

HVAC

HVAC - Automatic - Coupe And Wagon

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Actuator Screws- All	1 N.m	9 lb in
Air Inlet Valve Actuator Bolt	1 N.m	9 lb in
Blower Motor Control Module (LPM) Bolt	1 N.m	9 lb in
Blower Motor Control Module Screw	1 N.m	9 lb in
Heater and Air Conditioning Control Bolt	1.9 N.m	17 lb in
HVAC Control Module Screws	2 N.m	18 lb in
Mode Control Cam Actuator Bolt	1 N.m	9 lb in
Mode Valve Actuator Bolt	1 N.m	9 lb in
Temperature Valve Actuator Bolt	1 N.m	9 lb in

SENSOR RESISTANCE TABLE

Sensor Resistance Table

Temperature	Inside Air Temperature Sensor Resistance	Ambient Air Temperature Sensor Resistance	Evaporator Temperature Sensor Resistance
-17°C (2°F)	13790 ohms	81662 ohms	12235 ohms
-12°C (11°F)	10434 ohms	61711 ohms	9251 ohms
-1°C (31°F)	5831 ohms	34367 ohms	5147 ohms
5°C (41°F)	4317 ohms	25396 ohms	3804 ohms
15°C (59°F)	2680 ohms	15714 ohms	2357 ohms
23°C (73°F)	1868 ohms	10921 ohms	1636 ohms
31°C (87°F)	1324 ohms	7720 ohms	1154 ohms
42°C (107°F)	846 ohms	4918 ohms	733 ohms

SCHEMATIC WIRING DIAGRAMS

HVAC WIRING SCHEMATICS

Power, Ground, Data Communications and Blower Controls

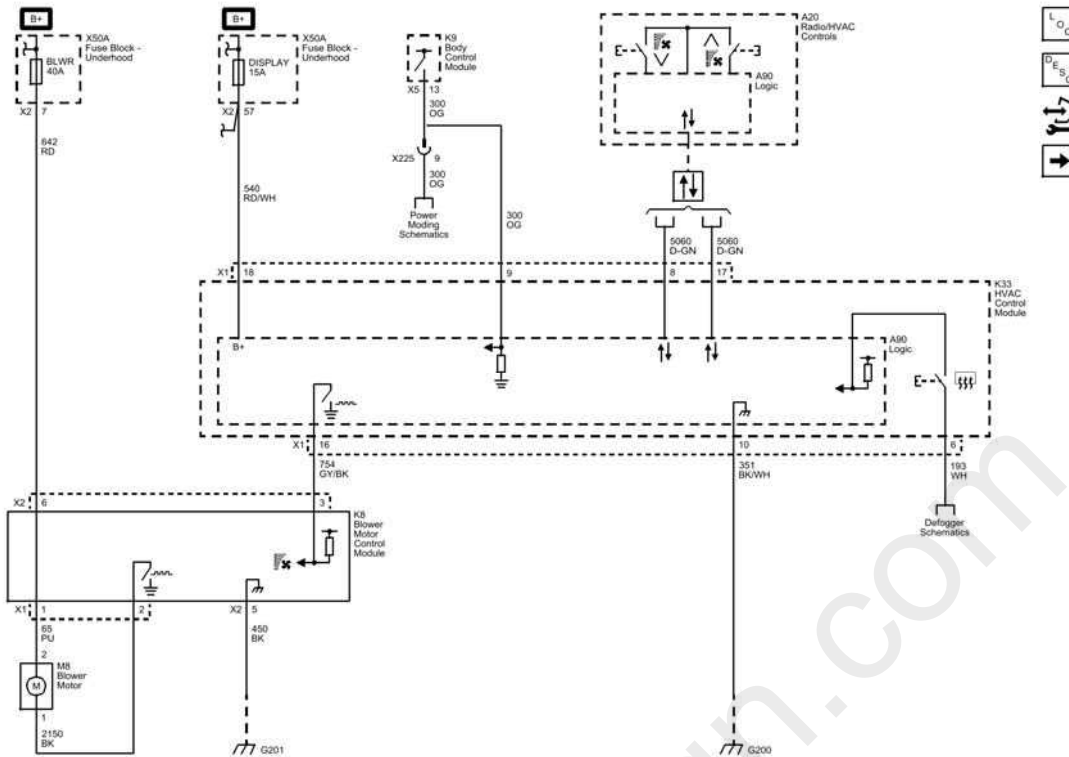


Fig. 1: Power, Ground, Data Communications and Blower Controls
 Courtesy of GENERAL MOTORS COMPANY

Mode and Temperature Controls (Left Hand Drive)

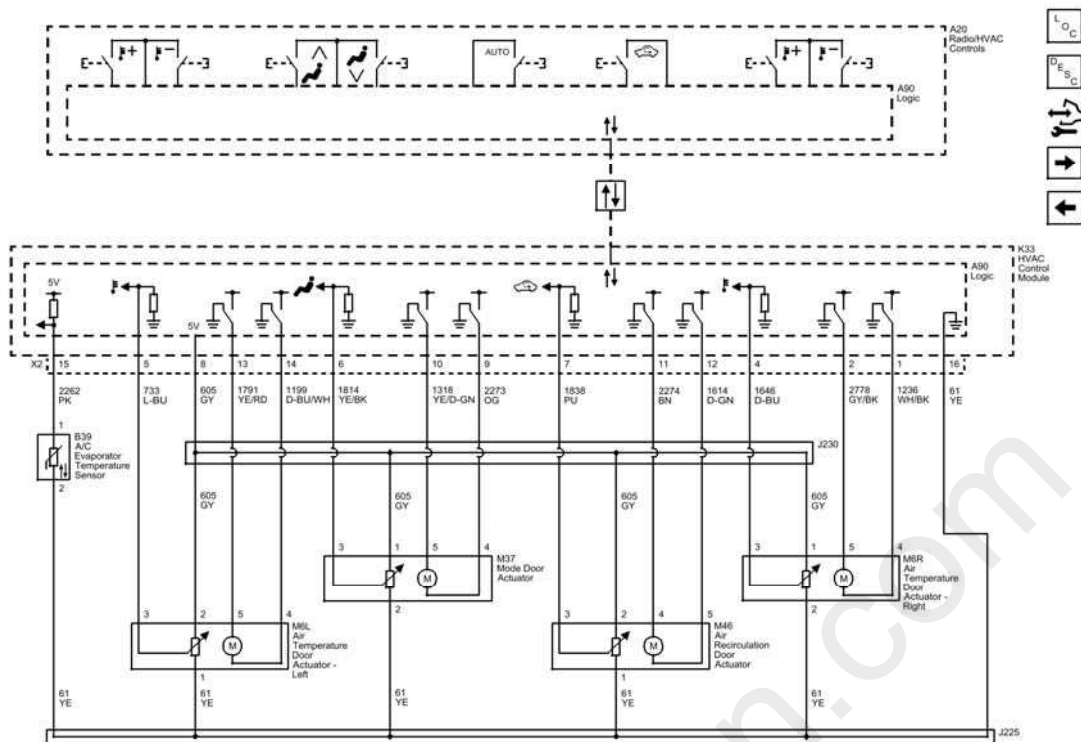


Fig. 2: Mode and Temperature Controls (Left Hand Drive)
Courtesy of GENERAL MOTORS COMPANY

Mode and Temperature Controls (Right Hand Drive)

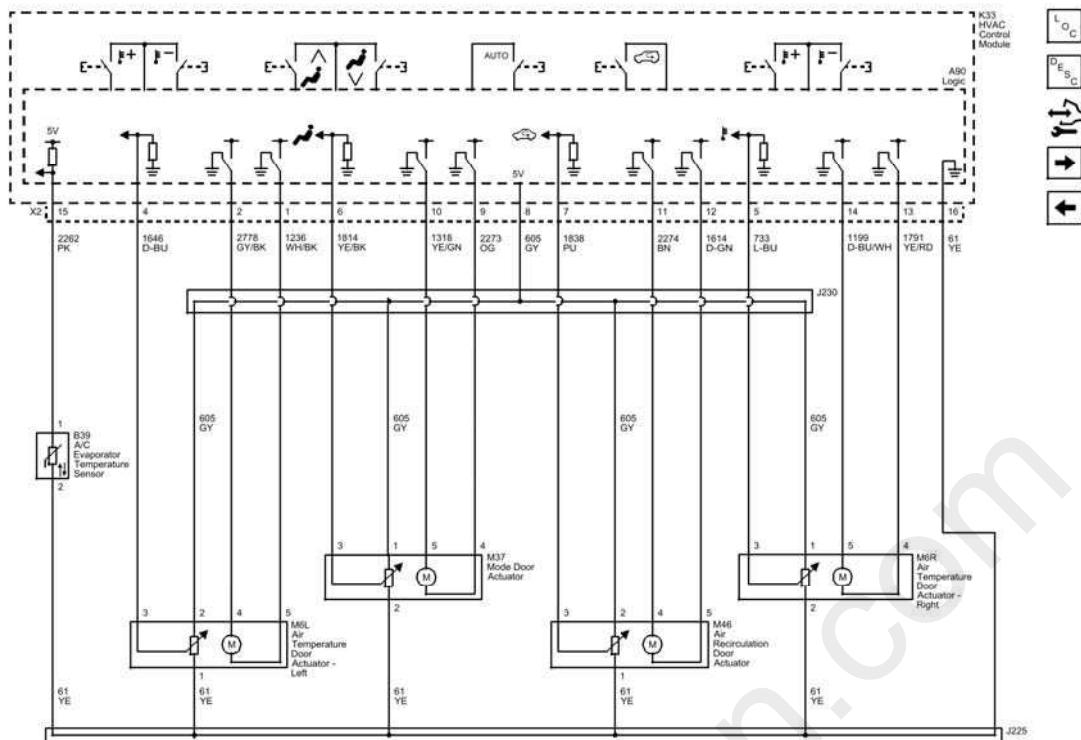
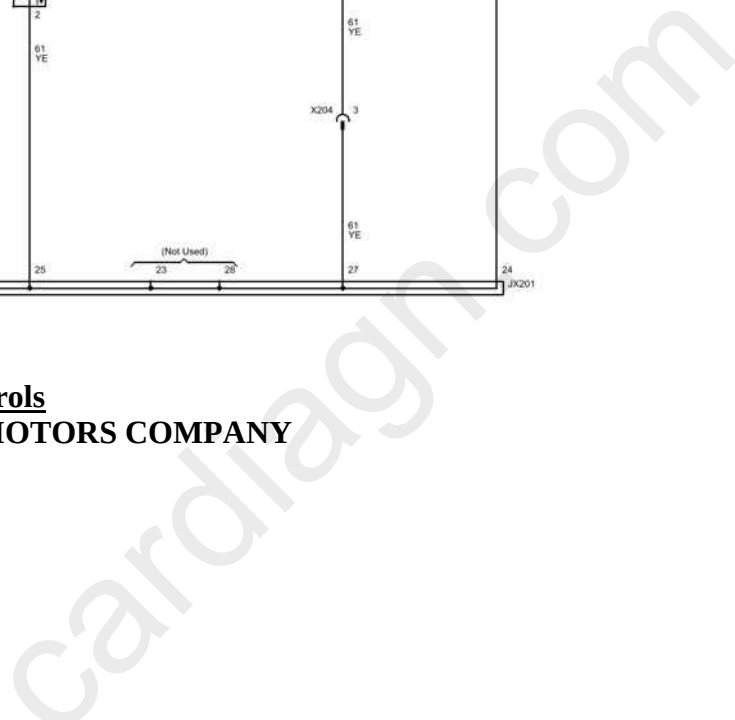


Fig. 3: Mode and Temperature Controls (Right Hand Drive)
 Courtesy of GENERAL MOTORS COMPANY

Temperature Controls



Courtesy of GENERAL MOTORS COMPANY

A/C Compressor Controls

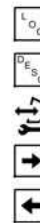
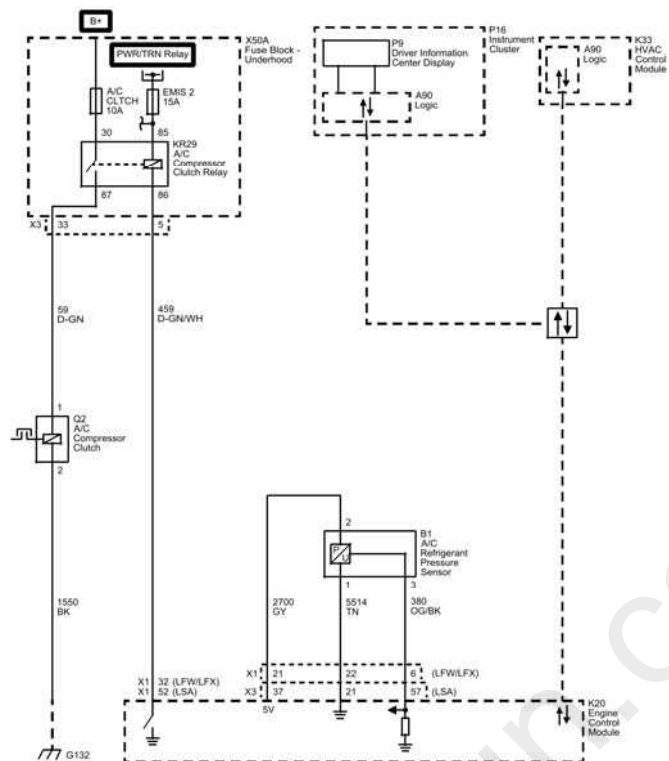


Fig. 5: A/C Compressor Controls
Courtesy of GENERAL MOTORS COMPANY

Temperature and Air Quality Controls

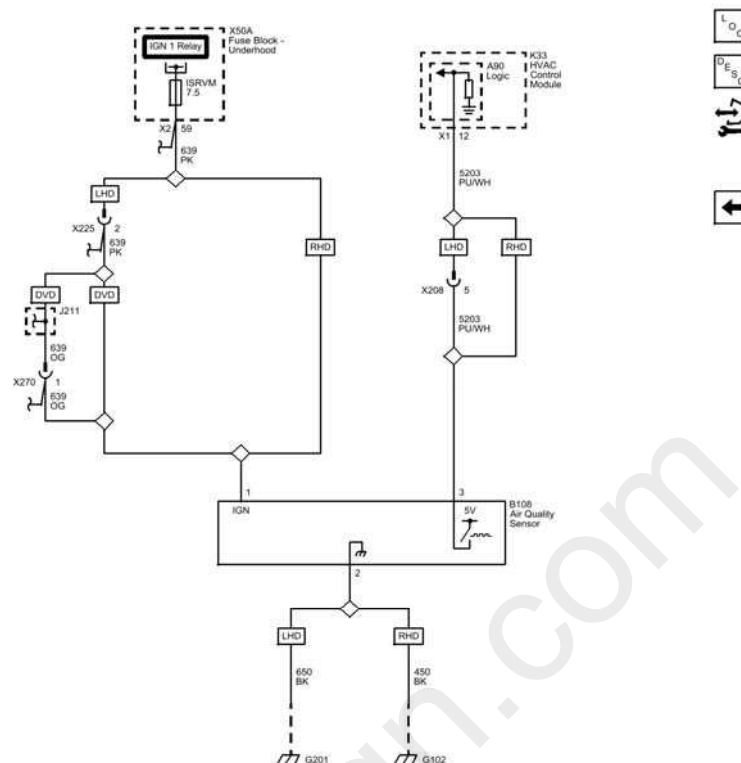


Fig. 6: Temperature and Air Quality Controls
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B0158 or B0163</u>	DTC B0158 03 Outside Air Temperature Sensor Voltage Below Threshold DTC B0158 07 Outside Air Temperature Sensor Voltage Above Threshold DTC B0163 06 Passenger Compartment Temp Sensor Circuit Short to Ground or Open
<u>DTC B0183 or B0188</u>	DTC B0183 06 Solar Load Sensor 1 Circuit Short to Ground or Open DTC B0188 06 Solar Load Sensor 2 Circuit Short to Ground or Open
<u>DTC B0248, B0268, B0408, B0413, B0418, B0423, B3761, or B3773</u>	DTC B0248 61 Air Flow Control 3 Circuit Actuator Stuck DTC B0268 61 Air Flow Control 7 Circuit Actuator Stuck DTC B0408 61 Temperature Control 1 Circuit Actuator Stuck DTC B0413 06 Temperature Control 1 Feedback Circuit Short to Ground or Open DTC B0418 61 Temperature Control 2 Circuit Actuator Stuck DTC B0423 06 Temperature Control 2 Feedback Circuit Short to Ground or

	DTC B3761 06 Air Flow Control 3 Feedback Circuit Short to Ground or Open DTC B3773 06 Air Flow Control 7 Feedback Circuit Short to Ground or Open
<u>DTC B3843</u>	DTC B3843 02 Outside Air Quality Sensor Circuit Short to Ground DTC B3843 05 Outside Air Quality Sensor Circuit High Voltage/Open DTC B3843 08 Outside Air Quality Sensor Circuit Performance - Signal Invalid
<u>DTC B3933</u>	DTC B3933 06 Evaporator Air Temperature Sensor Short to Ground or Open
<u>DTC P0532 or P0533</u>	DTC P0532 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit DTC P0533 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit Low Voltage
<u>DTC P0645, P0646, or P0647</u>	DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit DTC P0646 Air Conditioning (A/C) Clutch Relay Control Circuit Low Voltage DTC P0647 Air Conditioning (A/C) Clutch Relay Control Circuit High Voltage

DTC B0158 OR B0163: AIR TEMPERATURE SENSOR/PASSENGER COMPARTMENT TEMPERATURE SENSOR

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 B0158 03

Outside Air Temperature Sensor Voltage Below Threshold

DTC B0158 07

Outside Air Temperature Sensor Voltage Above Threshold

DTC B0163 06

Passenger Compartment Temp Sensor Circuit Short to Ground or Open

Diagnostic Fault Information

	Short to	Open/High	Short to	Signal
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Circuit	Ground	Resistance	Voltage	Performance
Outside Air Temperature Sensor Signal	B0158 03	B0158 07	B0158 07	-
Inside Air Temperature Sensor Signal	B0163 06	B0163 06	B0163 06	-
Low Reference	-	B0158 07, B0163 06	-	-

Circuit/System Description

The HVAC control module monitors the air temperature sensors with a low reference circuit and 5-volt signal circuit. The HVAC control module monitors the voltage drop across the sensor. When the ambient air temperatures are cold, the resistance of the sensor is high and the voltage signals are high. When the ambient air temperatures are hot, the resistance of the sensors is low and the voltage signals are low.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

- The HVAC control module detects the sensor signal circuit is less than -35°C (-39°F).
- The HVAC control module detects the sensor signal circuit is greater than 85°C (185°F) .

Action Taken When the DTC Sets

The HVAC control module uses a default air temperature value for further automatic control calculations. The default values are not displayed on the scan tool. The DIC will display the SERVICE A/C SYSTEM message.

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.

Reference Information

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Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the appropriate scan tool Air Temp Sensor parameter. The reading should be between -35°C (-39°F) and 85°C (185°F) and change with air temperature changes.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate air temperature sensor.
2. Ignition OFF, test for less than 10 ohms between the following low reference circuit terminal and ground.
 - Inside air temperature sensor terminal 2.
 - Ambient temperature sensor terminal B.
 - 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 the appropriate scan tool Air Temp Sensor parameter is less than -35°C (-39°F).
 - If greater than the specified range, test the following signal circuit terminal for a short to ground. If the circuit tests normal, replace the HVAC control module.
 - Inside air temperature sensor terminal 1.
 - Ambient temperature sensor terminal A.
4. Install a 3A fused jumper wire between the following signal circuit terminal and the low reference circuit terminal. Verify the scan tool Air Temp Sensor parameter is greater than 85°C (185°F).
 - Inside air temperature sensor terminal 1 and 2.
 - Ambient temperature sensor terminal A and B.
 - 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.
5. If all circuits test normal, test or replace the air temperature sensor.

Component Testing

1. A thermometer can be used to test the sensor off the vehicle in warm and or cold water. **Sensor Resistance Table** for this test.
2. Test the ambient air temperature sensor by varying the sensor temperature while monitoring the sensor resistance.

3. Compare the readings with the Temperature VS Resistance table and verify that the resistance is within 5 percent of the specification.
 - If not within the specified range, replace the sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Ambient Air Temperature Sensor Replacement**
- **Inside Air Temperature Sensor Replacement (Left Hand Drive), Inside Air Temperature Sensor Replacement (Right Hand Drive)**
- **Control Module References** for HVAC control module replacement, setup, and programming

DTC B0183 OR B0188: SOLAR LOAD SENSOR 1/2 CIRCUIT SHORT TO GROUND OR OPEN

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 B0183 06

Solar Load Sensor 1 Circuit Short to Ground or Open

DTC B0188 06

Solar Load Sensor 2 Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Sunload Sensor Signal	B0183 06	B0183 06	B0183 06	-
Right Sunload Sensor Signal	B0188 06	B0188 06	B0188 06	-
Low Reference	-	B0183 06, B0188 06	B0183 06, B0188 06	-

Circuit Description

The vehicle uses left and right sunload sensors that are integrated into one sensor assembly along with the ambient light sensor. Low reference and signal circuits enable the sensor to operate. The sensor signal varies between 0 and 5 volts. The HVAC control module converts the signal to a range between 0 and 255 counts. The sunload sensor provides the HVAC control module with a measurement of the amount of light shining on the

vehicle. Bright or high intensity light causes the vehicles interior temperature to increase. The HVAC system compensates for the increased temperature by diverting additional cool air into the vehicle.

The following DTCs are for the left and right sunload sensors.

- B0183 is for the left sunload sensor.
- B0188 is for the right sunload sensor.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The HVAC control module detects the signal circuit is less than 5 counts or greater than 250 counts.

Action Taken When the DTC Sets

- The driver information center (DIC) will display SERVICE A/C SYSTEM.
- If the DTC is set the system will act as if no sunload condition exists.

Conditions for Clearing the DTC

- The DTC will become history if the HVAC control module no longer detects the condition that set the DTC.
- The history DTC will clear after 50 fault-free ignition cycles.

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the appropriate scan tool Sunload Sensor parameter. The reading should be between 5 and 250 counts and change with sunlight changes.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the sunload sensor.
2. Test for less than 10 ohms between the ground circuit terminal C and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, test for 4.8-5.2 volts between the ground circuit terminal C and the appropriate signal circuit terminal listed below:
 - Left solar load sensor circuit terminal A.
 - Right solar load sensor circuit terminal B.
 - If less than the specified range, test the signal circuit for a short to ground or open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. If all circuits test normal, test or replace the sunload sensor.

Repair Instructions

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

- **Headlamp Automatic Control Ambient Light Sensor Replacement**
- **Control Module References** for HVAC control module replacement, setup, and programming

DTC B0248, B0268, B0408, B0413, B0418, B0423, B3761, OR B3773: AIR FLOW CONTROL CIRCUIT ACTUATOR/TEMPERATURE CONTROL FEEDBACK

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 the diagnostic category.

DTC Descriptors

DTC B0248 61

Air Flow Control 3 Circuit Actuator Stuck

DTC B0268 61

Air Flow Control 7 Circuit Actuator Stuck

DTC B0408 61

Temperature Control 1 Circuit Actuator Stuck

DTC B0413 06

Temperature Control 1 Feedback Circuit Short to Ground or Open

DTC B0418 61

Temperature Control 2 Circuit Actuator Stuck

DTC B0423 06

Temperature Control 2 Feedback Circuit Short to Ground or Open

DTC B3761 06

Air Flow Control 3 Feedback Circuit Short to Ground or Open

DTC B3773 06

Air Flow Control 7 Feedback Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Recirculation 5-Volt Reference	B0248 61, B0408 61, B0418 61, B0268 61	B3773 06	B0268 61, B3773 06	-
Recirculation Door Position Signal	B0268 61	B3773 06	B0268 61, B3773 06	-
Recirculation Door Control A	B0268 61	B0268 61	B0268 61	-
Recirculation Door Control B	B0268 61	B0268 61	B0268 61	-
Recirculation Low Reference	-	B0268 61	-	-
Driver Air Temperature 5-Volt Reference	B0248 61, B0408 61, B0418 61,	B0413 06	B0408 61, B0413 06	-

	B0268 61			
Driver Air Temperature Door Position Signal	B0408 61	B0413 06	B0408 61, B0413 06	-
Driver Air Temperature Door Control A	B0408 61	B0408 61	B0408 61	-
Driver Air Temperature Door Control B	B0408 61	B0408 61	B0408 61	-
Driver Air Temperature Low Reference	-	B0408 61	-	-
Passenger Air Temperature 5-Volt Reference	B0248 61, B0408 61, B0418 61, B0268 61	B0418 61	B0268 61, B0423 06	-
Passenger Air Temperature Door Position Signal	B0418 61	B0268 61, B0423 06	B0418 61	-
Passenger Air Temperature Door Control A	B0418 61	B0418 61	B0418 61	-
Passenger Air Temperature Door Control B	B0418 61	B0418 61	B0418 61	-
Passenger Air Temperature Low Reference	-	B0418 61	-	-
Mode 5-Volt Reference	B0248 61, B0408 61, B0418 61, B0268 61	B0248 61	B0248 61, B3761 06	-
Mode Door Position Signal	B0248 61	B0248 61, B3761 06	B0248 61, B3761 06	-
Mode Door Control A	B0248 61	B0248 61	B0248 61	-
Mode Door Control B	B0248 61	B0248 61	B0248 61	-
Mode Low Reference	-	B0248 61	-	-

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 module controls the direction of the actuator door by changing the polarity of the control circuits.

- Air Flow Control 3 is the mode actuator
- Air Flow Control 7 is the recirculation actuator
- Temperature Control 1 is the left temperature actuator
- Temperature Control 2 is the right temperature actuator

Conditions for Running the DTC

- Ignition 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

Control A and control B circuits are 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.

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, command the appropriate actuator to 100 percent with a scan tool. The scan tool should display between 224 and 230 counts on the mode actuator, all other actuators should display between 199 and 205 counts.

Circuit/System Testing

1. Ignition OFF, disconnect the X1 harness connector at the HVAC control module.
2. Ignition ON, Verify that a test lamp illuminates between the B+ circuit terminal 18 and ground.
 - If the test lamp does not illuminate, test the B+ circuit for an short to ground or a open/high resistance.
3. Ignition OFF, connect the harness connector at the HVAC control module and disconnect the harness connector at the appropriate actuator.
4. Ignition OFF, test for less than 10 ohms between the following low reference circuit terminal and ground.
 - Air temperature actuator-left terminal 1
 - Air temperature actuator-right terminal 2
 - Mode actuator terminal 2
 - Recirculation actuator terminal 1
 - 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.
5. Ignition ON, test for 4.8-5.2 volts between the following 5-volt reference circuit terminal and ground.
 - Air temperature actuator-left terminal 2
 - Air temperature actuator-right terminal 1
 - Mode actuator terminal 1
 - Recirculation actuator terminal 3
 - 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.
6. Verify the scan tool Door Position parameter is greater than 250 counts.
 - If less than the specified range, test the following signal circuit for a short to ground. If the circuit tests normal, replace the HVAC control module.
 - Air temperature actuator-left terminal 3
 - Air temperature actuator-right terminal 3
 - Mode actuator terminal 3
 - Recirculation actuator terminal 5
7. Install a 3A fused jumper wire between the following signal circuit terminal and the low reference circuit terminal. Verify the scan tool Door Position parameter is less than 3 counts.
 - Air temperature actuator-left terminal 3 and terminal 1
 - Air temperature actuator-right terminal 3 and terminal 2

- Mode actuator terminal 3 and terminal 2
 - Recirculation actuator terminal 5 and terminal 1
 - 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.
8. Ignition OFF, test for less than 10 ohms between the following control circuit terminal and ground.
- Air temperature actuator-left terminal 5
 - Air temperature actuator-right terminal 5
 - Mode actuator terminal 5
 - Recirculation actuator terminal 6
 - If greater than the specified range, test the control circuit for a short to voltage or an open/high resistance. If circuit tests normal, replace the HVAC control module.
9. Ignition OFF, test for less than 10 ohms between the following control circuit terminal and ground.
- Air temperature actuator-left terminal 4
 - Air temperature actuator-right terminal 4
 - Mode actuator terminal 4
 - Recirculation actuator terminal 7
 - If greater than the specified range, test the control circuit for a short to voltage or an open/high resistance. If circuit tests normal, replace the HVAC control module.
10. Connect a test lamp between following control circuit terminals.
- Air temperature actuator-left terminal 5 and terminal 4
 - Air temperature actuator-right terminal 5 and terminal 4
 - Mode actuator terminal 5 and terminal 4
 - Recirculation actuator terminal 6 and terminal 7
11. Ignition ON, command the appropriate actuator door in both directions with a scan tool. The test lamp should turn ON and OFF when commanded in both directions.
- If the test lamp remains OFF during either of the commands, test for a short to ground on either control circuit. If the circuits test normal, replace the HVAC control module.
12. If both circuits test normal, test or replace the actuator.

Repair Instructions

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

- **Air Inlet Valve Actuator Replacement (Right Hand Drive), Air Inlet Valve Actuator Replacement (Left Hand Drive)**
- **Mode Valve Actuator Replacement**
- **Temperature Valve Actuator Replacement - Left Side**
- **Temperature Valve Actuator Replacement - Right Side**
- **Control Module References** for the HVAC control module replacement, setup, and programming

DTC B3843: OUTSIDE AIR QUALITY SENSOR

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 B3843 02

Outside Air Quality Sensor Circuit Short to Ground

DTC B3843 05

Outside Air Quality Sensor Circuit High Voltage/Open

DTC B3843 08

Outside Air Quality Sensor Circuit Performance - Signal Invalid

Circuit/System Description

The HVAC control module detects exhaust gas by an air quality sensor. The air quality sensor is a 3-wire sensor with an ignition voltage circuit, a ground circuit and a signal circuit.

The information is pulse width modulation (PWM) signal generated on the output pin.

The HVAC control module evaluates the information of the air quality sensor and closes the recirculation door while in the automatic mode as soon as the concentration of pollutants exceeds a preset value.

Conditions for Running the DTC

- Ignition ON.
- The HVAC control module is ON.

Conditions for Setting the DTC

B3843 02

No PWM is detected and the signal is low.

B3843 05

No PWM is detected and the signal is high.

B3843 08

The Sensor sends a 5% PWM signal indicating an internal sensor short circuit or open circuit.

Action Taken When the DTC Sets

The automatic recirculation mode is disabled.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

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Scan Tool Reference

Control Module References

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B108 Air Quality Sensor.
2. Test for less than 10 ohms between the ground circuit terminal 2 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance. If the circuit tests normal, replace the K33 HVAC Control Module.
3. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 1 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, replace the K33 HVAC Control Module.
4. Verify the scan tool Odor Sensor parameter is greater than 95%.

- If less than the specified range, test the signal circuit for a short to ground. If the circuit tests normal, replace the K33 HVAC Control Module.
- 5. Install a 3 A fused jumper wire between the following signal circuit terminal 3 and the ground circuit terminal 2. Verify the scan tool Odor Sensor parameter is less than 5%.
 - If greater than the specified range, test the signal circuit for a short to voltage or open/high resistance. If the circuit tests normal, replace the K33 HVAC Control Module.
- 6. If all circuits test normal, replace the B108 Air Quality Sensor.

Repair Instructions

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

- **Ambient Air Quality Sensor Replacement**
- **Control Module References**

DTC B3933: EVAPORATOR AIR TEMPERATURE SENSOR SHORT TO GROUND OR OPEN

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 B3933 06

Evaporator Air Temperature Sensor Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Evaporator Temperature Sensor Signal	B3933 06	B3933 06	B3933 06	-
Low Reference	-	B3933 06	B3933 06	-

Circuit Description

The HVAC control module supplies the evaporator air temperature sensor with a low reference circuit and 5-volt signal circuit. The HVAC control module determines the voltage drop across the sensor, which is proportional to temperature. As the air temperature increases, the sensor resistance decreases and the voltage signal decreases. As the air temperature decreases, the sensor resistance increases and the voltage signal increases.

Conditions for Running the DTC

Ignition ON.

Conditions for Setting the DTC

The HVAC control module detects the evaporator air temperature sensor signal circuit is less than -36°C (-38°F) or more than 215°C (419°F) for more than 10 seconds.

Action Taken When the DTC Sets

The A/C compressor will be disabled and the A/C ON LED is turned off. The DIC will display Service A/C System to notify the driver.

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.

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool A/C Evaporator Temperature Sensor parameter. The reading should be between -35°C (-39°F) and 98°C (208°F) and change with evaporator temperature changes.

Circuit/System Testing

IMPORTANT: If the evaporator air temperature sensor has an out of range condition caused by a short to voltage, short to ground, open/high resistance or if the DTC is set, the scan tool will display 0°C (32°F).

1. Ignition OFF, disconnect the harness connector at the evaporator temperature sensor.
2. Ignition OFF, test for less than 10 ohms 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, test for 4.8-5.2 volts between the low reference circuit terminal 2 and the signal circuit terminal 1.
 - If less than the specified range, test the signal circuit for a short to ground or open/high resistance. If the circuit tests normal, replace the HVAC control module.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the HVAC control module.
4. If all circuits test normal, test or replace the evaporator air temperature sensor.

Component Testing

1. A thermometer can be used to test the sensor off the vehicle in warm and or cold water. **Sensor Resistance Table** for this test.
2. Test the evaporator air temperature sensor by varying the sensor temperature while monitoring the sensor resistance.
3. Compare the readings with the Temperature VS Resistance table and verify that the resistance is within 5 percent of the specification.
 - If not within the specified range, replace the sensor.

Repair Instructions

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

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

DTC P0532 OR P0533: AIR CONDITIONING (A/C) REFRIGERANT PRESSURE SENSOR

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 the diagnostic category.

DTC Descriptors

DTC P0532

Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit

DTC P0533

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5-Volt Reference	P0532	P0532	-	-
A/C Refrigerant Pressure Sensor Signal	P0532	P0532	P0533	-
Low Reference	-	P0533	-	-

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

- The ECM detects that the A/C pressure is less than 1 psi (0.01 volt) sets DTC P0532.
- The ECM detects that the A/C pressure is more than 428 psi (4.92 volts) sets DTC P0533.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The history DTC will clear after 40 consecutive ignition cycles have occurred without a malfunction.

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

Diagnostic Aids

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

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - COUPE AND WAGON

Description and Operation

Automatic HVAC Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Ignition ON, observe the scan tool A/C Pressure Sensor parameter. The reading should be between 0.1 volts (1 psi) and 4.90 volts (425 psi) and change with A/C refrigerant pressure changes.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the A/C refrigerant pressure sensor.
2. Ignition OFF, test for less than 10 ohms 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 volts (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 3A fused jumper wire between the signal circuit terminal 3 and the 5-volt reference circuit terminal 2. Verify the scan tool A/C High Side Pressure Sensor parameter is greater than 4.90 volts (425 psi).
 - If less than the specified range, test the signal circuit for short to ground or an open/high resistance. If the circuit tests normal, replace the ECM.
- 6. If all circuits test normal, test or replace the A/C refrigerant pressure sensor.

Repair Instructions

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

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

DTC P0645, P0646, OR P0647: AIR CONDITIONING (A/C) CLUTCH RELAY

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 P0645

Air Conditioning (A/C) Clutch Relay Control Circuit

DTC P0646

Air Conditioning (A/C) Clutch Relay Control Circuit Low Voltage

DTC P0647

Air Conditioning (A/C) Clutch Relay Control Circuit High Voltage

Diagnostic Fault Information

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

A/C Relay Coil Ignition	2	2	-	-
A/C Relay Switch B+	2	2	-	-
A/C Relay Control	P0645, P0646	P0645, P0647	P0645, P0647	-
A/C Clutch Control	2	2	1	-
A/C Compressor Clutch Ground	-	2	2	-
1. A/C Clutch Always Engaged 2. A/C Clutch Inoperative				

Circuit/System Description

When the A/C switch is pressed, the HVAC control assembly sends a serial data message to the engine control module (ECM) for an A/C request. This input will request the ECM to ground the A/C compressor clutch relay control circuit, which will switch the A/C CLTCH relay. With the relay contacts closed, battery voltage is supplied to the A/C compressor clutch assembly.

Conditions for Running the DTC

- The ignition voltage is between 9 and 18 volts.
- The engine speed is more than 600 RPM.
- An A/C request is made.

Conditions for Setting the DTC

- A short to ground on the A/C compressor clutch relay control circuit.
- A short to voltage on the A/C compressor clutch relay control circuit.
- An open circuit on the A/C compressor clutch relay control circuit or relay.
- An internally shorted or excessively low resistance A/C clutch relay coil.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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Automatic HVAC Description and Operation

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the A/C relay.
2. Ignition ON, verify that a test lamp does not illuminate between the control circuit terminal 86 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 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 ignition circuit fuse is open, test all components connected to the ignition circuit and replace as necessary.
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, replace the A/C clutch relay.
5. Disconnect the harness connector at the A/C clutch coil.
6. Test for less than 1 ohm between the ground circuit terminal 2 and ground.
 - If greater than the specified range, test the ground circuit for an open/high resistance.
7. Connect the harness connector at the A/C clutch coil.
8. Connect a 10-amp fused jumper wire between the B+ circuit terminal 30 and control circuit terminal 87. Verify the A/C clutch is activated.
 - If the A/C clutch does not activate, test the control circuit for an open/high resistance. If the circuit tests normal, test or replace the A/C clutch.
9. Connect a test lamp between the 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 clutch relay.

Component Testing

1. Ignition OFF, disconnect the A/C COMP relay.
2. Test for 60-180 ohms between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - If not the specified value, replace the relay.
4. Install a 30-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2 ohms between terminals 30 and 87.
 - If greater than the specified range, replace the relay.

Repair Instructions

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

- **Air Conditioning Compressor Replacement (LSA) , Air Conditioning Compressor Replacement (LFW LFX)**
- **Relay Replacement (Within an Electrical Center) , Relay Replacement (Attached to Wire Harness)**
- **Control Module References** for HVAC control module and ECM replacement, setup, and programming

SYMPTOMS - HVAC SYSTEMS - AUTOMATIC

IMPORTANT: The following steps must be completed before using the symptom tables:

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **Automatic HVAC 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.
- Verify that the customer is using the correct key to enable personalization and is not inadvertently activating auxiliary HVAC controls.
- The A/C compressor will not operate in cold outside air temperatures.
- The following conditions may cause window fogging:
 - Wet carpet or mats
 - High humidity
 - Interior water leak
 - Blocked A/C evaporator drain tube
 - Maximum passenger capacity
 - Blocked body pressure relief valves
- Inspect the air distribution system for causes of reduced air flow:
 - Obstructed or dirty passenger compartment air filter, if equipped
 - Blocked or damaged air inlet or outlet vents

Intermittent

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

Symptom List

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

- **Air Conditioning Compressor Malfunction**
- **Blower Motor Malfunction**
- **Air Temperature Malfunction**

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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
A/C Relay Coil Ignition	2	2	-	-

A/C Relay Switch B+	2	2	-	-
A/C Relay Control	P0645, P0646	P0645, P0647	P0645, P0647	-
A/C Clutch Control	2	2	1	-
A/C Compressor Clutch Ground	-	2	2	-
1. A/C Clutch Always Engaged 2. A/C Clutch Inoperative				

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 engine control module (ECM) to ground the A/C compressor clutch relay control circuit, which will switch the A/C CMPRSR CLUTCH relay on. 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 greater than 600 RPM
- Engine speed is less than 4,760 RPM
- A/C high side pressure is between 2929-269 kPa (39-425 psi) **Air Conditioning (A/C) System Performance Test**
- 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
- The ambient temperature is above 1°C (34°F)

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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Description and Operation

Automatic HVAC Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

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

Component Testing

1. Ignition OFF, disconnect the A/C COMP relay.
2. Test for 60-180 ohms between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - If not the specified value, replace the relay.
4. Install a 30-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 2 ohms between terminals 30 and 87.
 - If greater than the specified range, replace the relay.

Repair Instructions

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

- **Air Conditioning Compressor Replacement (LSA) , Air Conditioning Compressor Replacement (LFW LFX)**
- **Relay Replacement (Within an Electrical Center) , Relay Replacement (Attached to Wire Harness)**
- **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

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Blower Motor Control Module B+	1	1	-	-
Blower Motor B+	1	1	-	-
Blower Motor Speed Control	2	1	1	-
Blower Motor Control	2	1	1	-
Ground	-	1	-	-
1. Blower Motor Inoperative 2. Blower Motor Always On				

Circuit/System Description

The blower motor control module 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 module to operate. The HVAC control module provides a 0-1.0V variable voltage to the blower motor control module to request the selected blower speed. The blower motor control module provides a pulse width modulation (PWM) signal to the blower motor in order to control the blower motor speed. The module supplies 12 volts to the blower motor through the blower motor voltage supply circuit.

Diagnostic Aids

Prior to motor replacement connect a direct independent B+ and ground to verify operation.

Inspect the motor shaft for rust or other foreign material which may prohibit proper motor operation.

If the motor operates properly please reinstall it, check for PIs or TSBs, and refer to Testing for Intermittent Conditions and Poor Connections in the Electrical Information Reference section of this document.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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Automatic HVAC Description and Operation

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the X2 harness connector at the blower motor control module.
2. Test for less than 1.0 ohm between the ground circuit 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 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 BLWR 40-amp) in the underhood fuse block is open, test all components connected to the B+ circuit and replace as necessary.
4. Connect a DMM between the control circuit terminal 3 and ground.
5. Cycle the blower motor from OFF to HIGH. The voltage should increase from 0 V to 1.0V while changing between the commanded states.
 - If voltage remains greater than 1.5 volts while changing between the commanded states, test the control circuit for a short to voltage. If the circuit test normal, replace the HVAC control module.
 - If voltage is between 0-1.5 volts and does not increase when changing between the commanded states, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the HVAC control module.
6. Ignition OFF, reconnect the X2 harness connector at the blower motor control module. Disconnect the harness connector at the blower motor.
7. Ignition ON, 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 blower motor control module.
8. Connect a test lamp between the control circuit terminal B and the B+ circuit terminal A.
9. Turn the blower motor on high speed then to low speed. The test lamp intensity should be bright when in high speed and very dim or off when the blower is on low speed.
 - If the test lamp intensity does not vary, test the control circuit for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the blower motor control module.
10. If all circuits test normal, test or replace the blower motor.

Component Testing

Blower Motor

1. Ignition OFF, disconnect the harness at the blower motor.
2. Install a 40-amp fused jumper wire between circuit terminal A and 12 volts. Install a jumper wire between the low reference circuit terminal B and ground. Verify the blower motor activates.
 - If the blower motor does not activate, replace the blower motor.

Repair Instructions

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

- **Blower Motor Replacement (Left Hand Drive)** , **Blower Motor Replacement (Right Hand Drive)**
- **Control Module References** for blower motor control module and HVAC control module replacement, setup, and programming

AIR TEMPERATURE 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

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ambient Air Temperature Sensor Signal	B0158 03	B0158 03	B0158 07	1
Inside Air Temperature Sensor Signal	B0163 06	B0163 06	B0163 06	1
Left Sunload Sensor Signal	B0183 06	B0183 06	B0183 06	1
Right Sunload Sensor Signal	B0188 06	B0188 06	B0188 06	1
Evaporator Temperature Sensor Signal	B3933 06	B3933 06	B3933 06	1
Low Reference	-	B3933 06, B0158 03, B0163 06, B0183 06, B0188 06	-	1
Evaporator Temperature Sensor Low Reference	-	B3933 06	-	1
1. Air Temperature Malfunction				

Circuit Description

Evaporator, Inside and Ambient Air Temperature Sensors

The HVAC control module supplies the evaporator, inside and ambient air temperature sensors with a low reference circuit and 5-volt signal circuit. The HVAC control module determines the voltage drop across the sensors. As the air temperature increases, the sensor resistance decreases and the voltage signal decreases. As the air temperature decreases, the sensor resistance increases and the voltage signal increases.

Sunload Sensor Assembly

The sunload sensor is a 2-wire photo diode. Body ground and 5-volt signal circuits enable the sensor to operate. As the sunload increases, the sensor signal decreases. The sensor operates within an intensity range between completely dark and very bright. The sunload sensor provides the HVAC control module with a measurement of the amount of light shining on the vehicle. Bright or high intensity light causes the vehicles interior temperature to increase. The HVAC system compensates for the increased temperature by diverting additional cool air into the vehicle.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, cover the sunload sensor assembly with a shop towel or other suitable item. Verify the scan tool Right Sunload Sensor and Left Sunload Sensor parameters are within 3 counts of each other.
 - If not within the specified range, refer to Sunload Sensor Circuit Malfunction.
2. Measure actual outside air temperature using a thermometer. Compare this value to the scan tool Outside Air Temp. Raw parameter. The measured temperature should be within 5 degrees of parameter.
 - If not within the specified range, refer to Evaporator and Ambient Air Temperature Sensor Circuit Malfunction.
3. Measure actual inside air temperature using a thermometer. Compare this value to the scan tool Inside Air Temp. parameter. The measured temperature should be within 5 degrees of parameter.
 - If not within the specified range, refer to Inside Air Temperature Sensor Circuit Malfunction.
4. Measure actual evaporator air temperature using a thermometer. Compare this value to the scan tool A/C Evap. Temperature Sensor parameter. The measured temperature should be within 5 degrees of the parameter.
 - If not within the specified range, refer to Evaporator and Ambient Air Temperature Sensor Circuit Malfunction.

Circuit/System Testing

IMPORTANT: If any of the air temperature sensors or sunload sensors have an out of range condition caused by a short to voltage, short to ground, or an open/high

resistance a diagnostic trouble code (DTC) will set. The following tests describe conditions that can cause inaccurate information to be processed in the HVAC control module and also operate between the minimum and maximum operating range without setting a DTC.

Evaporator and Ambient Air Temperature Sensor Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the appropriate temperature sensor.
2. Ignition OFF, test for less than 10 ohms between the low reference circuit terminal listed below and ground.
 - Ambient air temperature sensor terminal B.
 - Evaporator temperature sensor terminal 2.
 - If greater than the specified range, test the low reference circuit for high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the low reference circuit terminal and the signal circuit terminal listed below.
 - Ambient air temperature sensor terminal A and B.
 - Evaporator temperature sensor terminal 1 and 2.
 - If less than the specified range, test the signal circuit for high resistance. If the circuit tests normal, replace the HVAC control module.
4. If all circuits test normal, test or replace the appropriate temperature sensor.

Sunload Sensor Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the sunload sensor.
2. Ignition OFF, test for less than 10 ohms between the low reference circuit terminal C and ground.
 - If greater than the specified range, test the ground circuit for high resistance.
3. Ignition ON, test for 4.8-5.2 volts between the low reference circuit terminal C and the appropriate signal circuit terminal listed below.
 - Left sunload sensor circuit terminal A.
 - Right sunload sensor circuit terminal B.
 - If less than the specified range, test the signal circuit for a high resistance. If the circuit tests normal, replace the HVAC control module.
4. If all circuits test normal, test or replace the sunload sensor.

Inside Air Temperature Sensor Circuit Malfunction

1. Ignition OFF, disconnect the harness connector at the inside air temperature sensor.
2. Ignition OFF, test for less than 10 ohms between the low reference circuit terminal 2 and ground.
 - If greater than the specified range, test the low reference circuit for high resistance. If the circuit tests normal, replace the HVAC control module.
3. Ignition ON, test for 4.8-5.2 volts between the low reference circuit terminal 2 and the signal circuit

terminal 1.

- If less than the specified range, test the signal circuit for a high resistance. If the circuit tests normal, replace the HVAC control module.
4. If all circuits test normal, test or replace the inside air temperature sensor.

Component Testing

1. A thermometer can be used to test the sensor off the vehicle in warm and or cold water. Refer to **Sensor Resistance Table** for this test.
2. Test the appropriate temperature sensor by varying the sensor temperature in water while monitoring the sensor resistance.
3. Compare the readings with the Temperature VS Resistance table and verify that the resistance is within 5 percent of the specification.
 - If not within the specified range, replace the sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- **Ambient Air Temperature Sensor Replacement**
- **Inside Air Temperature Sensor Replacement (Left Hand Drive), Inside Air Temperature Sensor Replacement (Right Hand Drive)**
- **Evaporator Air Temperature Sensor Replacement**
- **Headlamp Automatic Control Ambient Light Sensor Replacement**
- **Control Module References** for HVAC control module replacement, setup and programming

AFTERBLOW ENABLING

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.

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

1. Connect the Scan Tool.
2. Turn ON the ignition.
3. Select HVAC Control Module.
4. Select Module Setup.
5. Select Afterblow Option.

After the HVAC control module has been programmed for afterblow, the following conditions must be met for afterblow to operate:

- The engine has been turned off for at least 30 minutes.

- The ambient air temperature is at least 21°C (70°F).
- The A/C compressor operated for more than 2 minutes.
- The system voltage is at least 12 volts.

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

1. The blower motor will run for 20 seconds.
2. The blower motor will be off for 10 minutes.
3. The blower motor will run for and additional 20 seconds.
4. The blower motor will be off for 10 minutes.
5. The blower motor will run for and additional 20 seconds.

REPAIR INSTRUCTIONS

HVAC CONTROL MODULE REPLACEMENT

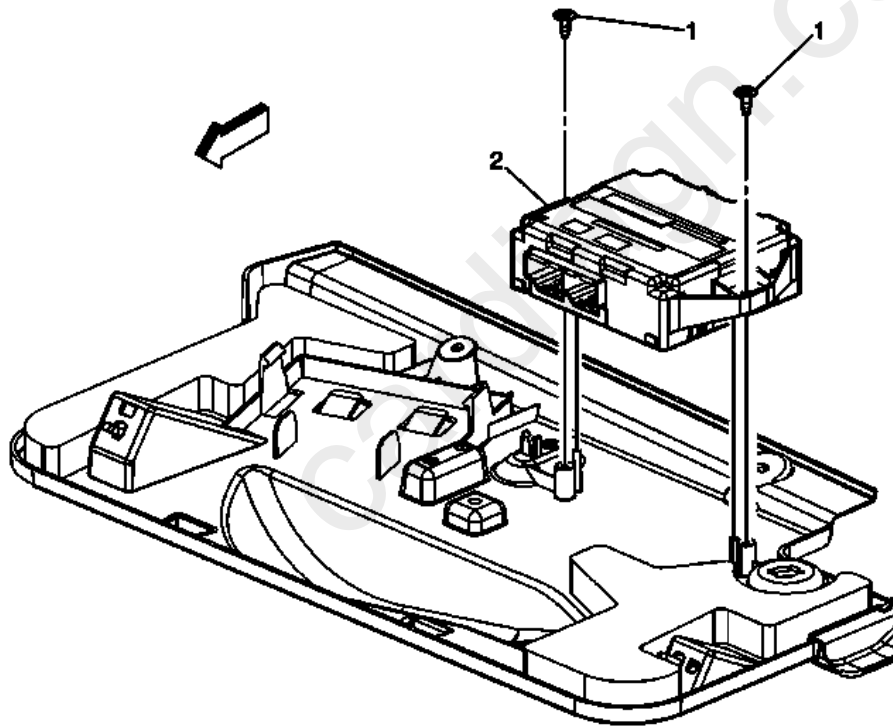


Fig. 7: HVAC Control Module
 Courtesy of GENERAL MOTORS COMPANY

HVAC Control Module Replacement

Callout	Component Name
Preliminary Procedure	

1. Remove the right sound insulator. Refer to **Instrument Panel Insulator Replacement - Right Side (Right Hand Drive)** , **Instrument Panel Insulator Replacement - Right Side (Left Hand Drive)** .
2. Remove the electrical connectors from the HVAC control module.

1	HVAC Control Module Screw (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 2 N.m (18 lb in)
2	HVAC Control Module

AIR INLET VALVE ACTUATOR REPLACEMENT (LEFT HAND DRIVE)

Removal Procedure

1. Remove the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Left Hand Drive)** .

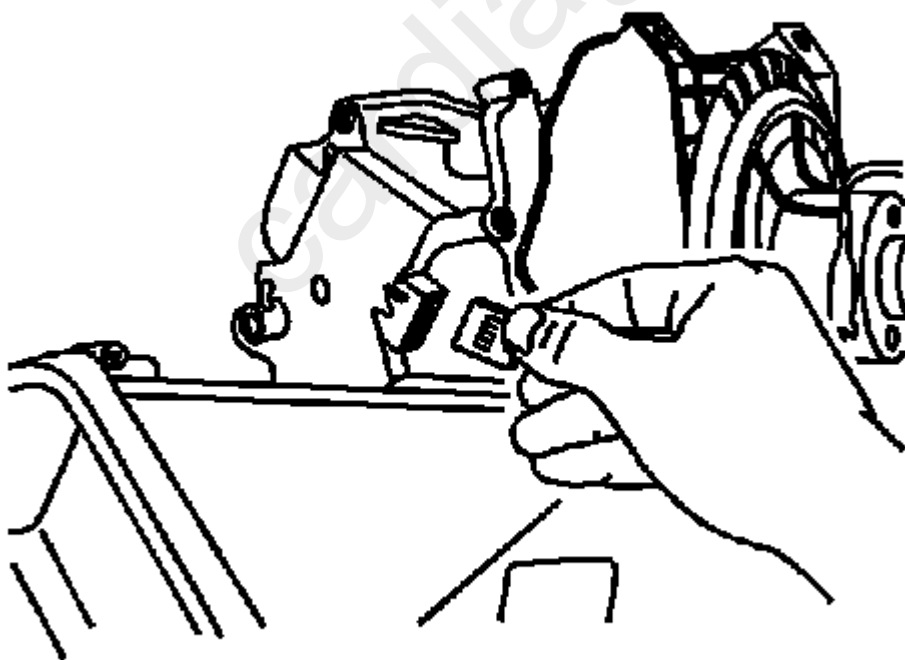


Fig. 8: View Of Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the electrical connector from the recirculation actuator.

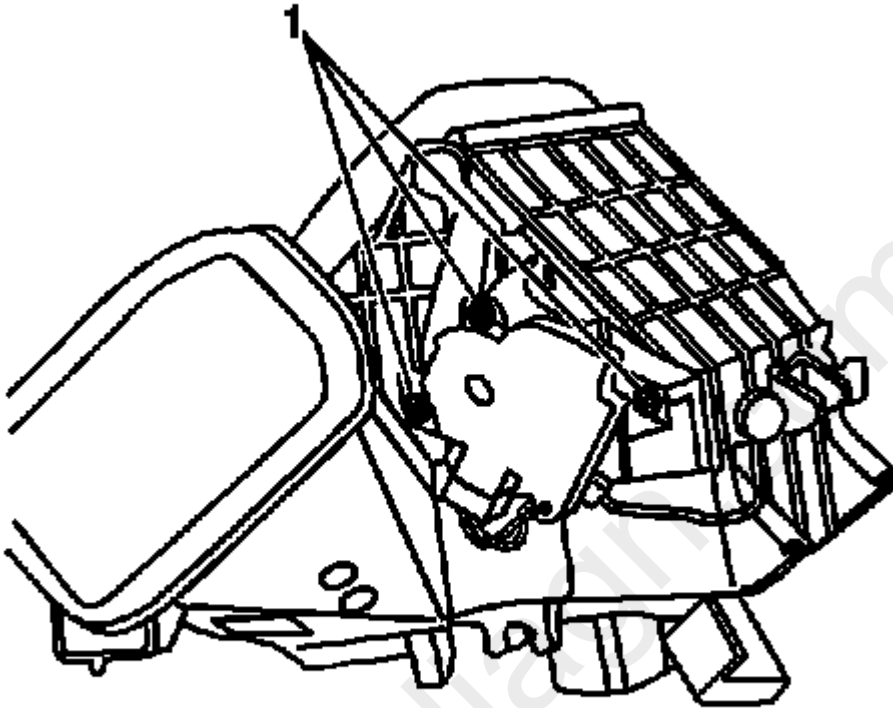


Fig. 9: Identifying Recirculation Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

3. Remove the recirculation actuator screws (1).
4. Remove the recirculation actuator.

Installation Procedure

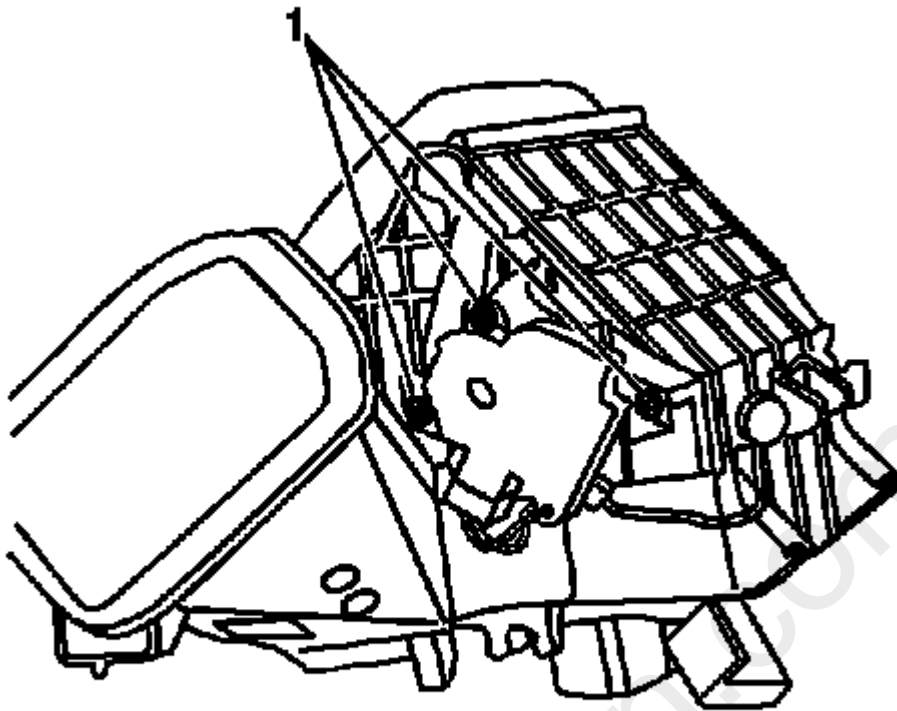


Fig. 10: Identifying Recirculation Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

1. Install the recirculation actuator.

CAUTION: Refer to Fastener Caution .

2. Install the recirculation actuator screws (1) and tighten to 1 N.m (9 lb in).

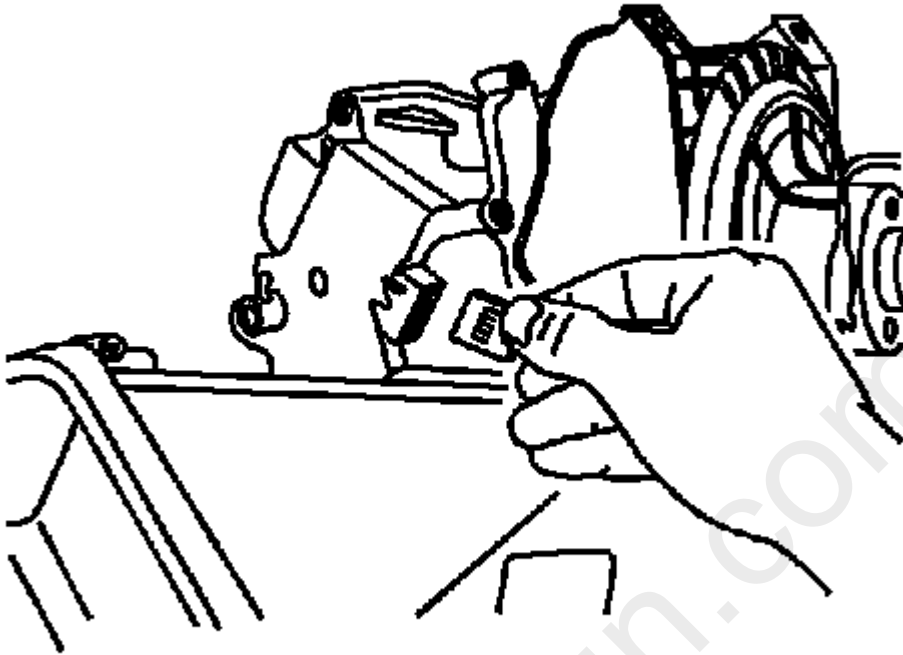


Fig. 11: View Of Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

3. Connect the electrical connector to the recirculation actuator.
4. Install the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Left Hand Drive)** .

AIR INLET VALVE ACTUATOR REPLACEMENT (RIGHT HAND DRIVE)

Removal Procedure

1. Remove the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Right Hand Drive)** .

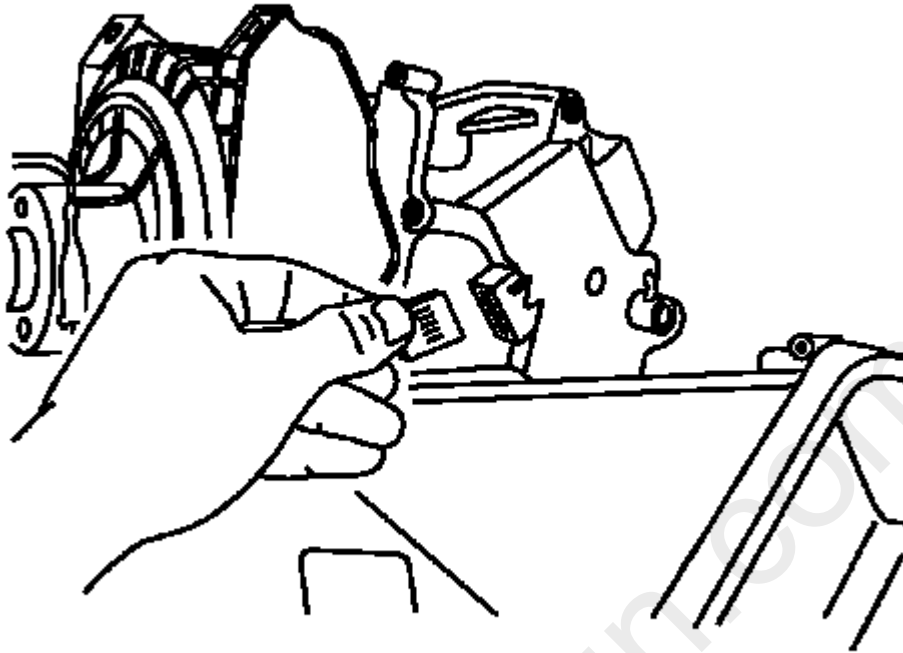


Fig. 12: View Of Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the electrical connector from the recirculation actuator.

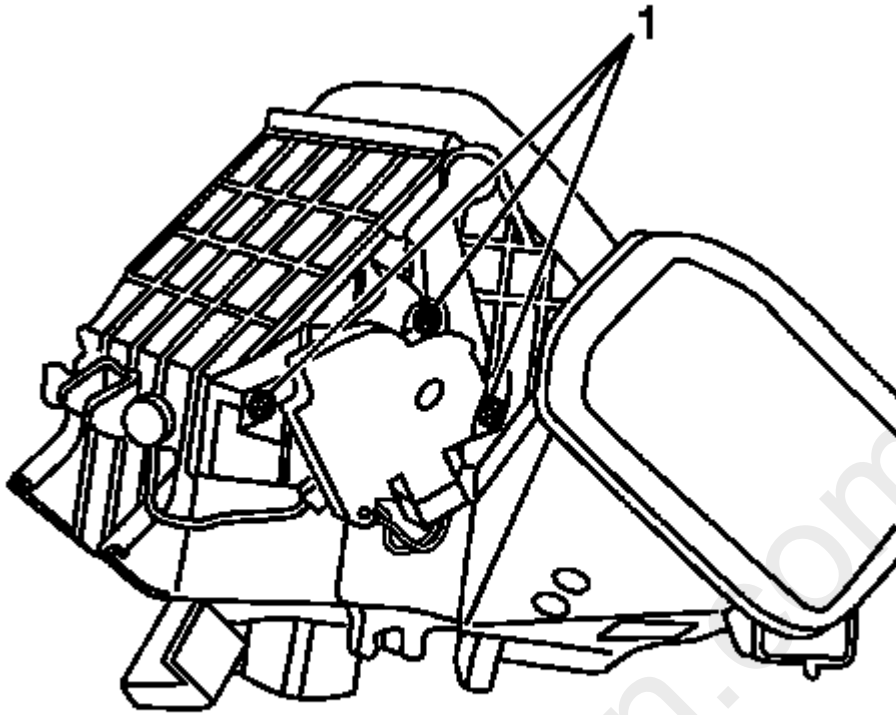


Fig. 13: Identifying Recirculation Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

3. Remove the recirculation actuator screws (1).
4. Remove the recirculation actuator.

Installation Procedure

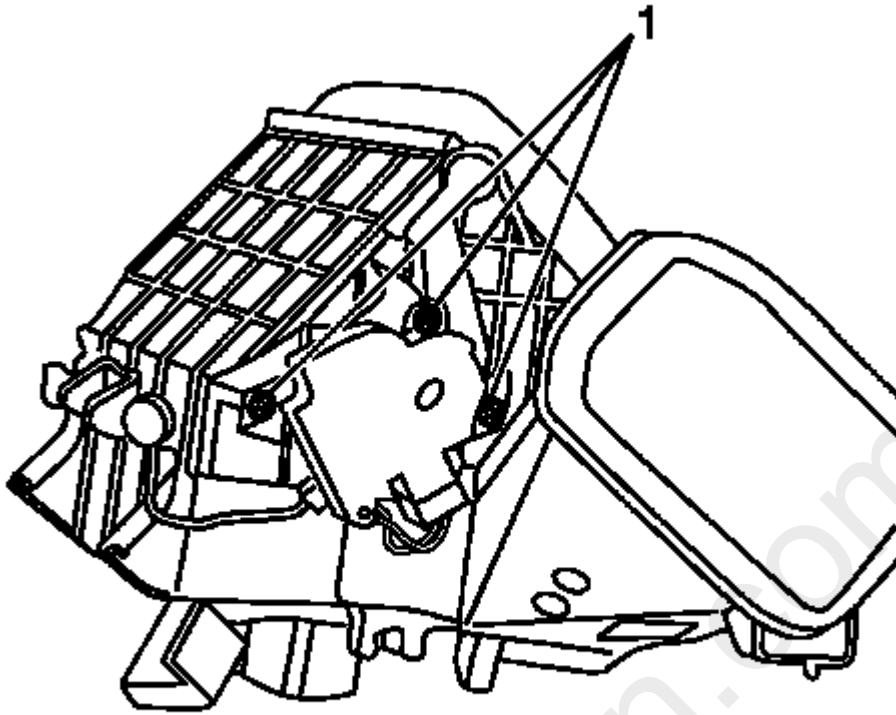


Fig. 14: Identifying Recirculation Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

1. Install the recirculation actuator.

CAUTION: Refer to Fastener Caution .

2. Install the recirculation actuator screws (1) and tighten to 1 N.m (9 lb in).

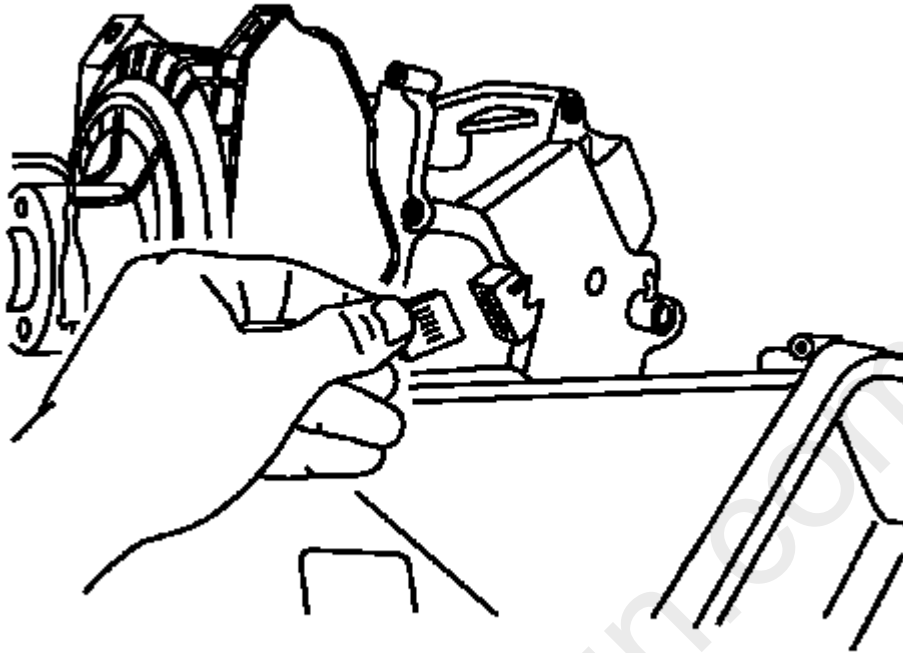


Fig. 15: View Of Recirculation Actuator Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

3. Connect the electrical connector to the recirculation actuator.
4. Install the air inlet assembly. Refer to **Air Inlet Assembly Replacement (Right Hand Drive)** .

MODE VALVE ACTUATOR REPLACEMENT

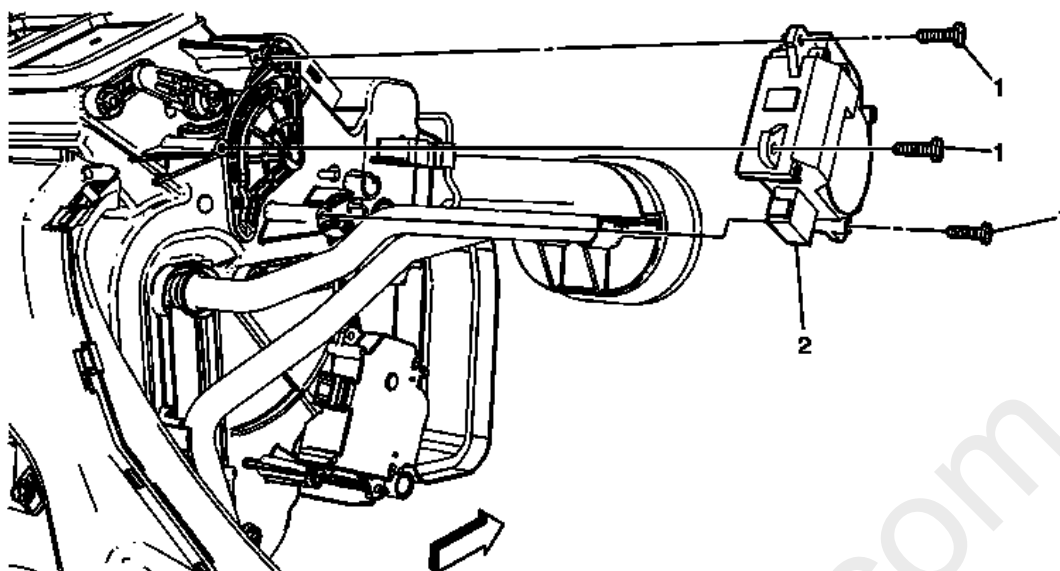


Fig. 16: Identifying Mode Valve Actuator
 Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Replacement

Callout	Component Name
Preliminary Procedure Remove the instrument panel carrier assembly. Refer to <u>Instrument Panel Carrier Replacement (Left Hand Drive)</u> , <u>Instrument Panel Carrier Replacement (Right Hand Drive)</u> .	
1	Mode Actuator Screw (Qty: 3) CAUTION: <u>Fastener Caution</u> . Tighten 2 N.m (18 lb in)
2	Mode Actuator Procedure Ensure all mode actuator cam and linkage is in proper position upon installation.

TEMPERATURE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE

Removal Procedure

1. Remove the I/P Compartment. Refer to **Instrument Panel Compartment Replacement (Right Hand**

Drive) , Instrument Panel Compartment Replacement (Left Hand Drive) .

2. Remove the blower motor control module. Refer to Blower Motor Control Module Replacement .

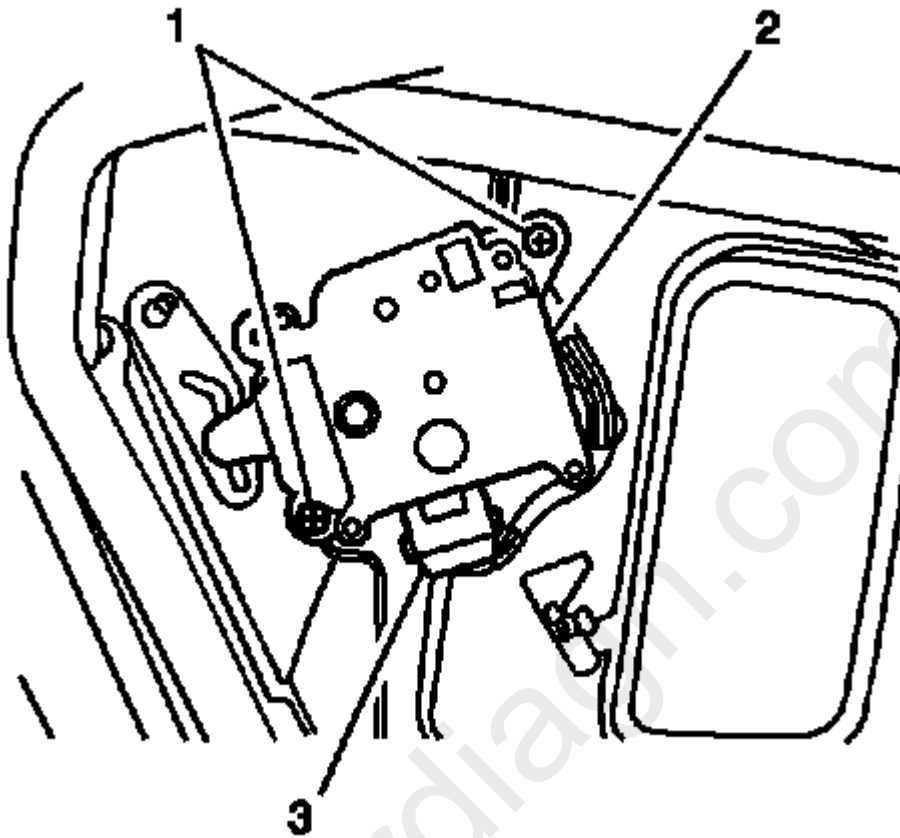


Fig. 17: Identifying Right Air Temperature Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

3. Remove the right air temperature actuator screws (1).

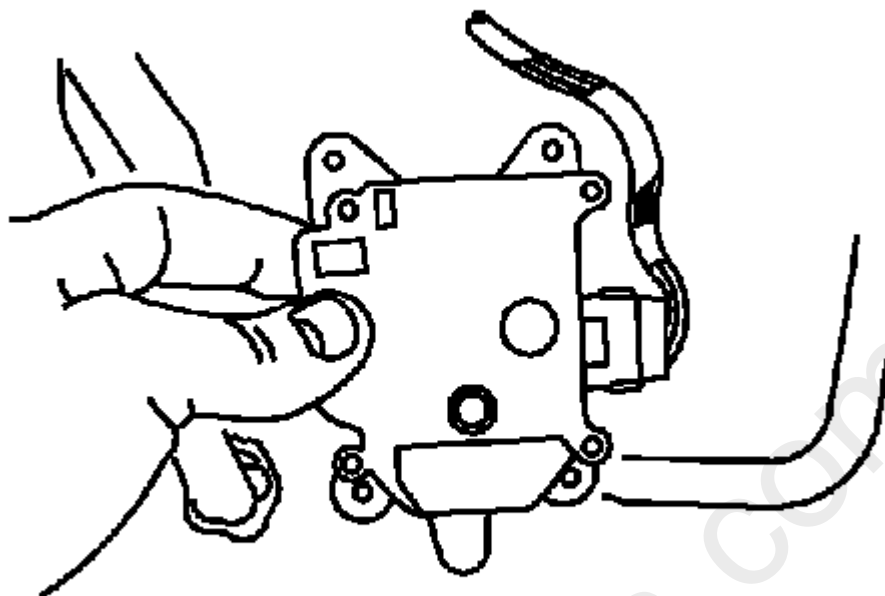


Fig. 18: View Of Right Air Temperature Actuator
Courtesy of GENERAL MOTORS COMPANY

4. Remove the right air temperature actuator.
5. Disconnect the right air temperature actuator electrical connector.

Installation Procedure

1. Connect the right air temperature actuator electrical connector.

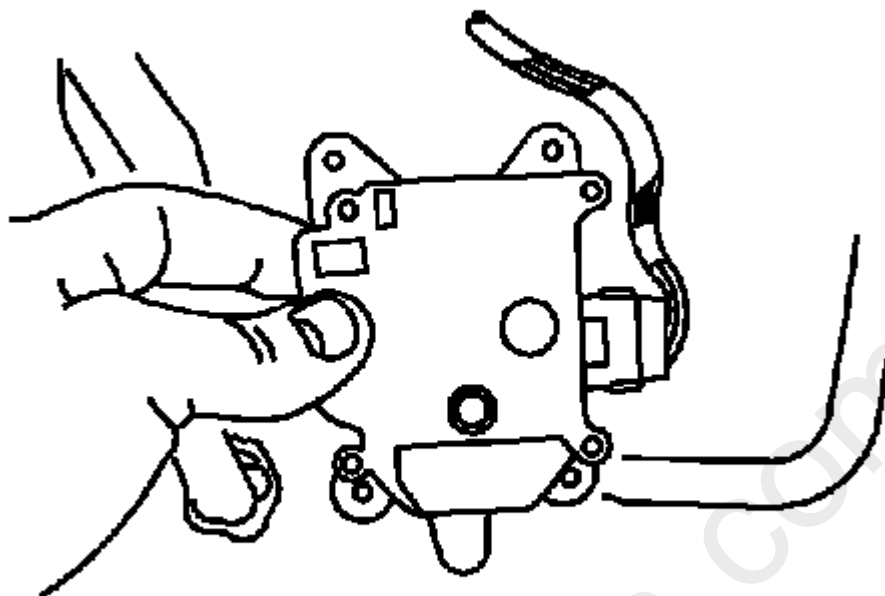


Fig. 19: View Of Right Air Temperature Actuator
Courtesy of GENERAL MOTORS COMPANY

2. Install the right air temperature actuator.

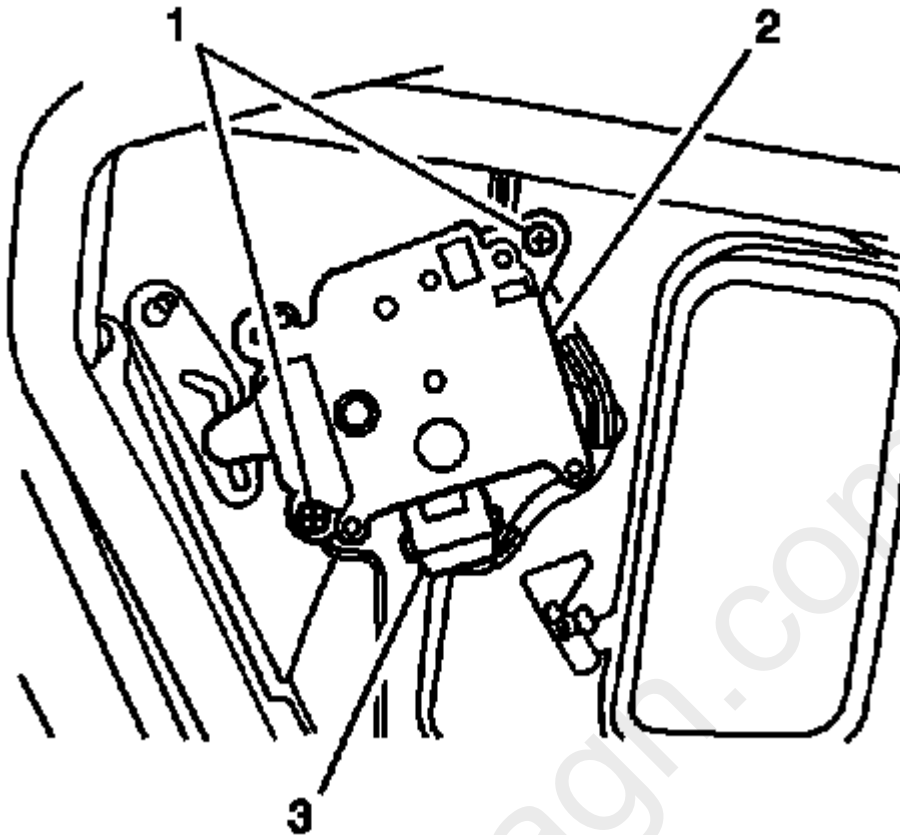


Fig. 20: Identifying Right Air Temperature Actuator Screws
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

3. Install the right air temperature actuator screws (1) and tighten to 1 N.m (9 lb in).
4. Install the blower motor control module. Refer to **Blower Motor Control Module Replacement** .
5. Install the I/P Compartment. Refer to **Instrument Panel Compartment Replacement (Right Hand Drive)** , **Instrument Panel Compartment Replacement (Left Hand Drive)** .

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE

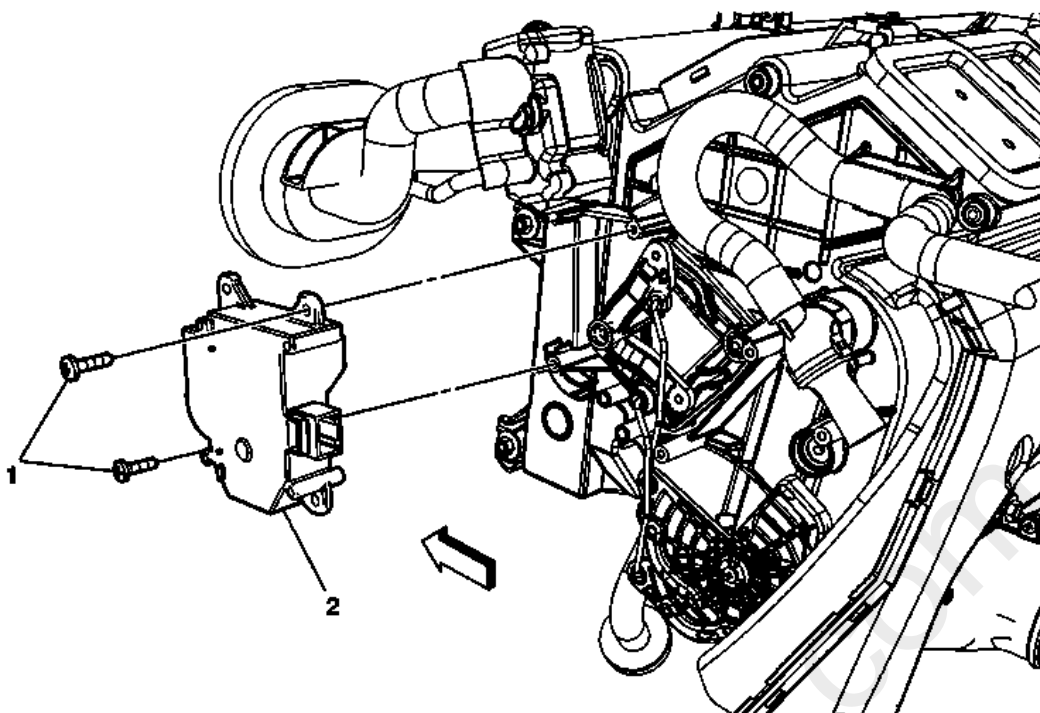


Fig. 21: Air Temperature Actuator - Left Side
 Courtesy of GENERAL MOTORS COMPANY

Temperature Valve Actuator Replacement - Left Side

Callout	Component Name
Preliminary Procedure Remove the left I/P insulator panel. Refer to <u>Instrument Panel Insulator Replacement - Left Side (Right Hand Drive)</u> , <u>Instrument Panel Insulator Replacement - Left Side (Left Hand Drive)</u> .	
1	Left Temperature Screw (Qty 2)
2	Left Temperature Actuator. CAUTION: Refer to <u>Fastener Caution</u> . Procedure Disconnect electrical connector. Tighten 1.5 N.m (13 lb in)

INSIDE AIR TEMPERATURE SENSOR ASPIRATOR REPLACEMENT

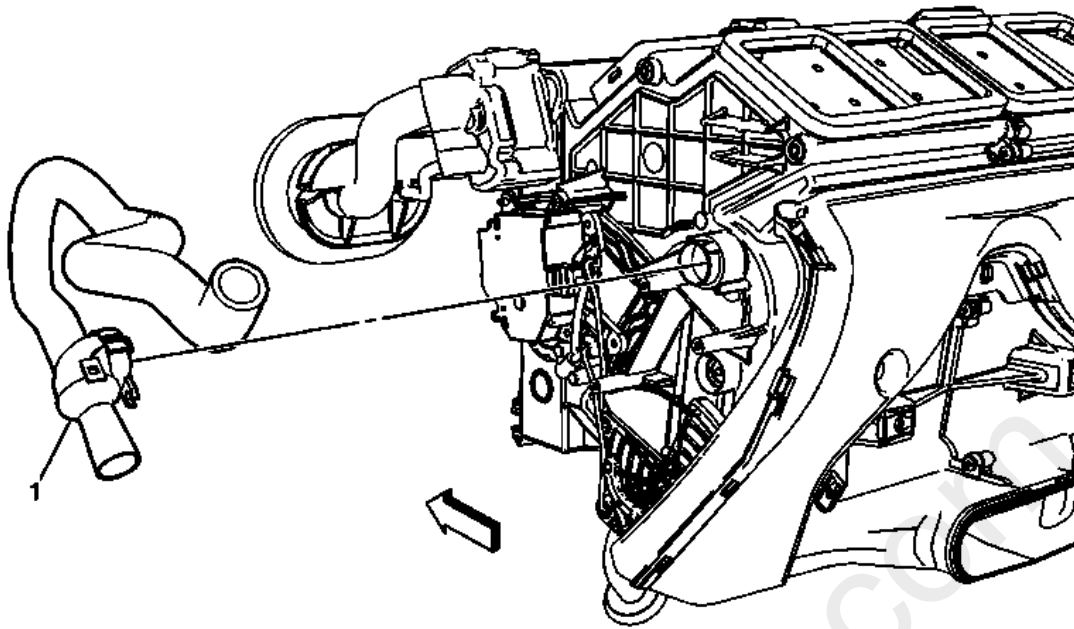


Fig. 22: Identifying Inside Air Temperature Sensor Aspirator
 Courtesy of GENERAL MOTORS COMPANY

Inside Air Temperature Sensor Aspirator Replacement

Callout	Component Name
Preliminary Procedure	
Remove the drivers knee bolster bracket. Refer to <u>Driver Knee Bolster Bracket Replacement (Right Hand Drive)</u> , <u>Driver Knee Bolster Bracket Replacement (Left Hand Drive)</u> .	
1	Aspirator Assembly

AMBIENT AIR QUALITY SENSOR REPLACEMENT

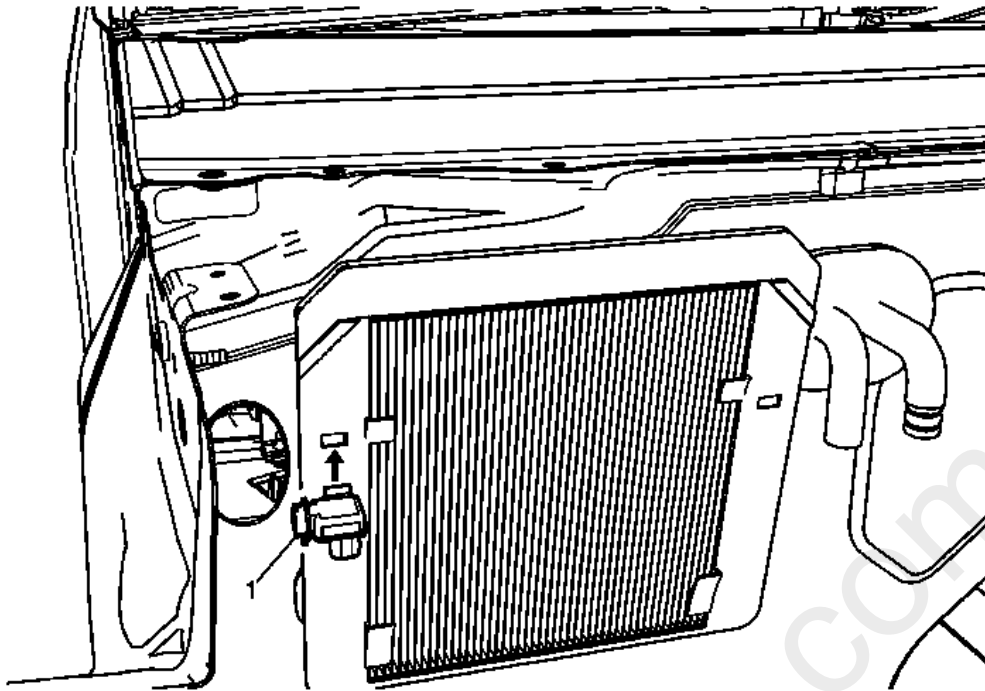


Fig. 23: Ambient Air Quality Sensor
 Courtesy of GENERAL MOTORS COMPANY

Ambient Air Quality Sensor Replacement

Callout	Component Name
Preliminary Procedure	
Remove the air filter housing. Refer to <u>Passenger Compartment Air Filter Housing Replacement</u> .	
1	Ambient Air Quality Sensor Procedures 1. Unsnap the ambient air quality sensor and move it forward. 2. Disconnect the electrical connector.

INSIDE AIR TEMPERATURE SENSOR REPLACEMENT (LEFT HAND DRIVE)

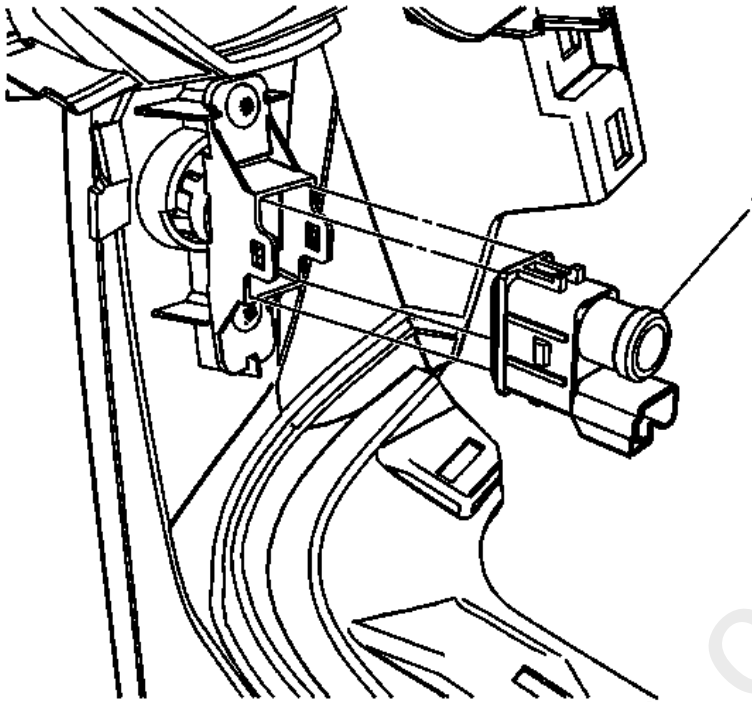


Fig. 24: Identifying Inside Air Temperature Sensor (Left Hand Drive)
 Courtesy of GENERAL MOTORS COMPANY

Inside Air Temperature Sensor Replacement (Left Hand Drive)

Callout	Component Name
Preliminary Procedure	
1. Remove the instrument panel driver knee bolster assembly. Refer to <u>Driver Knee Bolster Replacement (Left Hand Drive)</u> , 2. Disconnect the inside air temperature assembly electrical connection. 3. Disconnect the inside air temperature assembly tube.	
1	Inside Air Temperature Sensor. Procedure Use a flat bladed plastic trim tool in order to release the retaining clips securing the Inside air temperature sensor to the bracket.

INSIDE AIR TEMPERATURE SENSOR REPLACEMENT (RIGHT HAND DRIVE)

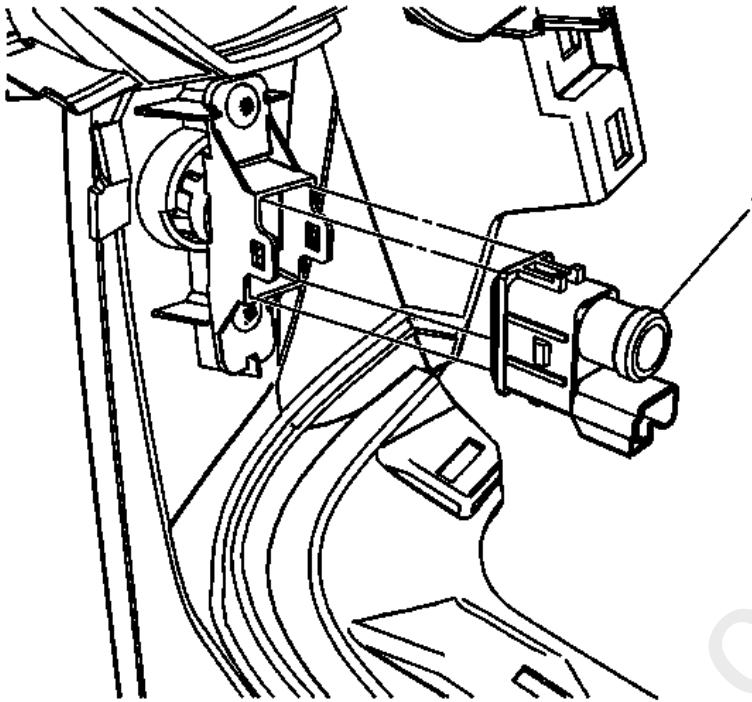


Fig. 25: Identifying Inside Air Temperature Sensor (Right Hand Drive)
 Courtesy of GENERAL MOTORS COMPANY

Inside Air Temperature Sensor Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedure	
1. Remove the insulator panel- left side. Refer to <u>Instrument Panel Insulator Replacement - Left Side (Right Hand Drive)</u> 2. Disconnect the inside air temperature assembly electrical connection. 3. Disconnect the inside air temperature assembly tube.	
1	Inside Air Temperature Sensor. Procedure Use a flat bladed plastic trim tool in order to release the retaining clips securing the Inside air temperature sensor to the bracket.

HEATER AND AIR CONDITIONING CONTROL WIRING HARNESS REPLACEMENT (LEFT HAND DRIVE)

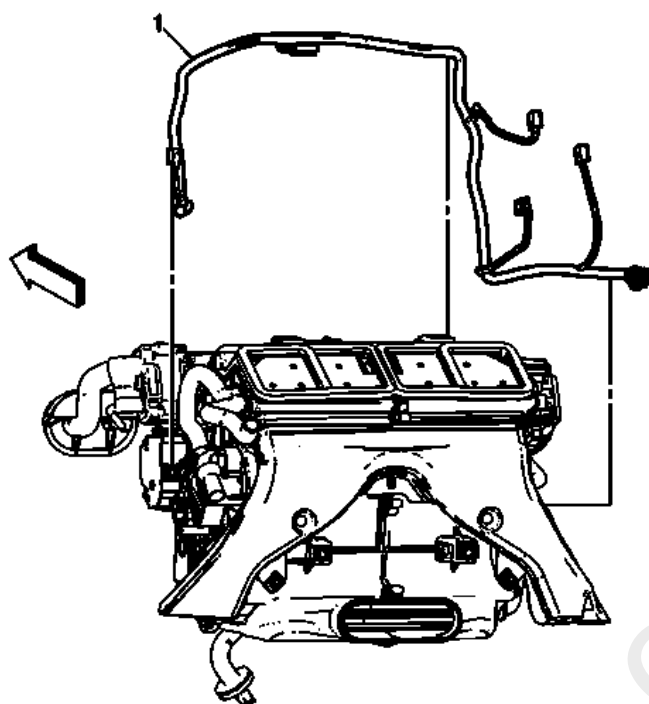


Fig. 26: Heater and Air Conditioning Control Wiring Harness (Left Hand Drive)
 Courtesy of GENERAL MOTORS COMPANY

Heater and Air Conditioning Control Wiring Harness Replacement (Left Hand Drive)

Callout	Component Name
Preliminary Procedure	
1. Remove the HVAC module. Refer to <u>Air Conditioning and Heater Module Assembly Removal and Installation</u> . 2. Disconnect all the electrical connectors from components associated with the heater and A/C control wiring harness. 3. Disconnect the evaporator temperature sensor from the control wiring harness. 4. Remove wiring harness mounting clips from HVAC module.	
1	Heater and A/C Control Wiring Harness.

HEATER AND AIR CONDITIONING CONTROL WIRING HARNESS REPLACEMENT (RIGHT HAND DRIVE)

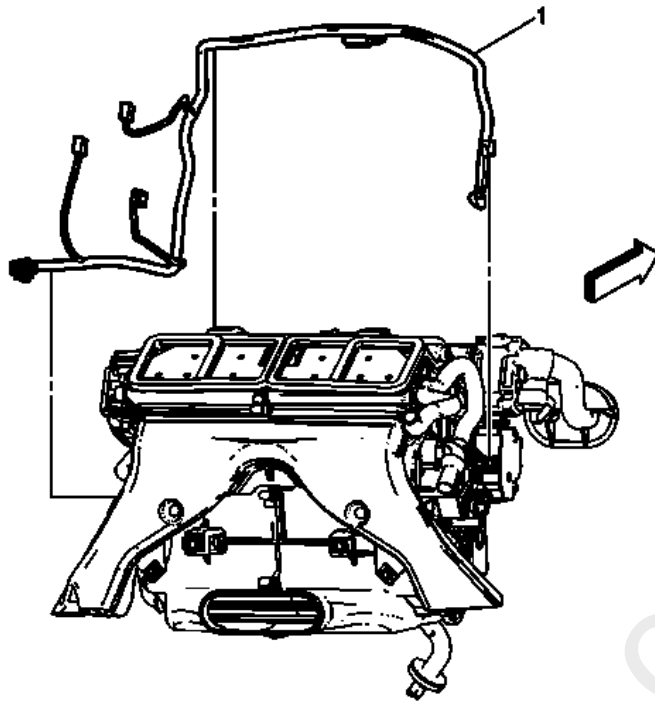


Fig. 27: Identifying Heater & Air Conditioning Control Wiring Harness (Right Hand Drive)
 Courtesy of GENERAL MOTORS COMPANY

Heater and Air Conditioning Control Wiring Harness Replacement (Right Hand Drive)

Callout	Component Name
Preliminary Procedure	
1. Remove the HVAC module. Refer to <u>Air Conditioning and Heater Module Assembly Removal and Installation</u> . 2. Disconnect all the electrical connectors from components associated with the heater and A/C control wiring harness. 3. Disconnect the evaporator temperature sensor from the control wiring harness. 4. Remove wiring harness mounting clips from HVAC module.	
1	Heater and A/C Control Wiring Harness.

BLOWER MOTOR CONTROL MODULE REPLACEMENT

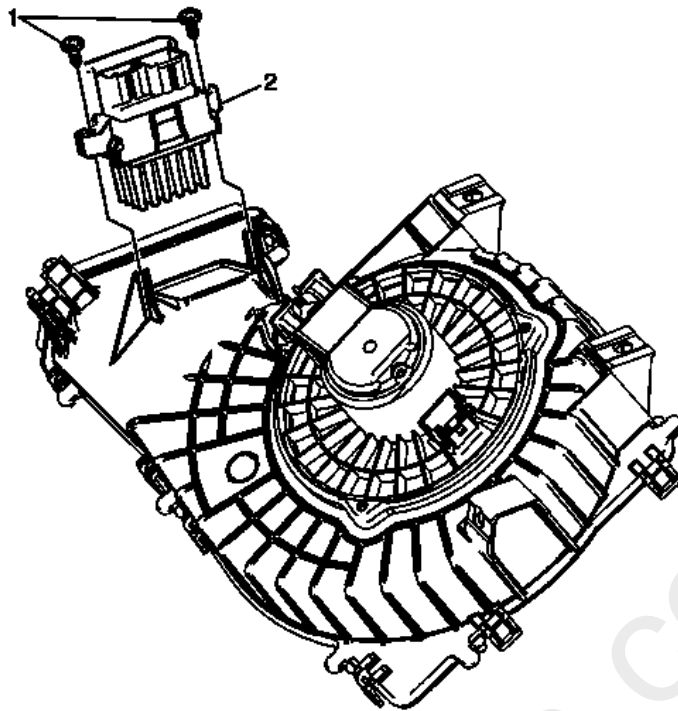


Fig. 28: View Of Blower Motor Control Processor
 Courtesy of GENERAL MOTORS COMPANY

Blower Motor Control Module Replacement

Callout	Component Name
Preliminary Procedures 1. Remove the right sound insulator. Refer to <u>Instrument Panel Insulator Replacement - Right Side (Right Hand Drive)</u> , <u>Instrument Panel Insulator Replacement - Right Side (Left Hand Drive)</u> . 2. Remove the I/P Compartment. Refer to <u>Instrument Panel Compartment Replacement (Right Hand Drive)</u> , <u>Instrument Panel Compartment Replacement (Left Hand Drive)</u> . 3. Remove the electrical connectors from the blower motor control processor.	
1	Blower Motor Control Processor Screw (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> . Tighten 9 N.m (80 lb in)
2	Blower Motor Control Processor

DESCRIPTION AND OPERATION

AUTOMATIC HVAC DESCRIPTION AND 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 air temperature and distribution settings. Operator interface dials and buttons are remote from the HVAC Control Module and are part of the Integrated Center Stack. Button presses are communicated from the Integrated Center Stack to the Radio via a dedicated communication line. The Radio then communicates the information to the HVAC Control Module over GMLAN communications. The battery positive voltage circuit provides power that the control module uses for keep alive memory (KAM). The body control module (BCM), which is the vehicle power mode master, provides a device on signal. The control module supports the following features:

Feature	Availability
Afterblow	Available if reprogrammed by the technician
Purge	Yes
Personalization	No
Actuator Calibration	No

Remote Start

During remote start, full auto mode and the previous set temp will be commanded if ambient air temperature is above 0°C (32°F). Defrost mode will be commanded when the ambient air temperature is below 0°C (32°F) and inside temperature sensor is below 10°C (50°F). When the key is turned ON, the HVAC control module will return to last stored settings.

Air Quality Sensor

The HVAC control module monitors the outside air quality while in AUTO mode via the air quality sensor. You can activate the air quality sensor on your vehicle, if equipped, by pressing the Auto button on the HVAC module. The air quality sensor is a 3-wire sensor, ignition, ground and a control circuit enable the sensor to operate. The sensor outputs a PWM Signal to the HVAC control module with different levels of pollution as detected outside.

Sensor outputs PWM signal between 15% (clean) to 85% (very polluted) to HVAC control module.

When the sensor has detected poor air quality. Then the recirculation actuator is forced to the recirculation position and the recirculation indicator will illuminate.

The following are conditions that will prevent the air quality sensor from controlling the recirculation actuator:

- The HVAC control module is in manual mode.
- Outside air temperature less than 5°C (41°F).
- 60 seconds sensor warm-up time after ignition is turned ON.

- Customer manually selects recirculation or outside air position.

If the HVAC system has detected a short to ground or open in the air quality sensor circuit or if invalid PWM data is output by sensor, a diagnostic trouble code will be set.

Temperature, Recirculation and Mode Actuators

The actuators are 5-wire bi-directional electric motors that incorporate a feedback potentiometer. Low reference, 5-volt reference, position signal, and 2 control circuits enable the actuator to operate. The control circuits use either a 0 or 12-volt value to co-ordinate 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 potentiometers adjustable contact changes the door position signal between 0-5 volts. The HVAC control module uses a range of 0-255 counts to index the actuator position. The door position signal voltage is converted to a 0-255 count range. When the module sets a commanded, or targeted, value, one of the control circuits is grounded. As the actuator shaft rotates the changing position signal is sent to the module. Once the position signal and the commanded value are the same, the module removes power and ground from the control circuits.

Air Temperature Sensors

The air temperature sensors are 2-wire negative temperature co-efficient thermistors. The vehicle uses the following air temperature sensors:

- Ambient
- Inside

A signal and low reference circuit enables the sensor to operate. As the air temperature surrounding the sensor increases, the sensor resistance decreases. The sensor signal decreases as the resistance decreases. The sensor signal varies between 0-5 volts. The HVAC control module converts the signal to a range between 0-255 counts.

The inside temperature sensor operates within a temperature range between -6.5°C and 57.5°C (20.3°C-135.5°F). If the sensor is shorted to ground, voltage, or an open, the system will operate using an estimated default value to allow the system to operate. The ambient sensor operates within a temperature range between -30°C to 51°C (-22 to 123.8°F). If the HVAC control module has determined that the ambient temperature sensor has failed, the radio display will not display the ambient temperature reading. The radio displays the ambient air temperature value that it receives from the HVAC control module through a GMLAN message. The ambient air temperature sensor mounts underhood and can be affected by city traffic, by idling, and by restarting a hot engine. Therefore, the HVAC control module filters the value of the ambient air temperature sensor for temperature display. The outside air temperature reading is always instantly updated if ambient air temperature has decreased. The ambient air temperature value is updated under the following conditions:

Condition	Display
When the A/C and Recirc buttons are pressed simultaneously for about 3 seconds.	Updates Outside air temperature display instantly to actual sensor reading

At start up with the engine off for less than 3 hours.	Displays last stored temperature unless the temperature has decreased.
At start up with the engine off more than 3 hours.	Displays actual sensor ambient temperature reading.
At start up with the ambient temperature reading less is than the last displayed value.	Displays actual sensor ambient temperature reading.
Vehicle speed below 16 km/h (10 mph).	Does not allow display to update to actual sensor reading unless temperature has decreased.
Vehicle speed above 16 km/h (10 mph) for a minimum period.	Updates temperature display at a slow filtered rate.
Vehicle speed above 51 km/h (32 mph) for a minimum period.	Updates temperature display at a medium filtered rate.
When the ambient air temperature decreases while driving.	Updates temperature display rapidly at a faster filtered rate.
When Ambient air temperature sensor/wiring fault or when communication fault between radio and HVAC Control module.	Outside air temperature display remains blank or displays four dashes HVAC uses last known or default value for Outside air temperature for auto control. Outside air temperature is displayed only in IGNITION RUN power Mode.
When HVAC control Module Battery Power is reset or HVAC control Module is programmed or Engine Off information is reset on BCM/ECM.	Displays actual sensor ambient temperature reading.

Sunload Sensor

The sunload sensor is a 2-wire photo diode. The vehicle uses left and right sunload sensors. The 2 sensors are integrated into the sunload sensor assembly along with the ambient light sensor. Low reference and signal circuits enable the sensor to operate. As the sunload increases, the sensor signal decreases. The sensor operates within an intensity range between completely dark and bright. The sensor signal varies between 0-5 volts. The HVAC control module converts the signal to a range between 0-255 counts. The sunload sensor provides the HVAC control module a measurement of the amount of light shining on the vehicle. Bright, or high intensity, light causes the vehicles inside temperature to increase. The HVAC system compensates for the increased temperature by diverting additional cool air into the vehicle. If the sensor is open or shorted, no sunload adjustment occurs.

Evaporator Temperature Sensor

The HVAC control module monitors the temperature of the air passing through the evaporator by the A/C evaporator air temperature sensor. This sensor is located on the evaporator core. The temperature is used to cycle the A/C compressor ON and OFF to prevent the evaporator core from freezing. A thermistor inside the sensor varies its resistance to monitor the evaporator air temperature. The HVAC control module monitors the voltage drop across the thermistor when supplied with a 5-volt reference signal. The HVAC control module will send a GMLAN message to the ECM to stop requesting the A/C compressor clutch operation if the temperature drops below 3°C (37°F). The sensor must be above 4°C (39°F) to request the A/C compressor clutch again.

The sensor operates within a temperature range between -40°C to 215°C (-40 to 355°F). If the HVAC control

module detects an open in the evaporator temperature sensor or circuit, the GMLAN message sent to the ECM will not submit the A/C ON request. The HVAC control module will then send a request to the Radio for display of the SERVICE A/C SYSTEM that will be displayed on the DIC. The HVAC control module will also display A/C OFF on the module as long as the condition is present.

A/C Refrigerant Pressure Sensor

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

The A/C refrigerant pressure sensor prevents the A/C system from operating when an excessively high or low pressure condition exists.

If the ECM detects a failure in the A/C refrigerant pressure sensor or circuit, the GMLAN message sent to the HVAC control module will be invalid. The HVAC control module will then send a request to the radio for display of the SERVICE A/C SYSTEM that will be displayed on the DIC. The HVAC control module will also display A/C OFF on the module as long as the condition is present.

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 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.

OnStar® Blower Control ON/OFF

During OnStar® audio control ON, the HVAC control module receives signals from OnStar® to reduce blower level to a level 4. OnStar® blower control becomes active in auto or manual blower operation. During this OnStar® blower control, if in manual or auto blower, the display will show AUTO for blower display. This blower reduction is to ensure that all incoming and outgoing voice calls will be recognized by the OnStar® module. The driver is allowed to override the OnStar® auto blower level by increasing or decreasing it manually to any desired level. When OnStar® no longer sends the request for blower control the HVAC control module will cancel OnStar® blower control and resume previous blower level if no manual override of the blower was selected.

Blower Motor Control Processor

The blower motor control module 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 module to operate. The HVAC control module provides a variable voltage signal to the blower motor control module to request the selected blower speed. The blower motor control module provides a pulse width modulation (PWM) signal to the blower motor in order to control the blower motor speed. The module supplies 12 volts to the blower motor through the blower motor voltage supply circuit.

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.

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

1. Connect the Scan Tool.
2. Turn ON the ignition.
3. Select HVAC Control Module.
4. Select Module Setup.
5. Select Afterblow Option.

After the HVAC control module has been programmed for afterblow, the following conditions must be met for afterblow to operate:

- The engine has been turned off for at least 30 minutes.
- The ambient air temperature is at least 21°C (70°F).
- The A/C compressor operated for more than 2 minutes before shut down.
- The system voltage is at least 12 volts.

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

1. The blower motor will RUN for 20 seconds.
2. The blower motor will be OFF for 10 minutes.
3. The blower motor will RUN for an additional 20 seconds.

Heating and A/C Operation

The purpose of the heating and A/C system is to provide the following:

- Heated air
- Cooled air
- Remove humidity from the interior of the vehicle
- Reduce windshield fogging

Regardless of the temperature setting, the following can effect the rate that the HVAC system can achieve a desired temperature:

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

- Mode setting

The HVAC control module commands or monitors the following actions when an air temperature setting is selected.

- WARMEST POSITION - The air temperature actuator door position directs maximum air flow through the heater core.
- COLDEST POSITION - The air temperature actuator door position directs maximum air flow around the heater core.

BETWEEN THE WARMEST AND COLDEST POSITION - The following sensors are monitored to direct the appropriate amount of air through the heater core to achieve the desired temperature:

- Sunload
- Ambient temperature
- Inside temperature

The A/C system is engaged by selecting any switch on the HVAC control module except the A/C OFF switch. The A/C switch will illuminate A/C OFF when the A/C switch is selected. The control module sends a A/C request message to the engine control module (ECM) for A/C compressor clutch operation. The following conditions must be met in order for the ECM to turn on the compressor clutch:

- HVAC control module
 - Evaporator Temperature more than 4°C (39°F).
 - Control module operating range 9 and 16 volts.
- ECM
 - Engine coolant temperature (ECT) is less than 125°C (257°F).
 - Engine RPM is between 0 RPM and 6000 RPM.
 - A/C pressure is between 3137 kPa (455 psi) or 2850 kPa (413 psi).

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

- Throttle position is 100 percent.
- A/C pressure is more than 3137 kPa (455 psi).
- A/C pressure is less than 193 kPa (28 psi).
- Engine coolant temperature (ECT) is more than 125°C (257°F).
- Engine speed is more than 5,500 RPM.
- Transmission shift
- ECM detects excessive torque load.
- ECM detects insufficient idle quality.
- ECM detects a hard launch condition.

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

voltage spike.

Dual Zone Operation

The HVAC control module has temperature settings for the driver and the passenger. If the passengers setting is turned off then the drivers setting controls both driver and passenger temperature actuators. The passengers setting can not be used without the drivers setting also being ON. The passengers setting can be turned ON or OFF by using passengers temperature switch. When the passengers setting is ON, the passenger temperature can be adjusted independently from the drivers setting and the passenger temperature is displayed on the passengers side of the control module. A different sunload on one side of the vehicle may cause different discharge air temperatures even when the passengers setting is not turned ON.

Air Distribution

The HVAC control module controls the mode actuator in order to distribute airflow to a desired outlet. The mode switch provides the vehicle operator with the ability to override the automatic setting. When the mode door is moved to the defrost position, the A/C compressor clutch engages and the recirculation actuator will be moved to the outside air position. In the outside air position, the incoming air is filtered by the passenger compartment air filter.

The HVAC system allows air to the outboard panel outlets in all air distribution modes. This allows air to be circulated higher in the cabin under any operating condition. The panel outlets have three operating positions, open, side window defogger and closed. To eliminate air from these outlets, the individual outlet thumb wheel must be turned to the OFF or side window defogger position.

Recirculation

The HVAC control module controls the air intake through the recirculation actuator. Recirculation is not available when the mode is in defrost. When the mode is in defog, Recirculation will only be available for 10 minutes. In the outside air position, the incoming air is filtered by the passenger compartment air filter.

Automatic Operation

In automatic operation, the HVAC control module will maintain the comfort level inside of the vehicle by controlling the A/C compressor clutch, the blower motor, the air temperature actuators, mode actuator and recirculation.

To place the HVAC system in automatic mode, the following is required:

- The blower motor switch must be in the AUTO position.
- The air temperature switch must be in any other position other than 60 or 90 degrees.
- The mode switch must be in the AUTO position.

Once the desired temperature is reached, the blower motor, mode, recirculation and temperature actuators will automatically adjust to maintain the temperature selected. The HVAC control module performs the following functions to maintain the desired air temperature:

- Regulate blower motor speed
- Position the air temperature actuator
- Position the mode actuator
- Position the recirculation actuator
- Request A/C operation

When the warmest position is selected in automatic operation the blower speed will increase gradually until the vehicle reaches normal operating temperature. When normal operating temperature is reached the blower will stay on high speed and the air temperature actuators will stay in the full heat position.

When the coldest position is selected in automatic operation the blower will stay on high and the air temperature actuators will stay in the full cold position. The mode actuator will remain in the panel position and the recirculation actuator will remain in the recirculation position.

In cold temperatures, the automatic HVAC system will provide heat in the most efficient manner. The vehicle operator can select an extreme temperature setting but the system will not warm the vehicle any faster. In warm temperatures, the automatic HVAC system will also provide air conditioning in the most efficient manner. Selecting an extreme cool temperature will not cool the vehicle any faster.

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. The outside air temperature (OAT) sensor on automatic systems, is utilized to determine the moding of the following features: Blower Mode, Bi-level, Floor, Defrost, Recirc and Rear Defrost. When the remote start active serial data is received, ignition-OFF loop HVAC algorithms will act the same as if a run power mode was received, i.e. re-calibration, afterblow, ignition-OFF motor positioning etc. The OFF timer and the ignition ON timer have the functionality as in the Run mode.

During remote start, full auto mode and the previous set temperature will be commanded if the ambient air temperature is above 0°C (32°F).

Defrost mode will be commanded when the ambient air temperature is below 0°C (32°F) and the inside air temperature sensor is below 10°C (50°F).

Rear defrost will be commanded ON when the ambient temperature is below 9°C (48°F).

When the key is turned ON, the HVAC control module will return to the last stored settings.

If the inside air temperature is below 12°C (54°F) OR if the ambient temperature is below 9°C (48°F), the heated seat will be commanded to high.

When the key is turned ON, heated seat remote start control is turned OFF.

Remote Start De-activation

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

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 39200 Tech 2

