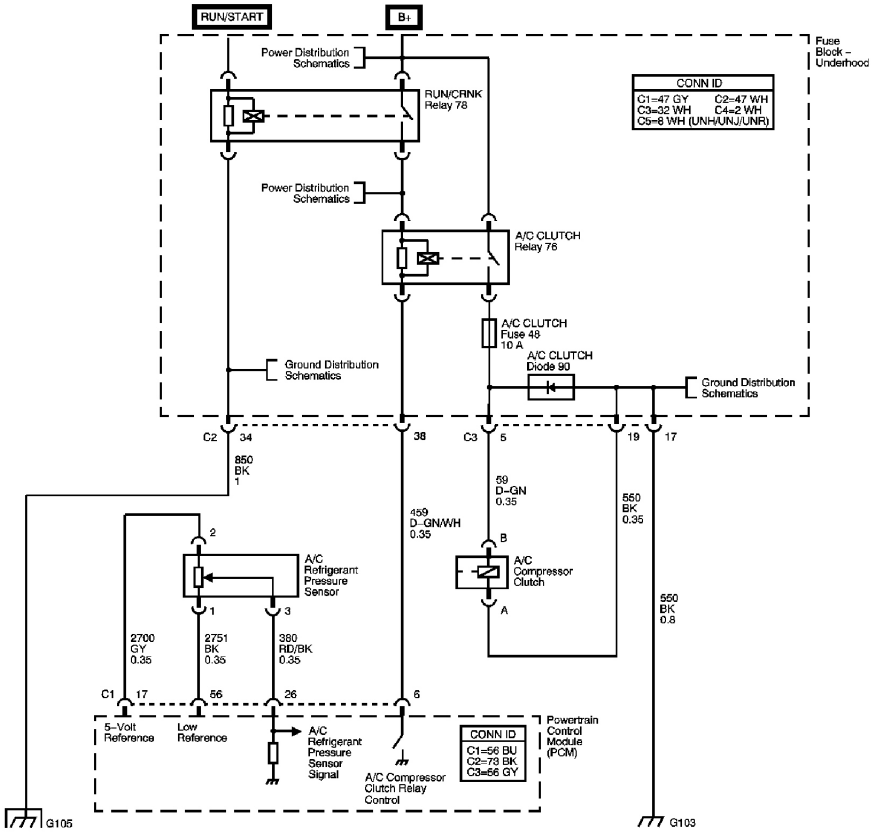


Fig. 4: Compressor Controls Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

HVAC COMPONENT VIEWS

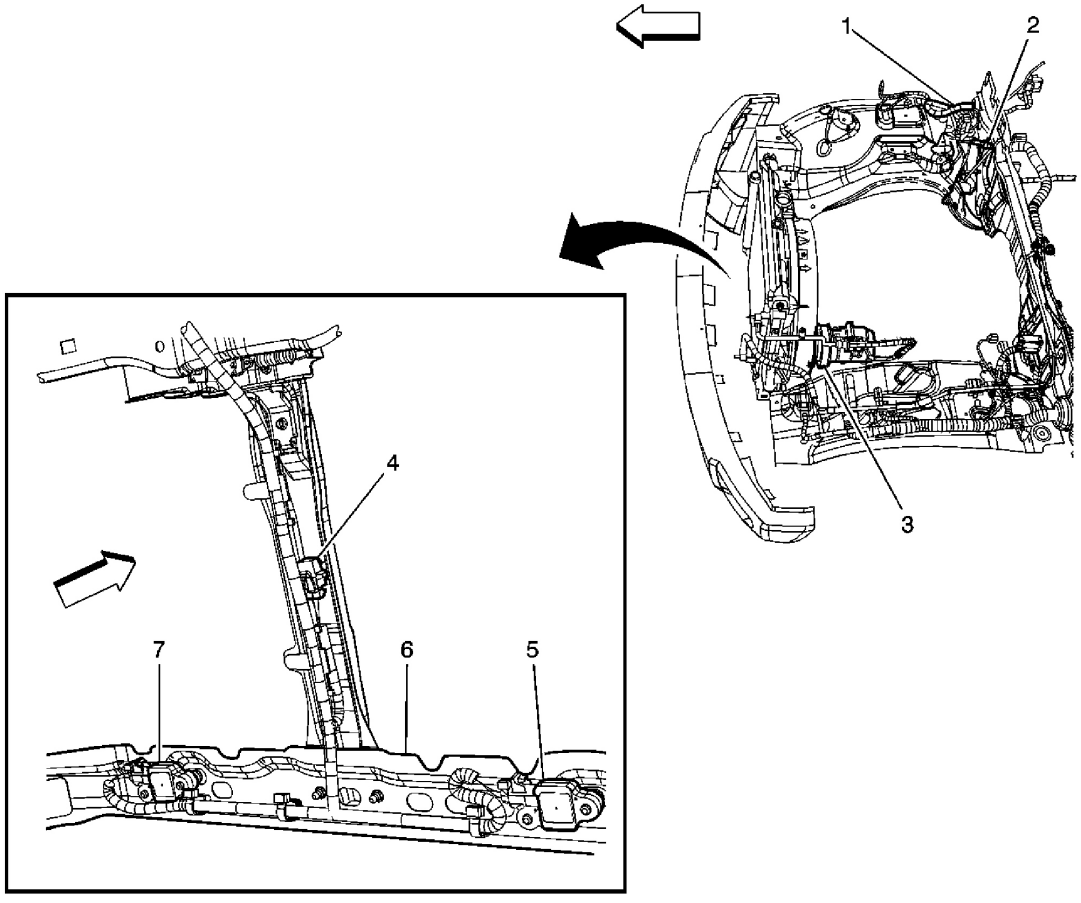


Fig. 5: Identifying Engine Compartment Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Body Harness
2	A/C Refrigerant Pressure Sensor
3	A/C Compressor Clutch
4	Ambient Air Temperature Sensor
5	Inflatable Restraint Front End Sensor - Right
6	Lower Radiator Support
7	Inflatable Restraint Front End Sensor - Left

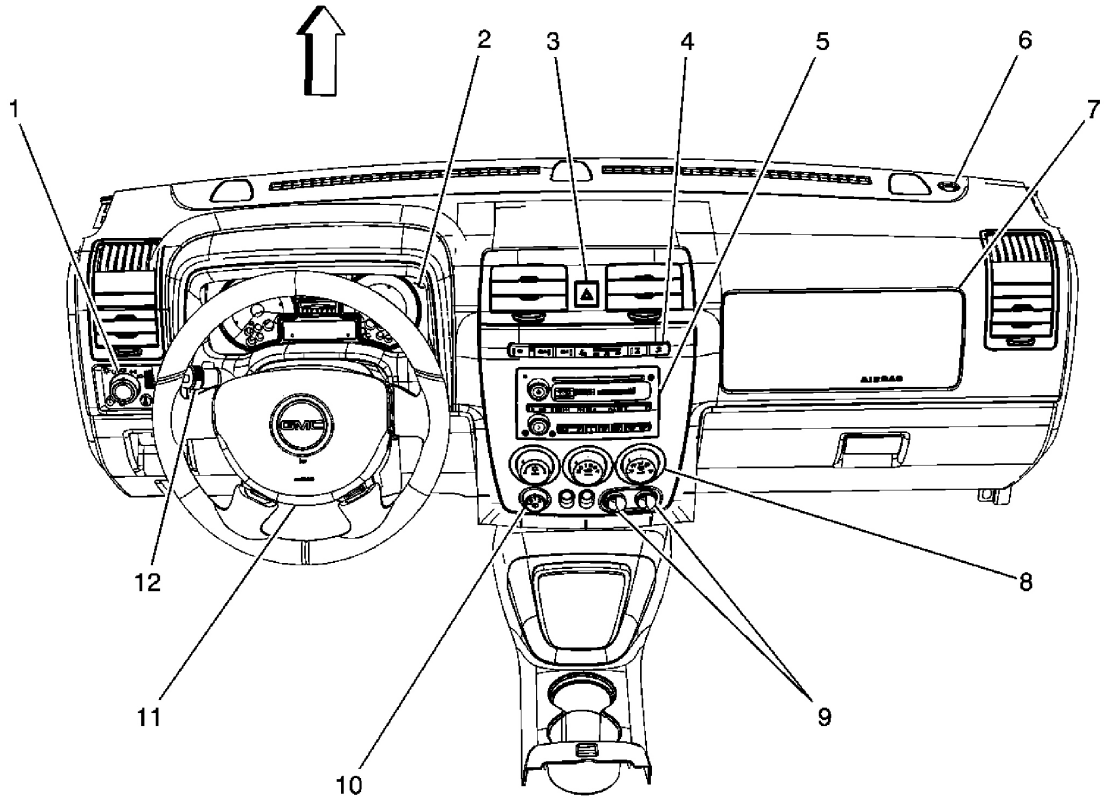


Fig. 6: Identifying I/P Harness Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Headlamp Switch
2	Instrument Panel Cluster (IPC)
3	Hazard Switch
4	Accessory Switch
5	Radio
6	Ambient Light Sensor
7	Inflatable Restraint I/P Module
8	HVAC Control Module
9	Auxiliary Power Outlets - Front
10	Rear Window Wiper/Washer Switch
11	Inflatable Restraint Steering Wheel Module
12	Turn Signal/Multifunction Switch

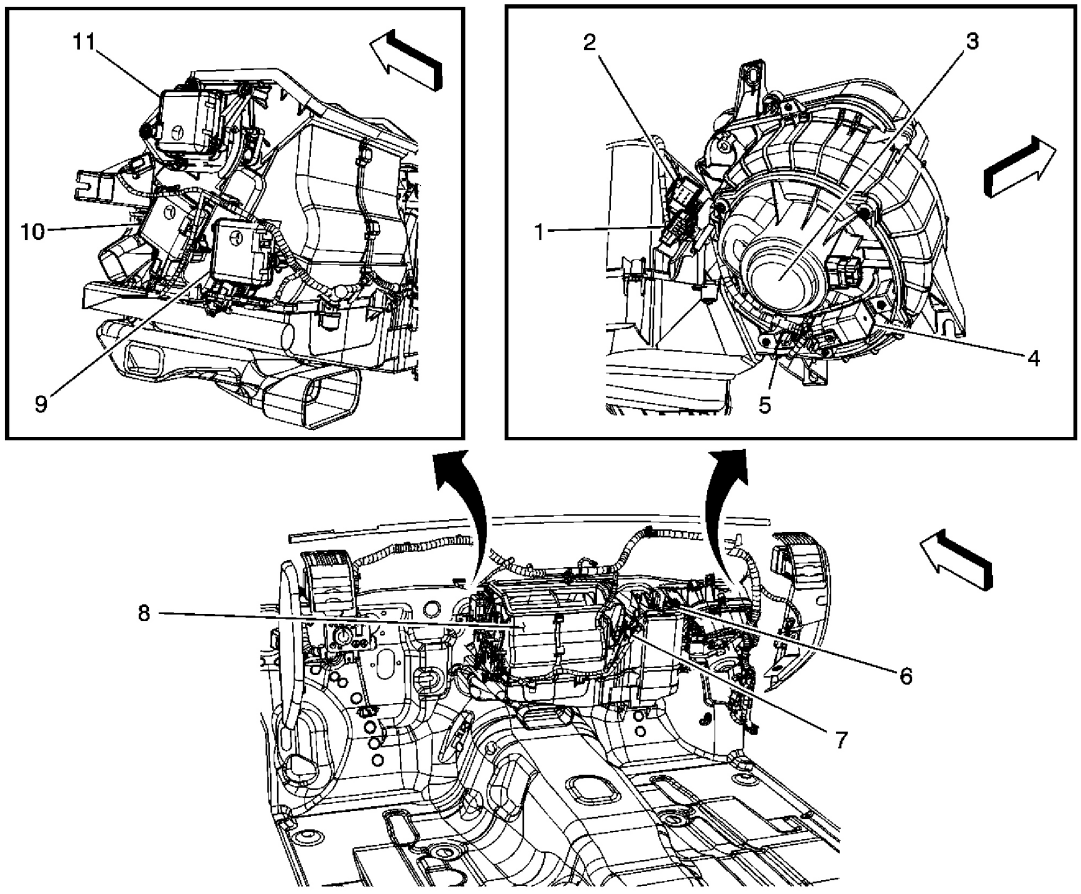


Fig. 7: Identifying HVAC Module Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	C205 HVAC Harness to I/P Harness
2	C203 Blower Motor Resistor Harness to I/P Harness
3	Blower Motor
4	High Speed Blower Motor Relay
5	Blower Motor Resistor Assembly
6	Recirculation Actuator
7	Evaporator Temperature Sensor
8	HVAC Module
9	Air Temperature Actuator - Right

10	Air Temperature Actuator - Left
11	Mode Actuator

HVAC CONNECTOR END VIEWS

A/C Compressor Clutch

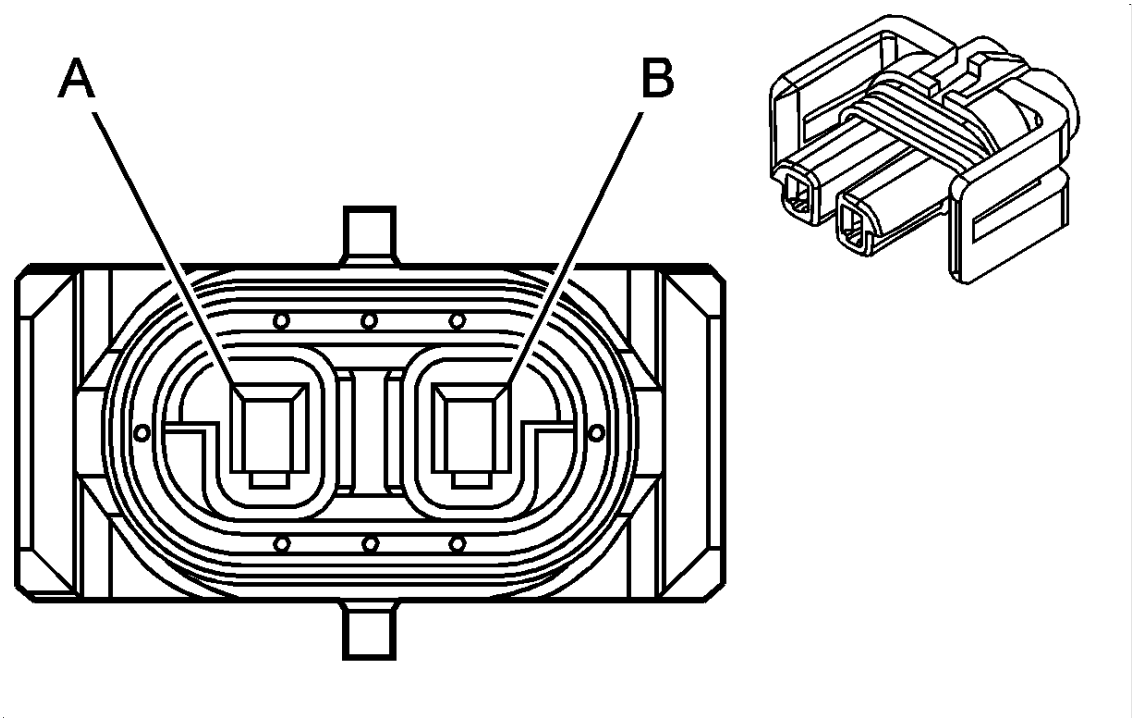


Fig. 8: A/C Compressor Clutch Connector End Views
Courtesy of GENERAL MOTORS CORP.

A/C Compressor Clutch Connector Parts Information

Connector Part Information

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

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

A/C Compressor Clutch Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	BK	550	Ground
B	D-GN	59	A/C Compressor Clutch Supply Voltage

A/C Refrigerant Pressure Sensor

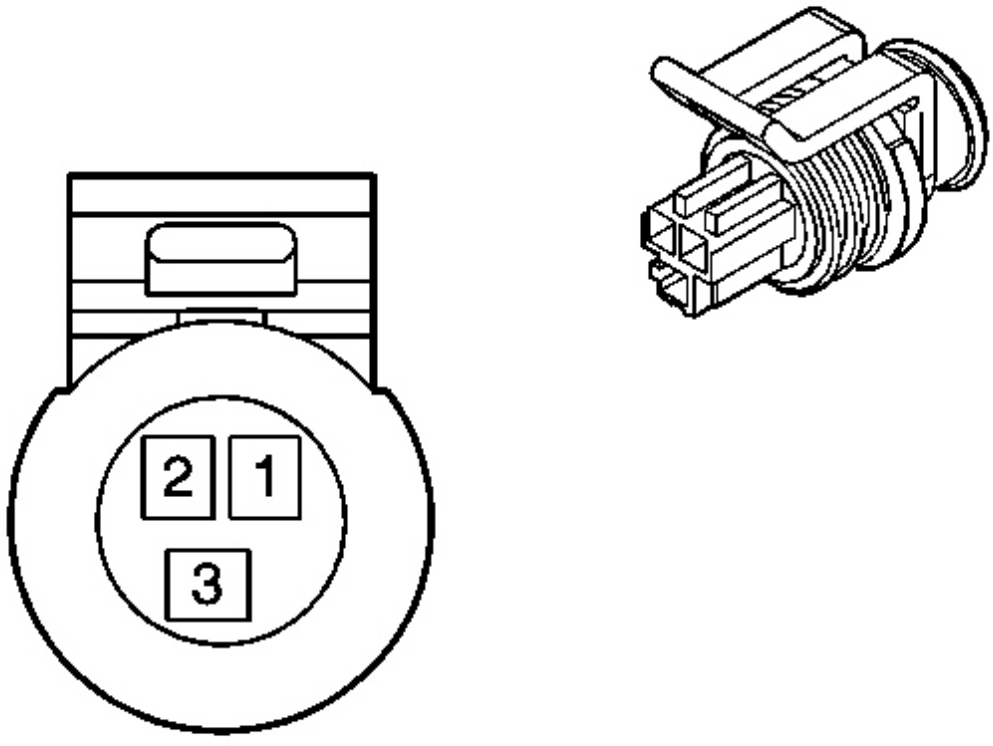


Fig. 9: A/C Refrigerant Pressure Sensor Connector End Views
Courtesy of GENERAL MOTORS CORP.

A/C Refrigerant Pressure Sensor Connector Parts Information

Connector Part Information

- OEM: 15397275

- Service: 88988301
- Description: 3-Way F Metri-Pack 150 Series Sealed (BK)

Terminal Part Information

- Terminal/Tray: 15326267/19
- Core/Insulation Crimp: E/4
- Release Tool/Test Probe: 15315247/J-35616-2A (GY)

A/C Refrigerant Pressure Sensor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	BK	2751	Low Reference
2	GY	2700	5V
3	RD/BK	380	A/C Refrigerant Pressure Sensor Signal

Air Temperature Actuator - Left

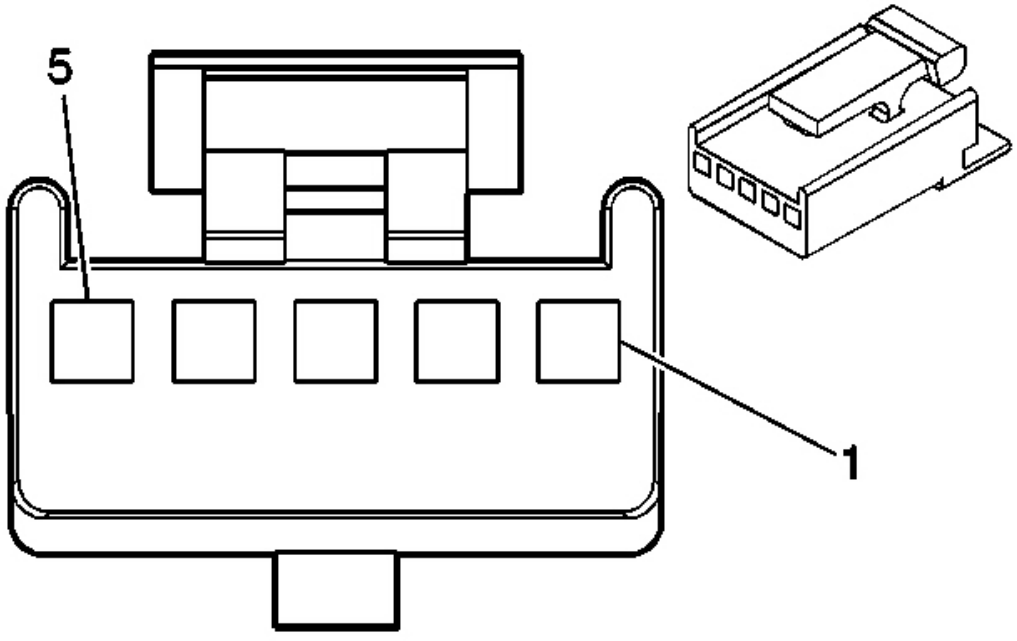


Fig. 10: Left Air Temperature Actuator Connector End Views
Courtesy of GENERAL MOTORS CORP.

Left Air Temperature Actuator Connector Parts Information

Connector Part Information

- OEM: 12064982
- Service: 12102633
- Description: 5-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

Left Air Temperature Actuator Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	YE	1791	Low Reference (LHD)
	L-BU/BK	1688	5V (RHD)
2	L-BU	733	Left Air Temperature Door Position Signal
3	L-BU/BK	1688	5V (LHD)
	YE	1791	Low Reference (RHD)
4	D-BU	1199	Left Air Temperature Door Control B (LHD)
	L-GN/BK	1647	Air Temperature Door Control A (RHD)
5	TN/BK	1647	Air Temperature Door Control A (LHD)
	D-BU	1199	Left Air Temperature Door Control B (RHD)

Air Temperature Actuator - Right

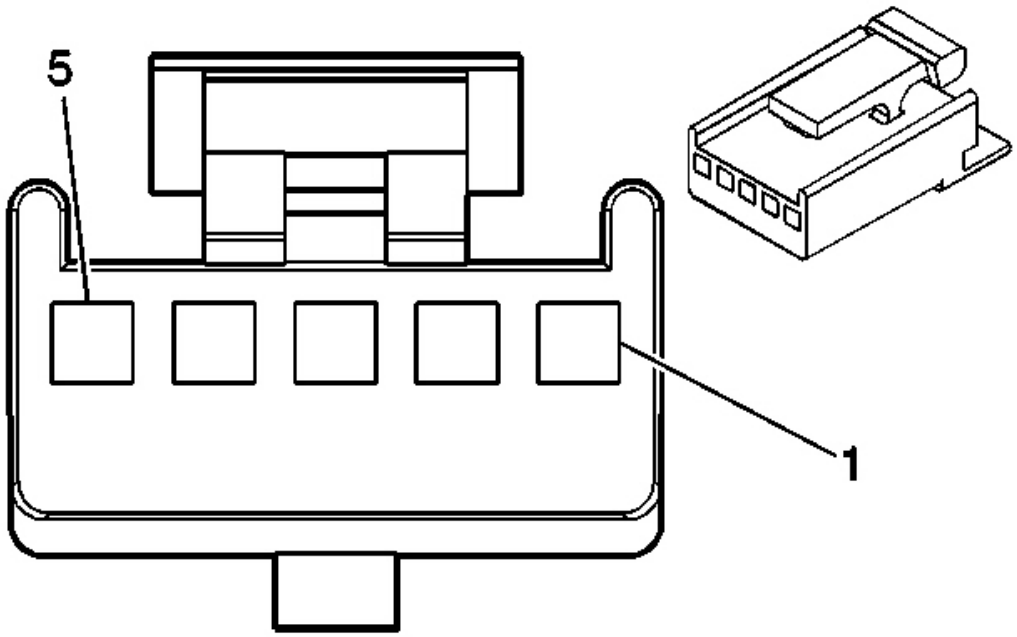


Fig. 11: Right Air Temperature Actuator Connector End Views
Courtesy of GENERAL MOTORS CORP.

Right Air Temperature Actuator Connector Parts Information

Connector Part Information

- OEM: 12064982
- Service: 12102633
- Description: 5-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

Right Air Temperature Actuator Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
	YE	1791	Low Reference (LHD)

1	L-BU/BK	1688	5V (RHD)
2	D-BU	1646	Right Air Temperature Door Position Signal
3	L-BU/BK	1688	5V (LHD)
	YE	1791	Low Reference (RHD)
4	TN/BK	1647	Air Temperature Door Control A (LHD)
	TN	2273	Mode/Right Air Temperature Door Control B (RHD)
5	TN	2273	Mode/Right Air Temperature Door Control B (LHD)
	L-GN/BK	1647	Air Temperature Door Control A (RHD)

Blower Motor

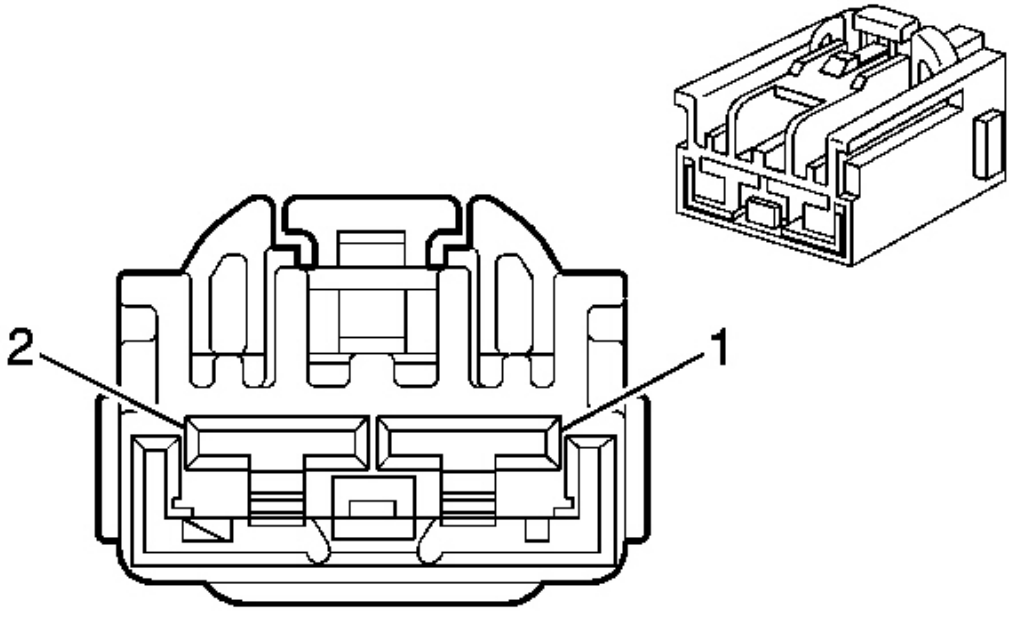


Fig. 12: Blower Motor Connector End View
Courtesy of GENERAL MOTORS CORP.

Blower Motor Connector Parts Information

Connector Part Information

- OEM: 7283-5590-40
- Service: 88988702
- Description: 2-Way F 6.3 System (L-GY)

Terminal Part Information

- Terminal/Tray: 7116-4122-02/10
- Core/Insulation Crimp: A/B
- Release Tool/Test Probe: 12094430/J-35616-42 (RD)

Blower Motor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	OG	52	High Blower Motor Control
2	BN	141	Ignition 3 Voltage

Blower Motor Resistor Assembly

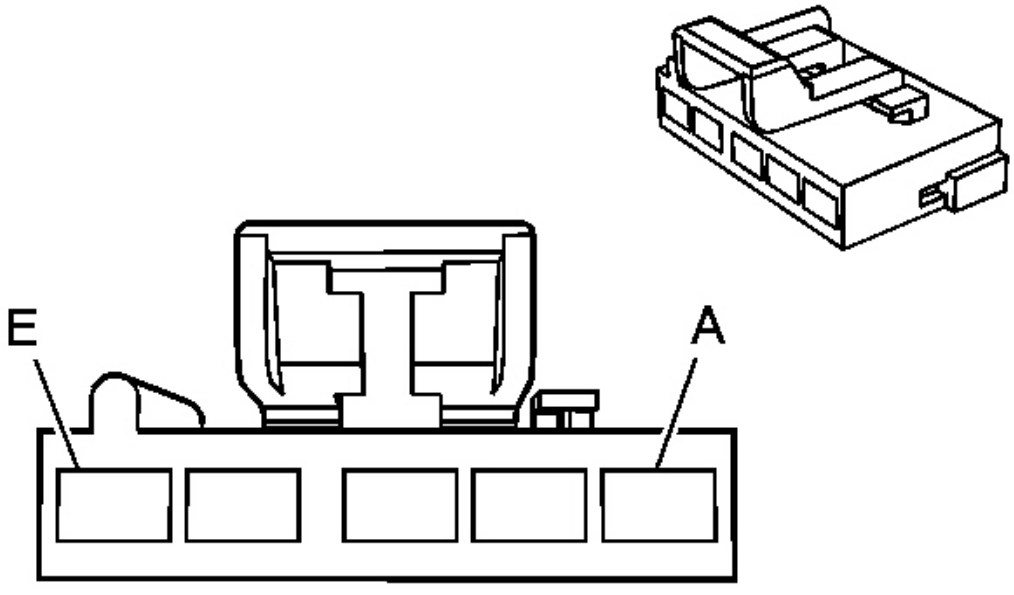


Fig. 13: Blower Motor Resistor Assembly Connector End Views
Courtesy of GENERAL MOTORS CORP.

Blower Motor Resistor Connector Parts Information

Connector Part Information

- OEM: 12059296
- Service: See Catalog
- Description: 5-Way F Metri-Pack 480 Series (RD)

Terminal Part Information

- Pins: A, E
- Terminal/Tray: 12084595/2
- Core/Insulation Crimp: F/G
- Release Tool/Test Probe: 12094430/J-35616-40 (BU)

- Pins: B-D
- Terminal/Tray: 12124304/2
- Core/Insulation Crimp: A/B
- Release Tool/Test Probe: 12094430/J-35616-40 (BU)

Blower Motor Resistor Assembly Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	OG	52	High Blower Motor Control
B	YE	60	Low Blower Motor Control
C	TN	63	Medium Blower Motor Control
D	L-BU	72	Medium 2 Blower Motor Control
E	OG	52	High Blower Motor Control

Evaporator Temperature Sensor

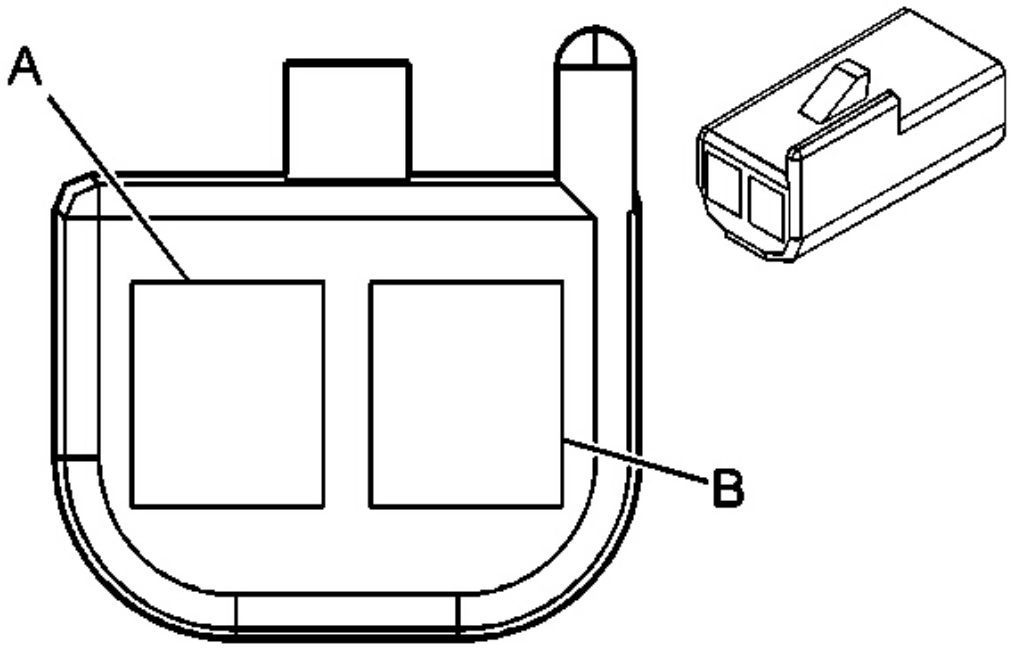


Fig. 14: Evaporator Temperature Sensor Connector End Views
Courtesy of GENERAL MOTORS CORP.

Evaporator Temperature Sensor Connector Parts Information

Connector Part Information

- OEM: 12047662
- Service: 12085535
- Description: 2-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Terminal/Tray: 12064971/5
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Evaporator Temperature Sensor Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function

A	YE	1791	Low Reference
B	GY	6137	Evaporative Temperature Sensor Signal

High Speed Blower Motor Relay

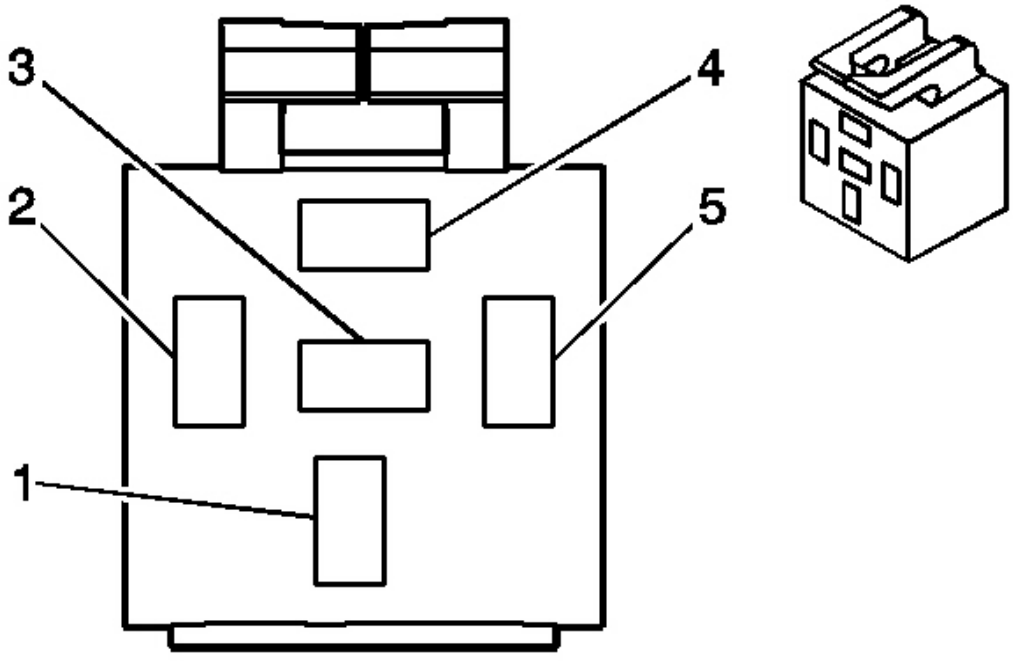


Fig. 15: High Speed Blower Motor Relay Connector End Views
Courtesy of GENERAL MOTORS CORP.

High Speed Blower Motor Relay Connector Parts Information

Connector Part Information

- OEM: 12034003
- Service: 88987189
- Description: 5-Way F Special Metri-Pack 630 Series (BK)

Terminal Part Information

- Pins: 1-4

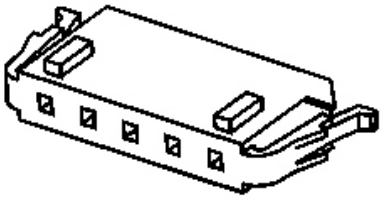
- Terminal/Tray: See Terminal Kit
- Core/Insulation Crimp: See Terminal Kit
- Release Tool/Test Probe: See Terminal Kit

- Pins: 5
- Terminal/Tray: 12015869/3
- Core/Insulation Crimp: E/A
- Release Tool/Test Probe: 12094430/J-35616-42 (RD)

High Speed Blower Motor Relay Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	BK	2050	Ground
2	BN	141	Run Ignition 3 Voltage
3	-	-	Not Used
4	OG	52	High Blower Motor Control
5	OG	52	High Blower Motor Control

HVAC Control Module C1



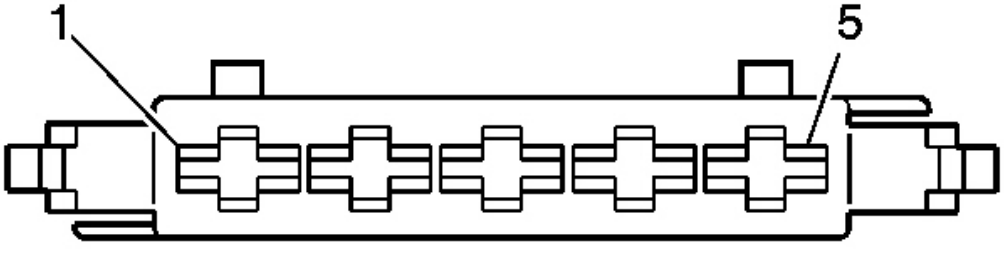


Fig. 16: HVAC Control Module C1 Connector End Views
Courtesy of GENERAL MOTORS CORP.

HVAC Control Module C1 Connector Parts Information

Connector Part Information

- OEM: 1534390-1
- Service: 88988350
- Description: 5-Way F Standard Power Timer (BK)

Terminal Part Information

- Terminal/Tray: See Terminal Kit
- Core/Insulation Crimp: See Terminal Kit
- Release Tool/Test Probe: See Terminal Kit

HVAC Control Module C1 Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1	OG	52	High Blower Motor Control
2	L-BU	72	Medium 2 Blower Motor Control
3	TN	63	Medium Blower Motor Control
4	YE	60	Low Blower Motor Control
5	BK	2050	Ground
	BK	850	Ground

HVAC Control Module C2

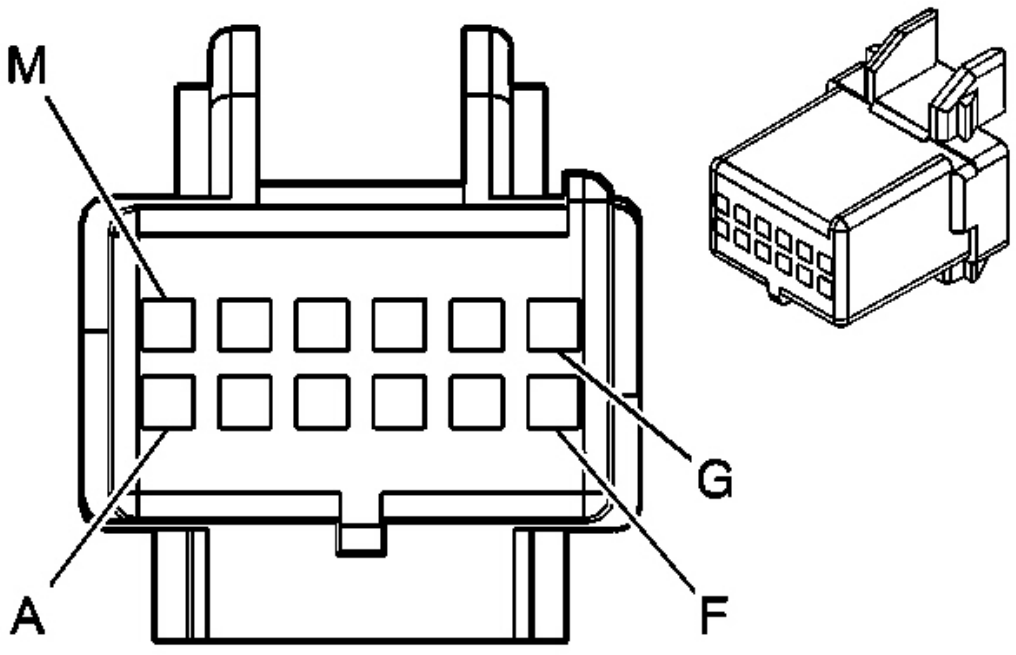


Fig. 17: HVAC Control Module C2 Connector End View
Courtesy of GENERAL MOTORS CORP.

HVAC Control Module C2 Connector Parts Information

Connector Part Information

- OEM: 15336594
- Service: 15336594
- Description: 12-Way F Micro-Pack 100 Series (GY)

Terminal Part Information

- Pins: B, L
- Terminal/Tray: 12146448/19
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

- Pins: C-K

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

HVAC Control Module C2 Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	-	-	Not Used
B	OG	1140	Battery Positive Voltage
C	BK	2050	Ground
D	GY	8	Instrument Panel Lamps Dimmer Switch Signal
E	-	-	Not Used
F	TN	683	Rear Defog Indicator Supply Voltage
G	D-GN/WH	762	A/C Request Signal
H	-	-	Not Used
J	L-BU	292	Rear Defog Switch Signal
K	BN	41	Ignition 3 Voltage
L	BK/WH	1151	Ground
M	-	-	Not Used

HVAC Control Module C3

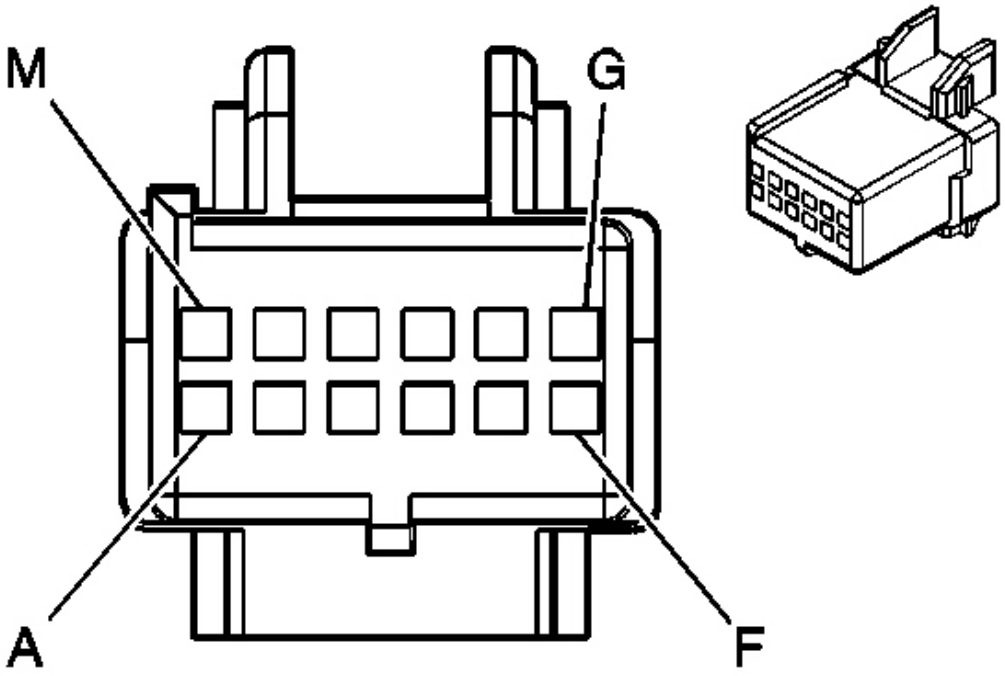


Fig. 18: HVAC Control Module C3 Connector End Views
Courtesy of GENERAL MOTORS CORP.

HVAC Control Module C3 Connector Parts Information

Connector Part Information

- OEM: 12064799
- Service: 15305996
- Description: 12-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

HVAC Control Module C3 Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
A	YE	1791	Low Reference
B	L-GN/BK	2276	Mode Door Position Signal
C	GY	6137	Evaporative Temperature Sensor Signal
D	D-BU	1646	Right Air Temperature Door Position Signal
E	L-BU	733	Left Air Temperature Door Position Signal
F	L-BU/BK	1688	5V
G	D-GN	1614	Recirculation Door Control A
H	TN/BK	2274	Recirculation Door Control B
J	L-GN	2275	Mode Door Control B
K	TN	2273	Mode/Right Air Temperature Door Control B
L	L-GN/BK	1647	Air Temperature Door A
M	D-BU	1199	Left Air Temperature Door Control B

Mode Actuator

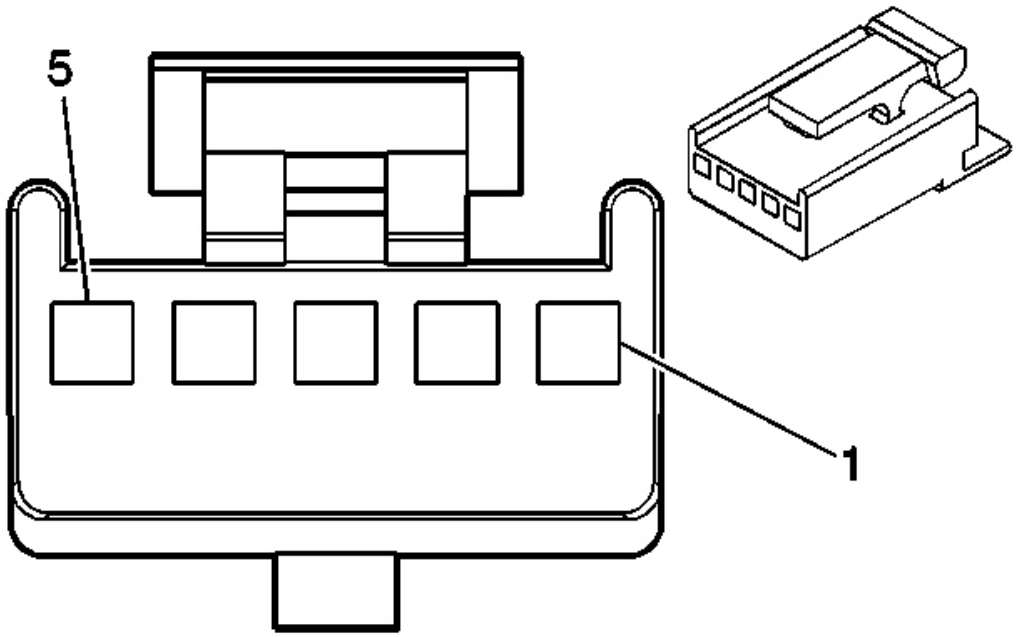


Fig. 19: Mode Actuator Connector End Views
Courtesy of GENERAL MOTORS CORP.

Mode Actuator Connector Parts Information

Connector Part Information

- OEM: 12064982
- Service: 12102633
- Description: 5-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

Mode Actuator Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
	YE	1791	Low Reference (LHD)

1	L-BU/BK	1688	5V (RHD)
2	L-GN/BK	2276	Mode Door Position Signal
3	L-BU/BK	1688	5V (LHD)
	YE	1791	Low Reference (RHD)
4	TN	2273	Mode/Right Air Temperature Door Control B (LHD)
	L-GN	2275	Mode Door Control B (RHD)
5	L-GN	2275	Mode Door Control B (LHD)
	TN	2273	Mode/Right Air Temperature Door Control B (RHD)

Recirculation Actuator

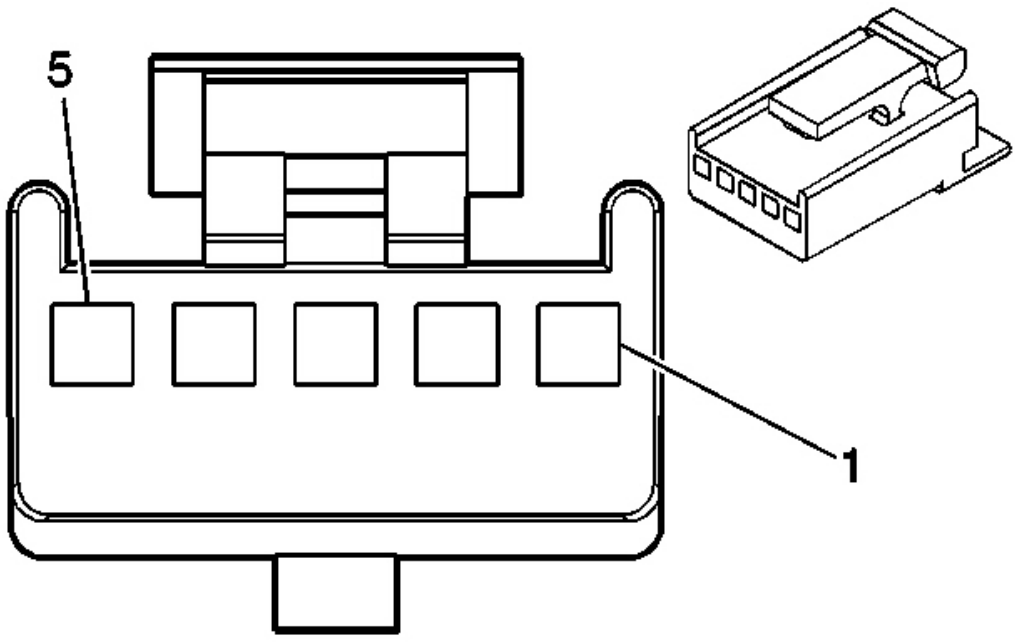


Fig. 20: Recirculation Actuator Connector End Views
Courtesy of GENERAL MOTORS CORP.

Recirculation Connector Parts Information

Connector Part Information

- OEM: 12064982
- Service: 12102633
- Description: 5-Way F Micro-Pack 100 Series (BK)

Terminal Part Information

- Terminal/Tray: 12146447/3
- Core/Insulation Crimp: E/C
- Release Tool/Test Probe: 12031876-1/J-35616-6 (BN)

Recirculation Actuator Connector Terminal Identification

Pin	Wire Color	Circuit No.	Function
1-3	-	-	Not Used
4	L-BU	1614	Recirculation Door Control A (LHD)
	TN-BK	2274	Recirculation Door Control B (RHD)
5	L-GN	2274	Recirculation Door Control B (LHD)
	D-GN	1614	Recirculation Door Control A (RHD)

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC P0532 or P0533	** MULTIPLE VALUES **
DTC B3787 or B3788	**DESCRIPTION NOT COLLECTED **

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
HVAC Fan Auto On	Outputs	When On is selected with the scan tool, the body control module (BCM) supplies a ground for coil of the ignition 3 relay (IGN 3) in the underhood bussed electrical center (UBEC), which supplies battery power to the blower motor and the HVAC control assembly. The blower motor switch must be

		in a speed position other than OFF for output to function. When OFF is selected with the scan tool, the BCM removes the ground for the IGN 3 relay and the blower motor is disabled.

SCAN TOOL DATA LIST

Body Control Module (BCM)

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	Inputs	Yes, No	Yes

Powertrain Control Module (PCM)

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 Pressure Sensor	Engine Data 2	kPa, psi	Varies
A/C Relay Command	Engine Data 1, Engine Data 2	On, Off	On
A/C Request Signal	Engine Data 2	Yes, No	Yes
ECT Sensor	Engine Data 1, Engine Data 2	°C/°F	Varies

SCAN TOOL DATA DEFINITIONS

AC Pressure Sensor

The scan tool displays 0-3450 kPa (0-500 psi). The voltage applied to the powertrain control module (PCM) input from the A/C refrigerant pressure sensor is converted to a pressure value.

A/C Relay Command

The scan tool displays On/Off. The scan tool displays the control decision for the compressor clutch relay output as determined by the PCM.

A/C Request

The scan tool displays Yes/No. Yes is displayed when the body control module (BCM) receives an input from the HVAC control assembly for an A/C request. No is displayed when there is no A/C request.

A/C Request Signal

The scan tool displays Yes/No. The scan tool displays Yes when the PCM receives a class 2 message from the body control module (BCM) to engage the A/C compressor clutch. The BCM receives a voltage input from the HVAC control assembly through the evaporator temperature sensor for an A/C request. The scan tool displays No when the PCM receives a class 2 message from the BCM to disengage the A/C compressor clutch.

ECT Sensor

The scan tool displays -39 to 140°C (-38 to 284°F). The voltage applied to the PCM input from the engine coolant temperature sensor is converted to a temperature value.

DTC P0532 OR P0533

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0532

Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit

DTC P0533

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

Diagnostic Fault Information

DTC P0532 or P0533

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance

5-Volt Reference Circuit	P0532	P0532	-	-
A/C Refrigerant Pressure Sensor Signal Circuit	P0532	P0532	P0533	-
Low Reference Circuit	-	P0533	-	-

Circuit/System Description

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

Conditions for Running the DTC

- Engine is running.
- Any of the conditions for setting the DTC are met for 15 seconds.
- Battery voltage is between 11-18 volts.

Conditions for Setting the DTC

- The ECM detects that the A/C pressure is less than 1 psi (0.01 volt).
- The ECM detects that the A/C pressure is more than 428 psi (4.92 volts).

Action Taken When the DTC Sets

- The ECM will not illuminate the malfunction indicator lamp (MIL)
- The ECM 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 will become history if the ECM no longer detects a failure.

Diagnostic Aids

A malfunction within the refrigerant system causing high pressure can cause this DTC to set.

Reference Information

Schematic Reference

HVAC Schematics

Description and Operation

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

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

Ignition ON, observe the scan tool A/C High Side Pressure Sensor parameter. The reading should be between 1 psi and 428 psi.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A/C pressure sensor.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit terminal 1 and ground.
    - If greater than 1 ohm, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the ECM.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 2 and ground.
    - If less than 4.8 volts, test the 5-volt reference circuit for a short to ground or an

open/high resistance. If the circuit tests normal, replace the ECM.
    - If greater than 5.2 volts, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the ECM.
4. Verify the scan tool A/C High Side Pressure Sensor parameter is less than 428 psi.
    - If greater than 428 psi, test the signal circuit terminal 3 for a short to voltage. If the circuit tests normal, replace the ECM.
5. Install a 3-amp fused jumper wire between the signal circuit terminal 3 and the 5-volt reference circuit terminal 2. Verify the scan tool A/C High Side Pressure Sensor parameter is greater than 428 psi.
    - If less than 428 psi, test the signal circuit for short to ground or an open/high resistance. If the circuit tests normal, replace the ECM.
6. If all circuits test normal, test or replace the A/C Pressure Sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (Left Hand Drive)** or **Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (Right Hand Drive)**
- **Control Module References** for ECM replacement, setup and programming

DTC B3787 OR B3788

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC DTC B3787

Blower Motor Relay Control Circuit Low

DTC DTC B37878

Blower Motor Relay Control Circuit High

Diagnostic Fault Information

DTC P3787 or 3788

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Blower Relay Coil B+	P3787	P3787	-	-
Blower Relay Control	1	P3787	P3788	-
1 - Blower Relay Always On				

Circuit/System Description

When the Ignition switch is in the run position, the Body Control Module (BCM) will ground the blower motor relay control circuit, which will switch the relay. With the relay contacts closed, battery voltage is supplied to the blower motor.

Conditions for Running the DTC

- The ignition voltage is between 11.0-18.0 volts.
- The ignition switch is in the run position.

Conditions for Setting the DTCs

- A short to ground on the blower motor relay control circuit.
- A short to voltage on the blower motor relay control circuit.
- An open circuit on the blower motor relay control circuit or relay.
- An internally shorted or excessively low resistance blower motor relay coil.

Action Taken When the DTC Sets

- The blower motor relay is commanded OFF.
- The conditions for which the DTC was set will be stored in the Failure Records data only. No information will be stored as Freeze Frame data.

Conditions for Clearing the DTC

A History DTC clears after 40 consecutive warm-up cycles.

Reference Information

Schematic Reference

HVAC Schematics

Description and Operation

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

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON with the engine OFF, command the A/C Relay ON and OFF with a scan tool.
2. Feel/listen for the A/C relay to click. Observe the scan tool A/C Relay Circuit Status function or A/C relay solenoid turns on and off clicks.

Circuit/System Testing

The A/C clutch relay terminal numbers called out per the following testing were verified on an actual vehicles underhood fuseblock and A/C clutch relay.

1. Ignition OFF, disconnect the A/C Relay.
2. Ignition ON, verify that a test lamp does not illuminate between the control circuit and ground.
    - If the test lamp illuminates, test the control circuit for a short to voltage.
3. Verify that a test lamp illuminates between the ignition circuit, relay coil feed circuit and ground.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or a open/high resistance. If the circuit tests normal and ignition circuit fuse is open, test all

components connected to the ignition circuit and replace as necessary.

4. Connect a test lamp between the relay coil B+ circuit terminal and the relay coil control circuit terminal and ground.
5. Command the A/C Relay output function ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
    - If the test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the ECM.
    - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
6. If all circuits test normal, replace the A/C Clutch Relay.

Component Testing

Relay Testing

1. Ignition OFF, disconnect the A/C Relay.
2. Test for 137 ohms across the relay coil terminals.
    - If the resistance is not close to the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
    - 30 and 86
    - 30 and 8
    - 30 and 85
    - 85 and 87

    If not the specified value, replace the relay.

4. Install a 30-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2 ohms of resistance between terminals 30 and 87.
    - If greater than 2 ohms, replace the relay.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References** for ECM replacement, setup and programming
- **Circuit/System Verification**.

SYMPTOMS - HVAC SYSTEMS - MANUAL

IMPORTANT: Review the system operation in order to familiarize yourself with the system functions. Refer to the following:

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the HVAC System. Refer to **Checking Aftermarket Accessories** .
- Inspect the 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 conditions may 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** .

Symptom List

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

HVAC COMPRESSOR CLUTCH DOES NOT ENGAGE

Diagnostic Aids

The air conditioning (A/C) compressor clutch will not engage under the following conditions:

- The A/C high side line pressure is over 2 413 kPa (350 psi).
- Throttle angle is at 100 percent.
- Engine speed is more than 5,500 RPM.
- Engine coolant temperature (ECT) is more than 123°C (253°F).
- Evaporator core temperature is less than 0°C (32°F).
- The powertrain control module (PCM) minimum OFF time to engage the compressor is 7-9 seconds. The scan tool, A/C Relay Command Delay, body control module (BCM) Inputs data list, can validate this.
- The evaporator temperature sensor is normally closed. The evaporator temperature sensor opens at 0°C (32°F).

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 ECT is above 124°C (255°F). The Check Gages indicator will illuminate at this temperature and the driver information center (DIC) will display the ENG HOT message.

3: These actions will enable the A/C compressor to operate.

5: This test ensures that there is sufficient refrigerant in the A/C system. The specific values come from the A/C System Performance Test.

7: If an audible click is heard when the 10-amp is installed then the answer is yes.

8: Checks the function of the thermistor of the evaporator temperature sensor. The thermistor and module side of the harness are located behind the glove box.

9: Checks the resistance of the 2 gray wires at the evaporator temperature sensor module behind the glove box. As the evaporator gets colder the evaporator circuit resistance goes up.

10: Checks the resistance of the 2 gray wires running out of the evaporator temperature sensor itself located at the evaporator core which is contained within the HVAC module or HEBA. As the evaporator gets colder the evaporator circuit resistance goes up.

16: If the OFF blower motor control circuit is shorted to ground, the output of the HVAC control module for an A/C request is disabled.

HVAC Compressor Clutch Does Not Engage

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 engage when an A/C request has been made and a Powertrain DTC has not been set.				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to **Step 2**	Go to **Diagnostic System Check - Vehicle**
2	1. Start the engine. 2. Observe the driver information center (DIC) message center. Does the DIC display the ENG HOT message?	-	Go to **Engine Overheating**	Go to **Step 3**
	IMPORTANT: **For air conditioning (A/C) compressor operation, the evaporator core temperature must be above 0°C (32°**			

	F).			
3	1. Start the engine. 2. Place the blower motor switch in the low speed position. 3. Place the A/C request switch to the ON position. Does the A/C compressor clutch engage?	-	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 4**
4	1. Turn OFF the ignition. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, observe the A/C Request Signal parameter in the body control module (BCM) inputs data list. 4. Place the A/C request switch to the ON position. Does the scan tool indicate that the A/C Request Signal parameter displays Yes?	-	Go to **Step 5**	Go to **Step 11**
	1. Park the vehicle inside or out of direct sunlight. 2. Open the window in order to ventilate the interior of the vehicle. 3. Turn OFF the ignition. 4. If the A/C system was operating, then wait for approximately 2 minutes. 5. Install **J 43600** ACR 2000 Air Conditioning Service Center.	• Above 16°C (60°F) 345 kPa (50 psi)		

5	6. Record the ambient 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. Are the low and the high side pressure values within the allowable limits for the recorded ambient air temperature. Are the pressure values within 103 kPa (15 psi) of each other?	• Above 24°C (75°F) 483 kPa (70 psi) • Above 33°C (90°F) 690 kPa (100 psi)	Go to **Step 6**	Go to **Leak Testing**
6	1. Disconnect the A/C compressor relay. 2. Probe the battery positive voltage circuit of the A/C compressor clutch relay with a test lamp connected to a good ground. Does the test lamp illuminate?	-	Go to **Step 7**	Go to **Step 18**
7	Connect a 10-amp fused jumper between the battery positive voltage circuit and the A/C compressor clutch supply voltage circuit of the A/C compressor clutch relay. Does the A/C compressor clutch engage?	-	Go to **Step 19**	Go to **Step 13**
	IMPORTANT: **Access the evaporator temperature sensor gray control circuits and module with 2-way connector to BCM and HVAC control module behind the**			

8	**glove box.** 1. Disconnect the evaporator temperature sensor at the 2-wire connector running from the evaporator temperature control circuits to the HVAC control module and BCM behind the glove box. 2. Connect a test light between the A/C request circuit of the HVAC control module and the BCM at the 2-wire connector of the evaporator temperature sensor. Does the A/C compressor engage?	-	Go to **Step 9**	Go to **Step 11**
9	**IMPORTANT:** **Access the evaporator temperature sensor gray control circuits and module with 2-way connector to BCM and HVAC control module behind the glove box.** 1. With a 3-amp fused jumper attached between the BCM and the HVAC control module A/C request circuits at the 2-wire evaporator temperature sensor behind the glove box. 2. Check the resistance of the 2 gray evaporator temperature sensor circuits at the evaporator temperature sensor behind the glove box. 3. Start the engine. Does the resistance value stay within the specified value range	Temperature Minimum 14.9°C (58.82°F) - Resistance Minimum 15651 ohms Temperature Maximum 30.1°C (86.18°F) - Resistance Maximum 8190 ohms		Go to **Step**

	even after compressor engagement?		Go to **Step 25**	**10**
10	**IMPORTANT:** **Access the evaporator temperature sensor gray control circuits and module with 2-way connector to BCM and HVAC control module behind the glove box.** 1. With a 3-amp fused jumper attached between the BCM and the HVAC control module A/C request circuits at the 2-wire evaporator temperature sensor behind the glove box. 2. Cut the 2 gray evaporator temperature sensor circuits no less than 2 inches from the evaporator temperature sensor module behind the glove box. 3. Start the engine. 4. Check the resistance of the 2 gray wires at the evaporator temperature sensor coming out of the evaporator core at the HVAC module. Does the resistance value move from the specified value range when the compressor is engaged?	Temperature Minimum 14.9°C (58.82°F) - Resistance Minimum 15651 ohms Temperature Maximum 30.1°C (86.18°F) - Resistance Maximum 8190 ohms	Go to **Step 25**	Go to **Step 26**
11	**IMPORTANT:** **Access the evaporator temperature sensor control circuits and module through the glove box.** 1. Disconnect the evaporator temperature sensor at the 2-wire pinout running to the HVAC control module	12 V		

	behind the radio. 2. Probe the A/C request signal circuit of the HVAC control module with a DMM connected to a good ground. Does the DMM indicate at least the specified value?		Go to **Step 12**	Go to **Step 15**
12	1. Connect a 3-amp fused jumper between the A/C request signal circuit of the HVAC control module and the A/C request signal circuit of the BCM. 2. Observe the A/C Request Signal parameter. Does the scan tool indicate the A/C Request Signal parameter is Yes?	-	Go to **Step 20**	Go to **Step 17**
13	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** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 14**
14	Test the supply voltage circuit of the A/C compressor clutch for a high resistance or for an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 23**
15	Test the A/C request signal circuit of the HVAC control module for a short to ground, a high resistance and for an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the	-		Go to **Step**

	condition?		Go to **Step 30**	**16**
16	Test the off blower motor control circuit of the HVAC control module for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 23**
17	Test the A/C request signal circuit of the BCM for a short to ground, a high resistance and for an open. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 21**
18	Repair the battery positive voltage circuit of the A/C compressor clutch relay. Refer to **Wiring Repairs** . Did you complete the repair?	-	Go to **Step 30**	-
19	Inspect for poor connections at the A/C compressor clutch relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 20**
20	Inspect for poor connections at the evaporator temperature sensor control circuits at the evaporator control module behind the glove box. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 25**
	Inspect for poor connections at the			

21	BCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 27**
22	Inspect for poor connections at the A/C compressor clutch. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 28**
23	Inspect for poor connections at 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 30**	Go to **Step 29**
24	Replace the A/C compressor clutch relay. Refer to **Compressor Relay Replacement** . Did you complete the replacement?	-	Go to **Step 30**	-
25	Replace the evaporator temperature sensor whole harness. This includes from the harness circuits and components at the sensor in the evaporator core to the evaporator control module side of the harness located behind the glove box. Refer to **Evaporator Temperature Sensor Replacement (Left Hand Drive)** or **Evaporator Temperature Sensor Replacement (Right Hand Drive)** . Did you complete the replacement?	-	Go to **Step 30**	-

	Did you complete the replacement?		Go to **Step 30**	
26	Replace the evaporator temperature sensor whole harness. This includes from the harness circuits and components at the sensor in the evaporator core to the evaporator control module side of the harness located behind the glove box. Refer to **Evaporator Temperature Sensor Replacement (Left Hand Drive)** or **Evaporator Temperature Sensor Replacement (Right Hand Drive)** . Did you complete the replacement?	-	Go to **Step 30**	-
27	Replace the BCM. Refer to **Control Module References** for replacement, setup and programming. Did you complete the replacement?	-	Go to **Step 30**	-
28	Replace the A/C compressor. Refer to **Compressor Replacement** . Did you complete the replacement?	-	Go to **Step 30**	-
29	Replace the HVAC control module. Refer to **Heater and Air Conditioning Control Replacement**. Did you complete the replacement?	-	Go to **Step 30**	-
30	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to **Step 2**

HVAC COMPRESSOR CLUTCH DOES NOT DISENGAGE

Test Description

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

2: This action will disable the HVAC control module output to evaporator temperature sensor.

HVAC Compressor Clutch Does Not Disengage

Step	Action	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**
2	1. Start the engine. 2. Place the blower motor switch in the OFF position. Is the A/C compressor clutch engaged?	Go to **Step 3**	Go to **Testing for Intermittent Conditions and Poor Connections**
3	With a scan tool, observe the A/C Request Signal parameter in the Body Control Module Input data list. Does the scan tool indicate the A/C Request Signal parameter is Yes?	Go to **Step 5**	Go to **Step 4**
4	Disconnect the A/C compressor clutch relay. Does the A/C compressor clutch disengage?	Go to **Step 9**	Go to **Step 6**
5	Disconnect the evaporator temperature sensor. Does the A/C compressor clutch disengage?	Go to **Step 7**	Go to **Step 8**
6	Test the supply voltage circuit of the A/C compressor clutch 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 10**
7	Test the A/C request signal circuit of the HVAC control module 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 11**

8	Test the A/C request signal circuit of the body control module (BCM) 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 12**
9	Inspect for poor connections at the A/C compressor clutch relay. 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 13**
10	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** . Did you find and correct the condition?	Go to **Step 17**	Go to **Step 14**
11	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 17**	Go to **Step 15**
12	Inspect for poor connections at the harness connector of the BCM. 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**
13	Replace the A/C compressor clutch relay. Refer to **Compressor Relay Replacement** . Did you complete the replacement?	Go to **Step 17**	-
14	Replace the A/C compressor. Refer to **Compressor Replacement** . Did you complete the replacement?	Go to **Step 17**	-
15	Replace the HVAC control module. Refer to **Heater and Air Conditioning Control Replacement**. Did you complete the replacement?	Go to **Step 17**	-

16	Replace the BCM. Refer to **Control Module References** for replacement, setup and programming. Did you complete the replacement?	Go to **Step 17**	-
17	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to **Step 3**

AIR CONDITIONING COMPRESSOR MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

When the A/C switch is pressed, the HVAC control assembly grounds the A/C request signal circuit. The body control module (BCM) receives the ground input and sends a GMLAN message to the engine control module (ECM) for an A/C request. This input will request the ECM to ground the A/C compressor clutch relay control circuit, which will switch the A/C CLUTCH relay. With the relay contacts closed, battery voltage is supplied to the A/C compressor clutch assembly.

Diagnostic Aids

The following conditions must be met in order for the ECM to turn on the compressor clutch:

- Battery voltage is between 9-16 volts.
- Engine coolant temperature (ECT) is less than 123°C (253°F).
- Engine speed is less than 5300 RPM.
- Engine speed is more than 600 RPM.
- A/C high side pressure is between 2951-310 kPa (428-44 psi).
- Throttle position is less than 100 percent.
- Evaporator temperature is greater than 0°C (32°F).
- ECM does not detect excessive torque load.
- ECM does not detect insufficient idle quality.

Reference Information

Schematic Reference

HVAC Schematics

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Press the A/C request switch. The A/C compressor clutch should engage.
2. Place the mode switch in the defrost position. The A/C compressor clutch should engage.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector C2 at the HVAC control module.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the ground circuit terminal L and ground.
    - If greater than 1.0 ohm, test the ground circuit for an open/high resistance.
3. Ignition ON, install a 3-amp fused jumper wire between the signal circuit terminal G and ground. Verify the scan tool A/C Request Switch parameter is ON.
    - If not On, test the signal circuit for a short to voltage or an open/high resistance. If circuit tests normal, replace the BCM.
4. Connect the harness connector C2 at the HVAC control module. With a scan tool, verify the A/C Request Switch parameter cycles between On and Off with each press of the A/C switch.
    - If the parameter does not cycle, test the signal circuit for a short to ground. If the circuit tests normal, replace the HVAC control module.

5. Disconnect the A/C compressor clutch relay.
6. Verify that a test lamp illuminates between the relay coil B+ circuit and ground.
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
7. Verify that a test lamp illuminates between the relay switch B+ circuit and ground.
    - If the test lamp does not illuminate, test the relay switch B+ circuit for an open/high resistance. If the A/C fuse is open, test the relay switch control circuit for a short to ground. If all circuits test normal, test or replace the A/C compressor clutch.
8. Disconnect the harness connector at the A/C compressor clutch.
9. Ignition OFF, test for less than 1.0 ohm of resistance between the A/C compressor ground circuit and ground.
    - If greater than 1.0 ohm, test the ground circuit for an open/high resistance.
10. Connect the harness connector at the A/C compressor clutch.
11. Ignition ON, connect a 10-amp fused jumper wire between the relay switch B+ circuit and the relay switch control circuit. Verify the A/C compressor clutch engages.
    - If the A/C compressor clutch does not activate, test the control circuit for an open/high resistance. If the circuit tests normal, test or replace the A/C compressor.
12. Connect a test lamp between the relay control circuit and the relay coil B+ circuit.
13. Using a scan tool, command the A/C relay output ON and OFF. The test lamp should turn ON and OFF when changing between the commanded states.
    - If the test lamp remains ON at all times, test for a short to ground on the control circuit. If the circuit tests normal, replace the ECM.
    - If the test lamp remains OFF at all times, test for a short to voltage or an open/high resistance on the control circuit. If the circuit tests normal, replace the ECM.
14. If all circuits test normal, test or replace the A/C CLTCH relay.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Compressor Replacement**
- **Control Module References** for BCM, HVAC and ECM replacement, setup and programming

BLOWER MOTOR MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The HVAC control assembly applies a 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 resistors

When the operator requests High speed, the HVAC control assembly applies ground to the high speed blower relay control circuit. When the relay contacts close, ground is applied directly to the blower motor through the blower motor resistor.

Reference Information

Schematic Reference

HVAC Schematics

Description and Operation

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

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Turn ON the ignition, verify that the HVAC relay turns on.
   - If the HVAC relay does not turn on, refer to the HVAC Relay Malfunction test under **Circuit/System Testing**.
2. Ignition On, place the blower switch in the highest speed position, the blower motor should operate at High speed.
   - If the blower motor does not function properly in the High speed position, refer to High Speed Blower Malfunction under **Circuit/System Testing**.
3. Place the blower switch in Low, Medium 1 and Medium 2 speed positions. The blower motor should operate in each speed position.
   - If the blower motor does not function properly in each speed position, refer to Blower Malfunction under **Circuit/System Testing**.

Circuit/System Testing

HVAC Relay Malfunction

1. Ignition OFF, disconnect the HVAC relay in the underhood fuse block.
2. Test for less than 1.0 ohm of resistance between the relay coil ground circuit terminal and ground.
   - If greater than specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the relay coil control circuit terminal and ground.
   - If the test lamp does not illuminate, replace the underhood fuse block.
4. If all circuits test normal, test or replace the HVAC relay.

High Speed Blower Malfunction

1. Ignition OFF, disconnect the harness connector C1 at the HVAC Control Module.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the ground circuit terminal 5 and ground.
   - If greater than the specified range, test the ground circuit for an open/high resistance.

3. Connect the harness connector at the HVAC Control Module.
4. Disconnect the High Speed Blower Relay.
5. Place the blower switch in the high speed position.
6. Ignition OFF test for less than 1.0 ohm of resistance between the ground circuit terminal 5 and ground.
    - If greater than the specified range, test the ground circuit for an open/high resistance. If the circuit test normal test or replace the HVAC Control Module.
7. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 2 and ground.
    - If the test lamp does not illuminate, test the ignition circuit for an open/high resistance.
8. Test for less than 1.0 ohm of resistance between the ground circuit terminal 1 and ground.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
9. Connect the High Speed Blower Relay. Disconnect the harness connector at the Blower Motor Resistor.
10. Ignition ON, place the blower switch in the high speed position.
11. Test for less than 1.0 ohm of resistance between the control circuit terminal E at the Blower Motor resistor and ground.
    - If greater than the specified range, test the control circuit for an open/high resistance. If the circuit test normal test or replace the High Speed Blower Relay.
12. Ignition OFF, connect the harness connector at the Blower Motor Resistor. Connect the High Speed Blower Relay. Disconnect the harness connector at the Blower Motor.
13. Ignition On, place the blower switch in the high speed position.
14. Verify that a test lamp illuminates between the control circuit terminal 1 and B+.
    - If the test lamp does not illuminate, test the control circuit for an open/high resistance.
    - If the circuit test normal, test or replace the Blower Motor Resistor.
15. Verify that a test lamp illuminates between the ignition circuit terminal 2 and ground.
    - If the test lamp does not illuminate test the ignition circuit for an open/high resistance.
16. If all circuits test normal, test or replace the Blower Motor.

Blower Malfunction

1. Ignition OFF, disconnect the harness connector at the HVAC Control Module.
2. Test for less than 1.0 ohm of resistance between the ground circuit terminal 5 and ground.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Connect the harness connector at the HVAC Control Module.

4. Disconnect the harness connector at the Blower Motor Resistor.
5. Ignition ON, place the Blower Switch in the appropriate speed for the circuit being tested.
6. Verify that a test lamp illuminates between the appropriate control circuit and B+.
    - If the test lamp does not illuminate, test the appropriate control circuit for a short to ground or an open/high resistance. If the circuit test normal, test or replace the HVAC control Module.
7. If all circuits test normal, test or replace the Blower Motor Resistor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Control Module References**
- **Blower Motor Replacement (Left Hand Drive)** or **Blower Motor Replacement (Right Hand Drive)**
- **Heater and Air Conditioning Control Replacement**
- **Blower Motor Resistor Assembly Replacement (Left Hand Drive)** or **Blower Motor Resistor Assembly Replacement (Right Hand Drive)**

TOO HOT IN VEHICLE

Test Description

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

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

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

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

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

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

Too Hot in Vehicle

Step	Action	Values	Yes	No	

Schematic Reference: HVAC Schematics

DEFINITION: The temperature cannot be adjusted or the cooling is insufficient during A/C operation.

1	Did you review the HVAC operation and perform the necessary inspections?	-	Go to **Step 2**	Go to **Symptoms - HVAC Systems - Manual**
2	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in each speed position. Does the blower motor operate at all?	-	Go to **Step 3**	Go to **Blower Motor Malfunction**
3	Does the blower motor operate correctly for each speed position?	-	Go to **Step 4**	Go to **Blower Motor Malfunction**
4	Is the HVAC control assembly inoperative?	-	Go to **Step 15**	Go to **Step 5**
5	Does the Too Hot in Vehicle concern occur when A/C cooling is desired?	-	Go to **Step 6**	Go to **Step 8**
6	**IMPORTANT:** **For A/C compressor operation, the ambient air temperature must be above 3℃ (38℉).** 1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the A/C request switch in the ON position. 4. Place the air	-		

	temperature switch in the coldest position. Does the A/C compressor operate?		Go to **Step 7**	Go to **HVAC Compressor Clutch Does Not Engage**
7	Perform the refrigerant system performance test. Refer to **Air Conditioning (A/C) System Performance Test** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 8**
8	1. Observe the drive shaft of both air temperature actuators. 2. Adjust the air temperature switch. Does the drive shaft of both air temperature actuators rotate?	-	Go to **Step 9**	Go to **Step 10**
9	Inspect the appropriate air temperature door and the appropriate air temperature actuator for the following conditions: • A misaligned air temperature actuator. • Broken linkages or binding linkages • A broken air temperature door or a binding air temperature door. • An obstruction that prevents the air temperature door from	-		

	operating within the full range of motion. • Missing seals to the air temperature door • Misaligned seals to the air temperature door. Did you find and correct the condition?		Go to **Step 22**	Go to **Testing for Intermittent Conditions and Poor Connections**
10	Test the position signal circuit of the appropriate temperature actuator for an open or for a high resistance. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 11**
11	Test the low reference circuit of the appropriate temperature actuator for an open or for a high resistance. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 12**
12	Test the 5-volt reference circuit of the appropriate temperature actuator for an open or for a high resistance. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 13**
	1. Turn OFF the ignition. 2. Reconnect the appropriate temperature actuator.			

13	3. Turn ON the ignition with the engine OFF. 4. Connect a test lamp between temperature door control A and temperature door control B circuits of the appropriate temperature actuator connector. 5. Place the temperature switch in the cold position. 6. Place the mode switch in the hot position. Does the test lamp illuminate in both positions?	-	Go to **Step 17**	Go to **Step 14**	
14	Test the temperature door control A and temperature door control B circuits of the appropriate temperature 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 22**	Go to **Step 19**	
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 22**			Go to **Step 16**
	Test the ground circuit of the HVAC control module for an				

16	open or for a high resistance. Refer to **Circuit Testing** and to **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	-
17	Inspect for poor connections at the harness connector of the appropriate air temperature actuator. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 18**
18	Inspect the appropriate air temperature actuator, the door and any attaching linkage for binding or for a condition that prevents drive shaft rotation. Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 20**
19	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to **Testing for Intermittent Conditions and Poor Connections** and to **Connector Repairs** . Did you find and correct the condition?	-	Go to **Step 22**	Go to **Step 21**
	IMPORTANT: **Perform the calibration procedure for the air temperature actuator.** Replace the appropriate air temperature actuator. Refer			

20	to **Air Temperature Actuator Replacement - Right Side (Left Hand Drive)** or **Air Temperature Actuator Replacement - Right Side (Right Hand Drive)** **Air Temperature Actuator Replacement - Left Side (Left Hand Drive)** or **Air Temperature Actuator Replacement - Left Side (Right Hand Drive)**.Did you complete the replacement?	-	Go to **Step 22**	-	
21	**IMPORTANT:** **Perform the calibration procedure for the HVAC control assembly.** Replace the HVAC control assembly. Refer to **Heater and Air Conditioning Control Replacement**.Did you complete the replacement?	-	Go to **Step 22**	-	
22	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to **Step 2**	

TOO COLD IN VEHICLE

Test Description

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

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

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

Too Cold in Vehicle

Step	Action	Values	Yes	No
Schematic Reference: HVAC Schematics DEFINITION: The temperature cannot be adjusted or the heating is insufficient.				
1	Did you review the HVAC operation and perform the necessary inspections?	-	Go to **Step 2**	Go to **Symptoms - HVAC Systems - Manual**
2	1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in each speed position. Does the blower operate in any of the speed positions?	-	Go to **Step 3**	Go to **Blower Motor Malfunction**
3	Does the blower actuator operate correctly for each speed position?	-	Go to **Step 4**	Go to **Blower Motor Malfunction**
4	Is the HVAC control assembly inoperative?	-	Go to **Step 17**	Go to **Step 5**
5	Inspect the cooling system for the following: • A low coolant level • A loose or worn accessory drive belt • Leaking radiator hoses or leaking heater hoses • Kinked radiator hoses or kinked heater hoses • A missing radiator cap pressure seal • A leaking radiator cap Did you find and correct the	-		

	condition?		Go to **Step 21**	Go to **Step 6**
6	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 **HVAC Compressor Clutch Does Not Disengage**	Go to **Step 7**
7	1. Observe the drive shaft of both air temperature actuators. 2. Adjust the air temperature switch. Does the drive shaft of both air temperature actuators rotate?	-	Go to **Step 8**	Go to **Step 9**
8	Inspect the appropriate air temperature door and the appropriate air temperature door actuator for the following conditions: • A misaligned actuator on the air temperature door • Broken linkages or binding linkages • A broken air temperature door or a binding air temperature door • An obstruction that prevents the air temperature door from operating within the full range of motion • Missing seals to the air temperature door • Misaligned seals to the air temperature door	-		

	Did you find and correct the condition?		Go to **Step 21**	Go to **Heating Performance Diagnostic**
9	Test the position signal circuit of the appropriate temperature actuator for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 10**
10	Test the low reference circuit of the appropriate temperature actuator for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 11**
11	Test the 5-volt reference circuit of the appropriate air temperature actuator for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 12**
12	1. Turn OFF the ignition. 2. Reconnect the appropriate temperature actuator. 3. Turn ON the ignition with the engine OFF. 4. Connect a test lamp between temperature door control A and temperature door control B circuits of the appropriate temperature actuator connector. 5. Place the temperature switch in the cold position. 6. Place the temperature switch	-		

	in the hot position. Does the test lamp illuminate in both positions?		Go to **Step 21**	Go to **Step 13**
13	Test the temperature door control A and temperature door control B circuits of the appropriate temperature actuator for an open, a high resistance, a short to ground or a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 14**
14	Test the ignition 3 voltage circuit of the HVAC control module for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 17**
15	Test the ground circuit of the HVAC control module for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 18**
16	Inspect the appropriate air temperature door for a mechanical condition or for a condition that allows excessive travel of the door. Did you complete the repair?	-	Go to **Step 21**	-
17	Inspect for poor connections at the harness connector of the appropriate 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 21**	Go to **Step 19**
18	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 21**	Go to **Step 20**
19	**IMPORTANT:** **Perform the calibration procedure for the air temperature actuator.** Replace the appropriate air temperature door actuator. Refer to **Air Temperature Actuator Replacement - Right Side (Left Hand Drive)**. **Air Temperature Actuator Replacement - Right Side (Right Hand Drive)**, **Air Temperature Actuator Replacement - Left Side (Left Hand Drive)** or **Air Temperature Actuator Replacement - Left Side (Right Hand Drive)**.Did you complete the replacement?	-	Go to **Step 21**	-
20	Replace the HVAC control module. Refer to **Heater and Air Conditioning Control Replacement**. 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 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 mode door in both directions.

15: Two voltage circuits supply the HVAC control assembly.

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 **Diagnostic System Check - Vehicle**
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 **Blower Motor Malfunction**
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 **Blower Motor Malfunction**
4	Does the blower motor operate in each speed position?	Go to **Step 5**	Go to **Blower Motor Malfunction**
5	Are all of the HVAC control assembly controls except for the blower motor inoperative?	Go to **Step 15**	Go to **Step 6**
	1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in the vent position.		

6	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 **Air Recirculation Malfunction**
7	1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in each mode position. Does air flow sufficiently from the proper air distribution outlets for each selected mode position?	Go to **Testing for Intermittent Conditions and Poor Connections**	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?	Go to **Step 21**	Go to **Step 9**
9	Inspect the mode door and the mode actuator for the following conditions: • A misaligned mode actuator-Refer to **Mode Actuator Replacement (Left Hand Drive)** or **Mode Actuator Replacement (Right Hand Drive)**. • 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 10**
10	Test the position signal circuit of the mode actuator for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 21**	Go to **Step 11**
11	Test the low reference circuit of the mode actuator for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 21**	Go to **Step 12**
12	Test the 5-volt reference circuit of the appropriate mode actuator for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 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 **Wiring Repairs** . Did you find and correct the condition ?	Go to **Step 21**	Go to **Step 18**
15	Test the voltage circuits of the HVAC control assembly for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 21**	Go to **Step 16**
16	Test the ground circuit of the HVAC control assembly for an open or for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 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 **Connector Repairs** . Did you find and correct the condition?	Go to **Step 21**	Go to **Step 19**
18	Inspect for bad connections at the harness connector of the HVAC control assembly. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 21**	Go to **Step 20**
19	Replace the mode actuator. Refer to **Mode Actuator Replacement (Left Hand Drive)** or **Mode Actuator Replacement (Right Hand Drive)**. Did you complete the replacement?	Go to **Step 21**	-
20	Replace the HVAC control assembly. Refer to **Heater and Air Conditioning Control Replacement**. 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.

5: This step tests the HVAC control assemblies ability to reverse the polarity of the door control A and door control B circuits. The test lamp should illuminate.

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**
2	1. Turn the ignition ON, with the engine OFF. 2. Place the blower motor switch to the low speed position. 3. Place the mode switch in the vent position. 4. Lower the glove box off its upper attachments. 5. Place the recirculation switch in the ON position. 6. Observe the recirculation door. 7. Place the recirculation switch in the OFF position. Does the recirculation door move from the recirculation to the outside air position?	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 3**

3	1. Turn the ignition OFF. 2. Disconnect the recirculation actuator. 3. Turn the ignition ON, with the engine OFF. 4. Connect a test lamp between the recirculation door control A circuit and the recirculation door control B circuit of the recirculation actuator. 5. Place the recirculation switch in the ON position. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 4**
4	Connect a test lamp between the recirculation door control B circuit of the recirculation actuator and a good ground. Does the test lamp illuminate?	Go to **Step 7**	Go to **Step 8**
5	Place the recirculation switch in the OFF position. Does the test light illuminate?	Go to **Step 6**	Go to **Step 10**
6	Inspect the recirculation door and the recirculation actuator for the following conditions: • A misaligned recirculation actuator- Refer to **Recirculation Actuator Replacement (Left Hand Drive)** or **Recirculation Actuator Replacement (Right Hand Drive)**. • 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 13**	Go to **Step 9**
7	Test the recirculation door control A circuit of the HVAC control assembly for a short to ground, short to voltage, an open and for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 13**	Go to **Step 10**
8	Test the recirculation door control B circuit of the HVAC control assembly for a short to ground, short to voltage, an open and for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 13**	Go to **Step 10**
9	Inspect for poor connections at the harness connector of the recirculation actuator. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 13**	Go to **Step 11**
10	Inspect for poor connections at the harness connector of the HVAC control assembly. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** . Did you find and correct the condition?	Go to **Step 13**	Go to **Step 12**
11	Replace the recirculation actuator. Refer to **Recirculation Actuator Replacement (Left Hand Drive)** or **Recirculation Actuator Replacement (Right Hand Drive)**. Did you complete the replacement?	Go to **Step 13**	-
12	Replace the HVAC control assembly. Refer to **Heater and Air Conditioning Control Replacement**. Did you complete the replacement?	Go to **Step 13**	-
13	Operate the system in order to verify the repair.		

	Did you correct the condition?	System OK	Go to **Step 3**

ACTUATOR RECALIBRATION

When replacing an air temperature, mode, recirculation actuator or the HVAC control assembly, the following calibration process needs to be performed:

IMPORTANT: Do not adjust any controls on the HVAC control assembly during self-calibration. If interrupted, improper HVAC performance will result.

1. Turn ON the ignition with the engine OFF.
2. Turn the Temperature dial all the way to the right.
3. Turn the blower control dial all the way to the right.
4. Turn the mode position dial all the way to the left.
5. Simultaneously press and hold the A/C and Defrost buttons until the LED's start to flash.
6. Once the LED's stop flashing, calibration is complete.

REPAIR INSTRUCTIONS

HEATER AND AIR CONDITIONING CONTROL REPLACEMENT

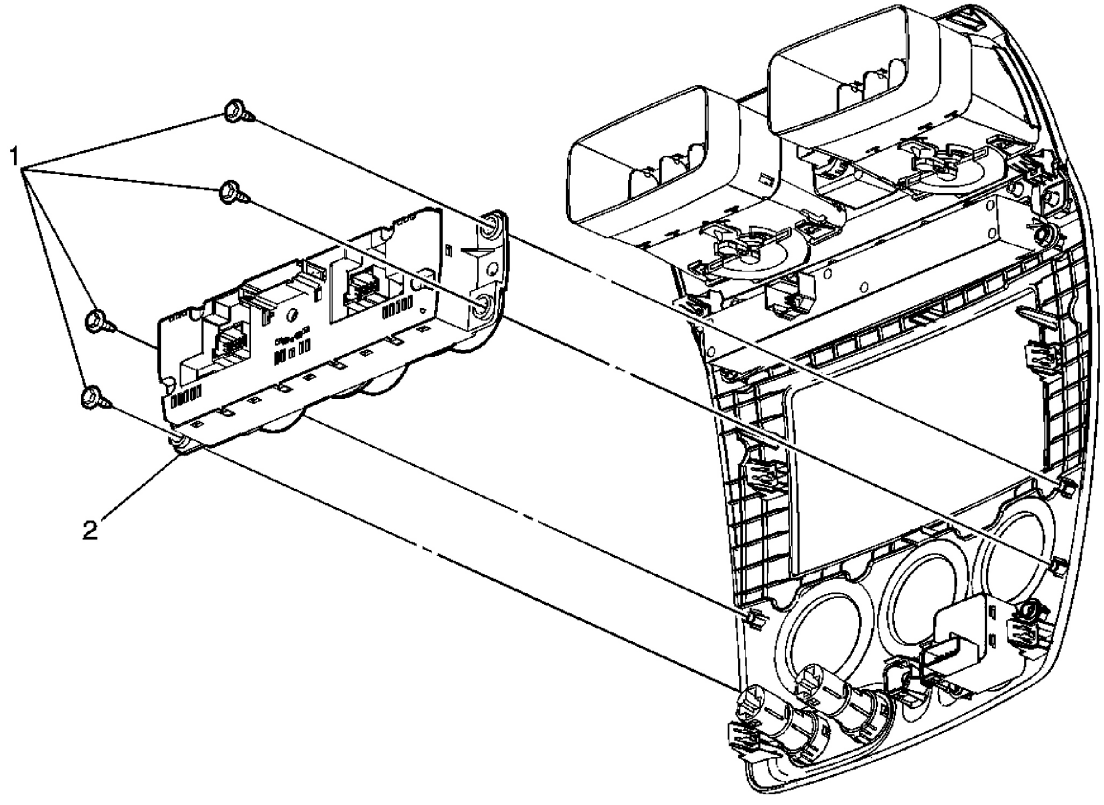


Fig. 21: HVAC Control Assembly Replacement
Courtesy of GENERAL MOTORS CORP.

Heater and Air Conditioning Control Replacement

Callout	Component Name
NOTE: **Refer to Fastener Notice .** **Fastener Tightening Specifications:** Refer to **Fastener Tightening Specifications**.**Preliminary Procedure:** Remove the center instrument panel trim plate. Refer to **Instrument Panel Center Trim Panel Replacement (Left Hand Drive)** or **Instrument Panel Center Trim Panel Replacement (Right Hand Drive)** .	
1	HVAC Control Module Screw **Tip:** Disconnect the electrical connector. **Tighten:** 1.9 N.m (17 lb in)
2	HVAC Control Module

AIR TEMPERATURE ACTUATOR REPLACEMENT - RIGHT SIDE (LEFT HAND DRIVE)

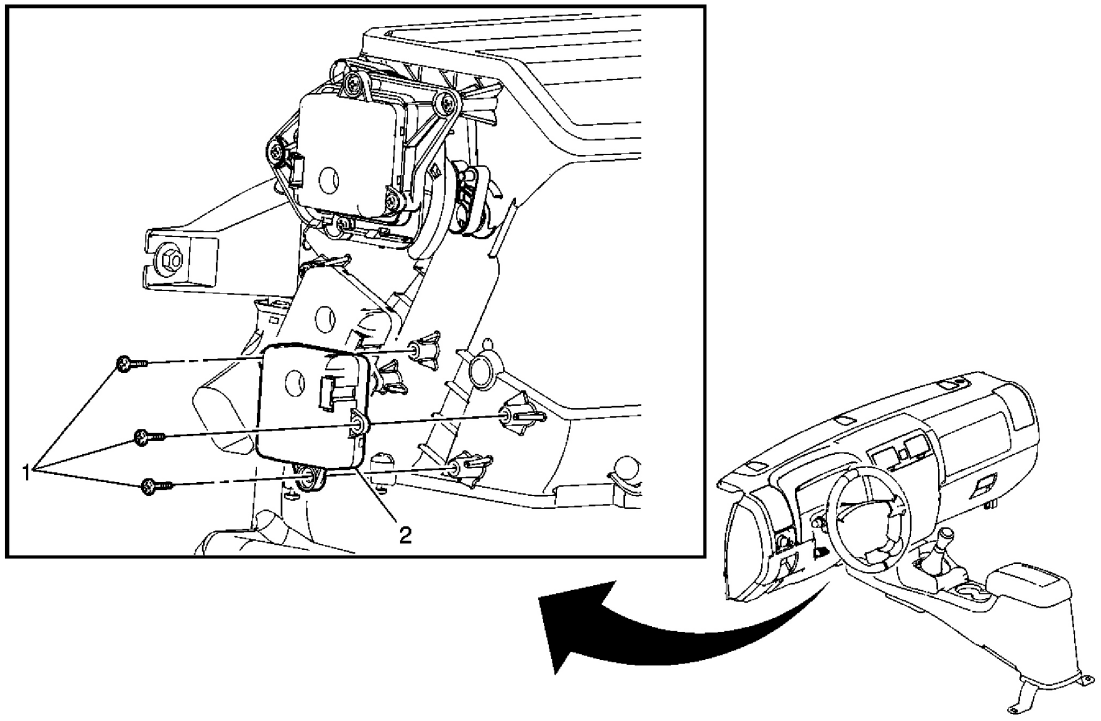


Fig. 22: Air Temperature Actuator Replacement - Right Side (Left Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Replacement - Right Side (Left Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Air Temperature Actuator Screw (Qty: 3) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Air Temperature Actuator - Front **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

AIR TEMPERATURE ACTUATOR REPLACEMENT - RIGHT SIDE (RIGHT HAND DRIVE)

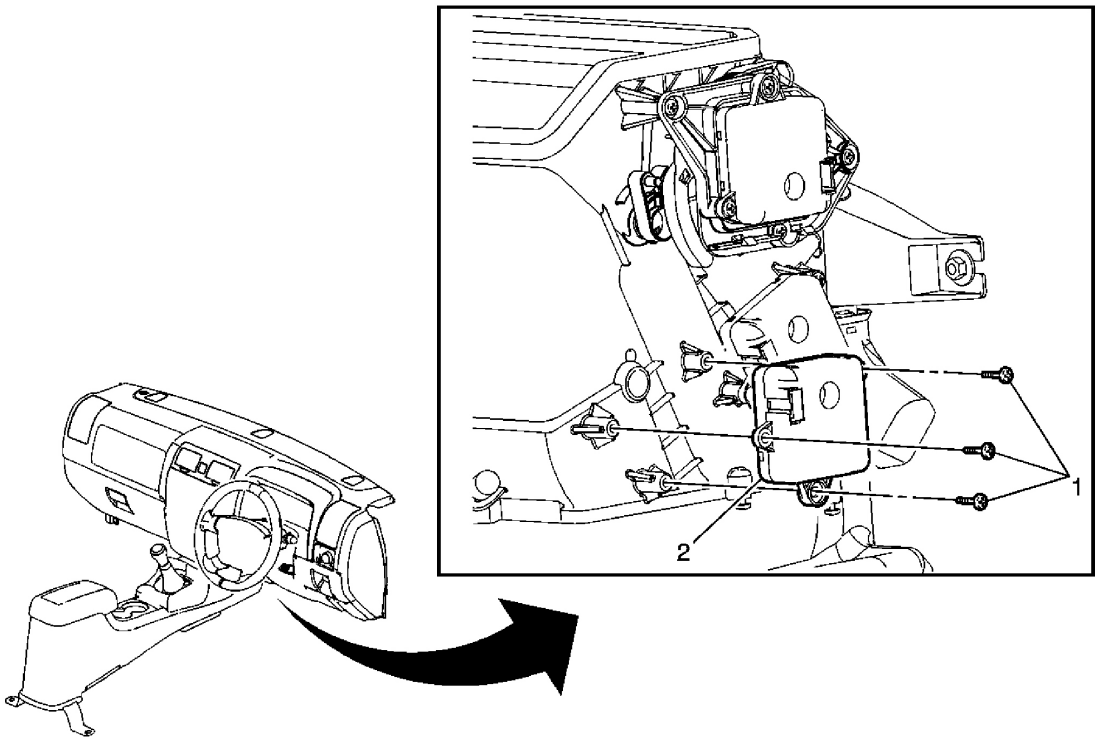


Fig. 23: Air Temperature Actuator Replacement - Right Side (Right Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Replacement - Right Side (Right Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Air Temperature Actuator Screw (Qty: 3) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Front Air Temperature Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

AIR TEMPERATURE ACTUATOR REPLACEMENT - LEFT SIDE (LEFT HAND DRIVE)

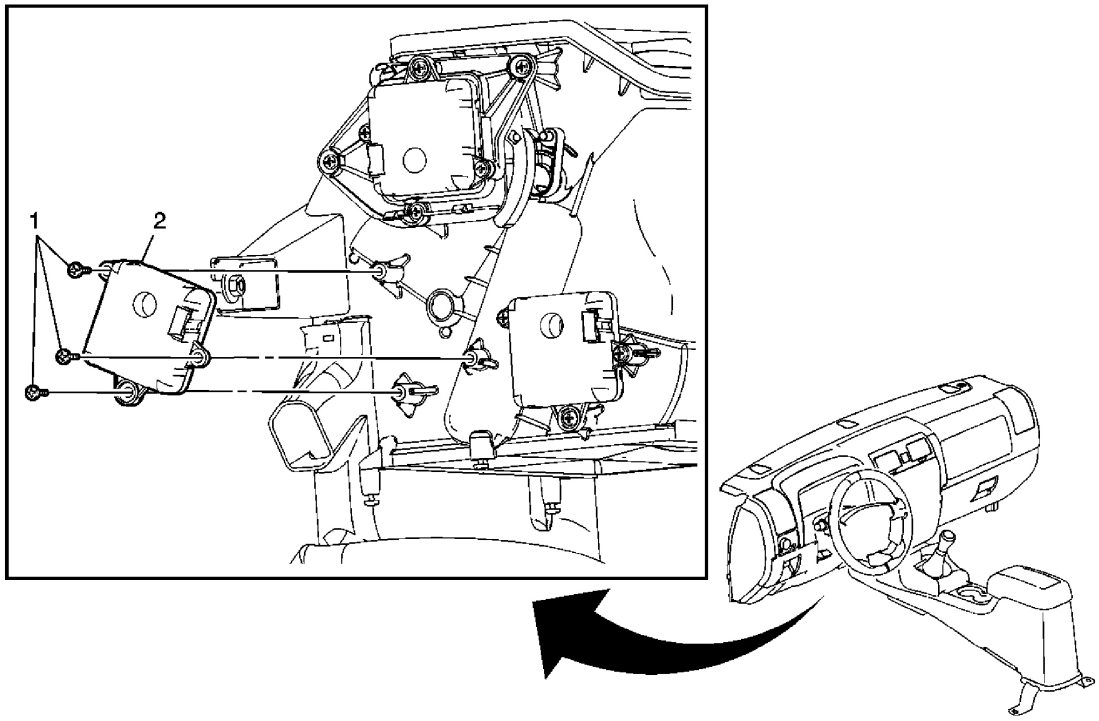


Fig. 24: Air Temperature Actuator Replacement - Left Side (Left Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Replacement - Left Side (Left Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Air Temperature Actuator Screw **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Air Temperature Actuator - Rear **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

AIR TEMPERATURE ACTUATOR REPLACEMENT - LEFT SIDE (RIGHT HAND DRIVE)

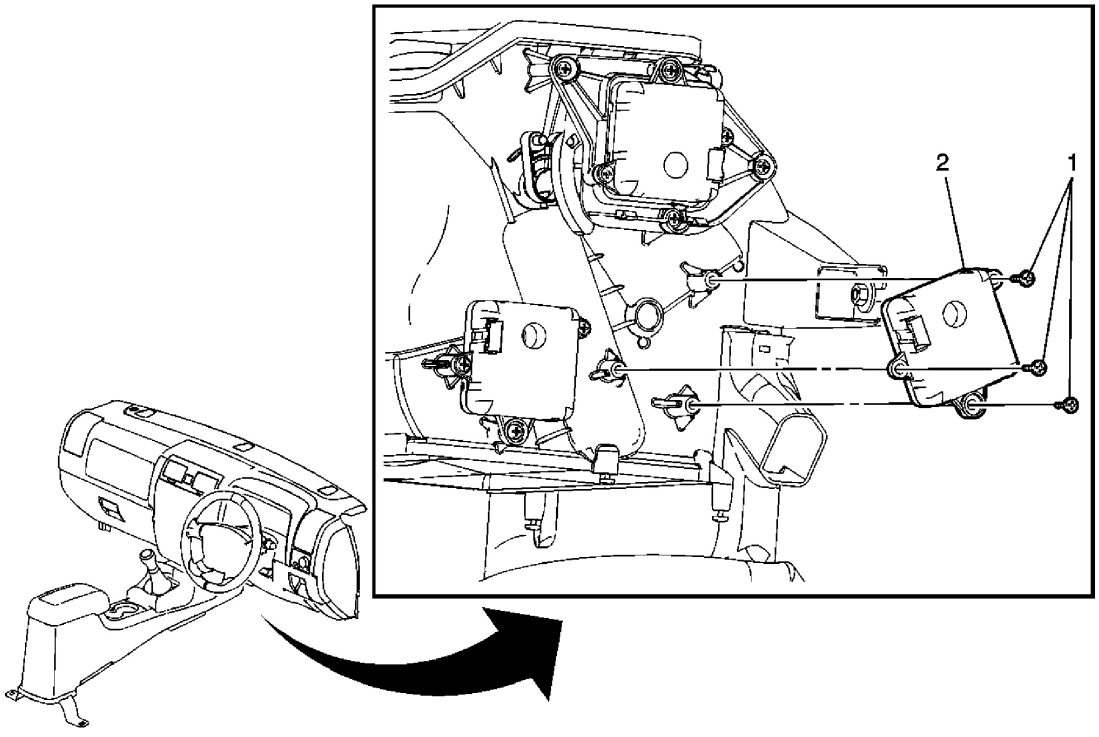


Fig. 25: Air Temperature Actuator Replacement - Left Side (Right Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Replacement - Left Side (Right Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Air Temperature Actuator Screw (Qty: 3) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Rear Air Temperature Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

MODE ACTUATOR REPLACEMENT (LEFT HAND DRIVE)

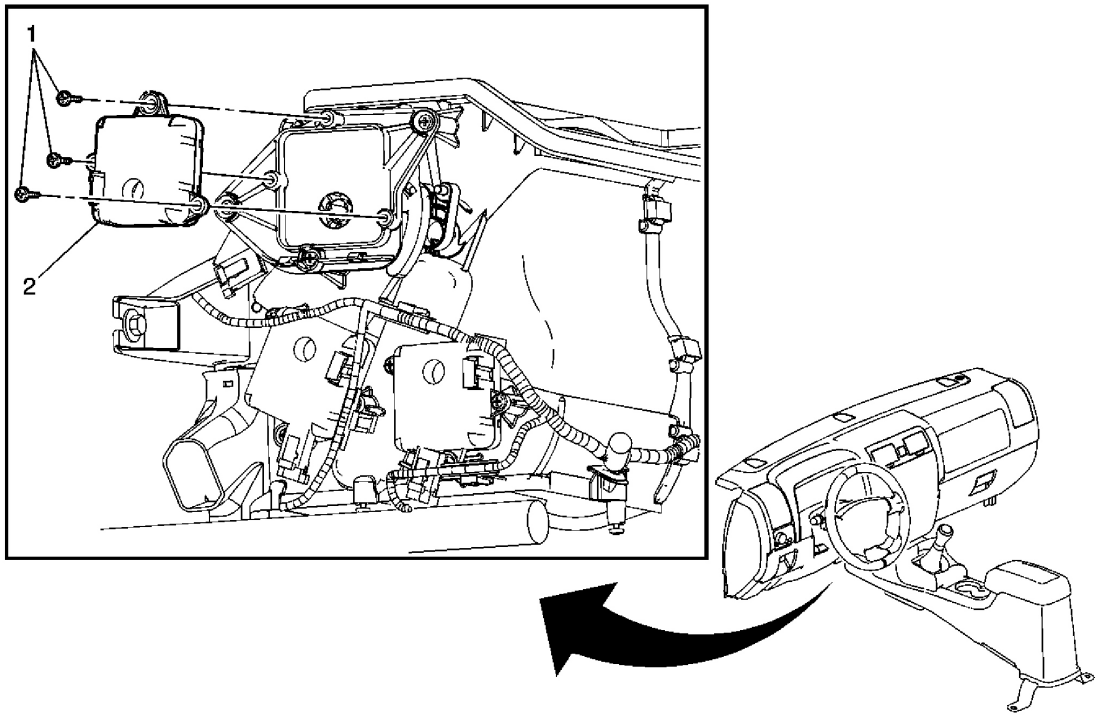


Fig. 26: Mode Actuator Replacement (Left Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Mode Actuator Replacement (Left Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Mode Actuator Screw **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Mode Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

MODE ACTUATOR REPLACEMENT (RIGHT HAND DRIVE)

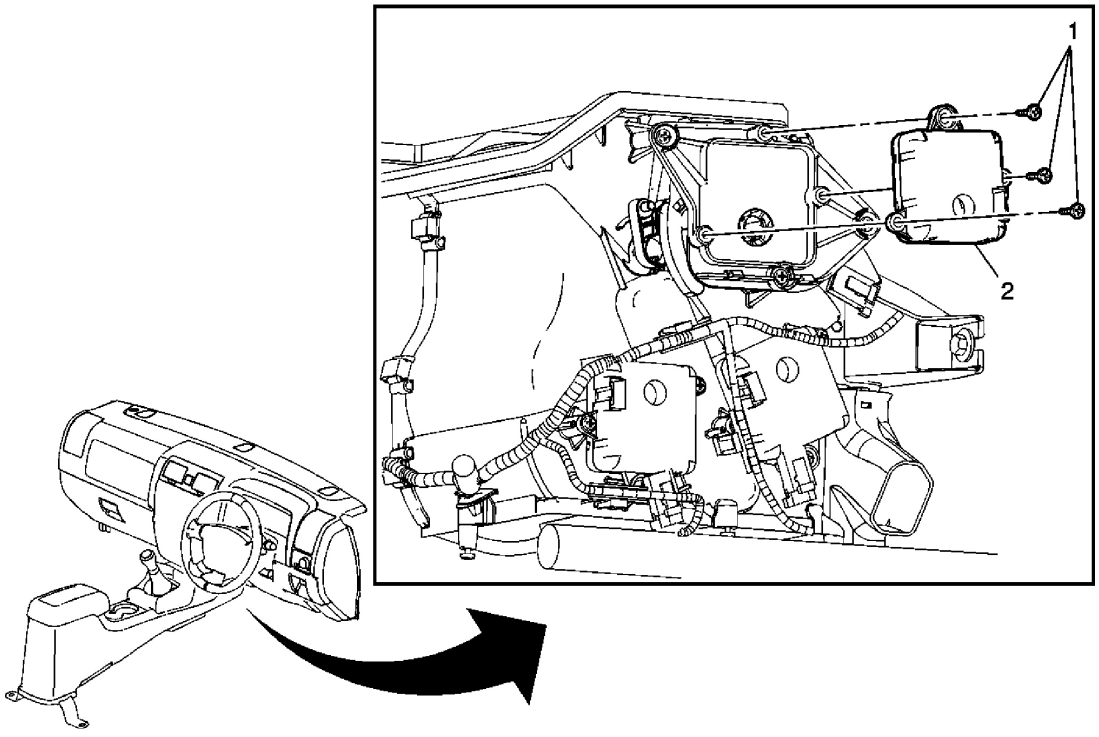


Fig. 27: Mode Actuator Replacement (Right Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Mode Actuator Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedure: Disconnect the electrical connector.	
1	Mode Actuator Screw (Qty: 3) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (13 lb in)
2	Mode Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

RECIRCULATION ACTUATOR REPLACEMENT (LEFT HAND DRIVE)

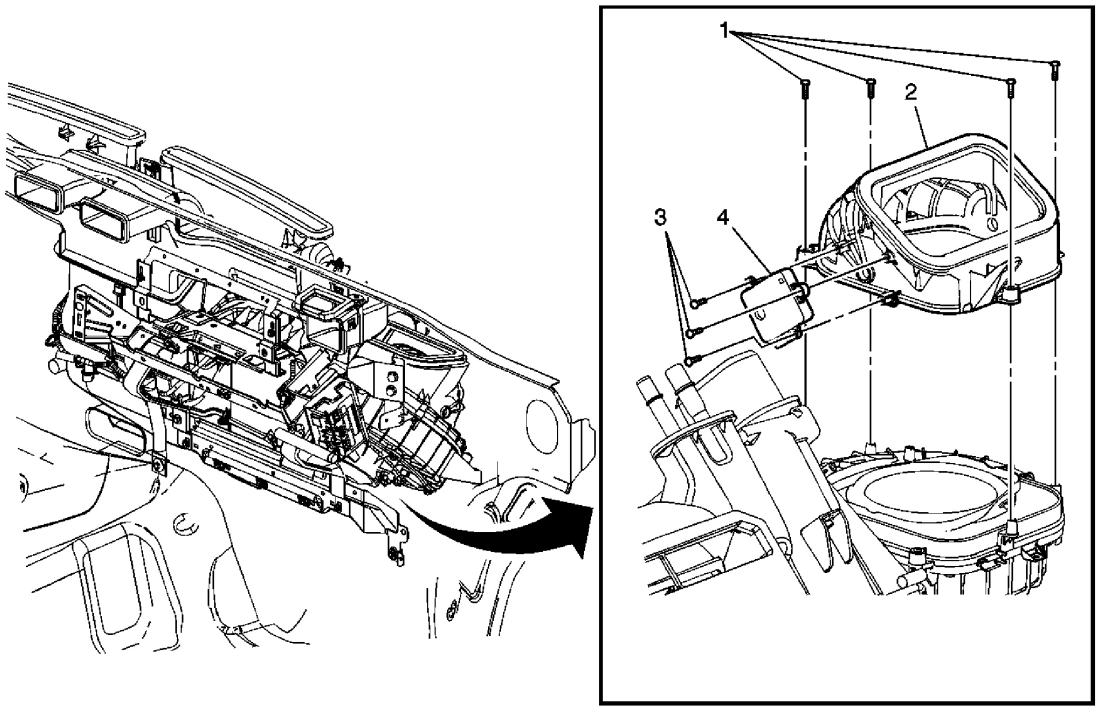


Fig. 28: Recirculation Actuator Replacement (Left Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Recirculation Actuator Replacement (Left Hand Drive)

Callout	Component Name
Preliminary Procedures 1. Remove the HVAC module assembly. Refer to **HVAC Module Assembly Replacement (Left Hand Drive)** or **HVAC Module Assembly Replacement (Right Hand Drive)** . 2. Remove the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Left Hand Drive)** or **Air Inlet Assembly Replacement (Right Hand Drive)** . 3. Disconnect the recirculation actuator electrical connector.	
1	Recirculation Housing Screw (Qty: 4) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (14 lb in)
2	Recirculation Housing

3	Recirculation Actuator Screw (Qty: 3) **Tighten:** 1.5 N.m (13 lb in)
4	Recirculation Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

RECIRCULATION ACTUATOR REPLACEMENT (RIGHT HAND DRIVE)

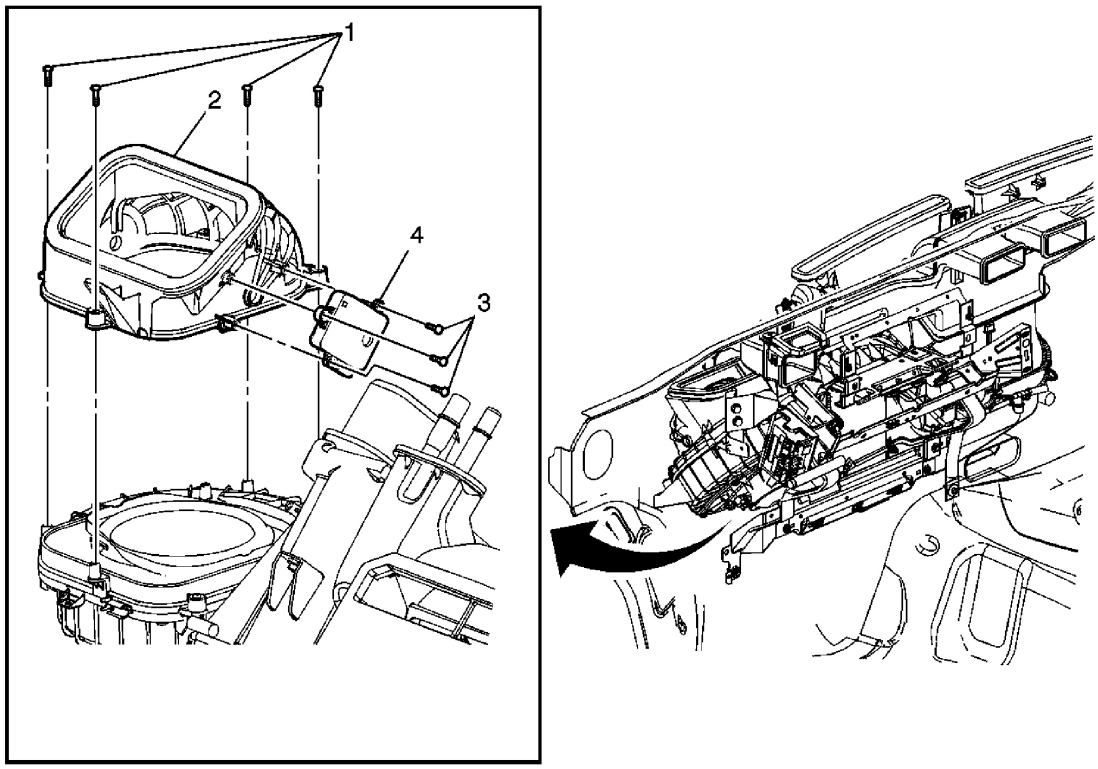


Fig. 29: Recirculation Actuator Replacement (Right Hand Drive)
Courtesy of GENERAL MOTORS CORP.

Recirculation Actuator Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedures 1. Remove the HVAC module assembly. Refer to **HVAC Module Assembly Replacement (Left Hand Drive)** or **HVAC Module Assembly Replacement (Right Hand Drive)** .	

	2. Remove the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Left Hand Drive)** or **Air Inlet Assembly Replacement (Right Hand Drive)** . 3. Disconnect the recirculation actuator electrical connector.
1	Recirculation Housing Screw (Qty: 4) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 1.5 N.m (14 lb in)
2	Recirculation Housing
3	Recirculation Actuator Screw (Qty: 3) **Tighten:** 1.5 N.m (13 lb in)
4	Recirculation Actuator **Procedure:** Recalibrate the Actuator. Refer to **Actuator Recalibration**.

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 Distribution
- Recirculation Operation

HVAC Control Components

HVAC Control Assembly

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. An ignition 3 voltage circuit provides power to the control assembly. The air temperature, mode and recirculation actuator are electrically controlled. The control assembly does support the following features:

Air Delivery Description and Operation

Feature	Availability

Afterblow	No
Purge	No
Personalization	No
Actuator Calibration	Yes

Air Speed

The HVAC control assembly applies a 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 resistors

When the operator requests High speed, the HVAC control assembly activates a relay which applies direct ground to the blower motor.

Air Distribution

Mode Actuator

The mode actuator is a 5-wire bi-directional electric motor that incorporates a feedback potentiometer. Low reference, control A, control B, 5-volt reference and position signal circuits enable the actuator to operate. 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. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

The HVAC control module uses a range of 0-255 counts to index the actuator position. The door position signal voltage is converted to a 0-255 count range. When the module sets a commanded or targeted value, the control circuits are energized to rotate to reach the commanded value. As the actuator shaft rotates the changing position signal is sent to the module. Once the position signal and the commanded value are the same, the module opens the control circuits.

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. Recirculation is not available in Defrost and Mix-Blend mode. If an operator requests recirc in defrost or mix blend the recirc LED will flash 3 times and then turn OFF. The system will remain in fresh air mode.

AIR TEMPERATURE DESCRIPTION AND OPERATION

The air temperature controls are divided into 4 areas:

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

HVAC Control Components

HVAC Control Assembly

The HVAC control assembly is a non-class 2 device that interfaces between the operator and the HVAC system to maintain air temperature and distribution settings. An ignition 3 voltage circuit provides power to the control assembly. The air temperature and mode doors are controlled by cables. The recirculation actuator is electrically controlled. The control assembly does support the following features:

Air Temperature Description and Operation

Feature	Availability
Afterblow	No
Purge	No
Personalization	No
Actuator Calibration	Yes

Air Temperature Actuator

The air temperature actuator is a 5-wire bi-directional electric motor that incorporates a feedback potentiometer. Low reference, control A, control B, 5-volt reference and position signal circuits enable the actuator to operate. 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. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door

position signal between 0-5 volts.

The HVAC control module uses a range of 0-255 counts to index the actuator position. The door position signal voltage is converted to a 0-255 count range. When the module sets a commanded or targeted, value, the control signal is changed to either 0 or 5 volts depending upon the direction that the actuator needs to rotate to reach the commanded value. As the actuator shaft rotates the changing position signal is sent to the module. Once the position signal and the commanded value are the same, the module opens the 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 excessively high or low pressure condition exists. The powertrain control module (PCM) disables the compressor clutch under the following conditions:

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

Evaporator Temperature Sensor

The evaporator temperature sensor will not allow an A/C request to the body control module (BCM) at temperatures less than 0°C (32°F).

Heating and A/C Operation

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

- Recirculation
- Difference between inside and desired temperature
- Difference between ambient and desired temperature

- Blower motor speed setting
- Mode setting

The vehicle operator can activate the A/C system by pressing the A/C switch. The A/C system can operate regardless of the air temperature or mode setting. When the A/C switch is pressed, the HVAC control assembly applies 10 volts to the A/C request signal circuit. The voltage is then sent through the evaporator temperature sensor, if the evaporator temperature is above 0°C (32° F), then the voltage is applied to the other A/C request signal circuit to the BCM. The BCM receives the voltage input and sends a class 2 message to the PCM for an A/C request.

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

- BCM
  - Battery voltage is between 9-16 volts.
  - A/C request from the HVAC control assembly
- PCM
  - Engine coolant temperature (ECT) is less than 123°C (253°F).
  - Engine speed is less than 5300 RPM.
  - Engine speed is more than 600 RPM.
  - A/C high side pressure is between 2951-310 kPa (428-44 psi).

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

- Throttle position is 100 percent for 10 seconds.
- A/C high side pressure is more than 2951 kPa (428 psi) and will re-engage once the pressure drops below 2068 kPa (300 psi).
- A/C high side pressure is less than 310 kPa (44 psi).
- Evaporator temperature is less than 0°C (32°F)
- Engine coolant temperature (ECT) is more than 123°C (253°F).
- Engine speed is less than 475 RPM.
- Engine speed is more than 6000 RPM.
- PCM detects excessive torque load.
- PCM detects insufficient idle quality.

- If the blower is switched to off.

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 an very low temperature gas that can transfer the undesirable heat and moisture from the passenger compartment to the outside air.

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

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

The condenser is located in front of the radiator for maximum heat transfer. The condenser is

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

The TXV is located in the liquid line between the condenser and the evaporator. 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 vaporize 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 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 ACR 2000 Air Conditioning Service Center