

2007 HVAC

HVAC - Manual - Outlook

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Actuator Mounting Screws	1.5 N.m	13 lb in
HVAC Control Module Mounting Screws	2 N.m	17 lb in

SENSOR RESISTANCE TABLE (VOLTS TO TEMP TO RESISTANCE)

Sensor Resistance Table (Volts to Temp to Resistance)

Voltage Tech 2 (V)	R Nominal (k ohms)	Outside Air Temp (° F)	Outside Air Temp (° C)
4.72-4.74	171.6	-22	-30
4.52-4.54	94.63	-4	-20
4.22-4.25	54.21	14	-10
3.81-3.85	32.00	32	0
3.31-3.34	19.61	50	10
2.76-2.79	12.31	68	20
2.22-2.25	7.959	86	30
1.73-1.75	5.268	104	40
1.31-1.34	3.563	122	50
0.99-1.01	2.458	140	60

The Tech 2 will display sensor value as a voltage. This gives the approximate voltage expected at different ambient temperatures as well as what should be read with an ohmmeter connected to the sensor. Since this is raw data any heat from underhood that changes ambient temp around the sensor might skew the reading, so let the engine compartment cool.

SCHEMATIC AND ROUTING DIAGRAMS

HVAC SCHEMATICS

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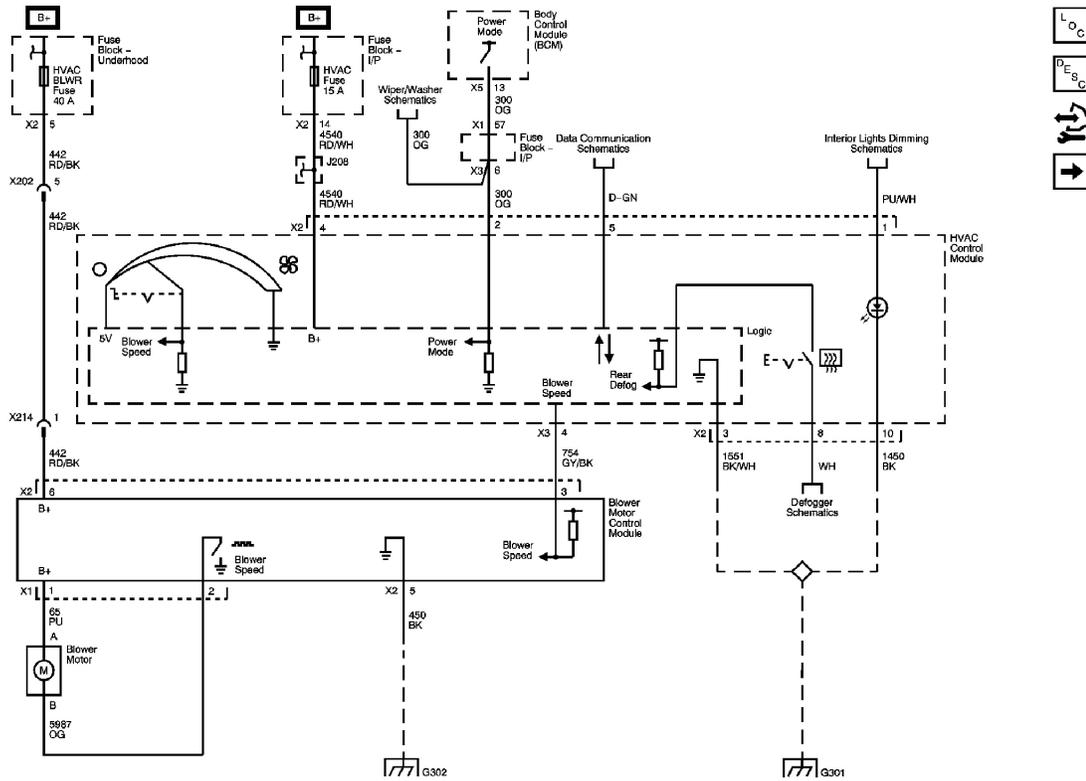


Fig. 1: Module Power & Ground, Blower Control & Subsystem References Schematic
Courtesy of GENERAL MOTORS CORP.

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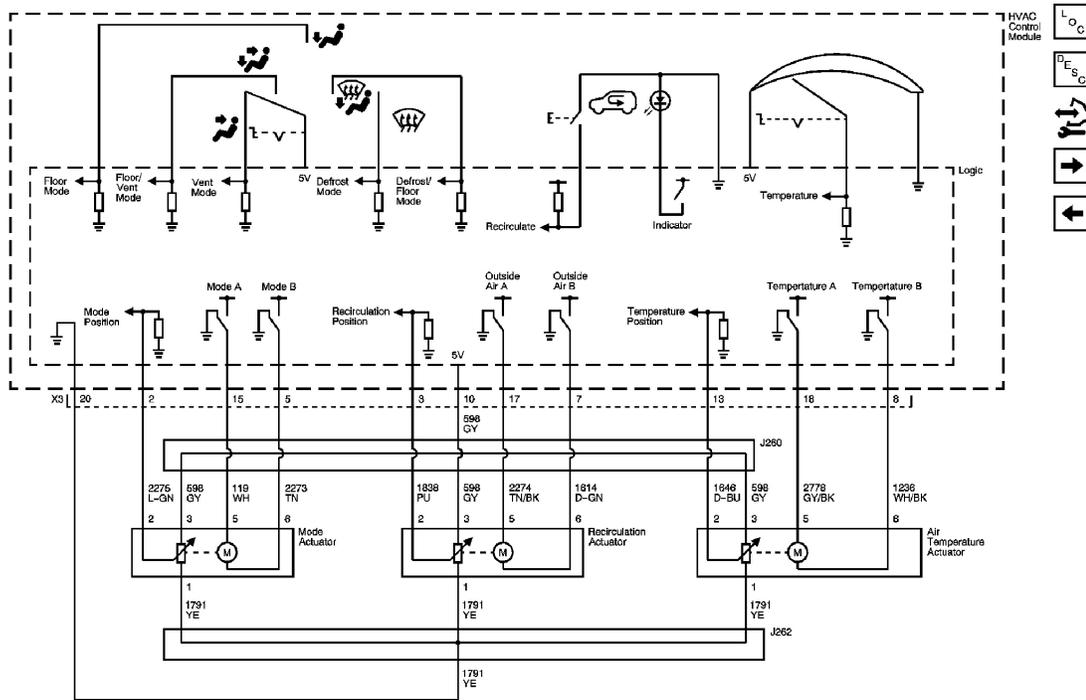


Fig. 2: Actuators Schematic
 Courtesy of GENERAL MOTORS CORP.

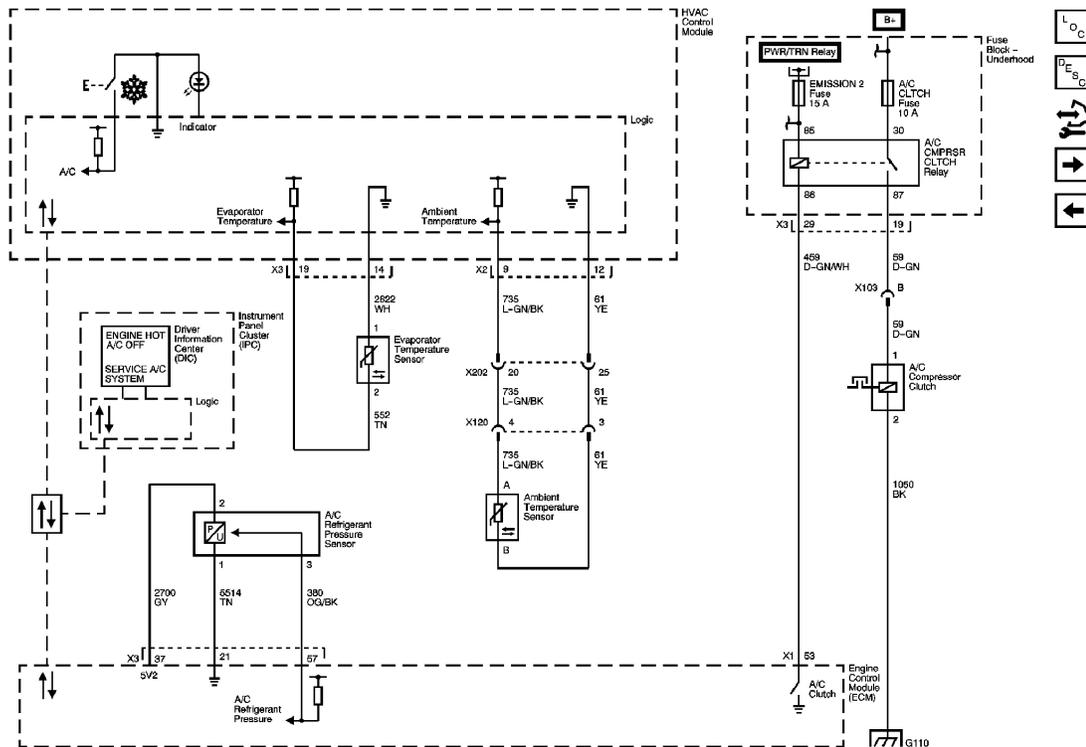


Fig. 3: Compressor Controls Schematic
 Courtesy of GENERAL MOTORS CORP.

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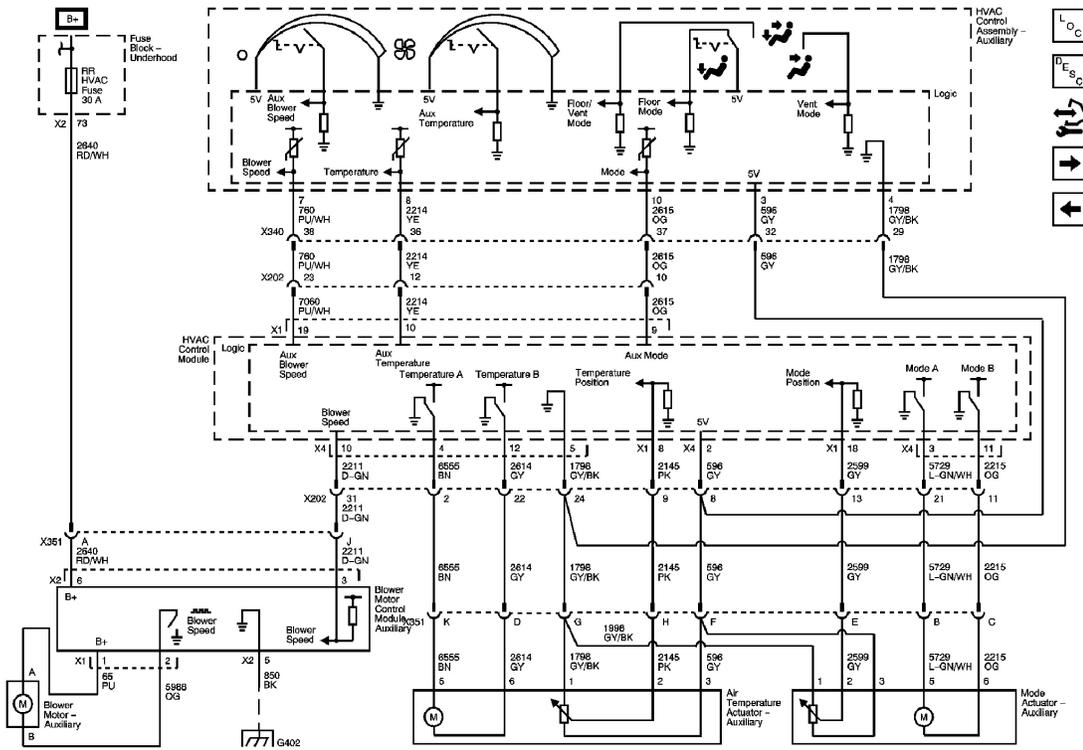


Fig. 4: Rear HVAC Schematic - UK6
Courtesy of GENERAL MOTORS CORP.

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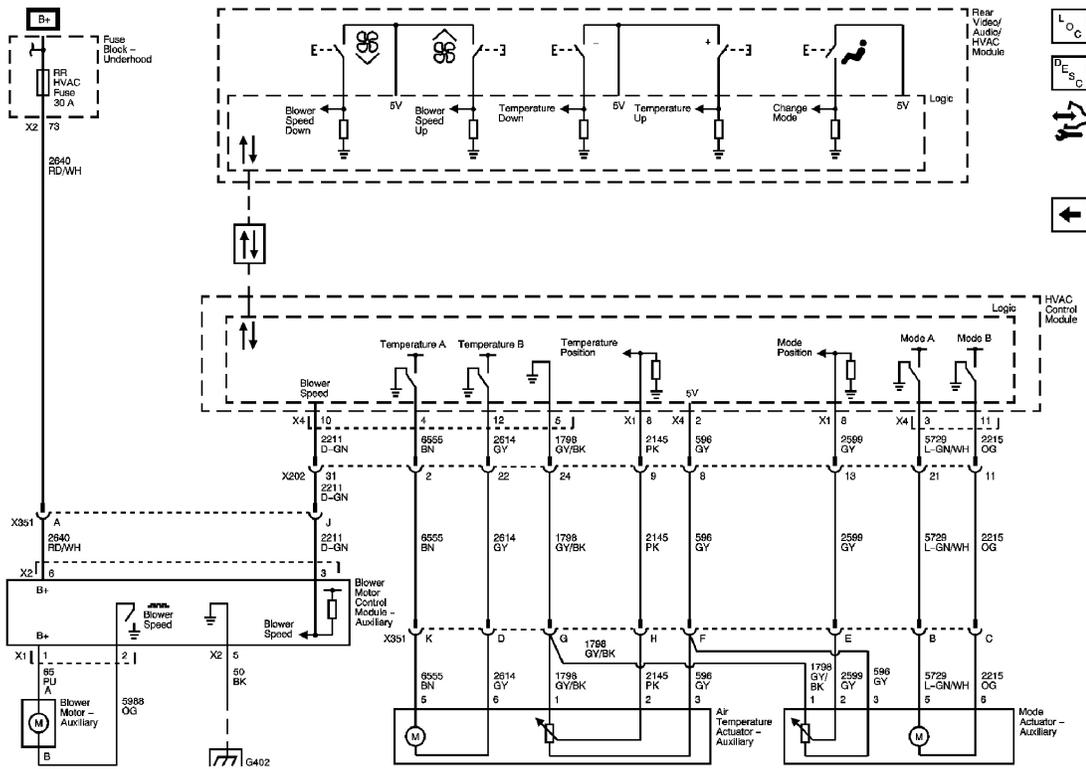


Fig. 5: Rear HVAC Schematic - UK6
 Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

HVAC COMPONENT VIEWS

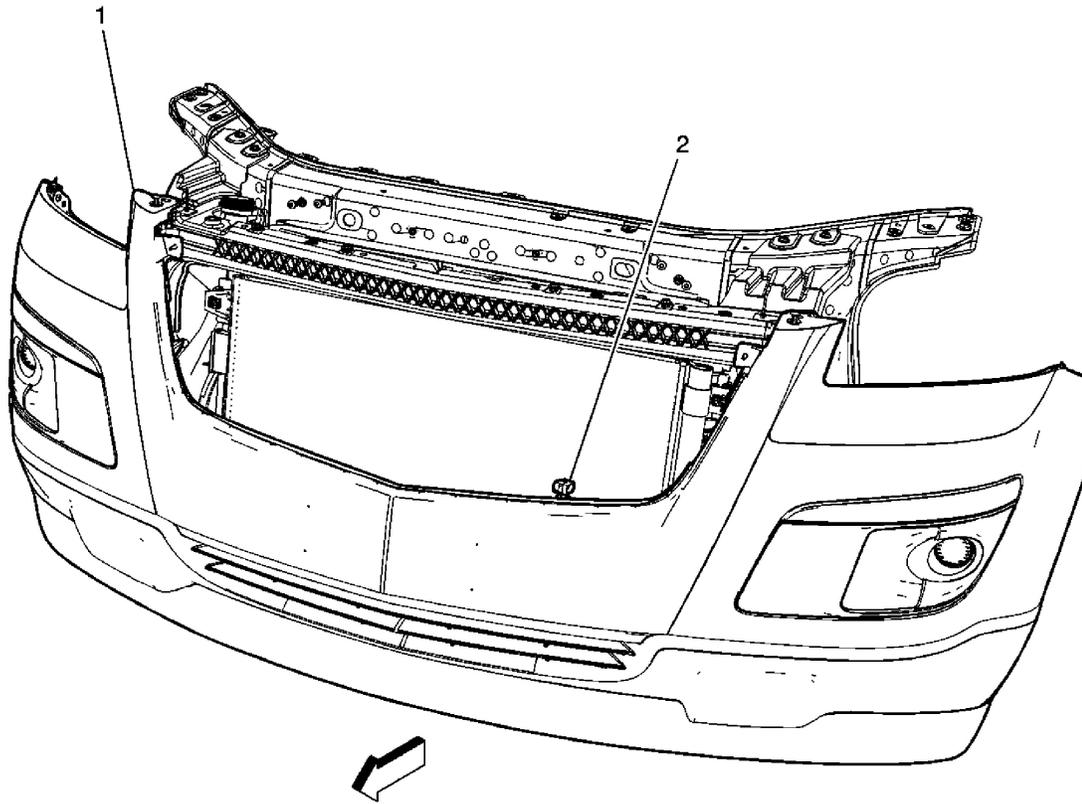


Fig. 6: Identifying Ambient Temperature Sensor
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 6

Callout	Component Name
1	Front Fascia
2	Ambient Temperature Sensor

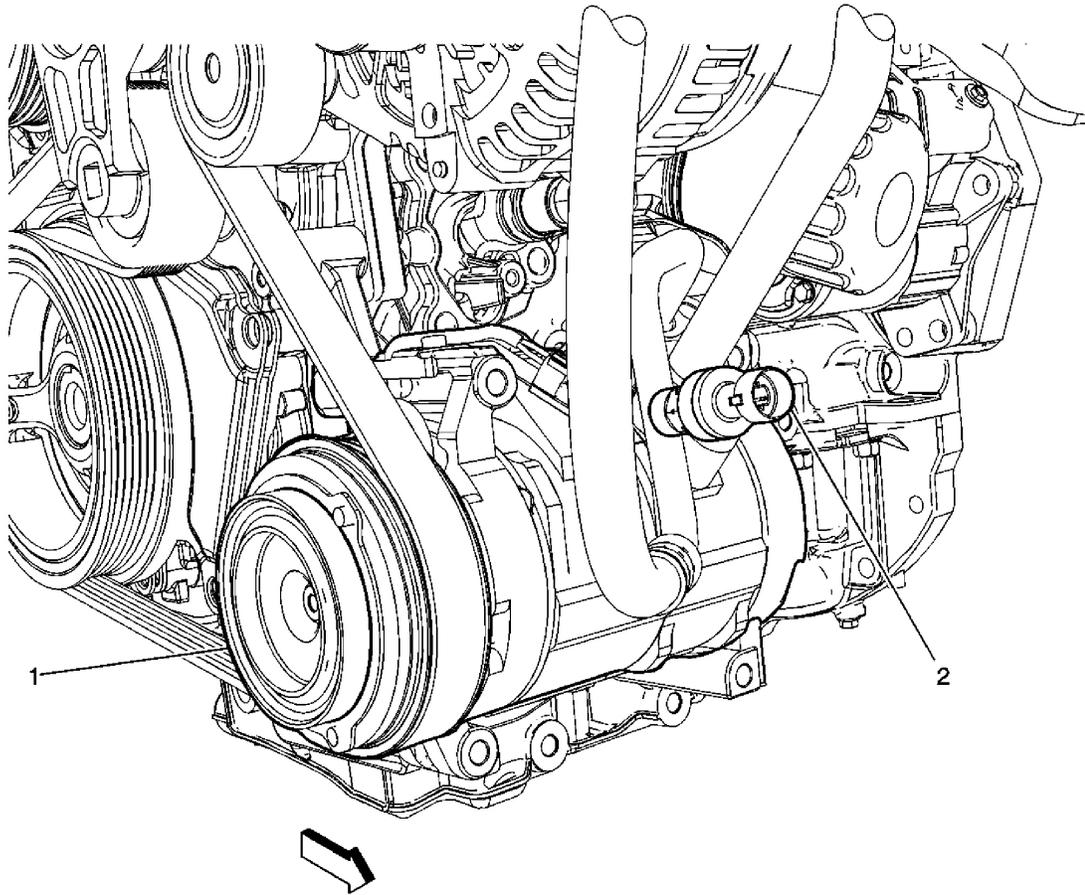


Fig. 7: Identifying A/C Refrigerant Pressure Sensor
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	A/C Compressor
2	A/C Refrigerant Pressure Sensor

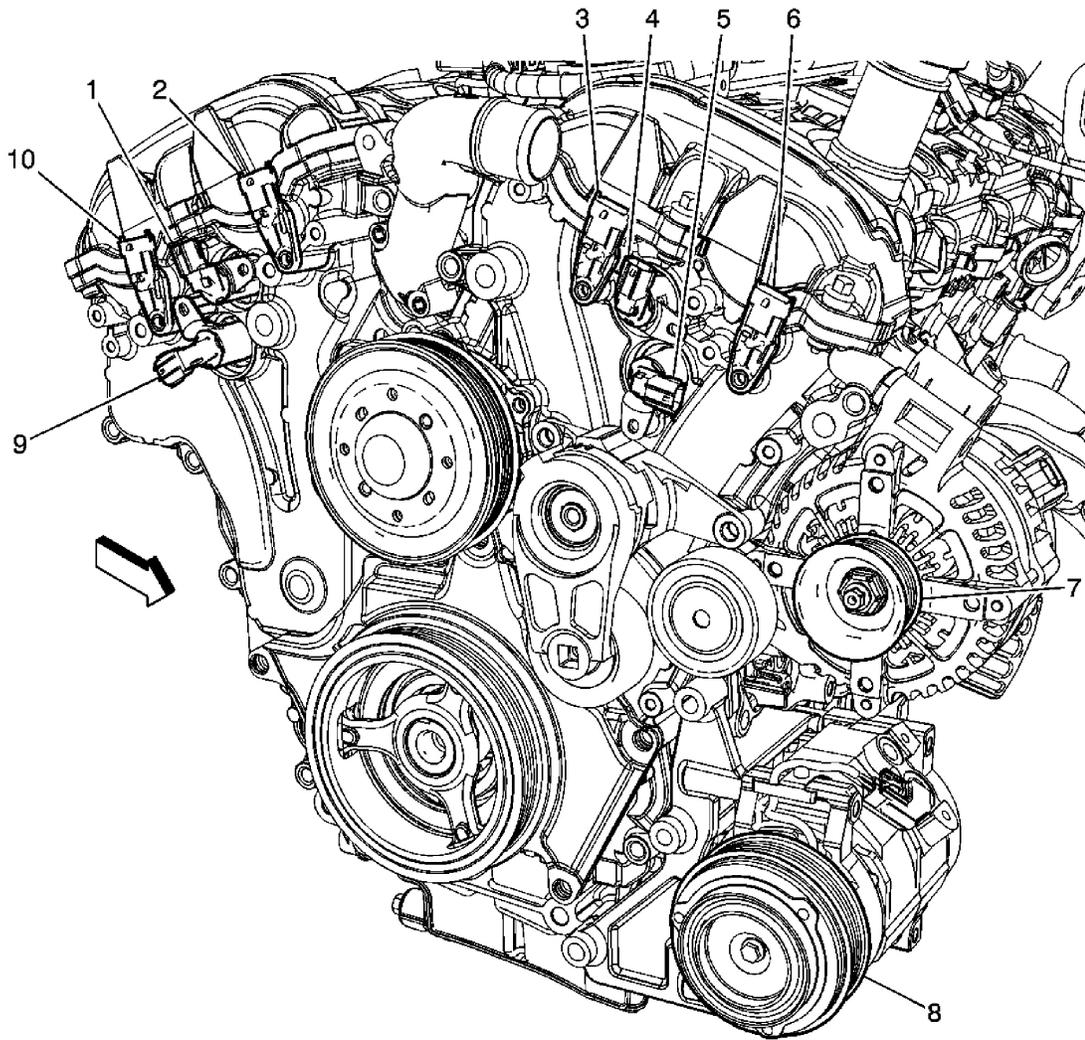


Fig. 8: View Near The Water Pump
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
1	Camshaft Position (CMP) Actuator Solenoid - Intake Bank 1
2	Camshaft Position (CMP) Sensor - Intake Bank 1
3	Camshaft Position (CMP) Sensor - Intake Bank 2
4	Camshaft Position (CMP) Actuator Solenoid - Intake Bank 2
5	Camshaft Position (CMP) Actuator Solenoid - Exhaust Bank 2
6	Camshaft Position (CMP) Sensor - Exhaust Bank 2
7	Generator

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8	A/C Compressor Clutch
9	Camshaft Position (CMP) Actuator Solenoid - Exhaust Bank 1
10	Camshaft Position (CMP) Sensor - Exhaust Bank 1

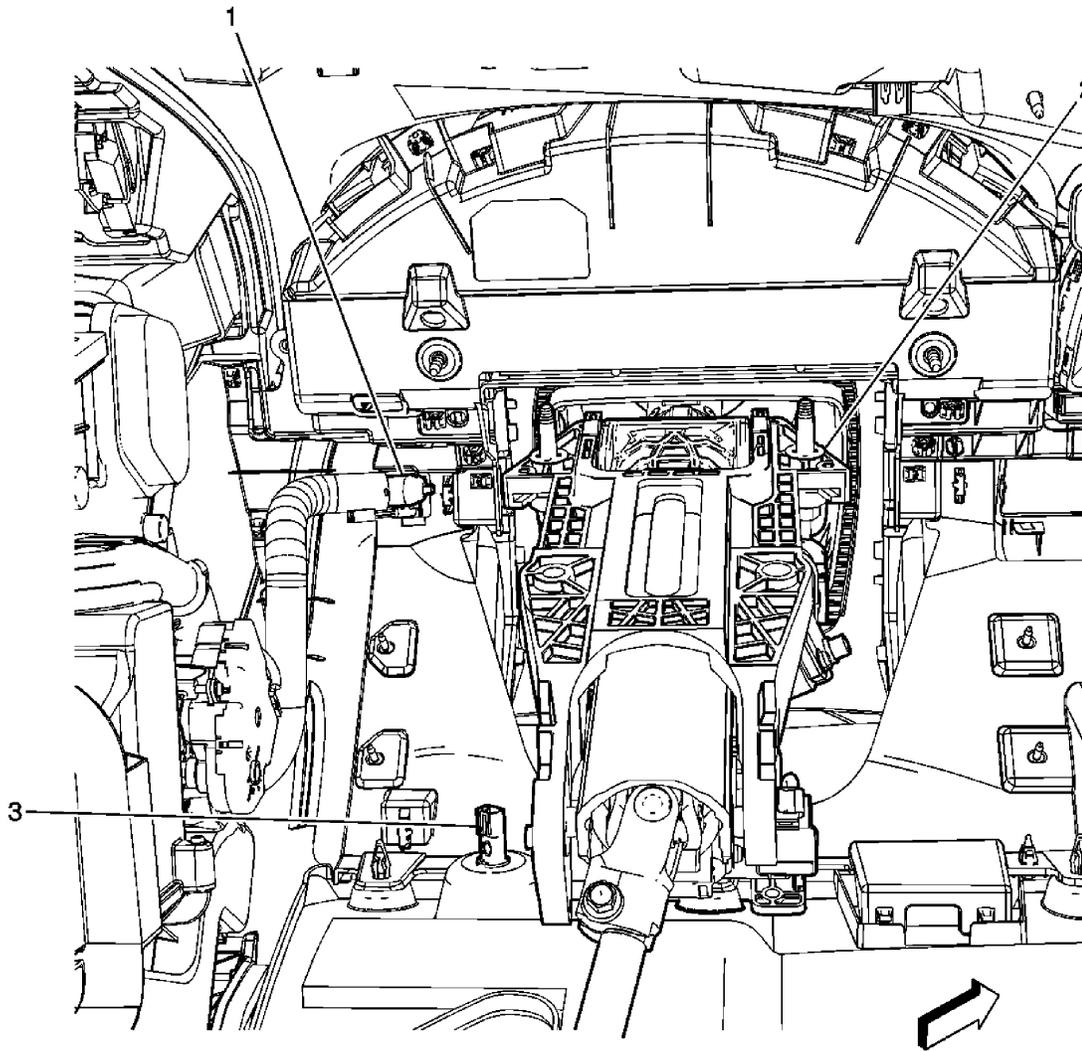


Fig. 9: View Near The Steering Column
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

Callout	Component Name
1	Ambient Air Temperature Sensor
2	Steering Column
3	Courtesy Lamp - Left Footwell

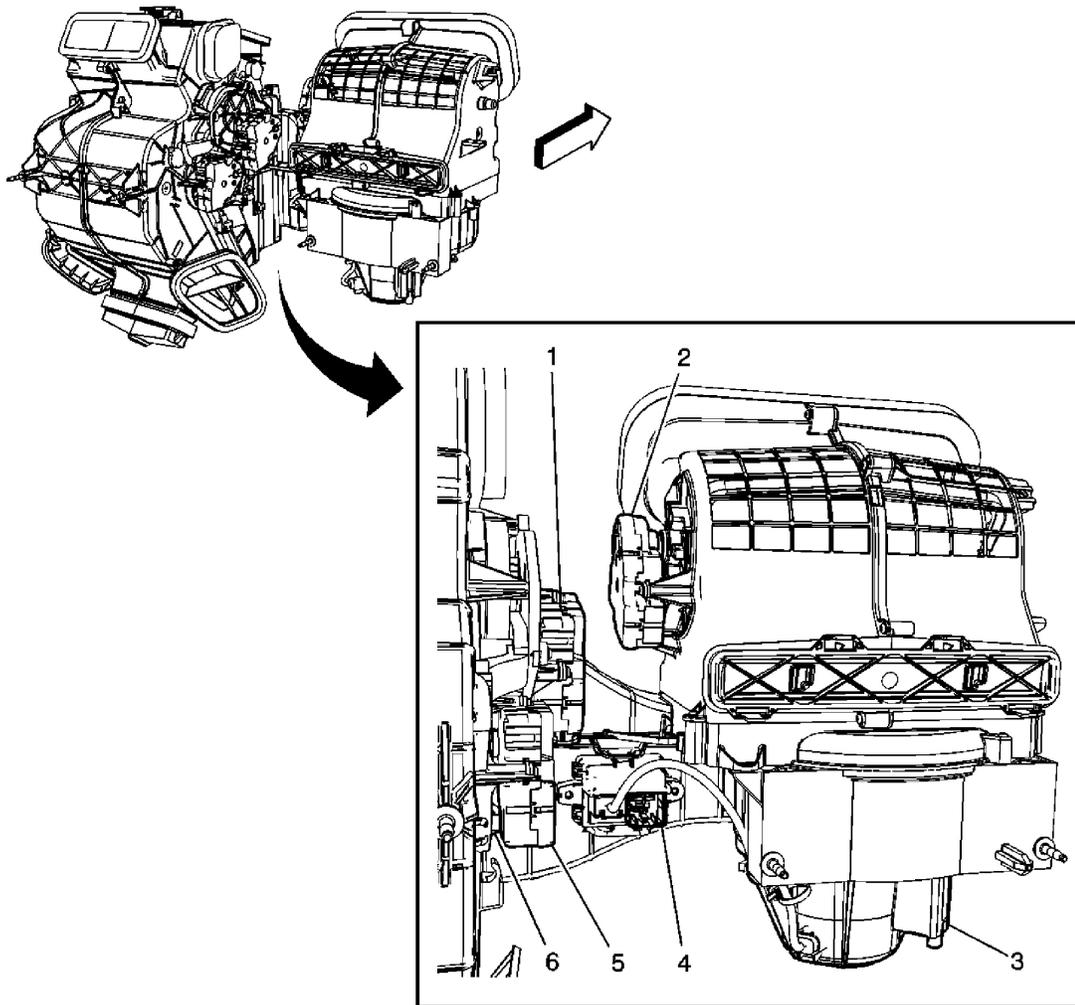


Fig. 10: View Of Front HVAC Module (C67)
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 10

Callout	Component Name
1	Mode Actuator
2	Recirculation Actuator
3	Blower Motor
4	Blower Motor Control Module
5	Air Temperature Actuator (C67)

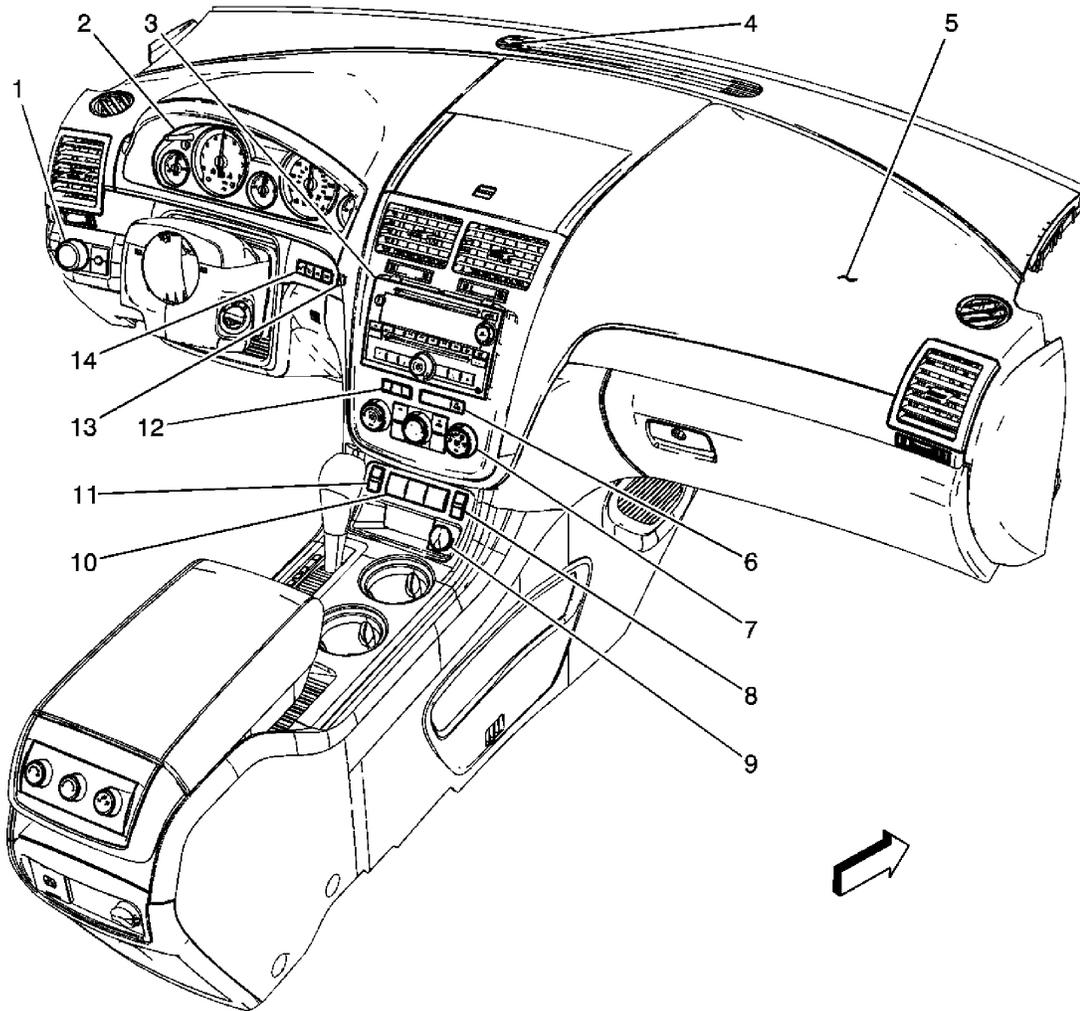


Fig. 11: Identifying I/P Components
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 11

Callout	Component Name
1	Headlamp Switch
2	Instrument Panel Cluster (IPC)
3	Radio
4	Sunload Sensor (CJ2)/Ambient Light Sensor (C67)
5	I/P Trim
6	Inflatable Restraint Passenger Air Bag ON/OFF Indicator
7	HVAC Control Module
8	Heated Seat Switch - Passenger (KA1)

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9	Auxiliary Power Outlet - I/P
10	I/P Switch Assembly
11	Heated Seat Switch - Driver (KA1)
12	Hazard Switch
13	Driver Information Center (DIC) Switch (UH9)

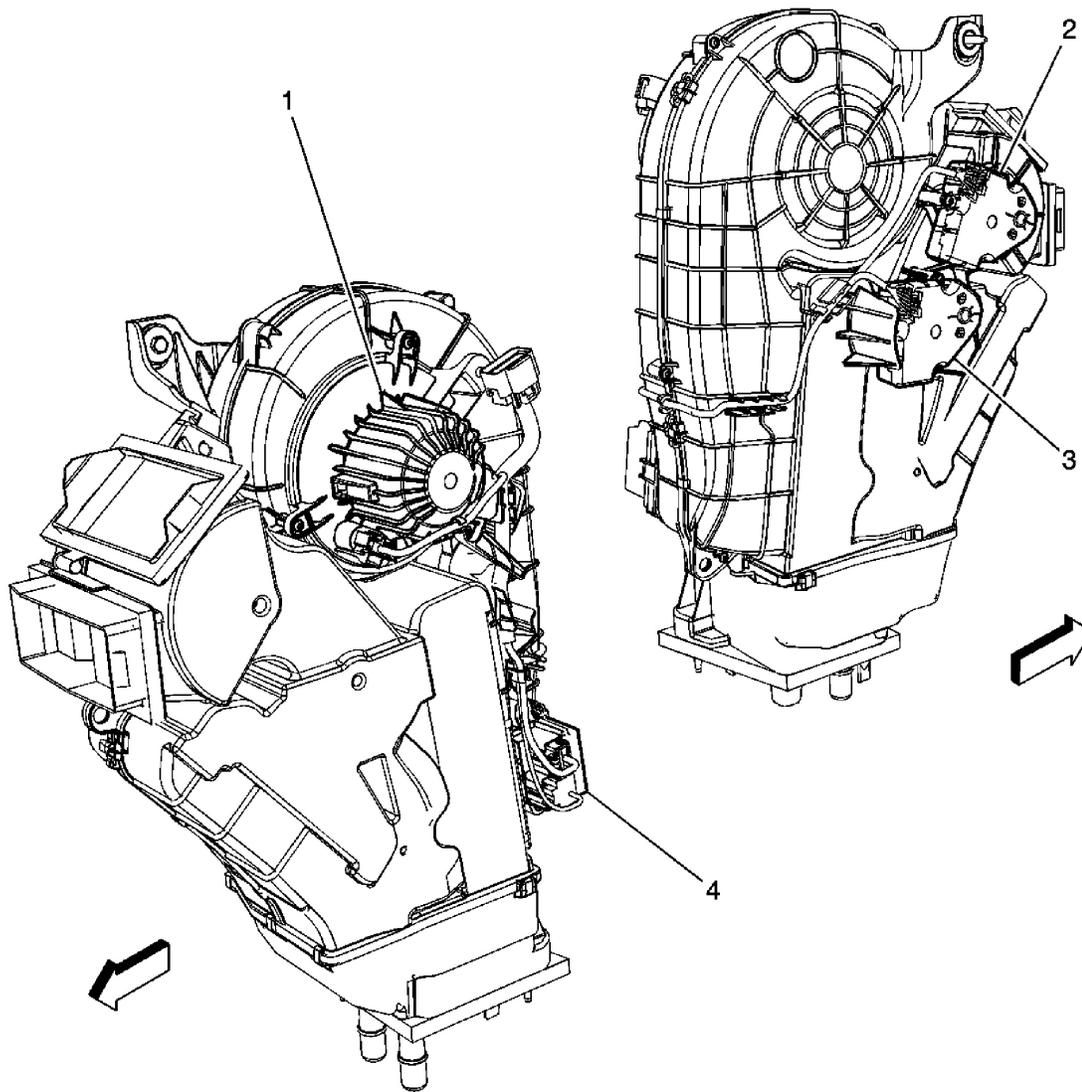


Fig. 12: Identifying Interior HVAC Module - Rear
 Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 12

Callout	Component Name

1	Blower Motor - Auxiliary
2	Mode Actuator - Auxiliary
3	Air Temperature Actuator - Auxiliary
4	Blower Motor Control Module - Auxiliary

HVAC CONNECTOR END VIEWS

A/C Compressor Clutch

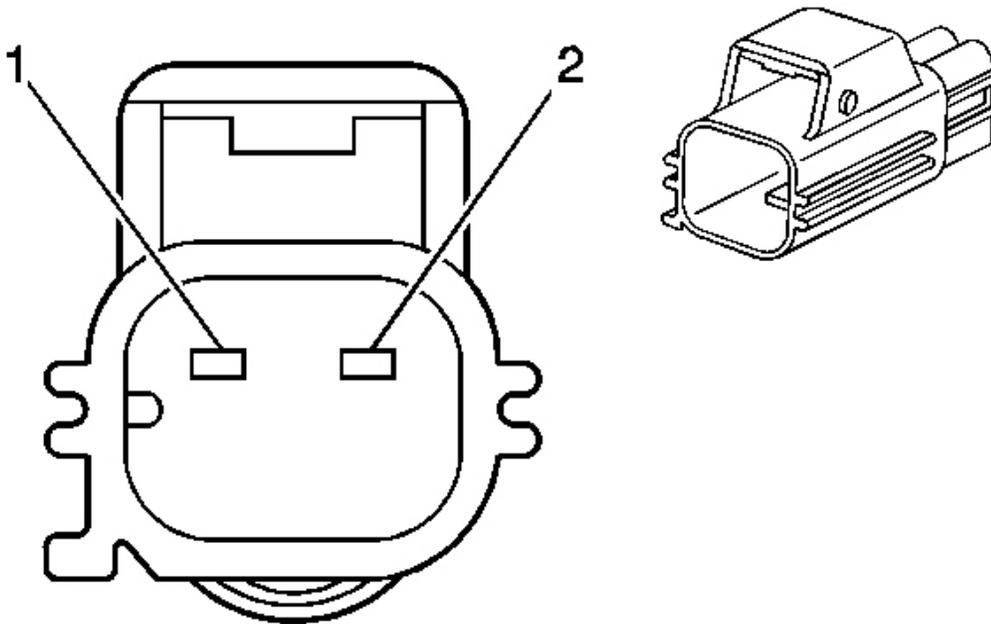


Fig. 13: A/C Compressor Clutch Connector End View
 Courtesy of GENERAL MOTORS CORP.

A/C Compressor Clutch Connector Parts Information

Connector Part Information

- OEM: 7282-5548-30
- Service: 88953303
- Description: 2-Way M YESC Weather Pack (BK)

Terminal Part Information

- Terminal/Tray: 7114-4103-08/9
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094430/J-35616-3 (GY)

A/C Compressor Clutch Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	D-GN	59	A/C Compressor Clutch Supply Voltage
2	BK	1050	Ground

A/C Refrigerant Pressure Sensor

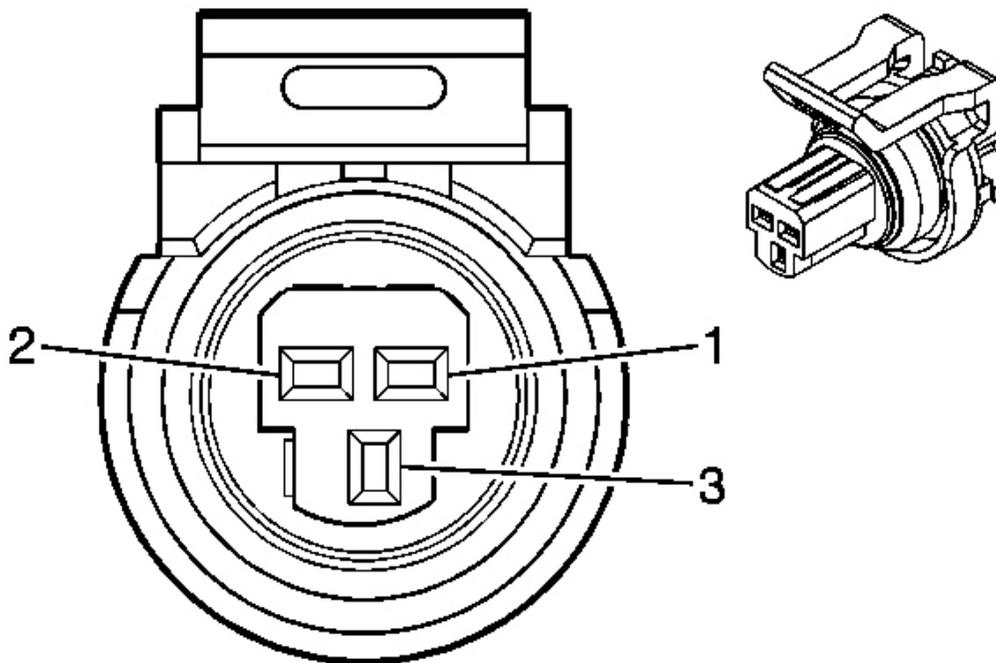


Fig. 14: A/C Refrigerant Pressure Sensor Connector End View
 Courtesy of GENERAL MOTORS CORP.

A/C Refrigerant Pressure Sensor Connector Parts Information

Connector Part Information

- OEM: 15477863
- Service: 88988301
- Description: 3-Way F GT 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	Circuit No.	Function
1	0.5 TN	5514	Low Reference
2	0.5 GY	2700	5-Volt Reference
3	0.5 OG/BK	380	A/C Refrigerant Pressure Sensor Signal

Air Temperature Actuator

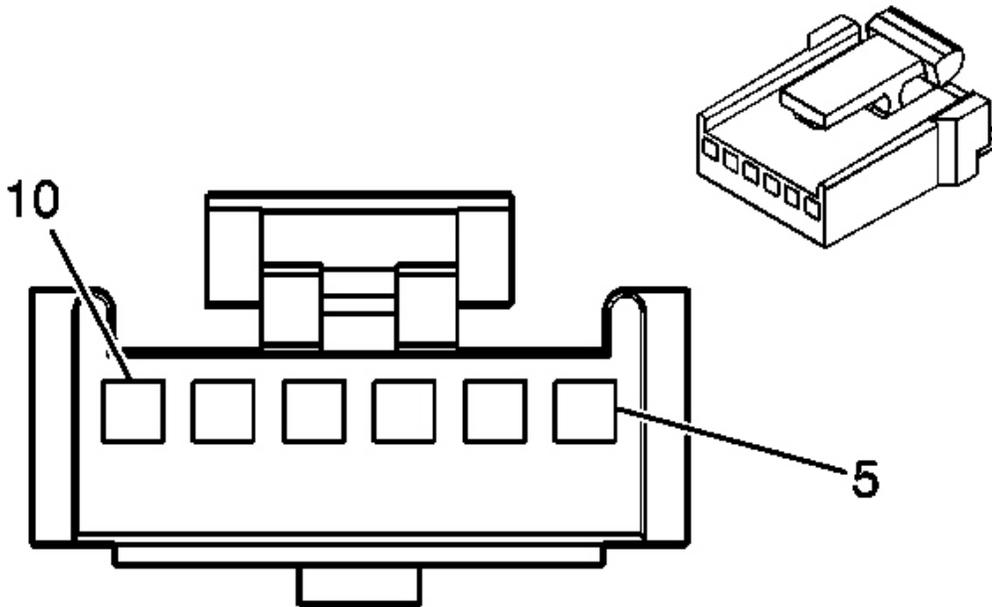


Fig. 15: Air Temperature Actuator Connector End View
 Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Connector Parts Information

Connector Part Information

- OEM: 1355082-1
- Service: See Catalog
- Description: 6-Way F (BK)

Terminal Part Information

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

Air Temperature Actuator Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 GY/BK	1789	Low Reference

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2	0.5 PK	2145	Air Temperature Switch Signal
3	0.35 GY	596	5-Volt Reference
4	-	-	Not Used
5	0.35 BN	6555	Auxiliary Temperature Motor Supply Voltage
6	0.35 GY	2614	Air Temperature Door Control

Air Temperature Actuator - Auxiliary

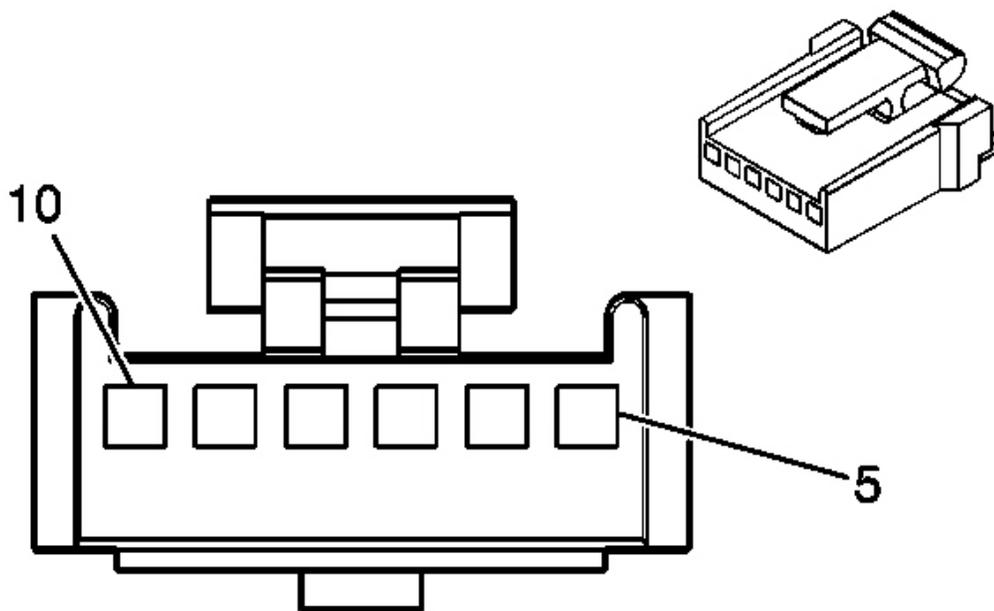


Fig. 16: Air Temperature Actuator - Auxiliary Connector End View
Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator - Auxiliary Connector Parts Information

Connector Part Information

- OEM: 1355082-1
- Service: See Catalog
- Description: 6-Way F (BK)

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Terminal Part Information

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

Air Temperature Actuator - Auxiliary Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 YE	1791	Low Reference
2	0.35 D-BU	1646	Auxiliary Air Temperature Door Position Signal
3	0.35 GY	598	5-Volt Reference
4	-	-	Not Used
5	0.35 GY/BK	2778	Right Air Temperature Door Control A
6	0.35 WH/BK	1336	Auxiliary Air Temperature Door Control

Ambient Temperature Sensor

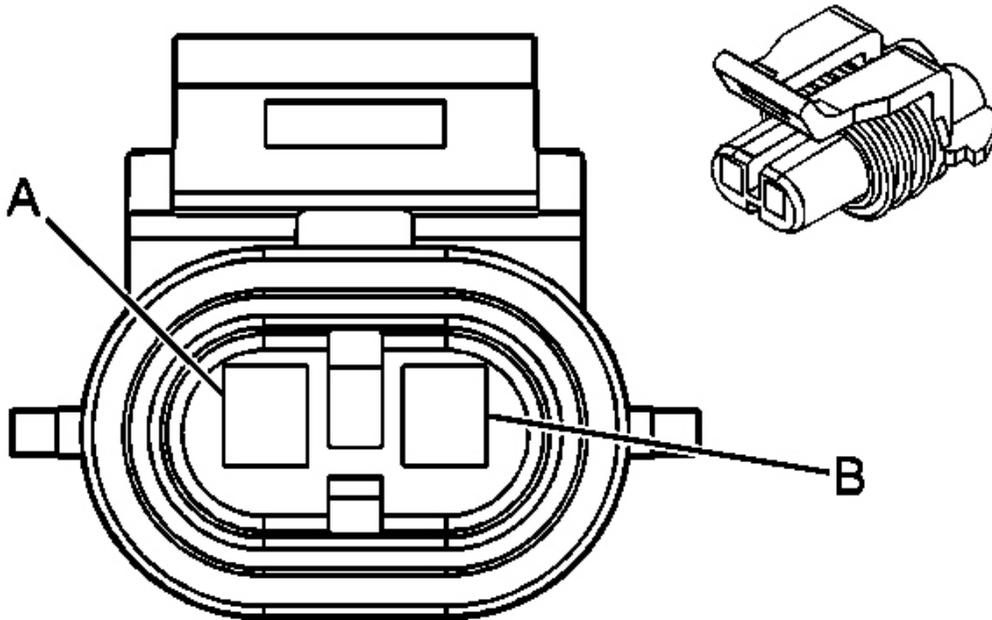


Fig. 17: Ambient Temperature Sensor Connector End View
 Courtesy of GENERAL MOTORS CORP.

Ambient Temperature Sensor Connector Parts Information

Connector Part Information

- OEM: 12052642
- Service: 12101856
- Description: 2-Way F Metri-Pack 150 Series, Sealed (L-GN)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-14 (GN)

Ambient Temperature Sensor Connector Terminal Identification

Pin	Wire	Circuit No.	Function
			Ambient Air Temperature Sensor

A	0.35 L-GN/BK	735	Signal
B	0.35 YE	61	Low Reference

Ambient Temperature Sensor (Z88)

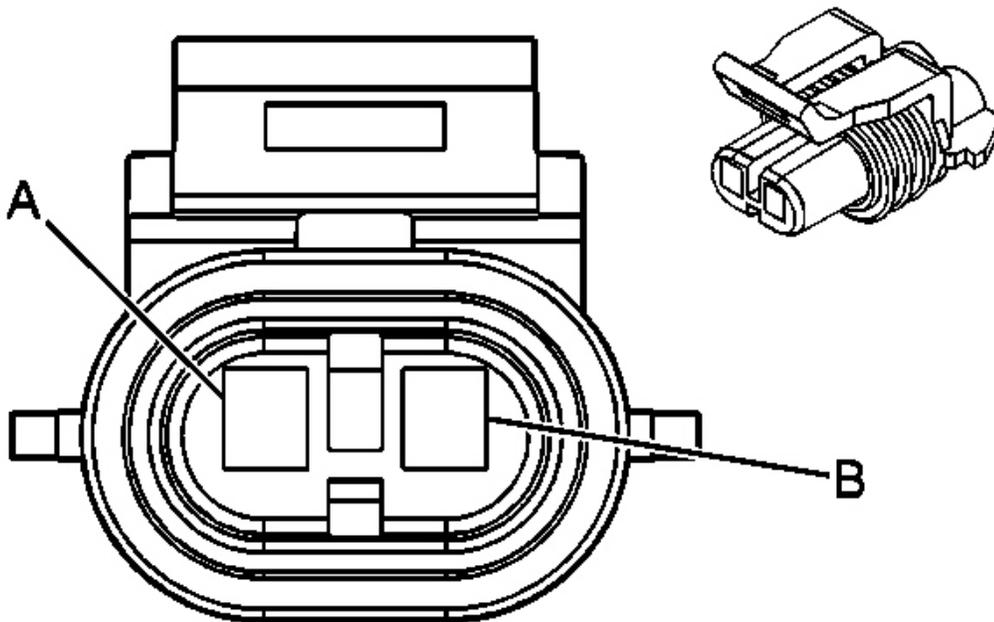


Fig. 18: Ambient Temperature Sensor (Z88) Connector End View
 Courtesy of GENERAL MOTORS CORP.

Ambient Temperature Sensor (Z88) Connector Parts Information

Connector Part Information

- OEM: 12052642
- Service: 12101856
- Description: 2-Way F Metri-Pack 150 Series, Sealed (L-GN)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1

- Release Tool/Test Probe: 12094429/J-35616-14 (GN)

Ambient Temperature Sensor (Z88) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
A	0.35 YE	61	Low Reference
B	0.35 L-GN/BK	735	Ambient Air Temperature Sensor Signal

Air Temperature Actuator - Auxiliary

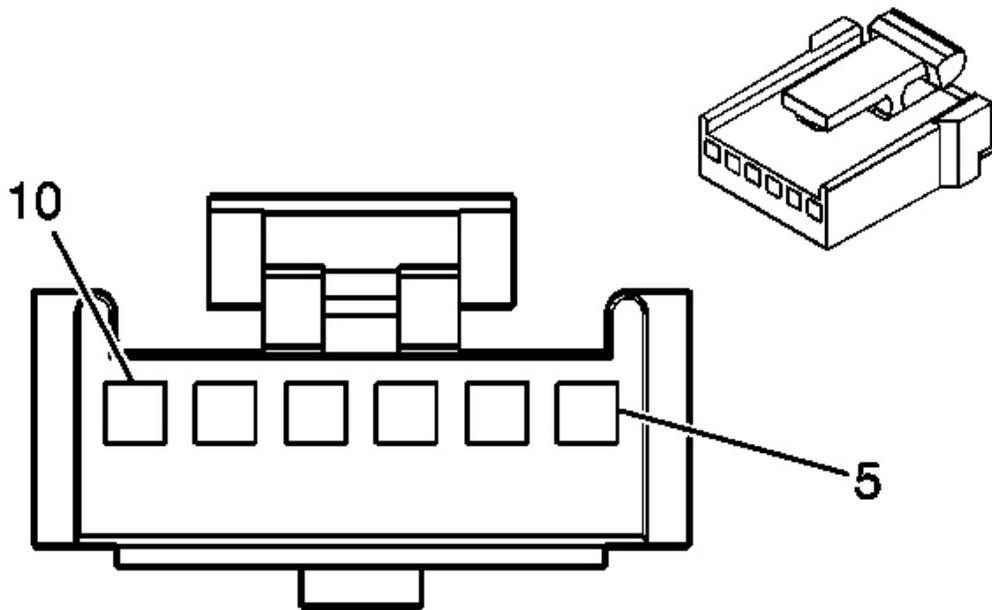


Fig. 19: Air Temperature Actuator - Auxiliary Connector End View
 Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator - Auxiliary Connector Parts Information

Connector Part Information

- OEM: 1355082-1
- Service: See Catalog

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- Description: 6-Way F (BK)

Terminal Part Information

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

Air Temperature Actuator - Auxiliary Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 YE	1791	Low Reference
2	0.35 PU	1838	Recirculation Door Position Signal
3	0.35 GY	598	5-Volt Reference
4	-	-	Not Used
5	0.35 TN/BK	2274	Recirculation Door Control Circuit
6	0.35 D-GN	1614	Recirculation Door Control

Blower Motor

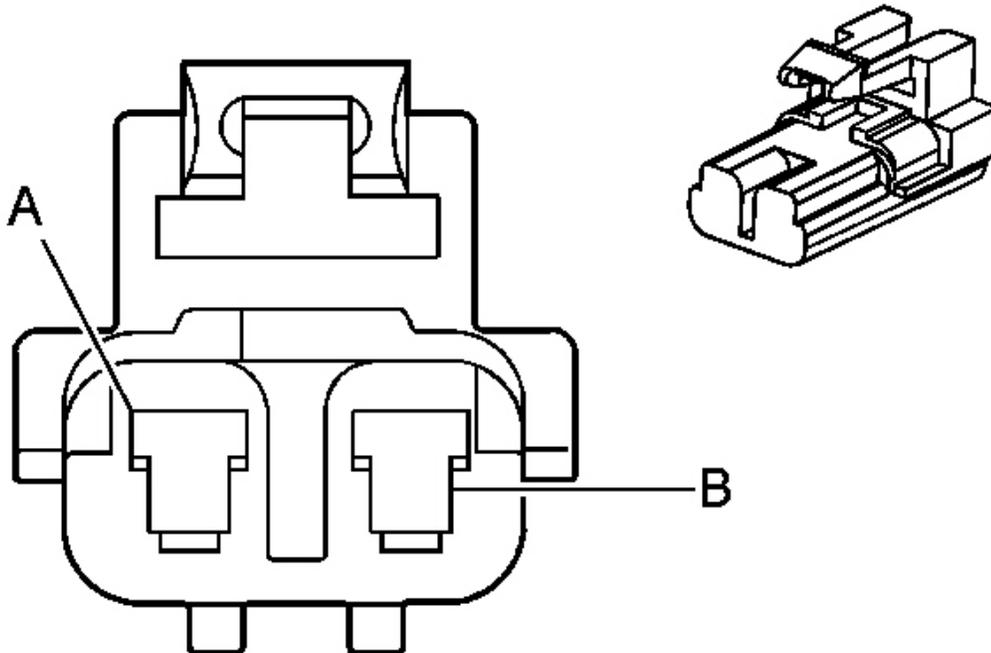


Fig. 20: Blower Motor Connector End View
 Courtesy of GENERAL MOTORS CORP.

Blower Motor Connector Parts Information

Connector Part Information

- OEM: 12084957
- Service: 12126461
- Description: 2-Way F (BK)

Terminal Part Information

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

Blower Motor Connector Terminal Identification

Pin	Wire	Circuit No.	Function

A	3.0 PU	65	Blower Motor Supply Voltage
B	3.0 OG	5987	Low Reference

Blower Motor - Auxiliary

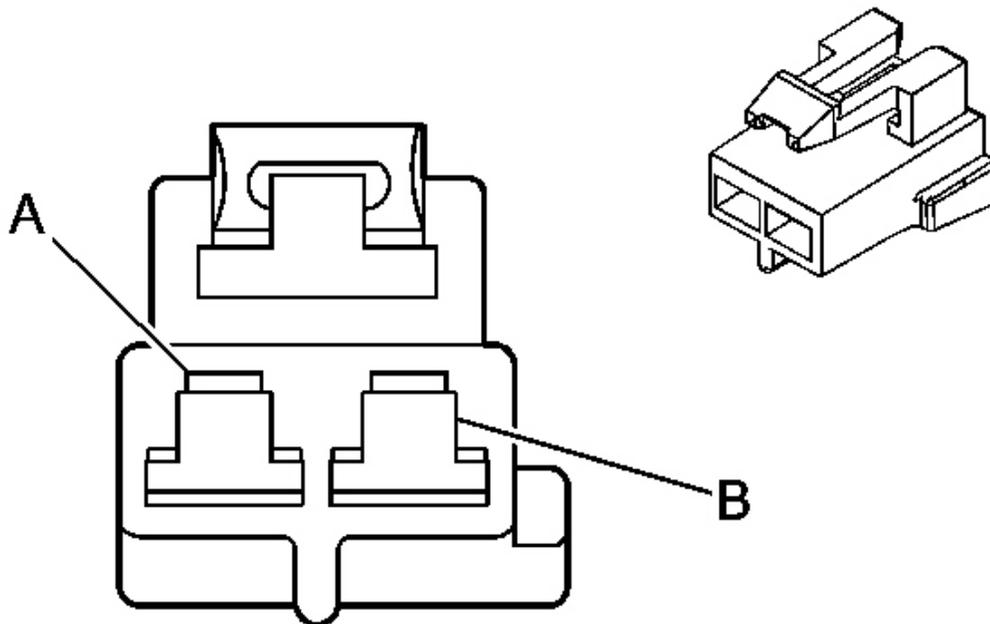


Fig. 21: Blower Motor - Auxiliary Connector End View
 Courtesy of GENERAL MOTORS CORP.

Blower Motor - Auxiliary Connector Parts Information

Connector Part Information

- OEM: 12064749
- Service: 12064749
- Description: 2-Way F (BK)

Terminal Part Information

- Terminal/Tray: See Terminal Repair Kit
- Core/Insulation Crimp: See Terminal Repair Kit

- Release Tool/Test Probe: See Terminal Repair Kit

Blower Motor - Auxiliary Connector Terminal Identification

Pin	Wire	Circuit No.	Function
A	3.0 PU	65	Blower Motor Supply Voltage
B	3.0 OG	5988	Low Reference

Blower Motor Control Module - Auxiliary X1

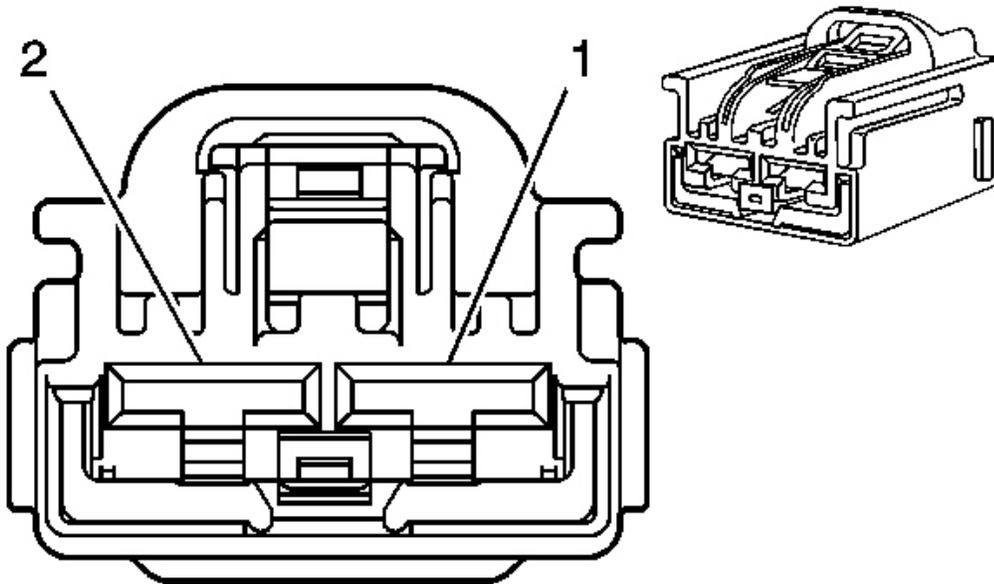


Fig. 22: Blower Motor Control Module - Auxiliary X1 Connector End View
 Courtesy of GENERAL MOTORS CORP.

Blower Motor Control Module - Auxiliary X1 Connector Parts Information

Connector Part Information

- OEM: 15226103
- Service: 88988507
- Description: 2-Way F (BK)

Terminal Part Information

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

Blower Motor Control Module - Auxiliary X1 Connector Terminal Identification

Pin	Wire	Circuit No.	Function
A	3.0 PU	65	Blower Motor Supply Voltage
B	3.0 OG	5988	Low Reference

Blower Motor Control Module - Auxiliary X2

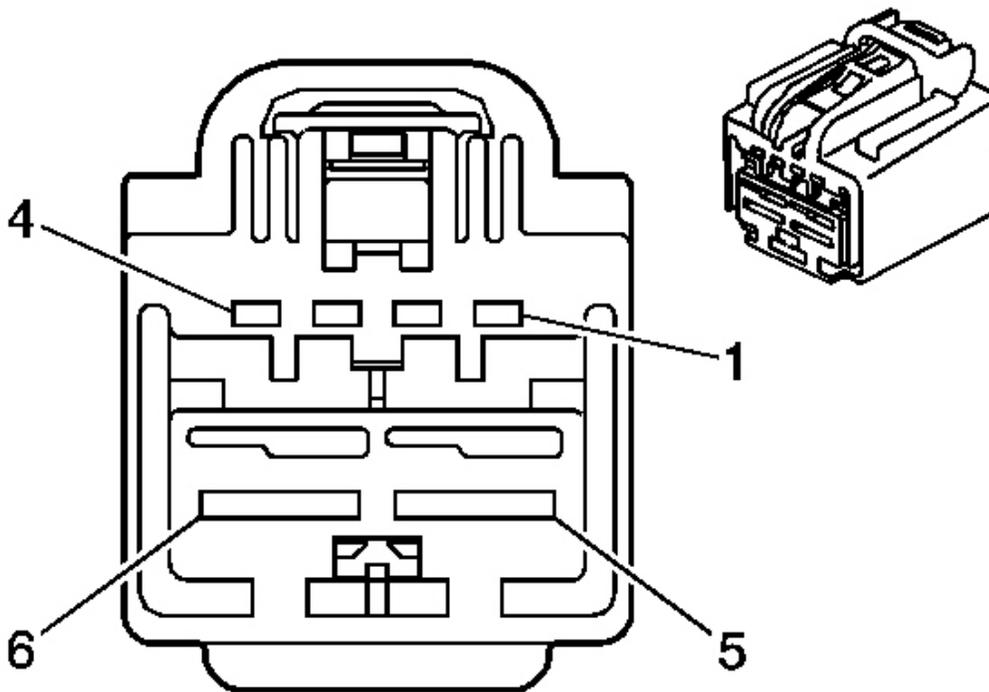


Fig. 23: Blower Motor Control Module - Auxiliary X2 Connector End View
 Courtesy of GENERAL MOTORS CORP.

Blower Motor Control Module - Auxiliary X2 Connector Parts Information

Connector Part Information

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- OEM: 15226104
- Service: 88988512
- Description: 6-Way F (BK)

Terminal Part Information

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

Blower Motor Control Module - Auxiliary X2 Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1-2	-	-	Not Used
3	0.35 D-GN	2211	Auxiliary Blower Motor Speed Control
4	-	-	Not Used
5	3.0 BK	850	Ground
6	3.0 RD/WH	2640	Battery Positive Voltage

Blower Motor Control Module X1

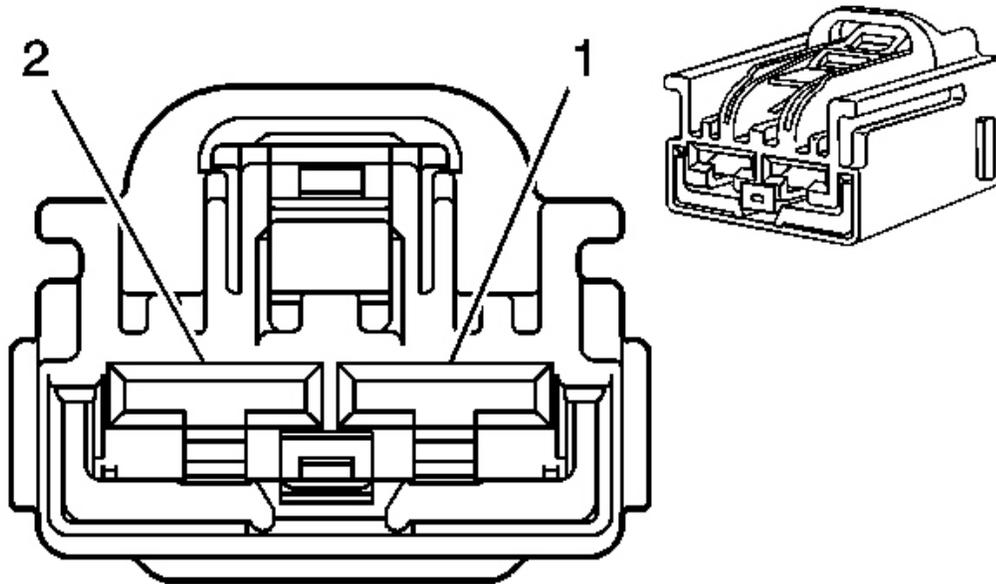


Fig. 24: Blower Motor Control Module X1 Connector End View
 Courtesy of GENERAL MOTORS CORP.

Blower Motor Control Module X1 Connector Parts Information

Connector Part Information

- OEM: 15226103
- Service: 88988507
- Description: 2-Way F (BK)

Terminal Part Information

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

Blower Motor Control Module - Auxiliary X1 Connector Terminal Identification

Pin	Wire	Circuit No.	Function
A	3.0 PU	65	Blower Motor Supply Voltage
B	3.0 OG	5988	Low Reference

Blower Motor Control Module X2

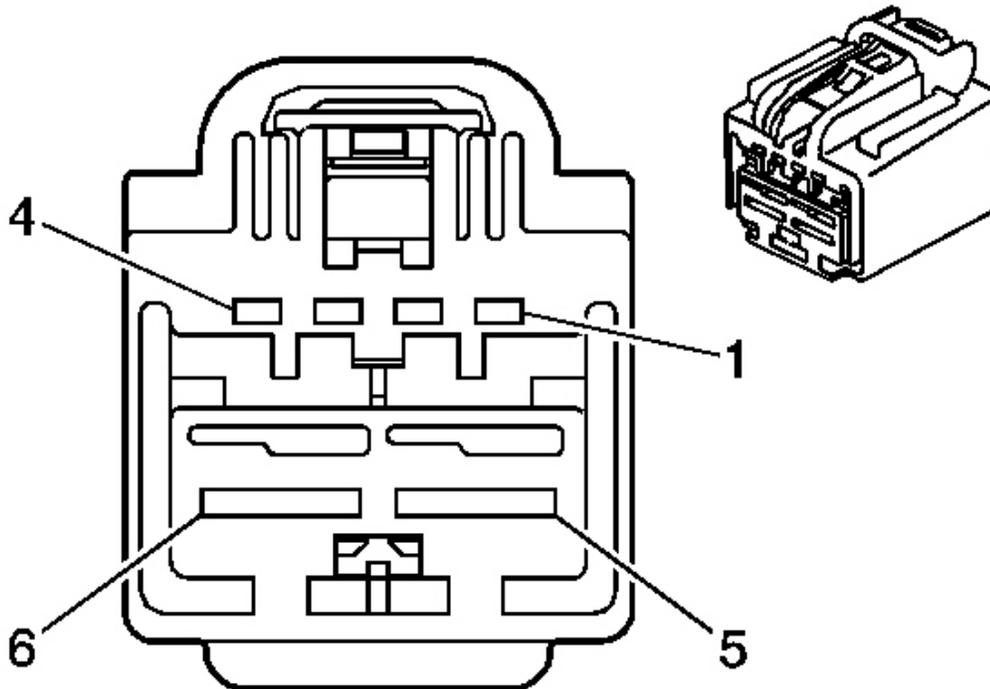


Fig. 25: Blower Motor Control Module X2 Connector End View
Courtesy of GENERAL MOTORS CORP.

Blower Motor Control Module X2 Connector Parts Information

Connector Part Information

- OEM: 15226104
- Service: 88988512
- Description: 6-Way F (BK)

Terminal Part Information

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

Blower Motor Control Module - Auxiliary X2 Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1-2	-	-	Not Used
3	0.35 D-GN	2211	Auxiliary Blower Motor Speed Control
4	-	-	Not Used
5	3.0 BK	850	Ground
6	3.0 RD/WH	2640	Battery Positive Voltage

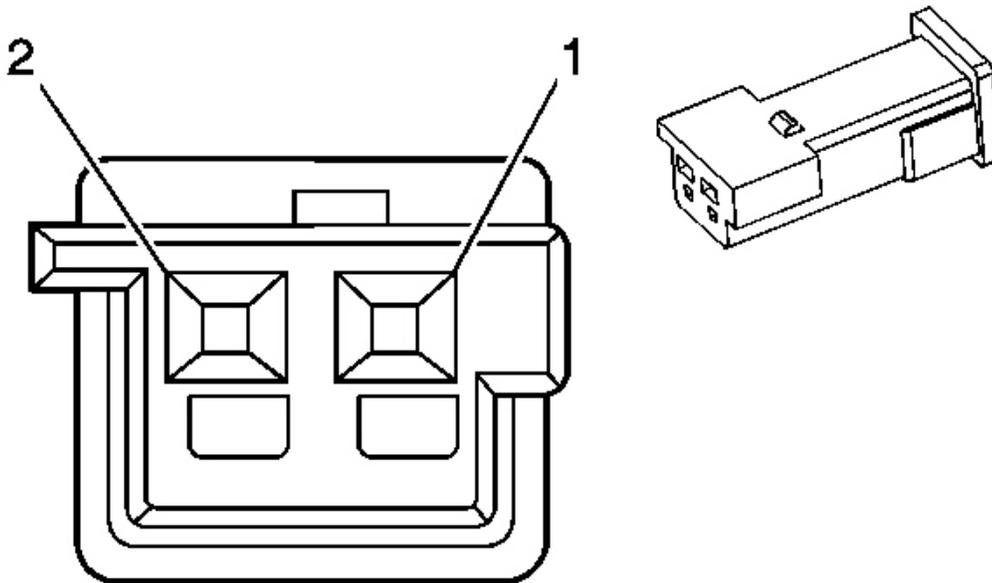
Evaporator Temperature Sensor

Fig. 26: Evaporator Temperature Sensor Connector End View
Courtesy of GENERAL MOTORS CORP.

Evaporator Temperature Sensor Connector Parts Information**Connector Part Information**

- OEM: 1-968704-1
- Service: See Catalog

- Description: 2-Way F (BK)

Terminal Part Information

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

Evaporator Temperature Sensor Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 WH	2622	Evaporator Temperature Sensor Signal
2	0.35 TN	552	Low Reference

HVAC Control Assembly - Auxiliary (-UK6)

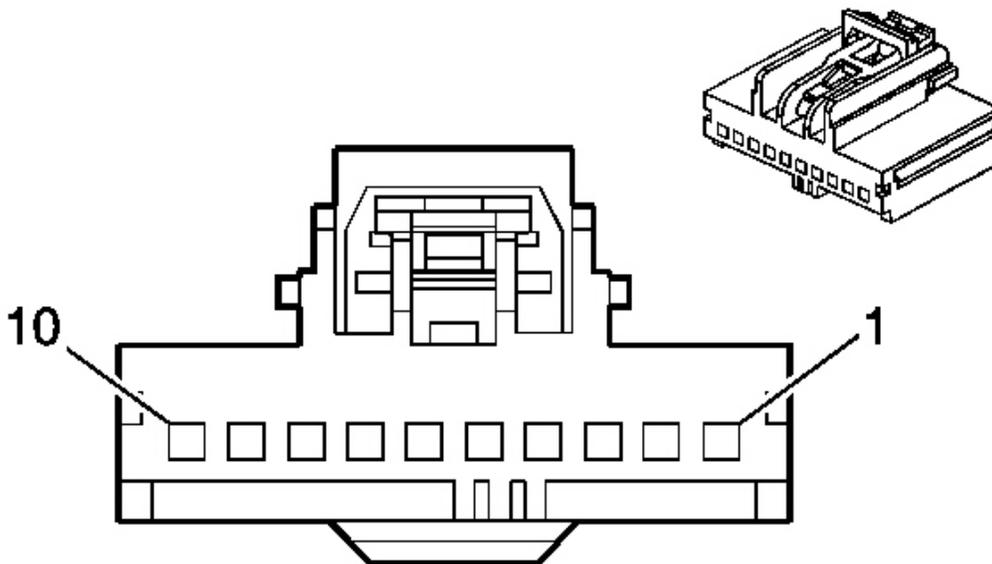


Fig. 27: HVAC Control Assembly - Auxiliary (-UK6) Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Assembly - Auxiliary (-UK6) Connector Parts Information

Connector Part Information

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- OEM: 89047355
- Service: See Catalog
- Description: 10-Way F 0.64 Unsealed (BK)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Assembly - Auxiliary (-UK6) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 GY	8	Instrument Panel Lamp Supply Voltage
2	0.5 BK	750	Ground
3	0.5 GY	596	5-Volt Reference
4	0.5 GY/BK	1798	Low Reference
5-6	-	-	Not Used
7	0.5 PU/WH	760	Auxiliary Blower Motor Speed Control
8	0.5 YE	2214	Auxiliary Air Temperature Door Control
9	-	-	Not Used
10	0.5 OG	2615	Auxiliary Mode Door Control

HVAC Control Module X1 (WDA)

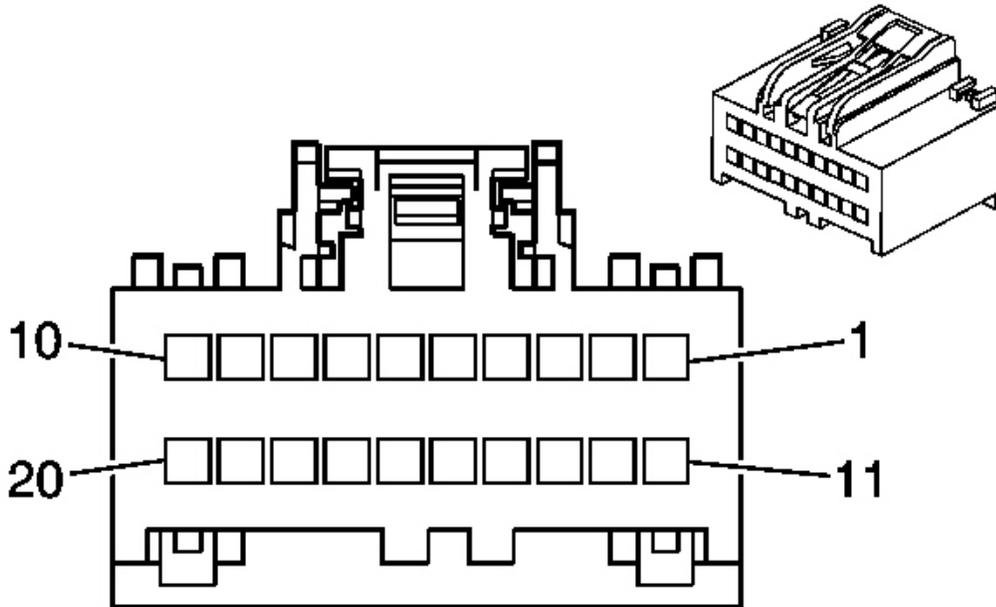


Fig. 28: HVAC Control Module X1 (WDA) Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X1 (WDA) Connector Parts Information

Connector Part Information

- OEM: 15126709
- Service: See Catalog
- Description: 20-Way F USCAR 0.64 Series (BN)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Module X1 (WDA) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1-7	-	-	Not Used

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8	0.5 PK	2145	Air Temperature Switch Signal - Right
9	0.5 OG	2615	Auxiliary Mode Door Control (-UK6)
10	0.5 YE	2214	Auxiliary Air Temperature Door Control (-UK6)
11-17	-	-	Not Used
18	0.5 GY	2599	Auxiliary Mode Door Control
19	0.5 PU/WH	760	Auxiliary Blower Motor Speed Control (-UK6)
20	-	-	Not Used

HVAC Control Module X1 (Z88)

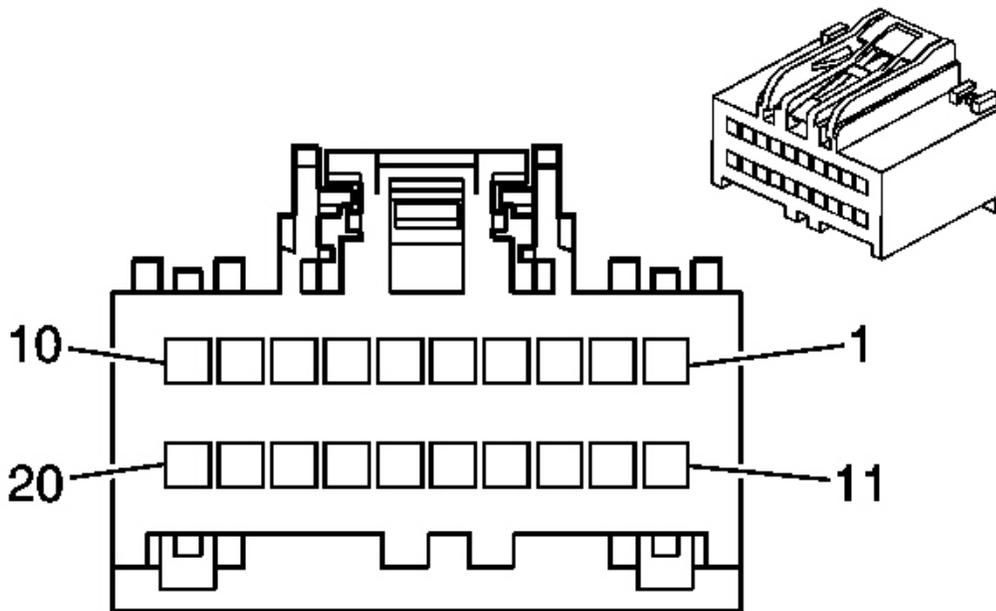


Fig. 29: HVAC Control Module X1 (Z88) Connector End View
Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X1 (Z88) Connector Parts Information

Connector Part Information

- OEM: 15126709

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- Service: See Catalog
- Description: 20-Way F USCAR 0.64 Series (BN)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Module X1 (Z88) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1-7	-	-	Not Used
8	0.5 PK	2145	Air Temperature Switch Signal - Right
9	0.5 OG	2615	Auxiliary Mode Door Control (-UK6)
10	0.5 YE	2214	Auxiliary Air Temperature Door Control (-UK6)
11-17	-	-	Not Used
18	0.5 GY	2599	Auxiliary Mode Door Control
19	0.5 PU/WH	760	Auxiliary Blower Motor Speed Control (-UK6)
20	-	-	Not Used

HVAC Control Module X2 (WDA)

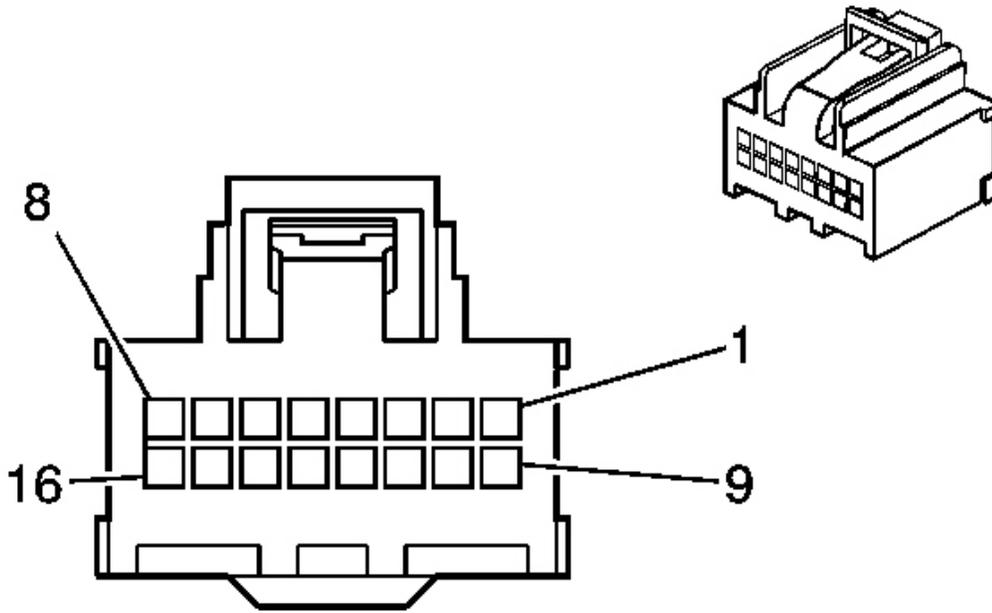


Fig. 30: HVAC Control Module X2 (WDA) Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X2 (WDA) Connector Parts Information

Connector Part Information

- OEM: 7283-9080-90
- Service: See Catalog
- Description: 16-Way F USCAR 0.64 Series (BU)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Module X2 (WDA) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 PU/WH	1382	LED Dimming Signal

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2	0.35 OG	300	Power Mode
3	0.35 BK/WH	1551	Ground
4	0.5 RD/WH	4540	Battery Positive Voltage
5	0.35 D-GN	5060	Low Speed GMLAN Serial Data
6-7	-	-	Not Used
8	0.35 WH	193	Rear Defog Relay Control
9	0.35 L-GN/BK	735	Ambient Air Temperature Sensor Signal
10	0.35 BK	1450	Ground
11	-	-	Not Used
12	0.35 YE	61	Low Reference
13-16	-	-	Not Used

HVAC Control Module X2 (Z88)

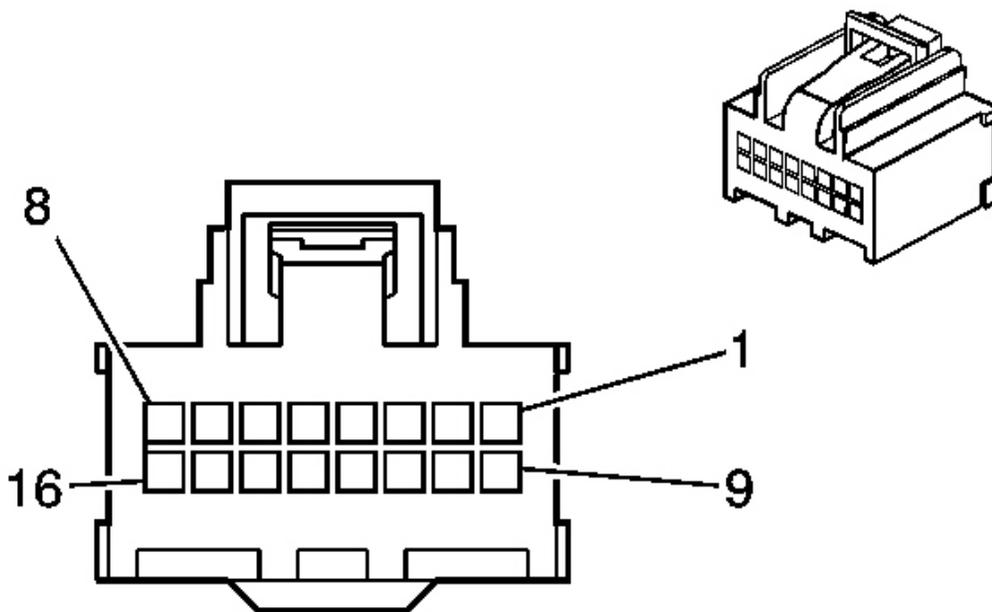


Fig. 31: HVAC Control Module X2 (Z88) Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X2 (Z88) Connector Parts Information**Connector Part Information**

- OEM: 7283-9080-90
- Service: See Catalog
- Description: 16-Way F USCAR 0.64 Series (BU)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Module X2 (Z88) Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 PU/WH	1382	LED Dimming Signal
2	0.35 OG	300	Power Mode
3	0.35 BK/WH	1551	Ground
4	0.5 RD/WH	4540	Battery Positive Voltage
5	0.35 D-GN	5060	Low Speed GMLAN Serial Data
6-7	-	-	Not Used
8	0.35 WH	193	Rear Defog Relay Control
9	0.35 L-GN/BK	735	Ambient Air Temperature Sensor Signal
10	0.35 BK	1450	Ground
11	-	-	Not Used
12	0.35 YE	61	Low Reference
13-16	-	-	Not Used

HVAC Control Module X3

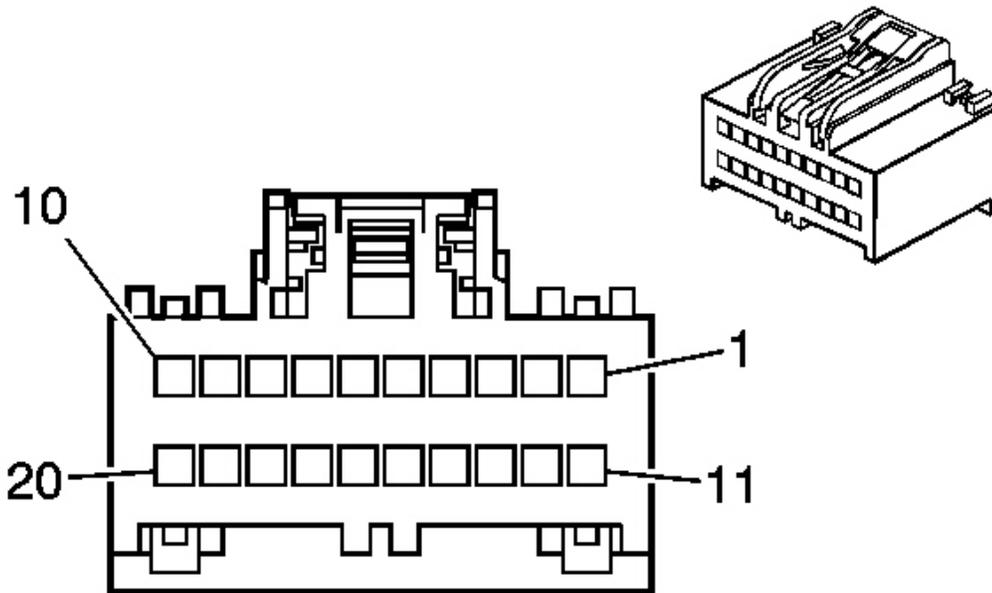


Fig. 32: HVAC Control Module X3 Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X3 Connector Parts Information

Connector Part Information

- OEM: 15126710
- Service: 15126710
- Description: 20-Way F (GY)

Terminal Part Information

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

HVAC Control Module X3 Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	-	-	Not Used

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2	0.35 L-GN	2275	Mode Door Position Signal
3	0.35 PU	1838	Recirculation Door Position Signal
4	0.35 GY/BK	754	Blower Motor Speed Control
5	0.35 TN	2273	Mode Door Control
6	-	-	Not Used
7	0.35 D-GN	1614	Recirculation Door Control
8	0.35 WH/BK	1236	Auxiliary Air Temperature Door Control
9	-	-	Not Used
10	0.35 GY	598	5-Volt Reference
11-12	-	-	Not Used
13	0.35 D-BU	1646	Auxiliary Air Temperature Door Position Signal
14	0.35 WH	2622	Evaporator Temperature Sensor Signal
15	0.35 WH	119	Mode Door Control
16	-	-	Not Used
17	0.35 TN/BK	2274	Recirculation Door Control Circuit
18	0.35 GY/BK	2778	Right Air Temperature Door Control A
19	0.35 TN	552	Low Reference
20	-	-	Not Used

HVAC Control Module X4

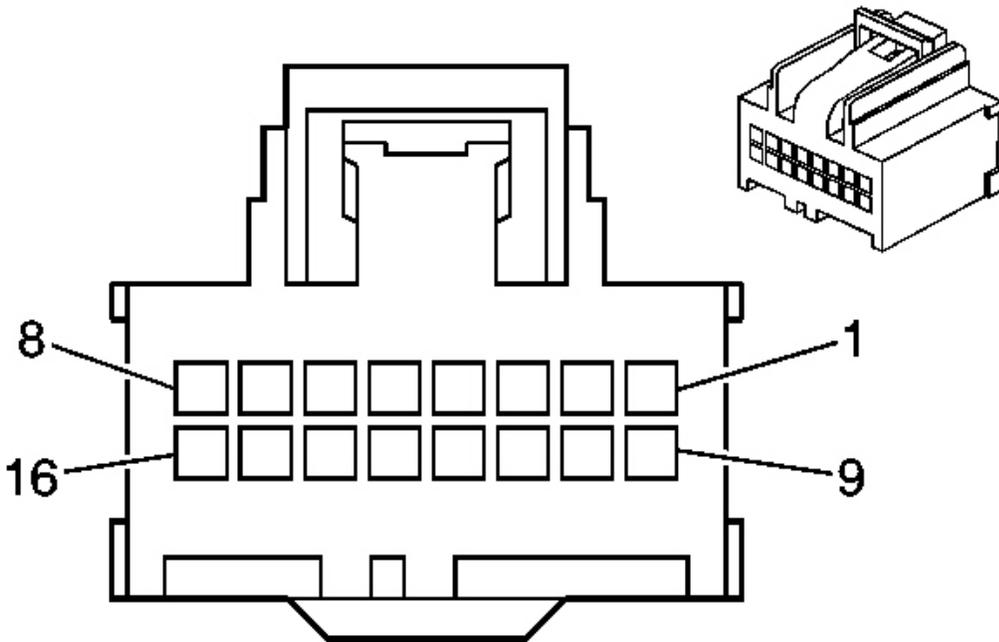


Fig. 33: HVAC Control Module X4 Connector End View
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module X4 Connector Parts Information

Connector Part Information

- OEM: 7283-9079-60
- Service: See Catalog
- Description: 16-Way F 064 Series Unsealed (GN)

Terminal Part Information

- Terminal/Tray: 7116-4618-02/14
- Core/Insulation Crimp: P/P
- Release Tool/Test Probe: J-38125-215/J-35616-64B (L-BU)

HVAC Control Module X4 Connector Terminal Identification

Pin	Wire	Circuit No.	Function

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1	-	-	Not Used
2	GY	596	5-Volt Reference
3	L-GN/WH	5729	Auxiliary Mode Motor Supply Voltage
4	BN	6555	Auxiliary Temperature Motor Supply Voltage
5	GY/BK	1798	Low Reference
6	GY/BK	1798	Low Reference
7-9	-	-	Not Used
10	D-GN	2211	Auxiliary Blower Motor Speed Control
11	OG	2215	Auxiliary Mode Door Control
12	GY	2614	Auxiliary Air Temperature Door Control
13-16	-	-	Not Used

Mode Actuator

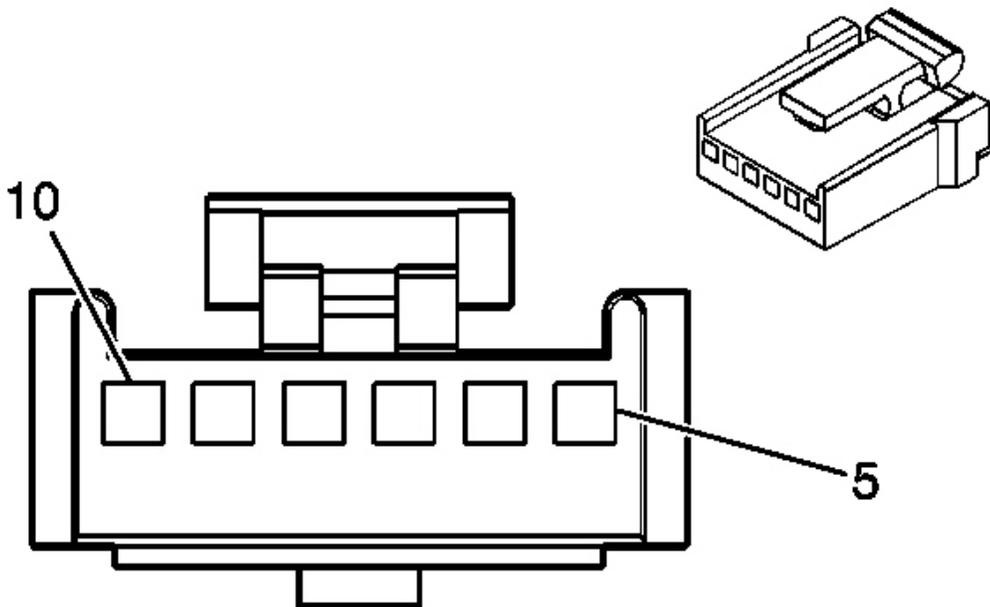


Fig. 34: Mode Actuator Connector End View

Courtesy of GENERAL MOTORS CORP.

Mode Actuator Connector Parts Information

Connector Part Information

- OEM: 1355082-1
- Service: See Catalog
- Description: 6-Way F (BK)

Terminal Part Information

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

Mode Actuator Connector Terminal Identification

Pin	Wire	Circuit No.	Function
1	0.35 YE	1791	Low Reference
2	0.35 PU	2275	Mode Door Position Signal
3	0.35 GY	598	5-Volt Reference
4	-	-	Not Used
5	0.35 TN/BK	119	Mode Door Control
6	0.35 TN	2273	Mode Door Control

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B0228</u>	Recirculation Actuator Circuit Malfunction(s)
<u>DTC B0233</u>	Air Flow Control Circuit
<u>DTC B0408</u>	Temperature Control 1 Feedback Circuit Short to Ground, Battery Or Open
<u>DTC B3779</u>	Air Flow Control 9 Feedback Circuit Malfunction(s)
<u>DTC B3933</u>	Evaporator Air Temperature Sensor Short to Ground, Battery Or Open
<u>DTC P0532 or P0533</u>	Air Conditioning A/C Refrigerant Pressure Sensor Circuit Low

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	Or High Voltage
DTC P0645	A/C Clutch Relay Control Circuit

SCAN TOOL OUTPUT CONTROLS**HVAC Control Module Scan Tool Output Controls**

Scan Tool Output Control	Additional Menu Selections	Description
A/C Request	Output Control	When you select A/C request, this command allows you to turn the A/C Relay On and Off. When the A/C Relay is commanded On, the A/C compressor clutch should be engaged.
Air Inlet Door Position	Output Control	When you select Outside, the HVAC control module commands the recirculation actuator toward the outside air position. When you select Recirc, the HVAC control module commands the recirculation actuator toward the recirculation position. This is shown through a command of On and Off.
Blower Motor	Output Control	When you select ON, the HVAC control module commands the blower motor relay ON and a command to increase or decrease air. When you select OFF, the HVAC control module commands the blower motor relay OFF.
Auxiliary Blower Motor	Output Control	When you select ON, the HVAC control module commands the blower motor relay ON and an increase or decrease of air. When you select OFF, the HVAC control module commands the blower motor relay OFF.
Left Temp Door Position	Output Control	When you select Cold, the HVAC control module commands the front air temperature actuator to the full cold position. When you select Hot, the HVAC control module commands the actuator to the full hot position.
Auxiliary Air Temp Door	Output Control	When you select Cold, the HVAC control module commands the rear air temperature actuator to the full cold position. When you select Hot, the HVAC control module commands the rear air temperature actuator to the full hot position.
		When you select A/C, the HVAC control module

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Mode Door Position	Output Controls	commands the mode actuator to the panel position. When you select Defrost, the HVAC control module commands the actuator to the defrost position.
Auxiliary Mode Door Position	Output Controls	When you select A/C, the HVAC control module commands the mode actuator to the panel position. When you select Defrost, the HVAC control module commands the actuator to the defrost position.
Passenger Temp Door Position	Output Controls	When you select Cold, the HVAC control module commands the passenger air temperature actuator to the full cold position. When you select Hot, the HVAC control module commands the actuator to the full hot position.
Rear Defog Request	Output Controls	The BCM must receive a Rear Defog request from the HVAC control module in order to enable the output control. The BCM de-energizes the Rear Defog Relay located in the I/P BEC when you select OFF. The relay remains de-energized until you select ON.
Recalibrate All Motors	Output Control	When you select On, all air temp and mode actuators have the capability to perform a recalibration.

ECM Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
A/C Request	Output Controls	The engine must be running and the ECM must receive an A/C request from the HVAC control module in order to enable the output control. The ECM de-energizes the A/C compressor clutch relay when you select OFF. The relay remains de-energized until you select ON.

SCAN TOOL DATA LIST

HVAC Control Module Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
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Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)

A/C LED	System Data	Off/On	Varies
A/C Head Pressure	A/C Permission Data	Normal/Out of Range	Normal
A/C Permission	A/C Permission Data	Withheld/Granted	Varies
A/C Request	A/C Permission Data	No/Yes	Varies
A/C Switch	Inputs Data	Inactive/Active	Varies
Ambient Air Temperature	A/C Permission Data	Normal/Out of Range	Normal
Air Inlet Door Actual	Door Positions	Counts	Varies
Air Inlet Door Commanded	Door Positions	0-255 Counts	Varies
Auxiliary Blower Motor PWM	System Data	%	Varies
Auxiliary LED	System Data	Off/On	Varies
Auxiliary Mode Door Commanded	Door Positions	0-255 Counts	Varies
Auxiliary Mode Switch Position	Inputs	Panel/Bilevel/Floor	Varies
Auxiliary Switch	Inputs	Inactive/Active	Varies
Auxiliary Temp Door Motor Command	Door Positions	0-255 Counts	Varies
Battery Voltage	A/C Permission	Normal/Out of Range	Normal
Blower Speed	A/C Permission	Normal/Off	Varies
Blower Motor Speed Command	System Data	%	Varies
Engine Coolant Temp	A/C Permission	Normal/Out of Range	Normal
Engine Running	A/C Permission	Yes/No	Varies
Temperature Door Motor Commanded	Door Positions	0-255 count	Varies
Temperature Door Position	Door Positions	0-255 count	Varies
Mode Switch Position	Inputs	Auto/Panel/Bi-Level/Floor/Defrost-Floor	Varies
Mode Door Actual	Door Positions	Counts	Varies

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Mode Door Motor Commanded	Door Positions	0-255 Count	Varies
Outside Air Temp Filtered	Sensors	°C	Varies
Outside Air LED	System Data	Off/On	Varies
Outside Air Temp RAW	Sensors	°C	Varies
Outside Air Mode Switch	Inputs	Inactive/Active	Varies
Rear Defrost LED	System Data	Off/On	Off
Rear Defrost Switch	Inputs	Inactive/Active	Inactive
Rear Defrost State	System Data	Off/On	Off
Recirculation LED	System Data	Off/On	Varies
Recirculation Switch	Inputs	Inactive/Active	Inactive

Rear HVAC Control Module/RSA Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)			
Battery Voltage Signal	Data Display	Volts	Varies
Display Dimming Signal	Data Display	Volts	Varies
Left Rear Heated Seat Switch	Data Display	Active	Varies
Rear HVAC Fan Down Switch	Data Display	Inactive/Active	Varies
Rear HVAC Fan Up Switch	Data Display	Inactive/Active	Varies
Rear HVAC Mode Switch	Data Display	Inactive/Active	Varies
Rear Temperature Down Switch	Data Display	Inactive/Active	Varies
Rear Temperature Up Switch	Data Display	Inactive/Active	Varies
Right Rear Heated Seat Switch	Data Display	Inactive/Active	Varies
Source Button	Data Display	Inactive/Active	Varies

Engine Control Module (ECM) Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Operating Conditions: Engine idling, A/C ON, ambient air temperature between 22-27°C (70-80°F)			
		None, A/C Pressure, Engine Speed, Battery Volts, Stall	

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A/C Disengage 1 History	Data Display	Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 2 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 3 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 4 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 5 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch	None

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		Performance, Coolant Hot	
A/C Disengage 6 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 7 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C Disengage 8 History	Data Display	None, A/C Pressure, Engine Speed, Battery Volts, Stall Prevention, RPM Unstable, WOT, Launch Performance, Coolant Hot	None
A/C High Side Pressure Sensor	Data Display	kPa	Varies
A/C High Side Pressure Sensor	Data Display	Volts	Varies
A/C off for WOT	Data Display	No/Yes	No
A/C Pressure Disable	Data Display	No/Yes	No
A/C Request Signal	Data Display	No/Yes	Varies
A/C Relay Command	Data Display	off/on	Varies
ECT Sensor	Data Display	°C/°F	°F
Engine Run Time	Data Display	seconds	Varies
Ignition 1 Signal	Data Display	Volts	Varies

Inside Air Temp

Data Display

°C/°F

°F

SCAN TOOL DATA DEFINITIONS

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

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

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

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

BCM - Battery 1

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

BCM - Switch Inputs-A/C Request

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

ECM - A/C Disengage

The scan tool displays the None, A/C Pressure, Engine Speed, Batt Voltage, Anti Stall, RPM Unstable, WOT, Launch Perf., Coolant Hot disable of the a/c compressor.

ECM - A/C High Side Pressure Sensor

The scan tool displays 0-2930 kPa (0-425 psi). This parameter represents the high side pressure sensor voltage signal converted to pressure.

ECM - A/C High Side Pressure Switch

The scan tool displays the High Pressure/Normal status of the high side pressure switch.

ECM - A/C Off for WOT

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

ECM - A/C Off Due to Pressure

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

ECM - A/C Auto Recirc

The scan tool displays the status of the recirculation actuator.

ECM - A/C Relay Command

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

ECM - A/C Refrigerant Pressure

The scan tool displays 0-2930 kPa (0-425 psi). This parameter represents the A/C refrigerant pressure sensor voltage signal converted to pressure.

ECM - A/C Refrigerant Pressure

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

ECM - A/C Request

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

ECM - ECT

The scan tool displays a range of 40-151°C (40-304°F). The ECM applies 5 volts to the

ECT sensor circuit. The sensor is a thermistor which changes internal resistance as the engine temperature changes. When the sensor is cold, internal resistance is high, the ECM senses a high signal voltage and interprets the voltage as a cold engine. As the sensor warms, internal resistance decreases, the voltage signal decreases and the ECM interprets the lower voltage as a warm engine.

ECM - Ignition 1 Signal

The scan tool shows available voltage at the ECM.

DTC B0228

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 B0228 04

Recirculation Actuator Open Circuit

DTC B0228 05

Recirculation Actuator Stall Short to Battery

DTC B0228 06

Recirculation Actuator Stall Short to Ground

DTC B0228 08

Recirculation Actuator Stalled Signal Invalid

DTC B0228 61

Recirculation Actuator Out of Range

Diagnostic Fault Information

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DTC B0228

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Recirculation Door Control Circuit A	1	1	1	1
Recirculation Door Control Circuit B	1	1	1	1
5-Volt Reference	B0228 06	B0228 06	B0228 04 B0228 06	B0228 05
Recirculation Door Position Signal	-	1	1	1
Recirculation Actuator Low Reference		1	1	-
B+ Circuit of the HVAC Control Module	1	1	1	-
Ground Circuit of the HVAC Control Module	-	1	1	-
1. Recirculation Actuator Inoperative				

Circuit/System Description

The recirculation actuator is a 5-wire bi-directional electric motor that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal and 2 control circuits enable the actuators to operate. The control circuits use either a 0 or 12-volt value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 volts. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

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**

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the recirculation actuator.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.

7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
8. If all circuits test normal, replace the recirculation actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Recirculation Actuator Replacement**

DTC B0233

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 B0233

Air Flow Control Circuit

Diagnostic Fault Information

DTC B0233

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Mode Door Control Circuit A	1	1	1	1
Mode Door Control Circuit B	1	1	1	1
5-Volt Reference	B0233 00	B0233 00	B0233 00	B0233 00
Mode Door Position				

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Signal	-	1	1	1
Mode Door Actuator Low Reference	-	1	1	-
B+ Circuit of the HVAC Control Module	1	1	1	-
Ground Circuit of the HVAC Control Module	-	1	1	-
1. Mode Door Actuator Inoperative				

Circuit Description

The mode actuator is an electronic device that incorporates a stepper motor and feedback potentiometer. The HVAC control module controls the mode door position by sending a control signal to the actuator. The signal value is dependent upon the desired mode selected by the vehicle occupants. As the actuator moves, the potentiometer produces the actual door position signal that is sent to the HVAC control module. The HVAC control module continues to command the actuator to move until the desired and actual values are equal. The door directs airflow through the outlets as selected by the vehicles occupants.

The HVAC control module commands the actuator through it's full range. The HVAC control module stores the learned minimum and maximum position values. The travel range value is calculated by subtracting the minimum and maximum position values. Then the HVAC control module compares the travel range, minimum and maximum values to calibrated value ranges. If the travel range value is less than or equal to the maximum calibrated limit and greater than or equal to the minimum calibrated limit, then the calibration is considered successful. The HVAC control module continuously compares the actual actuator position to the calibrated minimum and maximum position values.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is between 9-16 volts.

Conditions for Setting the DTC

- Mode actuator position signal is less than 3 counts.
- Mode actuator position signal is more than 250 counts.
- The mode actuators total travel range is less than or greater than the calibrated limits.

Action Taken When the DTC Sets

- The DTC is stored in DTC information.
- The HVAC control module will continue to make use of whatever travel range is still available.

Conditions for Clearing the DTC

- If the HVAC control no longer detects a failure, then the DTC will become history.
- The history DTC will clear after 50 ignition cycles without a failure.
- The DTC can be cleared with a scan tool.

Circuit/System Testing

1. Ignition OFF, disconnect the Mode actuator harness connector at the Mode actuator.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.

8. If all circuits test normal, replace the Mode actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Mode Actuator Replacement**

DTC B0408

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 B0408 02

Temperature Control 1 Feedback Circuit Short to Ground

DTC B0408 05

Temperature Control 1 Feedback Circuit Short to Battery or Open

DTC B0408 61

Temperature Control 1 Feedback Circuit Actuator Stuck Open

DTC B0423 02

Temperature Control 2 Feedback Circuit Short to Ground

DTC B0423 05

Temperature Control 2 Feedback Circuit Short to Battery or Open

DTC B0423 61

Temperature Control 2 Circuit Actuator Stuck

Diagnostic Fault Information

DTC B0408

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Driver Air Temperature Door Control A Circuit	B0408 61	B0408 61	-	-
Driver Air Temperature Door Control B Circuit	B0408 61	B0408 61	-	-
Driver Air Temperature Door Position Signal	B0408 61 B0408 02	B0408 05	B0408 61 B0408 02 B0408 05	-
Driver Air Temperature 5-Volt Reference Circuit	B0408 61	B0408 02 B0408 04	B0408 02 B0408 04	-
Driver Air Temperature Low Reference Circuit	-	-	-	-

Circuit/System Description

The HVAC control module controls the HVAC door actuator to regulate the airflow through the HVAC system. The actuator consists of an electric motor and a potentiometer. The module supplies a low reference and 5-volt reference source voltage to the potentiometer. The HVAC control module monitors the voltage drop across the potentiometer on the door position signal circuit. When the actuator shaft rotates, the voltage on the door position signal circuit changes. The control circuit uses either a 0, 2.5 or 5-volt signal to command the actuator movement. When the actuator is at rest, the control circuit value is 2.5 volts. A 0 or 5-volt control signal commands the actuator movement in opposite directions.

DTC B0408 is for the drivers air temperature actuator.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is between 9-16 volts.
- The HVAC module is ON.

Conditions for Setting the DTC

The actual door position differs from the commanded door position by more than 4 counts or the

HVAC control module detects the door position signal circuit is less than 7 counts or greater than 250 counts.

Action Taken When the DTC Sets

The control circuit is deactivated for the appropriate actuator.

Conditions for Clearing the DTC

- The DTC becomes history when the HVAC control module no longer detects the condition that set the DTC.
- The history DTC will clear after 50 fault-free ignition cycles.
- The DTC can be cleared with a scan tool.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the actuator.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.

- If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
 4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
 5. Install a 3 A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
 7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
 8. If all circuits test normal, replace the actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Air Temperature Actuator Replacement - Right Side**

DTC B3779

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 B3779 05

Air Flow Control 9 Feedback Circuit Short to Battery or Open

DTC B3779 06

Air Flow Control 9 Feedback Circuit Short to Ground or Open

DTC B3779 08

Air Flow Control 9 Feedback Circuit Signal Invalid

Diagnostic Fault Information

DTC B3779

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Mode Door Control A Circuit	1	1	1	-
Mode Door Control B Circuit	1	1	1	-
Mode Door Position Signal	B3779 05	B3779 06 B3779 05	B3779 06	B3779 08
Mode Door 5-Volt Reference Circuit	B3779 05	B3779 06 B3779 05	B3779 06	B3779 08
Mode Door Low Reference Circuit	-	1	1	-
1. Mode Door Actuator Inoperative				

Circuit/System Description

The HVAC control module controls the HVAC door actuators to regulate the airflow through the HVAC system. Each actuator consists of an electric motor and a potentiometer. The module supplies a low reference and 5-volt reference source voltage to the potentiometer. The HVAC control module monitors the voltage drop across the potentiometer on the door position signal circuit. When the actuator shaft rotates, the voltage on the door position signal circuit changes. The HVAC control module supplies the actuator motor with a 12-volt control circuit and a

ground control circuit. The HVAC module controls the direction of the actuator door by changing the polarity of the control circuits.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is between 9-16 volts.
- The HVAC module is ON.

Conditions for Setting the DTC

The actual mode door position differs from the commanded door position.

Action Taken When the DTC Sets

Driver A and Driver B circuits are deactivated for the mode door actuator.

Conditions for Clearing the DTC

- The DTC becomes history when the HVAC control module no longer detects the condition that set the DTC.
- The history DTC will clear after 50 fault-free ignition cycles.
- The DTC can be cleared with a scan tool.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

Electrical Information Reference

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

Scan Tool Reference

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

Circuit/System Verification

Ignition ON, adjust the mode actuator to panel or vent position and then to the defrost position, wait for air flow to change to the selected air duct. The air flow should noticeably change duct air delivery position.

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the recirculation actuator.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 and ground.
 - If less than the specified range, test the 5-volt reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
8. If all circuits test normal, replace the Mode actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Mode Actuator Replacement**

DTC B3933**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 B3933 03**

Evaporator Air Temperature Voltage High or above threshold Sensor

DTC B3933 07

Evaporator Air Temperature Voltage Low or below threshold Sensor

Diagnostic Fault Information**DTC B3933**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Evaporator Sensor Signal	B3933 07	-	B3933 03	-
Evaporator Low Reference Signal	-	-	-	-

Circuit Description

The HVAC control module monitors the evaporator temperature via the evaporator temperature sensor. When the air is cold, the sensor resistance and signal voltage are high. When the air is warm, the sensor resistance and signal voltage are low.

Conditions for Running the DTC

The ignition is turned ON.

Conditions for Setting the DTC

The HVAC control module detects the evaporator temperature sensor signal circuit is less than 0.443 volt or greater than 4.55 volts.

Action Taken When the DTC Sets

The air conditioning (A/C) compressor will be disabled.

Conditions for Clearing the DTC

- The DTC will become history if the HVAC control module no longer detects a failure.
- The history DTC will clear after 50 fault-free ignition cycles.
- The DTC can be cleared with a scan tool.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

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 Testing

1. Ignition OFF, disconnect the Evaporator Temperature Sensor harness connector at the Evaporator Temp Sensor.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 2 and ground.
 - If greater than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, verify Evaporator Temp Sensor Voltage parameter is greater than 4.55 volts.
 - If less than the specified range, test the signal circuit terminal 1 for a short to ground. If the circuit tests normal, replace the HVAC control module.
4. Install a 3-amp fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2. Verify the scan tool Evaporator Air Temp Sensor voltage parameter is less than 0.433 volt.
 - If greater than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
5. If all circuits test normal, replace the Evaporator Temp Sensor.

Repair Procedures

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

- **Evaporator Temperature Sensor Replacement**
- **Control Module References** for HVAC control module replacement, setup and programming

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 Low Voltage

DTC P0533

Air Conditioning A/C Refrigerant Pressure Sensor Circuit High Voltage

Diagnostic Fault Information**DTC P0532 or P0533**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
5-Volt Reference Circuit	P0532	P0532	P0533
A/C Refrigerant Pressure Sensor Signal Circuit	P0532	P0533	P0532
Low Reference Circuit	-	P0532	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 A/C refrigerant pressure sensor signal to the ECM to vary. When the pressure is low, the signal voltage is low. When the pressure is high, the ECM commands the cooling fans on. When pressure is too high or too low, the ECM will not allow the A/C compressor clutch to engage.

Conditions for Running the DTC

- The Engine is running.
- The 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 425 psi (4.90 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 or DTCs can be cleared by using the scan tool.
- 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

Connector End View Reference

HVAC Connector End Views

Electrical Information Reference

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

Scan Tool Reference

- Scan Tool Output Controls
- Scan Tool Data List

Circuit/System Testing

1. Ignition OFF, disconnect the A/C Refrigerant Pressure harness connector at the A/C Refrigerant Pressure Sensor.
2. Test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.

- If greater than the specified range, 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 the specified range, 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 the specified range, 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 0.1 volt (1 psi).
 - If greater than the specified range, 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 Refrigerant High Side Pressure Sensor is greater than 4.90 volts (425 psi).
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the ECM.
- 6. If all circuits test normal, replace the A/C Refrigerant Pressure Sensor.

Repair Procedures

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

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

DTC P0645

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 P0645

Air Conditioning (A/C) Clutch Relay Control Circuit

Diagnostic Fault Information**DTC P0645**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
A/C Compressor Clutch Relay Control	P0645	P0645	P0645	-
A/C Relay Coil Side Supply Voltage Circuit	1	1	-	-
A/C Relay Coil Side Ground Circuit	-	1	-	-
Ignition 1 Circuit	1	1	-	-
B+ Circuit	1	1	-	-
1. A/C Compressor Inoperative				

Circuit Description

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

The ECM will monitor the control circuit for the following:

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

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

Conditions for Running the DTC

- The ignition voltage is between 11-18 volts.

- The engine speed is less than 600 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

Conditions for Setting the DTCs

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

Action Taken When the DTC Sets

The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A History DTC clears after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

Reference Information

Schematic Reference

HVAC Connector End Views

Connector End View 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 Testing

The A/C Compressor Clutch Relay is located in the Underhood BEC.

1. Ignition OFF, disconnect the A/C Compressor Clutch Relay.
2. Ignition ON, verify that a test lamp does not illuminate between the A/C Compressor Clutch Relay control circuit terminal 87 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, terminal 85 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 the ignition circuit fuse is open, test or replace the a/c compressor clutch relay.
4. Verify that a test lamp illuminates between the relay B+ circuit, terminal 30 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or a open/high resistance. If the circuit tests normal and B+ circuit fuse is open, test or replace the a/c compressor clutch relay.
5. Disconnect the harness connector at the A/C Compressor Clutch Coil.
6. Test for less than 1 ohm of resistance between the A/C Compressor Clutch Coil ground circuit terminal 86 and ground.
 - If greater than 1 ohm, test the ground circuit for an open/high resistance.
7. Connect the harness connector at the A/C Compressor Clutch Coil.
8. Connect a 3-amp fused jumper wire between the B+ circuit terminal 30 and control circuit terminal 87 of the A/C Compressor Clutch Relay. Verify the A/C Compressor Clutch Relay is activated.
 - If the A/C Compressor Clutch Relay does not activate, test the control circuit for an open/high resistance. If the circuit tests normal, test or replace the A/C Compressor Clutch Relay.
9. Connect a test lamp between the coil side of the A/C Compressor Clutch Relay ignition circuit terminal 85 and the control circuit terminal 86.
10. 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.

11. If all circuits test normal, test or replace the A/C Compressor Clutch Relay.

Repair Procedures

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

- **Control Module References** for ECM replacement, setup and programming
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**

SYMPTOMS - HVAC SYSTEMS - MANUAL

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

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

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the HVAC System. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Verify the A/C compressor clutch turns freely and is not seized.
- The A/C compressor will not operate in cold outside air temperatures. Refer to **Air Temperature Description and Operation**.
- The following could cause window fogging:
 - Wet carpet or mats
 - High humidity
 - Interior water leak
 - Blocked A/C evaporator drain tube
 - Maximum passenger capacity

- Blocked body pressure relief valves
- Inspect the air distribution system for causes of reduced air flow:
 - Obstructed or dirty passenger compartment air filter, if equipped
 - Blocked or damaged air inlet or outlet vents

Intermittent

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

Symptom List

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

- **Blower Motor Malfunction**
- **Auxiliary Blower Motor Malfunction**
- **Air Conditioning Compressor Malfunction**
- **Too Hot in Vehicle**
- **Too Cold in Vehicle**
- **Too Hot in Vehicle - Auxiliary**
- **Too Cold in Vehicle - Auxiliary**
- **Air Delivery Improper**
- **Air Delivery Improper - Auxiliary**
- **Air Recirculation Malfunction**
- **Noise Diagnosis - HVAC Module**
- **Noise Diagnosis - Air Conditioning (A/C) System**
- **Noise Diagnosis - Blower Motor**
- **Odor Diagnosis**

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 module grounds the A/C request signal circuit. This input will request the ECM to ground the A/C compressor clutch relay control circuit, which will switch the A/C CMPRSR 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 9-18 volts.
- Engine coolant temperature (ECT) is less than 123°C (253°F).
- Engine speed is less than 4760 RPM.
- Engine speed is more than 600 RPM.
- A/C high side pressure is between 2929-269 kPa (425-39 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****Connector End View Reference****HVAC Connector End Views****Electrical Information Reference**

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

Scan Tool Reference

- **Scan Tool Output Controls**

- **Scan Tool Data List**
- **Scan Tool Data Definitions**

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector X2, terminal 8 ground circuit terminal at the HVAC control module.
2. Test for less than 1.0 ohm of resistance between the ground circuit terminal 2 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Remove the A/C compressor clutch relay.
4. Verify that a test lamp illuminates between the relay coil B+ circuit terminal 85 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
5. Verify that a test lamp illuminates between the relay switch B+ circuit terminal 30 and ground.
 - If the test lamp does not illuminate, test the relay switch B+ circuit for an open/high resistance. If the A/C clutch 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.
6. Disconnect the harness connector at the A/C compressor clutch terminal 1.
7. Ignition OFF test for less than 1.0 ohm of resistance between the A/C compressor ground circuit terminal 2 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
8. Connect the harness connector at the A/C compressor clutch.
9. Connect a 10-amp fused jumper wire between the relay switch B+ circuit terminal 30 and the relay switch control circuit terminal 87. 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.
10. Connect a test lamp between the relay control circuit terminal 86 and the relay coil B+ circuit terminal 85.
11. 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 all the time, test for a short to ground on the control circuit connector X1 terminal 53. If the circuit tests normal, replace the ECM.
 - If the test lamp remains OFF all the time, test for a short to voltage or an open/high resistance on the control circuit. If the circuit tests normal, replace the ECM.
12. If all circuits test normal, test or replace the A/C compressor.

Repair Procedures

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

- **Compressor Clutch Assembly Replacement**
- **Compressor Replacement**
- **Control Module References** for HVAC control module 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.

Diagnostic Fault Information**Blower Motor Malfunction**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Blower Motor Speed Control Circuit at the Blower Motor Control Processor	1, 2	1	1, 2	-
Battery Positive Voltage Circuit at the Blower Motor Control Processor	-	1	-	-
Ground Circuit of the Blower Motor Control Processor	-	1	-	-
Blower Motor Low Reference Circuit (between motor and control processor)	-	1	-	-
1. Blower Motor Inoperative 2. Blower Motor Always On				

Circuit/System Description

Blower Motor Control Processor

The blower motor control processor is an interface between the HVAC control module and the blower motor. The blower motor speed control, battery positive and ground circuits enable the control processor to operate. The HVAC control module provides a pulse width modulation (PWM) signal to the blower motor speed control processor in order to command the blower motor speed. The processor supplies 12 volts to the blower motor through the blower motor voltage supply circuit. The control processor uses the blower motor ground or low reference as a low side control to adjust the blower motor speed.

Air Speed

The blower motor forces air to circulate within the vehicles interior. The vehicle operator determines the blower motors speed by placing the blower motor switch in a desired speed position. The blower motor will only operate if the blower motor switch is in any position other than OFF and the ignition switch is in the RUN position. Once a blower speed is selected, the blower speed remains constant until a new speed is selected.

As the requested blower speed increases, the following conditions occur:

- The HVAC control module increases the amount of time that the blower motor speed control circuit is modulated to ground.
- The voltage and duty cycle, measured between the blower motor speed control circuit and ground, decrease.

As the requested blower speed decreases, the following conditions occur:

- The HVAC control module decreases the amount of time that the blower motor speed control circuit is modulated to ground.
- The voltage and duty cycle, measured between the blower motor speed control circuit and ground, increase.

Diagnostic Aids

Be sure the blower motor housing is not shorted to a grounded surface causing the blower motor to always be on in high speed.

Reference Information**Schematic Reference****HVAC Schematics**

Connector End View Reference

HVAC Connector End Views

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 Testing

1. Ignition OFF, disconnect the harness connector at the blower motor control processor connector X2.
2. Test for less than 1.0 ohm of resistance between the ground circuit connector X2 terminal 5 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the B+ circuit of the blower motor speed control processor supply voltage terminal connector X2 terminal 6 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance. If the circuit tests normal and the B+ circuit fuse (HVAC 15-amp) fuse in the instrument panel (IP) BEC is open, test all components connected to the B+ circuit and replace as necessary.
4. Connect a test lamp between the blower motor speed control circuit connector X1 terminal 3 and the blower motor supply voltage circuit connector X2 terminal 6 of the blower motor control processor.
5. Turn the blower motor ON high speed and then OFF. The test lamp should dimly 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 HVAC control module.
 - If the test lamp is always OFF, test the speed control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Ignition OFF, connect the harness connector at the blower motor control processor.
 7. Disconnect the harness connector at the blower motor terminal A.
 8. Ignition ON, verify that a test lamp illuminates between the blower motor supply voltage circuit terminal 6 of the blower motor control processor and ground.
 - If the test lamp does not illuminate, test the blower motor supply voltage circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the blower motor control processor.
 9. Connect a test lamp between the blower motor supply voltage circuit terminal 6 and the blower motor ground circuit terminal 5 of the blower motor control processor.
 10. Turn the blower motor ON high speed then to low speed. The test lamp intensity should be bright when ON high speed and very dim or out when the blower is on low speed.
 - If the test lamp intensity is not correct, test the blower motor ground circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the blower motor control processor.
 11. If all circuits test normal, replace the blower motor.

Repair Procedures

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

- **Blower Motor Control Module Replacement**
- **Blower Motor Replacement**
- **Control Module References** for ECM and HVAC control module setup, replacement and programming

AUXILIARY 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 auxiliary blower motor is a variable speed fan. The HVAC control module controls the fan speed by sending a pulse width modulated signal to the auxiliary blower motor control module. The auxiliary blower motor control module varies the voltage drop across the auxiliary blower motor in relation to the pulse width modulated signal. The auxiliary blower motor speed can be adjusted from 10 percent to 90 percent duty cycle (PWM), 90 percent is considered high speed fan. During normal operation the control circuit voltage will be low and near battery voltage when OFF.

Reference Information**Schematic Reference****HVAC Schematics****Connector End View Reference****HVAC Connector End Views****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 Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Circuit/System Verification

Ignition ON, command the auxiliary blower motor ON and OFF with a scan tool. Observe that the auxiliary blower motor turns ON and OFF with each command.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector X2 at the Auxiliary Blower Motor 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 1.0 ohm, test the ground circuit for an open/high resistance.
3. Ignition ON, verify that a test lamp illuminates between the B+ circuit terminal 6 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance. If the REAR HVAC fuse is open, test battery positive voltage circuit for a short to ground.
4. Test for the following voltages between the control circuit terminal 3 and ground with the auxiliary blower motor speed set at the specified levels:
 - Off-Less than 1 volt
 - Level 1-0.5-8.5 volts
 - Level 2-8.5-9.5 volts
 - Level 3-0.5-10.5 volts
 - Level 4-0.5-11.5 volts
 - If greater than the specified range, test the control circuit for a short to voltage. If the circuit tests normal, replace the HVAC Control Module.
 - If less than the specified range, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC Control Module.
5. Reconnect the harness connect X2 at the Auxiliary Blower Motor Control Module. Disconnect the harness connector at the auxiliary blower motor.
6. Verify that a test lamp illuminates between the B+ circuit terminal A and ground.
 - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the Auxiliary Blower Motor Control Module.
7. Install a test lamp between the B+ circuit terminal A and the low reference circuit terminal B.
8. While monitoring the test lamp, cycle the auxiliary blower motor through the various speeds. The test lamp should not illuminate with the auxiliary blower motor in the OFF position and become progressively brighter as the auxiliary blower motor speed is increased.
 - If the test lamp is ON with the auxiliary blower motor in the OFF position, test the low reference circuit terminal B for a short to ground. If the circuit tests normal, replace the Auxiliary Blower Motor Control Module.

- If the test lamp is always OFF, test the low reference circuit terminal B for a short to voltage or an open/high resistance. If the circuit tests normal, replace the Auxiliary Blower Motor Control Module.
- If the test lamp does not become progressively brighter as the auxiliary blower motor speed is increased, replace the Auxiliary Blower Motor Control Module.

9. If all circuits test normal, test or replace the auxiliary blower motor.

Component Testing

Install a 30A fused Jumper wire between the auxiliary blower motor supply voltage terminal A and B+. Momentarily install a jumper wire between the auxiliary blower motor low reference terminal B and ground. The auxiliary blower motor should turn on.

- If the function does not perform as specified, replace the auxiliary blower motor.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Auxiliary Blower Control Module Replacement**
- **Auxiliary Blower Motor Replacement**

TOO HOT IN VEHICLE

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.

Diagnostic Fault Information

Too Hot in Vehicle

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Air Temperature Door Control A Circuit	1	1	1	1	-
Air Temperature Door					

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Control B Circuit	1	1	1	1	1
5-Volt Reference	1	1	1	1	-
Air Temperature Door Position Signal	-	1	1	1	-
Air Temperature Actuator Low Reference	-	1	1	-	-
1. Air Temperature Circuit Inoperative					

Circuit/System Description

The air temperature actuator is a 5-wire bi-directional electric motor that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal and 2 control circuits enable the actuators to operate. The control circuits use either a 0 or 12-volt value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 volts. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

Diagnostic Aids

Air Conditioning (A/C) System Performance Test

Inspect the air temperature door and the air temperature actuator for the following conditions:

- A misaligned air temperature actuator.
- Broken or binding linkages or air temperature door.
- An obstruction that prevents the air temperature door from operating within its full range of motion.
- Missing seals to the air temperature door.
- Misaligned seals to the air temperature door.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

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. Turn ON the ignition, with the engine OFF.
2. Place the blower motor switch at the maximum speed position.
3. Place the mode switch in the vent or panel position.
4. Place the Air Temperature switch in the full COLD position.
5. Place the Air Temperature switch in the full HOT position.

The air temperature should follow the commanded status of Full Hot or Cold temp through the Vent or Panel positions.

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the air temperature actuator.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.
 - If greater than 1.0 ohm, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.

3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 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 HVAC control module.
 - If greater than 5.2 volts, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
8. If all circuits test normal, replace the air temperature actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Air Temperature Actuator Replacement - Right Side**

TOO COLD IN VEHICLE

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.

Diagnostic Fault Information**Too Cold in Vehicle**

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Air Temperature Door Control A Circuit	1	1	1	1
Air Temperature Door Control B Circuit	1	1	1	1
5-Volt Reference	1	1	1	1
Air Temperature Door Position Signal	-	1	1	1
Air Temperature Actuator Low Reference	-	1	1	-
B+ circuit of the HVAC control module	1	1	1	-
Ground circuit of the HVAC control module	-	1	1	-
1. Air Temperature Actuator Inoperative				

Circuit/System Description

The air temperature actuator is a 5-wire bi-directional electric motor that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal and 2 control circuits enable the actuators to operate. The control circuits use either a 0 or 12-volt value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 volts. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

Diagnostic Aids**Air Conditioning (A/C) System Performance Test**

Observe the air delivery operation using the following operation:

1. Ignition ON, engine ON, blower motor switch in the MAX speed position
2. A/C switch in the ON position
3. Mode switch in the Panel or Bi-Level position

4. Press the recirculation switch, press the outside air switch
 - o Observe the recirculation door for proper movement to the recirc position. If the movement is not correct refer to **Air Recirculation Malfunction**

Observe the following operation for proper A/C compressor operation:

1. Blower motor switch in the Max speed position
2. Mode switch in the Vent or Heater position
3. Temperature switch in the warmest position

If the A/C compressor still operates, refer to **Air Conditioning Compressor Malfunction**

Observe the blower motor operation at various and desired speeds. If the speeds are not correct, refer to **Blower Motor Malfunction**

Inspect the air temperature door and the air temperature actuator for the following conditions:

- A misaligned air temperature actuator.
- Broken or binding linkages or air temperature door
- An obstruction that prevents the air temperature door from operating within its full range of motion
- Missing seals to the air temperature door
- Misaligned seals to the air temperature door
- Inspect the air temperature actuator, door and any attaching linkage for binding or a condition that prevents drive shaft rotation

Inspect the cooling system for the following conditions:

- A low coolant level
- A loose or worn accessory belt
- A leaking radiator hose or heater hose
- A kinked radiator or heater hose
- A missing radiator cap pressure seal
- A leaking radiator cap
- **Heating Performance Diagnostic (Front System Only)** or **Heating Performance Diagnostic (Auxiliary System)**

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

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. Turn ON the ignition, with the engine OFF.
2. Place the blower motor switch at the High speed position.
3. Place the mode switch in the vent or panel position.
4. Place the Air Temperature switch in the full COLD position.
5. Place the Air Temperature switch in the full HOT position.

The air temperature should change through the vent or panel.

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the recirculation actuator.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.

- If greater than 1.0 ohm, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the 5-volt reference circuit terminal 3 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 HVAC control module.
 - If greater than 5.2 volts, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
 4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
 5. Install a 3A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
 6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
 7. Command the actuator in both directions with a scan tool. The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
 8. If all circuits test normal, replace the air temperature actuator.

Repair Procedures

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

- **Control Module References** for HVAC control module replacement, setup and programming
- **Air Temperature Actuator Replacement - Right Side**

TOO HOT IN VEHICLE - AUXILIARY

Test Description

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

- 7: The specified values are from the A/C System Performance Test.
- 8: The functionality of the auxiliary air temperature drive shaft is questioned.
- 9: The functionality of the auxiliary air temperature door control circuit of the auxiliary HVAC control module is questioned.
- 10: This step questions the status of the air temperature door control signal communication between the front and auxiliary HVAC control module.
- 11: This step checks for proper auxiliary air temperature actuator drive shaft movement.
- 12: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step. This checks for proper operation of the air temperature actuator door control circuit and the HVAC control module.
- 15: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step. This checks for proper operation of the air temperature actuator door control circuit and the HVAC control module.
- 16: The auxiliary blower motor switch control circuit should not have continuity to ground when front auxiliary blower control switch is in any position except auxiliary control.
- 18: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step.

Too Hot in Vehicle - Auxiliary

Step	Action	Value(s)	Yes	No
<p>Schematic Reference: <u>HVAC Schematics</u> Connector End View Reference: <u>HVAC Connector End Views</u> DEFINITION: Auxiliary air temperature cannot be adjusted from the auxiliary controls or the auxiliary heating is insufficient. This table diagnoses vehicles equipped with the auxiliary HVAC control module.</p>				
1	Did you perform the Diagnostic System Check - Vehicle?	-	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	The auxiliary HVAC control module cannot request A/C compressor operation. An A/C request must be generated by the HVAC control module to provide cooled airflow through the auxiliary system. Does the HVAC control	-		Go to <u>Diagnostic Starting Point - Heating, Ventilation</u>

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	module operate and provide sufficient heating?		Go to Step 3	<u>and Air Conditioning</u>
3	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Observe the DTC List in Vehicle DTC Information. <p>Does the scan tool display any DTC B0423, B0433 or B3779?</p>	-	Go to <u>Diagnostic Trouble Code (DTC) List - Vehicle</u>	Go to Step 4
4	<ol style="list-style-type: none"> 1. Turn ON the ignition, with the engine OFF. 2. Place the mode switch in any position except OFF. 3. Place the auxiliary blower control work in each speed position. <p>Does the auxiliary blower motor operate at all?</p>	-	Go to Step 5	Go to <u>Auxiliary Blower Motor Malfunction</u>
5	Does the auxiliary blower motor operate in each speed position?	-	Go to Step 6	Go to <u>Auxiliary Blower Motor Malfunction</u>
6	<ol style="list-style-type: none"> 1. Start the engine. 2. Place the blower motor switch in the maximum speed position. 3. Place the mode switch in the Vent position. 4. Press the A/C request switch. 5. Place the temperature switch in the coldest position. 	-		Go to <u>Air Conditioning</u>

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	Does the A/C compressor operate?		Go to Step 7	<u>Compressor Malfunction</u>
7	Perform the A/C System performance test. Refer to <u>Air Conditioning (A/C) System Performance Test</u> . Did you find and correct the condition?	-	Go to Step 35	Go to Step 8
8	Does the Auxiliary Too Hot in Vehicle condition happen only with the auxiliary HVAC control module?	-	Go to Step 11	Go to Step 9
9	Does the Auxiliary Too Hot in Vehicle condition occur only when using the front HVAC control module?	-	Go to Step 15	Go to Step 10
10	Does the Auxiliary Too Hot in Vehicle condition happen with both the front and auxiliary HVAC control modules?	-	Go to Step 17	Go to <u>Too Hot in Vehicle</u>
11	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Set the front HVAC Auxiliary Blower motor control switch to any setting except AUX or OFF. 3. Turn ON the ignition, with the engine OFF. 4. Observe the AUX Temp Door Motor Position. 5. Place the front air temp switch from the coldest to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between cold and hot?</p>	0-255 Counts	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 12

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<p align="center">12</p>	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Set the front HVAC auxiliary blower motor switch control to any setting except Auxiliary or OFF. 3. Disconnect the auxiliary air temperature actuator. 4. Turn ON the ignition, with the engine OFF. 5. Observe the Auxiliary Temp Door Motor Command. 6. Place the front air temperature switch from the coldest position to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between COLD and HOT?</p>	<p align="center">0-255 Counts</p>	<p align="center">Go to Step 13</p>	<p align="center">Go to Step 22</p>
<p align="center">13</p>	<p>Connect a test light between the auxiliary air temperature actuator door A and B control circuits and the ground circuit of the auxiliary air temperature actuator.</p> <p>Does the test light illuminate?</p>	<p align="center">-</p>	<p align="center">Go to Step 21</p>	<p align="center">Go to Step 14</p>
<p align="center">14</p>	<p>Connect a test light between the auxiliary air temperature actuator door A and B control circuits and a good ground.</p> <p>Does the test light illuminate?</p>	<p align="center">-</p>	<p align="center">Go to Step 23</p>	<p align="center">Go to Step 24</p>
	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Set the front HVAC auxiliary control blower motor switch to any 			

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<p align="center">15</p>	<p>setting except Auxiliary or OFF.</p> <ol style="list-style-type: none"> 3. Disconnect the auxiliary HVAC control. 4. Turn ON the ignition, with the engine OFF. 5. Observe the Auxiliary Temp Door Motor Command. 6. Place the front air temperature switch from the coldest position to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between COLD and HOT?</p>	<p align="center">0-255 Counts</p>	<p align="center">Go to Step 16</p>	<p align="center">Go to Step 26</p>
<p align="center">16</p>	<ol style="list-style-type: none"> 1. Place the front auxiliary blower motor switch to any position except Auxiliary or OFF. 2. Connect a test lamp between the ignition 3 voltage circuit of the auxiliary blower motor between the underhood fuse block and auxiliary blower motor control circuit of the front HVAC control module. <p>Does the test lamp illuminate?</p>	<p align="center">-</p>	<p align="center">Go to Step 25</p>	<p align="center">Go to Step 18</p>
<p align="center">17</p>	<p>Connect a test lamp between the ignition 1 voltage circuit of the front HVAC control module and a good ground.</p> <p>Does the test lamp illuminate?</p>	<p align="center">-</p>	<p align="center">Go to Step 30</p>	<p align="center">Go to Step 26</p>

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18	<ol style="list-style-type: none"> 1. Install a scan tool. 2. With a scan tool observe the Auxiliary Temp Door Motor Command. 3. Disconnect the auxiliary HVAC control module. 4. Place the front auxiliary blower motor switch to the Auxiliary control position. 5. Place the auxiliary air temperature switch from the coldest position to the warmest position. <p>Does the value measure within the specified range with a smooth transition between COLD and HOT?</p>	0-255 Counts	Go to Step 19	Go to Step 26
19	<ol style="list-style-type: none"> 1. Place the front auxiliary blower motor switch to the auxiliary control position. 2. Connect a test lamp between the ignition 3 voltage circuit of the HVAC control module and the auxiliary blower motor control circuit of the front HVAC control module. <p>Does the test lamp illuminate?</p>	-	Go to Step 26	Go to Step 20
20	<p>Connect test lamp between the ignition 3 voltage circuit of the auxiliary blower motor and a good ground.</p> <p>Does the test lamp illuminate?</p>	-	Go to Step 25	Go to Step 28

<p>21</p>	<p>Inspect the auxiliary air temperature door and the auxiliary air temperature actuator for the following conditions:</p> <ul style="list-style-type: none"> • An incorrectly installed auxiliary air temperature actuator-Refer to <u>Auxiliary Air Temperature Actuator Replacement</u> . • Broken or binding linkages or air temperature door • An obstruction that prevents the air temperature door from operating within its full range of motion • Missing seals to the air temperature door • Misaligned seals to the air temperature door <p>Did you find and correct the condition?</p>	<p>-</p>	<p>Go to Step 35</p>	<p>Go to Step 29</p>
<p>22</p>	<p>Test the auxiliary air temperature door control A and B circuits of the auxiliary air temperature actuator from the HVAC control module to the auxiliary air temperature actuator for the following conditions:</p> <ul style="list-style-type: none"> • An open • High resistance 	<p>-</p>		

	<ul style="list-style-type: none"> • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>			Go to Step 35	Go to Step 25
23	<p>Test the ground circuit of the auxiliary air temperature actuator for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-		Go to Step 35	Go to Step 29
24	<p>Test the auxiliary air temperature door 5 volt reference circuit of the auxiliary air temperature actuator from the HVAC control module to the auxiliary HVAC control module for the following conditions:</p> <ul style="list-style-type: none"> • An open • High resistance • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-		Go to Step 35	Go to Step 30
25	<p>Test the rear auxiliary blower motor speed control circuit for short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring</u></p>	-			

	<p><u>Repairs</u> . Did you find and correct the condition?</p>		Go to Step 35	Go to Step 28
26	<p>Test the auxiliary air temperature actuator 5 volt reference circuit for the following:</p> <ul style="list-style-type: none"> • An open • High resistance • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 28
27	<p>Test the rear auxiliary blower motor speed control circuit for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 30
28	<p>Test the ignition 3 voltage circuit of the auxiliary blower motor for an open or a high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 30
29	<p>Inspect for poor connections at the harness connector of the auxiliary air temperature actuator. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and</p>	-		

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	<p><u>Connector Repairs</u> . Did you find and correct the condition?</p>		Go to Step 35	Go to Step 32
30	<p>Inspect for poor connections at the harness connector of the HVAC control module. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 33
31	<p>Inspect for poor connections at the harness connector of the auxiliary HVAC control module. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 34
32	<p>Replace the auxiliary air temperature actuator. Refer to <u>Auxiliary Air Temperature Actuator Replacement</u> . Did you complete the replacement?</p>	-	Go to Step 35	-
33	<p>Replace the HVAC control module. Refer to <u>Control Module References</u> for HVAC replacement, setup and programming. Did you complete the replacement?</p>	-	Go to Step 35	-
34	<p>Replace the auxiliary HVAC control. Refer to <u>Control Module References</u> for HVAC replacement, setup and programming.</p>	-		-

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	Did you complete the replacement?		Go to Step 35	
35	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

TOO COLD IN VEHICLE - AUXILIARY

Test Description

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

7: The specified values are from the A/C System Performance Test.

8: The functionality of the auxiliary air temperature drive shaft is questioned.

9: The functionality of the auxiliary air temperature door control circuit of the auxiliary HVAC control module is questioned.

10: This step questions the status of the air temperature door control signal communication between the front and auxiliary HVAC control module.

11: This step checks for proper auxiliary air temperature actuator drive shaft movement.

12: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step. This checks for proper operation of the air temperature actuator door control circuit and the HVAC control module.

15: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step. This checks for proper operation of the air temperature actuator door control circuit and the HVAC control module.

16: The auxiliary blower motor switch control circuit should not have continuity to ground when front auxiliary blower control switch is in any position except auxiliary control.

18: The value will vary between 0-255 counts during normal operation. The HVAC control module connector must be connected during this step.

Too Cold in Vehicle - Auxiliary

Step	Action	Value(s)	Yes	No
Schematic Reference: <u>HVAC Schematics</u>				
Connector End View Reference: <u>HVAC Connector End Views</u>				
DEFINITION: Auxiliary air temperature cannot be adjusted from the auxiliary controls or the auxiliary heating is insufficient.				
This table diagnoses vehicles equipped with the auxiliary HVAC control module.				
	Did you perform the			Go to

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1	Diagnostic System Check - Vehicle?	-	Go to Step 2	<u>Diagnostic System Check - Vehicle</u>
2	The auxiliary HVAC control module cannot request A/C compressor operation. An A/C request must be generated by the front HVAC control module to provide cooled airflow through the auxiliary system. Does the HVAC control module operate and provide sufficient heating?	-	Go to Step 3	Go to <u>Diagnostic Starting Point - Heating, Ventilation and Air Conditioning</u>
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Observe the DTC List in Vehicle DTC Information. Does the scan tool display any DTC B0233, B0423, B3779?	-	Go to <u>Diagnostic Trouble Code (DTC) List - Vehicle</u>	Go to Step 4
4	1. Turn ON the ignition, with the engine OFF. 2. Place the mode switch in any position except OFF. 3. Place the auxiliary blower control in each speed position. Does the auxiliary blower motor operate at all?	-	Go to Step 5	Go to <u>Auxiliary Blower Motor Malfunction</u>
5	Does the auxiliary blower motor operate in each speed position?	-	Go to Step 6	Go to <u>Auxiliary Blower Motor Malfunction</u>
	1. Start the engine.			

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6	<p>2. Place the blower motor switch in the maximum speed position.</p> <p>3. Place the mode switch in the Vent position.</p> <p>4. Press the A/C request switch.</p> <p>5. Place the temperature switch in the coldest position.</p> <p>Does the A/C compressor operate?</p>	-	Go to Step 7	Go to <u>Air Conditioning Compressor Malfunction</u>
7	<p>Perform the A/C System performance test. Refer to <u>Air Conditioning (A/C) System Performance Test</u> .</p> <p>Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 8
8	<p>Does the Auxiliary Too Cold in Vehicle condition happen only with the auxiliary HVAC control module?</p>	-	Go to Step 11	Go to Step 9
9	<p>Does the Auxiliary Too Cold in Vehicle condition occur only when using the front HVAC control module?</p>	-	Go to Step 15	Go to Step 10
10	<p>Does the Auxiliary Too Cold in Vehicle condition happen with both the front and auxiliary HVAC control modules?</p>	-	Go to Step 17	Go to <u>Too Hot in Vehicle</u>
	<p>1. Install a scan tool.</p> <p>2. Set the front HVAC auxiliary control blower motor switch to any setting except Auxiliary or OFF.</p>			

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<p align="center">11</p>	<ol style="list-style-type: none"> 3. Turn ON the ignition, with the engine OFF. 4. Observe the Auxiliary Temp Door Motor Position. 5. Place the front air temperature switch from the coldest position to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between COLD and HOT?</p>	<p align="center">0-255 Counts</p>	<p align="center">Go to <u>Testing for Intermittent Conditions and Poor Connections</u></p>	<p align="center">Go to Step 12</p>
<p align="center">12</p>	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Set the front HVAC auxiliary blower motor switch control to any setting except Auxiliary or OFF. 3. Disconnect the auxiliary air temperature actuator. 4. Turn ON the ignition, with the engine OFF. 5. Observe the Auxiliary Temp Door Motor Command. 6. Place the front air temperature switch from the coldest position to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between COLD and HOT?</p>	<p align="center">0-255 Counts</p>	<p align="center">Go to Step 13</p>	<p align="center">Go to Step 22</p>
	<p>Connect a test light between the auxiliary air temperature</p>			

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13	<p>actuator door A and B control circuits and the ground circuit of the auxiliary air temperature actuator.</p> <p>Does the test light illuminate?</p>	-	Go to Step 21	Go to Step 14
14	<p>Connect a test light between the auxiliary air temperature actuator door A and B control circuits and a good ground.</p> <p>Does the test light illuminate?</p>	-	Go to Step 23	Go to Step 24
15	<ol style="list-style-type: none"> 1. Install a scan tool. 2. Set the front HVAC auxiliary control blower motor switch to any setting except Auxiliary or OFF. 3. Disconnect the auxiliary HVAC control module. 4. Turn ON the ignition, with the engine OFF. 5. Observe the Auxiliary Temp Door Motor Command. 6. Place the front air temperature switch from the coldest position to the warmest position. <p>Does the value measured stay within the specified range with a smooth transition between COLD and HOT?</p>	0-255 Counts	Go to Step 16	Go to Step 26
	<ol style="list-style-type: none"> 1. Place the front auxiliary blower motor switch to any position except Auxiliary or OFF. 2. Connect a test lamp between the ignition 3 			

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<p align="center">16</p>	<p>voltage circuit of the auxiliary blower motor between the underhood fuse block and auxiliary blower motor control circuit of the front HVAC control module.</p>	<p align="center">-</p>		
	<p>Does the test lamp illuminate?</p>		<p>Go to Step 25</p>	<p>Go to Step 18</p>
<p align="center">17</p>	<p>Connect a test lamp between the ignition 1 voltage circuit of the front HVAC control module and a good ground.</p>	<p align="center">-</p>		
	<p>Does the test lamp illuminate?</p>		<p>Go to Step 30</p>	<p>Go to Step 26</p>
<p align="center">18</p>	<ol style="list-style-type: none"> 1. Install a scan tool. 2. With a scan tool observe the Auxiliary Temp Door Motor Command. 3. Disconnect the auxiliary HVAC control module. 4. Place the front auxiliary blower motor switch to the Auxiliary control position. 5. Place the auxiliary air temperature switch from the coldest position to the warmest position. <p>Does the value measure within the specified range with a smooth transition between COLD and HOT?</p>	<p align="center">0-255 Counts</p>		
			<p>Go to Step 19</p>	<p>Go to Step 26</p>
	<ol style="list-style-type: none"> 1. Place the front auxiliary blower motor switch to the auxiliary control position. 2. Connect a test lamp 			

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19	<p>between the ignition 3 voltage circuit of the HVAC control module and the auxiliary blower motor control circuit of the front HVAC control module.</p> <p>Does the test lamp illuminate?</p>	-	Go to Step 26	Go to Step 20
20	<p>Connect test lamp between the ignition 3 voltage circuit of the auxiliary blower motor and a good ground.</p> <p>Does the test lamp illuminate?</p>	-	Go to Step 25	Go to Step 28
21	<p>Inspect the auxiliary air temperature door and the auxiliary air temperature actuator for the following conditions:</p> <ul style="list-style-type: none"> • An incorrectly installed auxiliary air temperature actuator-Refer to <u>Auxiliary Air Temperature Actuator Replacement</u> . • Broken or binding linkages or air temperature door • An obstruction that prevents the air temperature door from operating within its full range of motion • Missing seals to the air temperature door • Misaligned seals to the air temperature door 	-		

	Did you find and correct the condition?		Go to Step 35	Go to Step 29
22	<p>Test the auxiliary air temperature door control A and B circuits of the auxiliary air temperature actuator from the HVAC control module to the auxiliary air temperature actuator for the following conditions:</p> <ul style="list-style-type: none"> • An open • High resistance • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	-		
	Did you find and correct the condition?		Go to Step 35	Go to Step 25
23	<p>Test the ground circuit of the auxiliary air temperature actuator for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	-		
	Did you find and correct the condition?		Go to Step 35	Go to Step 29
	<p>Test the auxiliary air temperature door control circuit of the auxiliary air temperature actuator from the HVAC control module to the auxiliary HVAC control module for the following conditions:</p> <ul style="list-style-type: none"> • An open 			

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<p>24</p>	<ul style="list-style-type: none"> • High resistance • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	<p>-</p>	<p>Go to Step 35</p>	<p>Go to Step 30</p>
<p>25</p>	<p>Test the rear auxiliary blower motor speed control circuit for short to ground. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	<p>-</p>	<p>Go to Step 35</p>	<p>Go to Step 28</p>
<p>26</p>	<p>Test the auxiliary air temperature 5 volt reference circuit for the following conditions:</p> <ul style="list-style-type: none"> • An open • High resistance • A short to ground • A short to voltage <p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	<p>-</p>	<p>Go to Step 35</p>	<p>Go to Step 28</p>
<p>27</p>	<p>Test the rear auxiliary blower motor speed control circuit for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	<p>-</p>	<p>Go to Step 35</p>	<p>Go to Step 30</p>

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28	<p>Test the ignition 3 voltage circuit of the auxiliary blower motor for an open or a high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 30
29	<p>Inspect for poor connections at the harness connector of the auxiliary air temperature actuator. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 32
30	<p>Inspect for poor connections at the harness connector of the HVAC control module. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 33
31	<p>Inspect for poor connections at the harness connector of the auxiliary HVAC control module. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> . Did you find and correct the condition?</p>	-	Go to Step 35	Go to Step 34
32	<p>Replace the auxiliary air temperature actuator. Refer to <u>Auxiliary Air Temperature Actuator Replacement</u> . Did you complete the</p>	-		

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	replacement?		Go to Step 35	-
33	Replace the HVAC control module. Refer to Control Module References for HVAC replacement, setup and programming. Did you complete the replacement?	-	Go to Step 35	-
34	Replace the auxiliary HVAC control module. Refer to Control Module References for Auxiliary HVAC replacement, setup and programming. Did you complete the replacement?	-	Go to Step 35	-
35	Operate the system in order to verify the repair. Did you correct the condition?	-	System OK	Go to Step 2

AIR DELIVERY IMPROPER

Test Description

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

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

15: Two ignition circuits supply the HVAC control module. Test the ignition 1 voltage circuit.

Air Delivery Improper

Step	Action	Yes	No
Schematic Reference: <u>HVAC Schematics</u>			
Connector End View Reference: <u>HVAC Connector End Views</u>			
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

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2	<ol style="list-style-type: none"> 1. Turn ON the ignition, with the engine OFF. 2. Place the blower motor switch in the OFF position. <p>Is the blower motor OFF?</p>	Go to Step 3	Go to <u>Blower Motor Malfunction</u>
3	<p>Place the blower motor switch in each speed position.</p> <p>Does the blower motor operate in any speed position?</p>	Go to Step 4	Go to <u>Blower Motor Malfunction</u>
4	<p>Does the blower motor operate in each speed position?</p>	Go to Step 5	Go to <u>Blower Motor Malfunction</u>
5	<p>Are all of the HVAC control module controls except for the blower motor inoperative?</p>	Go to Step 15	Go to Step 6
6	<ol style="list-style-type: none"> 1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in the vent position. 3. Place the recirculation switch in the ON position. 4. Observe the recirculation door. 5. Place the recirculation door in the outside air position. <p>Does the recirculation door move from the recirculation to the outside air position?</p>	Go to Step 7	Go to <u>Air Recirculation Malfunction</u>
7	<ol style="list-style-type: none"> 1. Place the blower motor switch in the maximum speed position. 2. Place the mode switch in each mode position. <p>Does air flow sufficiently from the proper air distribution outlets for each selected mode position?</p>	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 8

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8	<p>Inspect the air delivery system for the following conditions:</p> <ul style="list-style-type: none"> • A dirty HVAC air filter, if applicable • An obstruction to the airflow • Air leaks • Misaligned air ducts <p>Did you find and correct the condition?</p>	Go to Step 21	Go to Step 9
9	<p>Inspect mode door and the mode actuator for the following conditions:</p> <ul style="list-style-type: none"> • A misaligned mode actuator Refer to <u>Mode Actuator Replacement</u> . • 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 <p>Did you find and correct the condition?</p>	Go to Step 21	Go to Step 10
10	<p>Test the position signal circuit of the mode actuator for an open or for a high resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 21	Go to Step 11
11	<p>Test the low reference circuit of the mode actuator for an open or for a high resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 21	Go to Step 12
	<p>Test the 5-volt reference circuit of the mode actuator for an open or for a high</p>		

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12	resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> . Did you find and correct the condition?	Go to Step 21	Go to Step 13
13	<ol style="list-style-type: none"> 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 <u>Circuit Testing</u> and to <u>Wiring Repairs</u> . Did you find and correct the condition?	Go to Step 21	Go to Step 18
15	Test the ignition 1 voltage circuit of the HVAC control module for an open or for a high resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> . Did you find and correct the condition?	Go to Step 21	Go to Step 16
16	Test the ground circuit of the HVAC control module for an open or for a high resistance. Refer to <u>Circuit Testing</u> and to <u>Wiring Repairs</u> . Did you find and correct the condition?	Go to Step 21	Go to Step 18
	Inspect for bad connections at the harness connector of the mode actuator.		

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

AIR DELIVERY IMPROPER - AUXILIARY

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- **Strategy Based Diagnosis**
- **Diagnostic Procedure Instructions**

Test Description

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

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

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

8: The measured voltage should be near the specified value for each mode position.

Air Delivery Improper - Auxiliary

Mode Position	Value
Vent	0.0-1.2 V
Bi-Level	2.1-4.0 V
Floor	5.0-7.0 V
Off	B+

Air Delivery Improper - Auxiliary

Step	Action	Yes	No
<p>Schematic Reference: <u>HVAC Schematics</u> Connector End View Reference: <u>HVAC Connector End Views</u> DEFINITION: Air does not flow correctly from the auxiliary air distribution outlets.</p>			
1	Did you perform the Diagnostic System Check - Vehicle?	Go to Step 2	Go to <u>Diagnostic System Check - Vehicle</u>
2	1. Turn ON the ignition, with the engine OFF. 2. Place the auxiliary blower motor switch in the OFF position. Is the auxiliary blower motor OFF?	Go to Step 3	Go to <u>Auxiliary Blower Motor Malfunction</u>
3	Place the auxiliary blower motor switch in each speed position. Does the auxiliary blower motor operate in each speed position?	Go to Step 4	Go to <u>Auxiliary Blower Motor Malfunction</u>
4	Does the auxiliary blower motor operate at the desired speed?	Go to Step 5	Go to <u>Auxiliary Blower Motor Malfunction</u>
5	Place the auxiliary mode switch in each mode position. Does the air flow from the correct air distribution outlets in each selected mode position?	Go to <u>Testing for Intermittent Conditions and Poor Connections</u>	Go to Step 6
	1. Turn OFF the ignition. 2. Disconnect the auxiliary mode		

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6	<p>actuator.</p> <ol style="list-style-type: none"> 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the auxiliary mode actuator supply voltage circuit and ground. <p>Does the test lamp illuminate?</p>	Go to Step 7	Go to Step 9
7	<p>Connect a test lamp between the auxiliary mode actuator supply voltage circuit and the low reference circuit of the auxiliary mode actuator.</p> <p>Does the test lamp illuminate?</p>	Go to Step 8	Go to Step 10
8	<ol style="list-style-type: none"> 1. Measure the voltage from the auxiliary mode door control circuit to a good ground. 2. Place the auxiliary mode switch in each mode position. Refer to Test Description. <p>Does the voltage measure near the specified values for each mode selected?</p>	Go to Step 12	Go to Step 11
9	<p>Test the auxiliary mode actuator supply voltage circuit for an open, short to ground or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 14
10	<p>Test the low reference circuit of the auxiliary mode actuator for an open or high resistance. Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 14
11	<p>Test the auxiliary mode door control circuit for the following:</p> <ul style="list-style-type: none"> • An open • A short to ground • A short to voltage 		

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	<p>Refer to <u>Circuit Testing</u> and <u>Wiring Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 14
12	<p>Inspect the auxiliary mode door and the auxiliary mode actuator for the following conditions:</p> <ul style="list-style-type: none"> • A misaligned auxiliary mode actuator. Refer to <u>Auxiliary Mode Actuator Replacement</u> . • Broken or binding linkages or auxiliary mode door • An obstruction that prevents the door from operating within its full range of motion • Missing seals to the auxiliary mode door • Misaligned seals to the auxiliary mode door <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 13
13	<p>Inspect for poor connections at the harness connector of the auxiliary mode actuator. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 15
14	<p>Inspect for poor connections at the harness connector of the auxiliary HVAC control module. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> .</p> <p>Did you find and correct the condition?</p>	Go to Step 17	Go to Step 16
15	<p>Replace the auxiliary mode actuator. Refer to <u>Auxiliary Mode Actuator Replacement</u> .</p>		

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	Did you complete the replacement?	Go to Step 17	-
16	Replace the auxiliary HVAC control module. 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 2

AIR RECIRCULATION 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.

Diagnostic Fault Information

Air Recirculation Malfunction

Circuit	Short to Ground	High Resistance	Open	Short to Voltage
Recirculation Door Control Circuit A	1	1	1	1
Recirculation Door Control Circuit B	1	1	1	1
5-Volt Reference	1	1	1	1
Recirculation Door Position Signal	-	1	1	1
Recirculation Actuator Low Reference		1	1	-
B+ circuit of the HVAC control module	1	1	1	-
Ground circuit of the HVAC control module	-	1	1	-
1. Recirculation Actuator Inoperative				

Circuit/System Description

The recirculation actuator is a 5-wire bi-directional electric motor that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal and 2 control circuits enable the actuators to operate. The control circuits use either a 0 or 12-volt value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 volts. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 volts. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. This gives the actuator the power to adjust the air source being used from fresh air to recirculation (cabin air). When the actuator shaft rotates, the potentiometer's adjustable contact changes the door position signal between 0-5 volts.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

HVAC Connector End Views

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. Turn ON the ignition, with the engine OFF.

2. Place the blower motor switch at the maximum speed position.
3. Place the mode switch in the vent or panel position.
4. Place the recirculation switch in the recirc position.
5. Place the recirculation switch in the fresh air position.
6. Observe the air inlet door commanded parameter in the scan tool.

The scan tool air in let commanded counts parameter should change.

Circuit/System Testing

1. Ignition OFF, disconnect the recirc actuator harness connector at the recirculation actuator.
2. Ignition OFF, test for less than 1.0 ohm of resistance between the low reference circuit terminal 1 and ground.
 - If greater than 1.0 ohm, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8 to 5.2 volts between the 5-volt reference circuit terminal 3 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 HVAC control module.
 - If greater than 5.2 volts, test the 5-volt reference circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. Verify the appropriate scan tool parameter is less than 3 counts.
 - If greater than the specified range, test the signal circuit terminal 2 for a short to ground. If the circuit tests normal, replace the HVAC control module.
5. Install a 3 A fused jumper wire between the signal circuit terminal 2 and the low reference circuit terminal 1. Verify the appropriate scan tool actuator parameter is greater than 250 counts.
 - If less than the specified range, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Connect a test lamp between control circuit A terminal 5 and control circuit B terminal 6.
7. Command the actuator in both directions with a scan tool (air inlet door command). The test lamp should turn ON and OFF with each command.
 - If the test lamp remains always ON or always OFF during either commands, test for an open, short to ground or short to voltage on either control circuit. If the circuit tests normal, replace the HVAC control module.
8. If all circuits test normal, replace the recirculation actuator.

Repair Procedures

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

- **Control Module References** for HVAC replacement, setup and programming.
- **Recirculation Actuator Replacement**

AFTERBLOW ENABLING

The afterblow mode can be enabled using the scan tool. The afterblow mode allows the blower motor to operate after the engine has been turned off. This operation of the blower motor dries the evaporator core, which reduces the amount of microbial growth which can create undesirable odors.

Use the following procedure in order to enable the afterblow mode:

1. Connect the Scan Tool.
2. Turn ON the ignition, with the engine OFF.
3. Select HVAC Module.
4. Select HVAC Systems Automatic or Manual.
5. Select Module Setup.
6. Select Afterblow Option.
7. Upon selecting the afterblow option a asterix will appear next to the word afterblow meaning the function is enabled.
8. Select the save option in the lower left of the screen.

When afterblow has been enabled the blower motor will operate for 2 minutes 30 seconds to 4 minutes after the engine has been in Key OFF for 30 minutes.

The following conditions must be met for the HVAC module to operate the afterblow:

- The outside air temperature must be at least 21°C (70°F).
- The A/C compressor must have operated during the latest key cycle.
- The engine must be turned off for at least 30 minutes.
- The system voltage must be at least 12 volts.

ACTUATOR RECALIBRATION

When replacing the HVAC control module it will be necessary to allow the HVAC control

module to perform a calibration process. When installing the HVAC control module be sure to perform the following:

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

1. Place the ignition switch to the OFF position.
2. Disconnect the scan tool.
3. Install the HVAC control module.
4. Connect all previously disconnected components.
5. Start the vehicle.
6. Wait 40 seconds for the HVAC control module to self-calibrate.
7. Verify that no DTCs have set as current DTCs.

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

Preferred Method (w/Scan Tool)

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

1. Clear all DTCs.
2. Place the ignition switch in the OFF position.
3. Install the HVAC actuator.
4. Connect all previously disconnected components.
5. Start the vehicle.
6. With the scan tool, initiate the Motor Re-calibration feature of the Heating and Air Conditioning Special Functions menu.
7. Verify that no DTCs have set as current DTCs.

Alternate Method (w/o Scan Tool)

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

HVAC performance will result.

1. Clear all DTCs.
2. Place the ignition switch to the OFF position.
3. Install the HVAC actuator.
4. Connect all previously disconnected components.
5. Remove the HVAC fuse for a minimum of 10 seconds.
6. Install the HVAC fuse.
7. Start the vehicle.
8. Wait 40 seconds for the HVAC control module to self-calibrate.
9. Verify that no DTCs have set as current DTCs.

REPAIR INSTRUCTIONS

HVAC CONTROL MODULE REPLACEMENT

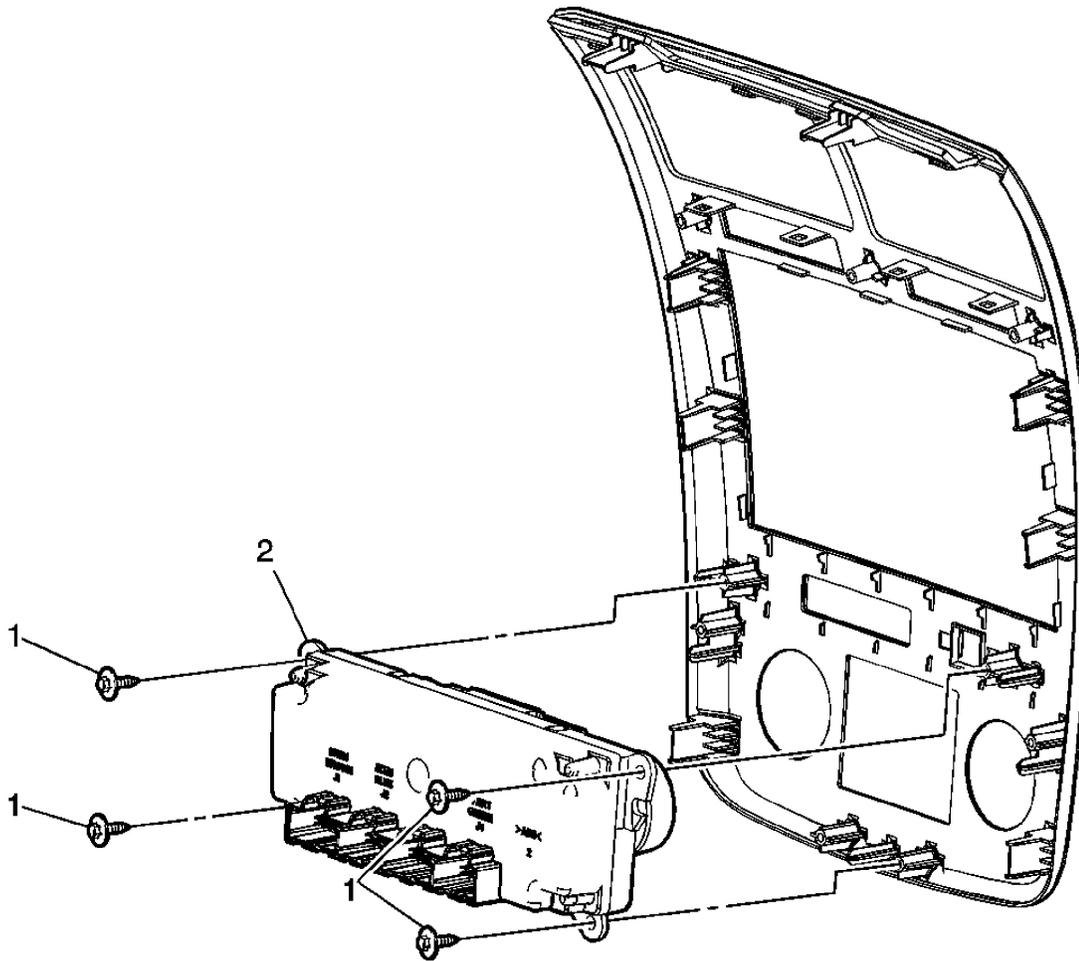


Fig. 35: Identifying HVAC Control Module
 Courtesy of GENERAL MOTORS CORP.

HVAC Control Module Replacement

Callout	Component Name
Preliminary Procedure: Remove the instrument panel (I/P) accessory trim plate. Refer to <u>Instrument Panel Accessory Trim Plate Replacement</u> .	
1	HVAC Control Module Screw (Qty: 4) NOTE: Refer to <u>Fastener Notice</u> . Tighten: 2 N.m (18 lb in)
	HVAC Control Module

2

Procedure:

Disconnect the electrical connectors.

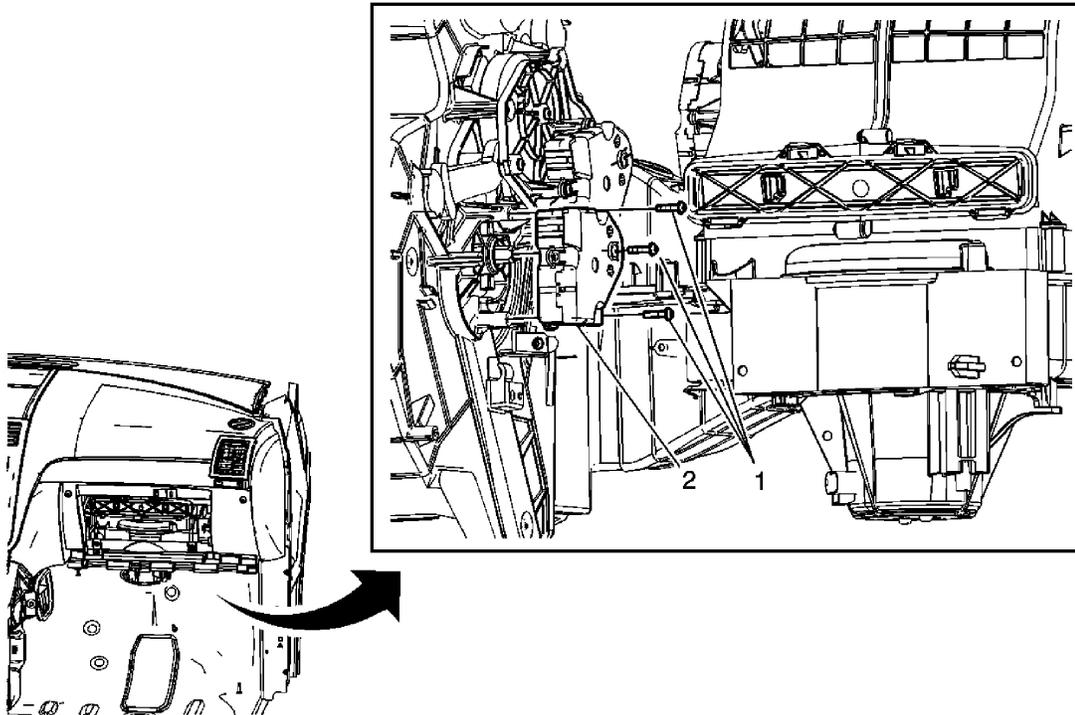
AIR TEMPERATURE ACTUATOR REPLACEMENT - RIGHT SIDE

Fig. 36: Identifying Air Temperature Actuator - Right Side
 Courtesy of GENERAL MOTORS CORP.

Air Temperature Actuator Replacement - Right Side

Callout	Component Name
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NOTE:

In order to avoid actuator damage, DO NOT apply power to the actuator when it is not installed in the HVAC module.

Preliminary Procedures

1. Remove the front floor console extension panel - right side. Refer to **Front Floor Console Extension Panel Replacement - Right Side** .
2. Remove the instrument panel insulator - right side. Refer to **Instrument Panel Insulator Panel Replacement - Right Side** .
3. Remove the instrument panel (I/P) compartment. Refer to **Instrument Panel**

Compartment Replacement .

1	<p>Right Temperature Actuator Screw (Qty: 3)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tighten: 2 N.m (18 lb in)</p>
2	<p>Right Temperature Actuator</p> <p>Procedure</p> <ol style="list-style-type: none"> 1. Disconnect the electrical connectors. 2. Re-calibrate the right temperature actuator. Refer to <u>Actuator Recalibration</u> .

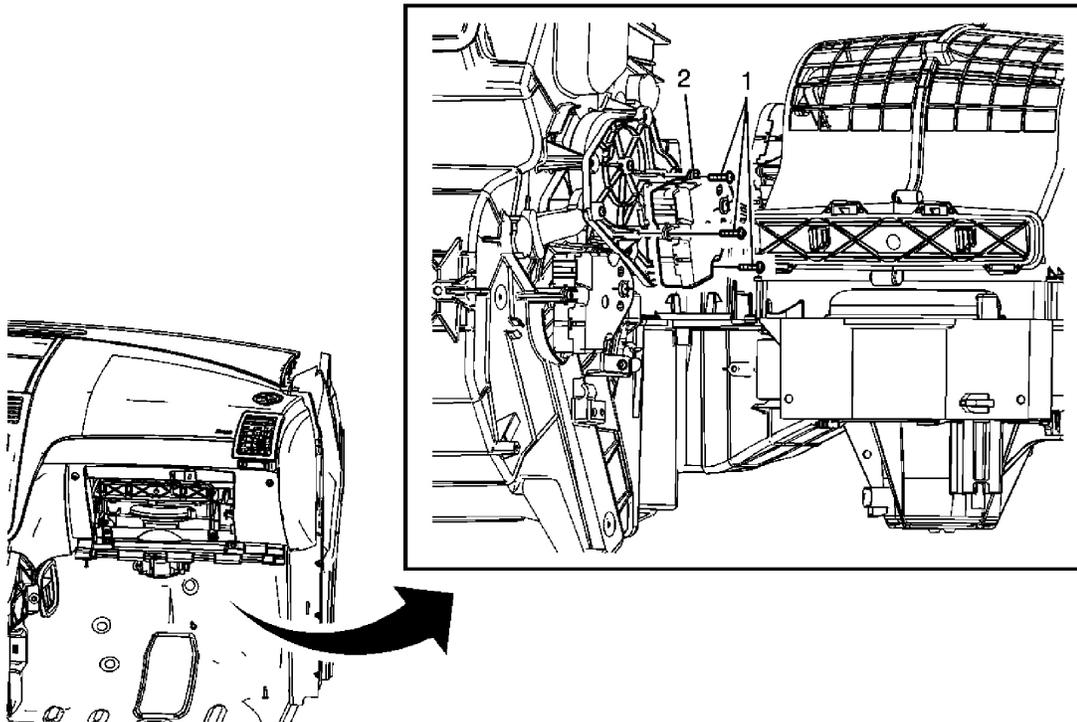
MODE ACTUATOR REPLACEMENT

Fig. 37: Identifying Mode Actuator
Courtesy of GENERAL MOTORS CORP.

Mode Actuator Replacement

Callout	Component Name
<p>NOTE: In order to avoid actuator damage, DO NOT apply power to the actuator when it is not installed in the HVAC module.</p> <p>Preliminary Procedures</p> <ol style="list-style-type: none"> 1. Remove the front floor console extension panel - right side. Refer to <u>Front Floor Console Extension Panel Replacement - Right Side</u> . 2. Remove the instrument panel insulator - right side. Refer to <u>Instrument Panel Insulator Panel Replacement - Right Side</u> . 3. Remove the instrument panel (I/P) compartment. Refer to <u>Instrument Panel Compartment Replacement</u> . 	
1	<p>Mode Actuator Screw (Qty: 3)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tighten: 2 N.m (18 lb in)</p>
2	<p>Mode Actuator</p> <p>Procedure</p> <ol style="list-style-type: none"> 1. Disconnect the electrical connectors. 2. Re-calibrate the right temperature actuator. Refer to <u>Actuator Recalibration</u> .

RECIRCULATION ACTUATOR REPLACEMENT

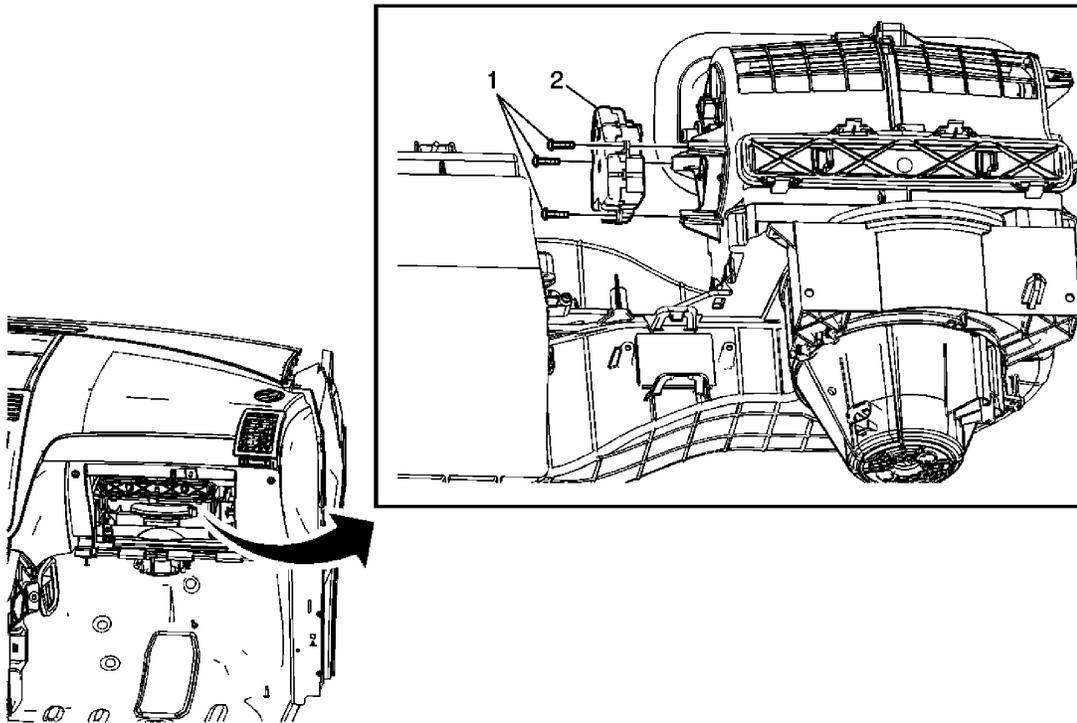


Fig. 38: Identifying Recirculation Actuator
 Courtesy of GENERAL MOTORS CORP.

Recirculation Actuator Replacement

Callout	Component Name
<p>NOTE: In order to avoid actuator damage, DO NOT apply power to the actuator when it is not installed in the HVAC module.</p>	
<p>Preliminary Procedures</p> <ol style="list-style-type: none"> 1. Remove the instrument panel insulator - right side. Refer to <u>Instrument Panel Insulator Panel Replacement - Right Side</u> . 2. Remove the instrument panel (I/P) compartment. Refer to <u>Instrument Panel Compartment Replacement</u> . 	
<p>1</p>	<p>Recirculation Actuator Screw (Qty: 3)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tighten: 2 N.m (18 lb in)</p>

Recirculation Actuator

Procedure

2

1. Disconnect the electrical connectors.
2. Re-calibrate the air recirculation actuator. Refer to **Actuator Recalibration** .

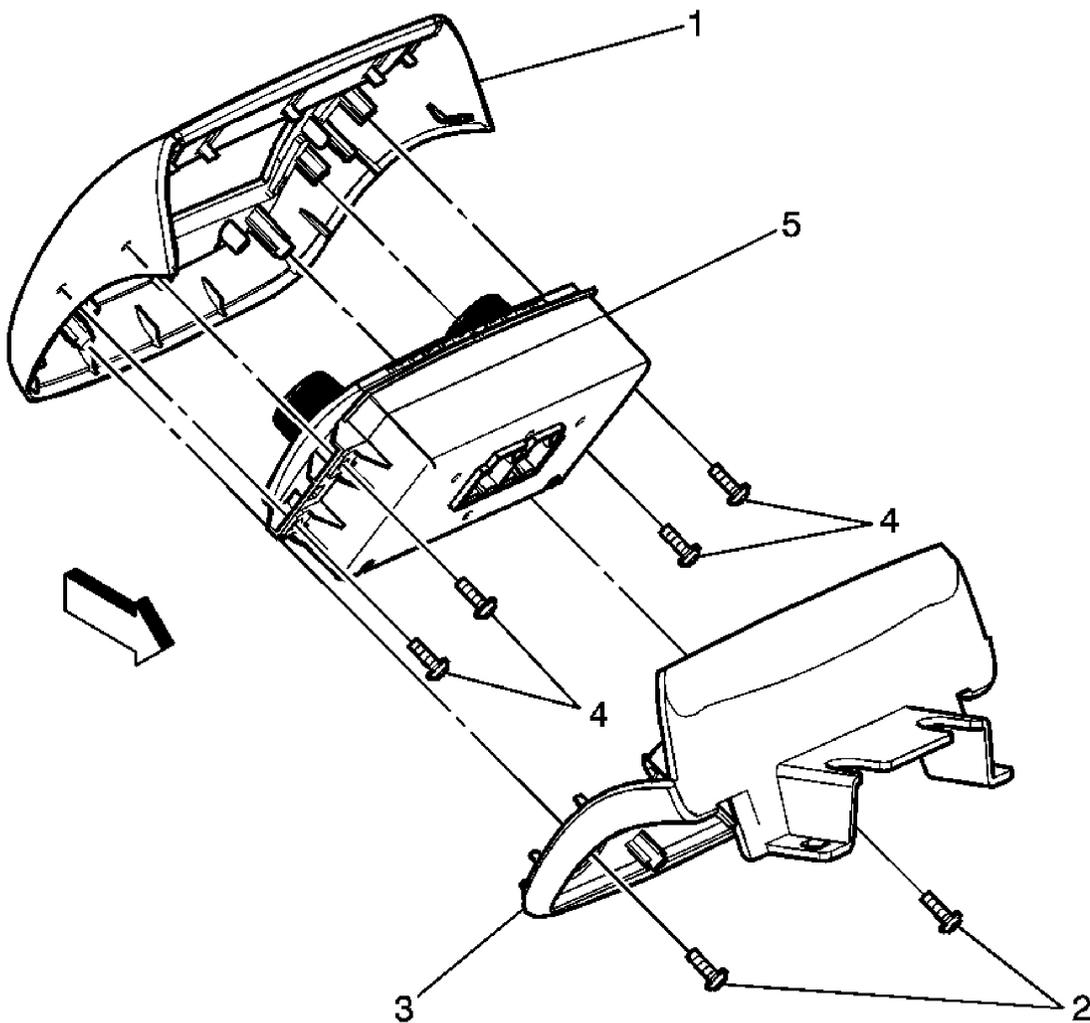
AUXILIARY HEATER AND AIR CONDITIONING CONTROL MODULE REPLACEMENT

Fig. 39: View Of Auxiliary Heater and Air Conditioning Control Modules
Courtesy of GENERAL MOTORS CORP.

Auxiliary Heater and Air Conditioning Control Module Replacement

Callout	Component Name
1	Front Floor Console Extension Accessory Upper Bezel Refer to <u>Front Floor Console Extension Accessory Upper Bezel Replacement</u> .
2	Front Floor Console Extension Accessory Upper Bezel Screw (Qty: 2) NOTE: Refer to <u>Fastener Notice</u> . Tighten: 2 N.m (18 lb in)
3	Front Floor Console Extension Accessory Upper Bezel Closeout
4	Auxiliary HVAC Control Module Screw (Qty: 4) NOTE: Refer to <u>Fastener Notice</u> . Tighten: 2 N.m (18 lb in)
5	Auxiliary HVAC Control Module Assembly

AUXILIARY AIR TEMPERATURE ACTUATOR REPLACEMENT

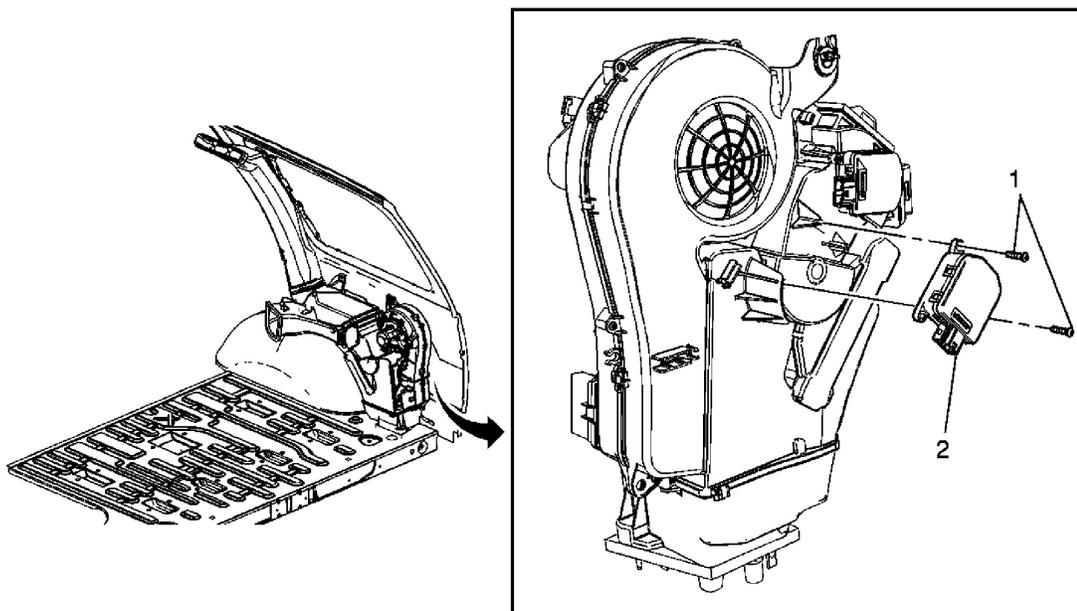


Fig. 40: Locating Auxiliary Air Temperature Actuator
Courtesy of GENERAL MOTORS CORP.

Auxiliary Air Temperature Actuator Replacement

Callout	Component Name
<p>NOTE: In order to avoid actuator damage, DO NOT apply power to the actuator when it is not installed in the HVAC module.</p>	
<p>Preliminary Procedures</p> <ol style="list-style-type: none"> 1. Remove the rear quarter lower trim panel. Refer to <u>Rear Quarter Lower Trim Panel Replacement (without RPO E61)</u> or <u>Rear Quarter Lower Trim Panel Replacement (with RPO E61)</u> . 2. Reposition the auxiliary HVAC module inward to gain access to the temp door actuator. 3. Disconnect the electrical connector from the temp actuator (2). 	
1	<p>Temp Door Actuator Screw (Qty: 2)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tighten: 2.5 N.m (16 lb in)</p>
2	<p>Auxiliary Temp Door Actuator</p> <p>Procedure: Re-calibrate the air temp actuator. Refer to <u>Actuator Recalibration</u> .</p>

AUXILIARY MODE ACTUATOR REPLACEMENT

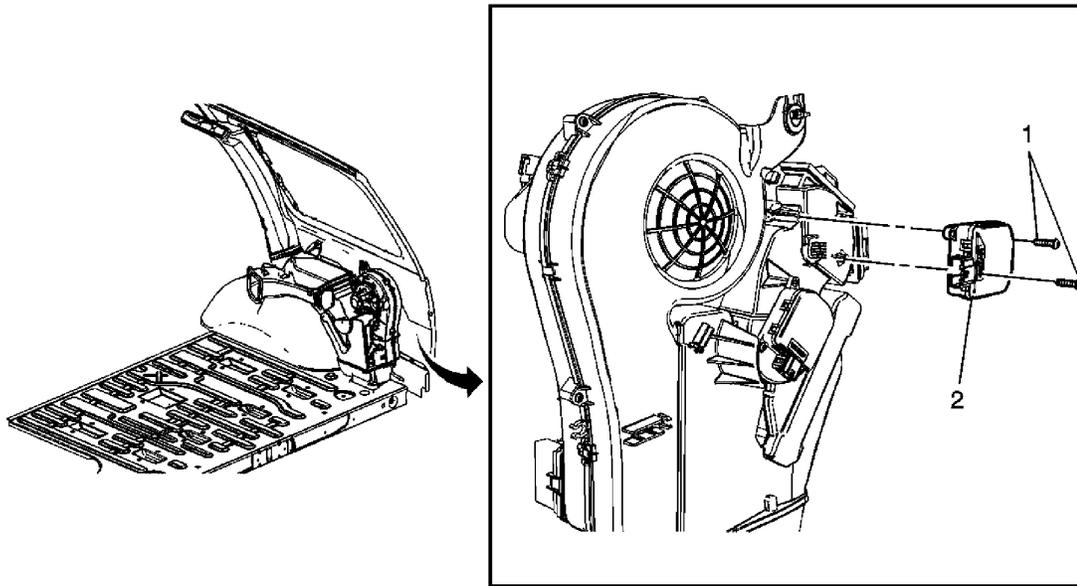


Fig. 41: View Of Auxiliary Mode Valve Actuator
 Courtesy of GENERAL MOTORS CORP.

Auxiliary Mode Actuator Replacement

Callout	Component Name
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NOTE:

In order to avoid actuator damage, DO NOT apply power to the actuator when it is not installed in the HVAC module.

Preliminary Procedures

1. Remove the right rear quarter trim panel. Refer to **Rear Quarter Lower Trim Panel Replacement (without RPO E61)** or **Rear Quarter Lower Trim Panel Replacement (with RPO E61)** .
2. Reposition the auxiliary HVAC module inward to gain access to the mix door actuator.
3. Disconnect the electrical connector from the mix door actuator.

1	Mix Door Actuator Screw (Qty: 2) NOTE: Refer to <u>Fastener Notice</u> . Tighten: 2.5 N.m (16 lb in)
---	--

2

Auxiliary Mix Door Actuator

Procedure:Re-calibrate the mode 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 Delivery
- Recirculation Operation

HVAC Control Components**HVAC Control Module**

The HVAC control module is a GMLAN device that interfaces between the operator and the HVAC system to maintain desired air temperature and distribution settings. The battery positive voltage circuit provides power that the control module uses for keep alive memory (KAM). If the battery positive voltage circuit loses power, all HVAC DTCs and settings will be erased from KAM. The body control module (BCM), which is the vehicle mode master, provides a device on signal. The HVAC control module provides blower, air delivery mode, air temperature settings and input signals to auxiliary HVAC control module. The HVAC system assembly receives power from battery input with ignition 3 voltage circuit as a backup.

The HVAC control module supports the following features:

Air Delivery Description and Operation

Feature	Availability
Afterblow	Yes
Purge	No
Personalization	Yes
Actuator Calibration	Yes

Auxiliary HVAC Control Module

The auxiliary HVAC control module provides blower, air delivery mode and air temperature

settings. When the auxiliary position is selected, from the HVAC control module, inputs from this control assembly will be processed by the Aux. HVAC control module. If equipped with rear seat audio (RSA) the auxiliary HVAC system will support GMLAN.

Front Mode Actuator

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

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

Auxiliary Mode Actuator

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

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

Air Speed

Front Blower Motor Control Processor

The front blower motor control processor is an interface between front HVAC control module and front blower motor. The front blower control processor regulates supply voltage and ground circuits to front blower motor. The front HVAC control module provides a blower speed signal to the control processor in order to command the desired blower motor speed. The control processor uses the blower motor ground as a low side control to adjust the blower motor speed.

The blower motor forces air to circulate within the vehicle's interior. The vehicle operator determines the blower motors speed by placing the blower motor switch in a desired speed position or by selecting automatic operation. In manual operation, once a blower speed is selected, the blower speed remains constant, until a new speed is selected. In automatic operation, the HVAC control module will determine what blower speed is necessary in order to achieve or maintain a desired temperature.

As the requested blower speed increases, the following conditions occur:

- The HVAC control module increases the amount of time that the blower motor speed control circuit is modulated to ground.
- The voltage and duty cycle, measured between the blower motor speed control circuit and ground, decrease.

As the requested blower speed decreases, the following conditions occur:

1. The HVAC control module decreases the amount of time that the blower motor speed control circuit is modulated to ground.
2. The voltage and duty cycle, measured between the blower motor speed control circuit and ground, increase.

Afterblow

Afterblow is a feature that dries the evaporator core by operating the blower motor after the engine is turned off. This reduces the amount of microbial growth that can create undesirable odors. The vehicle does not come equipped with the afterblow feature turned on. If the afterblow feature is required due to an odor concern, it must be turned on by the scan tool.

The following conditions must be met for afterblow to operate:

- The A/C compressor operated during the prior key cycle.
- The system voltage is at least 11 volts to start and 10 volts to continue to run.
- The ignition has been in the OFF position for at least 30 minutes.

Once the above conditions have been met the following sequence of events will occur:

- The blower will run for a range of 2 minutes 30 seconds to 4 minutes.
- The recirculation door moves to outside air position.
- The mode valve moves to the floor position.

Auxiliary Blower Motor Control Processor

The auxiliary blower motor control processor is an interface between the auxiliary HVAC control module and the rear blower motor. The auxiliary blower motor control processor monitors supply voltage and ground circuits to the rear blower motor. The auxiliary HVAC control module provides a pulse width modulation (PWM) signal to the control processor in order to command the blower motor speed. The auxiliary blower motor control processor uses the blower motor ground as a low side control to adjust the blower motor speed.

The blower motor forces air to circulate within the vehicles interior. The vehicle operator determines the blower motors speed by placing the blower motor switch in a desired speed position or by selecting automatic operation. In manual operation, once a blower speed is selected, the blower speed remains constant, until a new speed is selected. In automatic operation, the HVAC control module will determine what blower speed is necessary in order to achieve or maintain a desired temperature.

As the requested blower speed increases, the following conditions occur:

- The HVAC control module increases the amount of time that the blower motor speed control circuit is modulated to ground.
- The voltage and duty cycle, measured between the blower motor speed control circuit and ground, decrease.

As the requested blower speed decreases, the following conditions occur:

- The HVAC control module decreases the amount of time that the blower motor speed control circuit is modulated to ground.
- The voltage and duty cycle, measured between the blower motor speed control circuit and ground, increase.

Air Delivery

Front Control

The HVAC control module controls the distribution of air by the use of recirculation and mode

actuators. The modes that may be selected are:

- Defrost
- Defog
- Panel
- BI-Level
- Floor

The mode actuator is connected to the mode door by a cam type linkage system. Depending on the position of the door, air is directed through the HVAC module and distributed through various ducts leading to the outlets in the dash. If a fault is detected within the mode door travel, the HVAC control module will drive the actuator to defrost, which is a default position for the mode door actuator. Turning the mode door position to either defrost or defog positions, the HVAC control module will move the recirculation actuator to outside air reducing window fogging. When defrost/defog is selected, the A/C compressor is activated. The A/C compressor clutch will engage when ambient temperatures are above 3°C (38°F). A/C is available in all modes. Recirculation is only available in Panel and Bi-Level modes. The rear window defogger does not affect the HVAC system.

Auxiliary Control

The auxiliary HVAC system provides ventilation for the rear seat occupants. The rear seat occupants will exercise control of the auxiliary air delivery modes, air speed and the air temperature setting. The HVAC control module will have the ability to override the auxiliary HVAC control module by placing it in any position other than auxiliary.

The auxiliary mode switch in the HVAC control module allows the driver to direct the air flow in the rear of the vehicle between the floor, headliner or a blend between the 2 options. Power is provided to both front and auxiliary HVAC control modules from I/P fuse block on the ignition 3 voltage circuit.

Recirculation Operation

The HVAC control module controls the air intake through the recirculation actuator. The recirculation switch closes the recirculation door in order to circulate the air within the vehicle. The outside air switch opens the recirculation door in order to route outside air into the vehicle. Regardless of the blower motor switch position, recirculation is available only in the Panel and Bi-Level mode switch positions. The mode switch must be placed in either the Panel or Bi-Level position before the blower motor switch is placed in the OFF position. When Defrost or Defog positions are selected outside air is circulated to the windshield to reduce fogging. If the

recirculation switch is pressed into the ON position when the mode switch is in an unavailable mode position, then the recirculation switch LED will flash 3 times.

Dual Zone Operation

The HVAC control module uses dual temperature button switches. The dual zone controls allows for maximum temperature offset between and comfort between the driver and passenger. It is possible to select maximum airflow over the evaporator core with one dual zone switch along with maximum airflow over the heater core with the other dual zone switch. Each air temperature actuator is independent from the other and the passenger side is not limited in its range of temperature offset.

Remote Start

Remote Start Activation

The following describes the HVAC control head functionality upon receiving the remote start active serial data message and a power mode status is set to off/awake. During remote start on the manual HVAC system the blower motor, mode doors, temperature doors, recirc door and A/C request will be set to the current setting on the control panel when the vehicle was last turned off. The rear defrost will be activated and the heated seats will be disabled.

Remote Start De-activation

When the remote start is exited, GMLAN power mode equals run mode or remote start engine. In the case of manual settings, the displays will revert to the actual state of operation of the features, on the basis of their normal control algorithms.

AIR TEMPERATURE DESCRIPTION AND OPERATION

The air temperature controls are divided into 5 areas:

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

HVAC Control Components

HVAC Control Module

The HVAC control module is a GMLAN device that interfaces between the operator and the HVAC system to maintain desired air temperature and distribution settings. The battery positive voltage circuit provides power that the control module uses for keep alive memory (KAM). If the battery positive voltage circuit loses power, all HVAC DTCs and settings will be erased from KAM. The body control module (BCM), which is the vehicle mode master, provides a device on signal. The HVAC control module provides blower, air delivery mode, air temperature settings and input signals to auxiliary HVAC control module. The HVAC system assembly receives power from battery input with ignition 3 Voltage circuit as a backup.

The HVAC control module supports the following features:

Air Temperature Description and Operation

Feature	Availability
Afterblow	Yes
Purge	No
Personalization	Yes
Actuator Calibration	Yes

Auxiliary HVAC Control Module

The auxiliary HVAC control module provides blower, air delivery mode and air temperature settings. When the auxiliary position is selected, from the HVAC control module, inputs from this control assembly will be processed by the auxiliary HVAC control module. If equipped with rear seat audio (RSA) the auxiliary HVAC system will support GMLAN.

Front Temperature Actuators

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

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

Auxiliary Temperature Actuator

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

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

A/C Refrigerant Pressure Sensor

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

The A/C refrigerant pressure sensor protects the A/C system from operating when an excessively high pressure condition exists. The PCM disables the compressor clutch if the A/C pressure is more than 3234 kPa. The clutch will be enabled after the pressure decreases to less than 1931 kPa.

Dual Zone Operation

The HVAC control module uses dual temperature button switches. The dual zone controls allows for maximum temperature offset between and comfort between the driver and passenger. It is possible to select maximum airflow over the evaporator core with one dual zone switch along with maximum airflow over the heater core with the other dual zone switch. Each air temperature actuator is independent from the other and the passenger side is not limited in it's range of temperature offset.

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. Regardless of the temperature setting, the following can affect the rate that the HVAC system can achieve the desired temperature:

- Recirculation actuator setting
- Difference between inside and desired temperature
- Difference between ambient and desired temperature
- Blower motor speed setting
- Mode setting
- Auxiliary HVAC settings

The manual HVAC system is a dual temperature zone system. There are 2 separate air temperature levers. Moving the air temperature levers to the upward position diverts most of the airflow through the heater core, which increases the outlet air temperature. Moving the air temperature levers to the most downward position diverts most of the airflow around the heater core, which decreases the outlet air temperature. The right air temperature actuator controls the duct air temperature flowing through the center console to the second row seating passengers. The air temperature offset can be as much as 16.7°C (30°F).

Pressing the A/C button enables the HVAC control module to request A/C compressor engagement and turn ON the A/C button LED. The HVAC control module sends a GMLAN message to the Powertrain Control Module (PCM) for A/C compressor engagement. The PCM will provide a ground for the A/C compressor relay enabling it to close its internal contacts to send battery voltage to the A/C compressor clutch coil. The A/C compressor diode will prevent a voltage spike, resulting from the collapse of the magnetic field of the coil, from entering the vehicle electrical system when the compressor is disengaged. Defrost and Defog mode selections will request A/C operation but not turn ON the A/C LED.

The following conditions must be met in order for the A/C compressor clutch to turn ON:

- Ambient air temperature above 2°C
- A/C low pressure switch signal circuit is grounded.
- A/C refrigerant pressure sensor parameter is less than 3234 kPa.
- A/C compressor temperature switch contacts are closed.
- PCM receives an A/C request from the HVAC control module.
- Engine coolant temperature (ECT) is less than 124°C.
- The engine RPM is less than 5,800 RPM.

The sensor information is used by the PCM to determine the following:

- The A/C high side pressure
- An A/C system load on the engine
- An excessive A/C high side pressure
- The heat load at the A/C condenser

The A/C compressor has an A/C compressor temperature switch. This switch protects the compressor from over heating. The switch interrupts power to the compressor clutch coil. When the compressor core temperature rises above 124°C (255°F) the switch opens, disabling the compressor clutch coil. When the temperature lowers to 120°C (248°F) the switch closes, enabling the compressor clutch coil. This switch is not a serviceable part, it is integral to the A/C compressor.

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

- Ambient air temperature is less than 1°C (35°F).
- A/C compressor temperature switch contacts are open.
- Throttle position is 100 percent.
- The A/C low pressure switch is open.
- A/C high side pressure is more than 1931 kPa.
- A/C low side pressure is less than 151 kPa (22 psi).
- Engine coolant temperature (ECT) is more than 124°C.
- Engine speed is more than 5,800 RPM.
- Transmission shift
- PCM detects excessive torque load.
- PCM detects insufficient idle quality.
- PCM detects a hard launch condition.

Auxiliary Heating and A/C Operation

The auxiliary air temperature switch is a rotary knob switch. Turning the air temperature switch to the warmest position diverts most of the airflow through the heater core, which increases the outlet air temperature. Turning the air temperature switch to the coolest position diverts most of the airflow around the heater core, which decreases the outlet air temperature.

Engine Coolant

Engine coolant is the essential element of the heating system. The thermostat controls the normal 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 ambient air drawn through the HVAC module absorbs the heat of the coolant flowing through the heater core. Heated air is distributed to the passenger compartment, through the HVAC module, for passenger comfort. Opening or closing the air temperature door controls the amount of heat delivered to the passenger compartment. 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 orifice tube.

The orifice tube is located in the liquid line between the condenser and the evaporator. The orifice tube is the dividing point for the high and the low pressure sides of the A/C system. As the refrigerant passes through the orifice tube, the pressure on the refrigerant is lowered. Due to the pressure differential on the liquid refrigerant, the refrigerant will begin to vaporize at the orifice

tube. The orifice tube also meters the amount of liquid refrigerant that can flow into the evaporator.

Refrigerant exiting the orifice tube 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.

A/C Cycle with Auxiliary

The auxiliary A/C system operates from the vehicles primary A/C system. The front or primary A/C system must be ON to allow the rear A/C system to function.

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 system used on this vehicle is a non cycling system. Non cycling A/C systems use a high pressure switch to protect the A/C system from excessive pressure. The high pressure switch will OPEN the electrical signal, to the compressor clutch, in the event that the refrigerant pressure becomes excessive. After the high and low side of the A/C system pressure equalize, the high pressure switch will CLOSE. Closing the high pressure switch will complete the electrical circuit to the compressor clutch. The A/C system is also mechanically protected with the use of a high pressure relief valve. If the high pressure switch were to fail or if the refrigerant system becomes restricted and refrigerant pressure continued to rise, the high pressure relief will pop open and release refrigerant from the system.

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.

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. The liquid line flow is split and the liquid refrigerant flows to both the front or primary A/C system and to the liquid line for the rear A/C system.

The liquid refrigerant, flowing to the rear A/C system, flows into the rear thermal expansion valve (TXV). The rear TXV is located at the rear evaporator inlet. The TXV is the dividing point for the high and the low pressure sides of the rear A/C system. As the refrigerant passes through the TXV, the pressure on the refrigerant is lowered. Due to the pressure differential on the liquid refrigerant, the refrigerant will begin to boil at the expansion device. 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 rear A/C 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 primary A/C systems suction line. Refrigerant in the primary A/C system suction line flows back to the compressor, in a vapor state and completes 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 rear A/C module for passenger comfort. The heat and moisture removed from the rear passenger compartment will also change form or condense and is discharged from the rear A/C module as water.

SPECIAL TOOLS AND EQUIPMENT

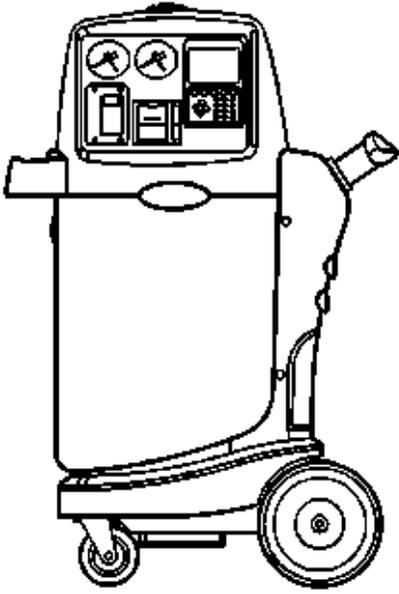
SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description

2007 Saturn Outlook XE

2007 HVAC HVAC - Manual - Outlook



J 43600
ACR 2000 Air Conditioning Service Center