

HVAC

HVAC - Automatic - CTS Sedan

SCHEMATIC WIRING DIAGRAMS

HVAC WIRING SCHEMATICS

Power, Ground, Serial Data, Blower Motor and Controls

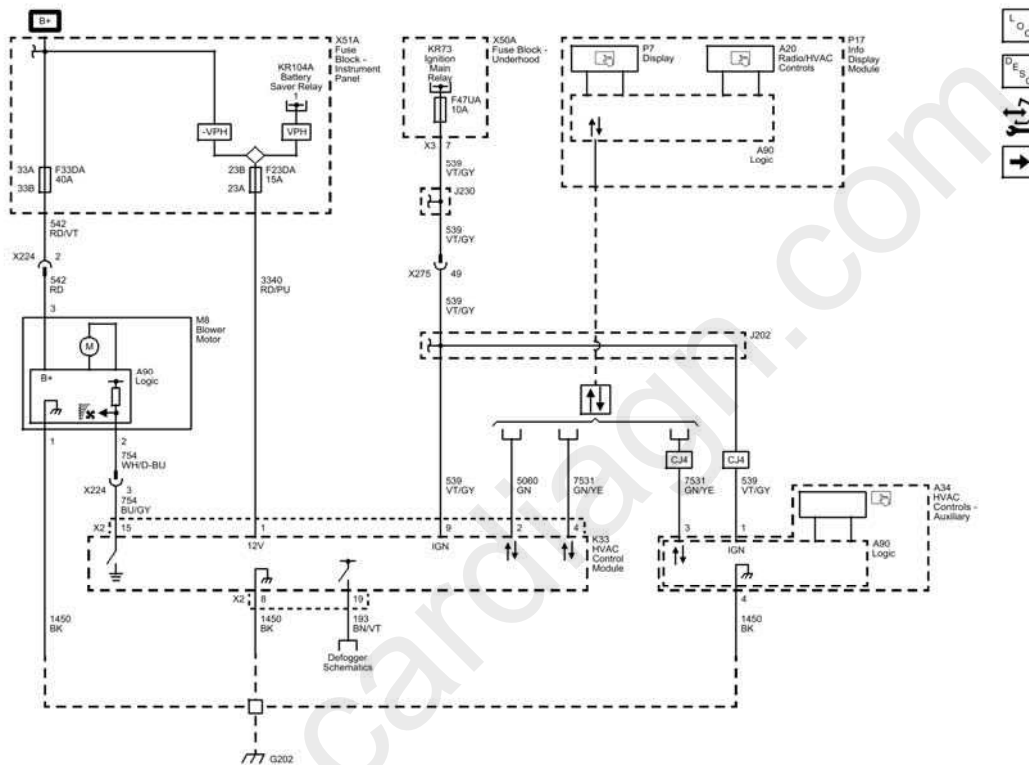


Fig. 1: Power, Ground, Serial Data, Blower Motor and Controls
Courtesy of GENERAL MOTORS COMPANY

A/C Compressor Controls

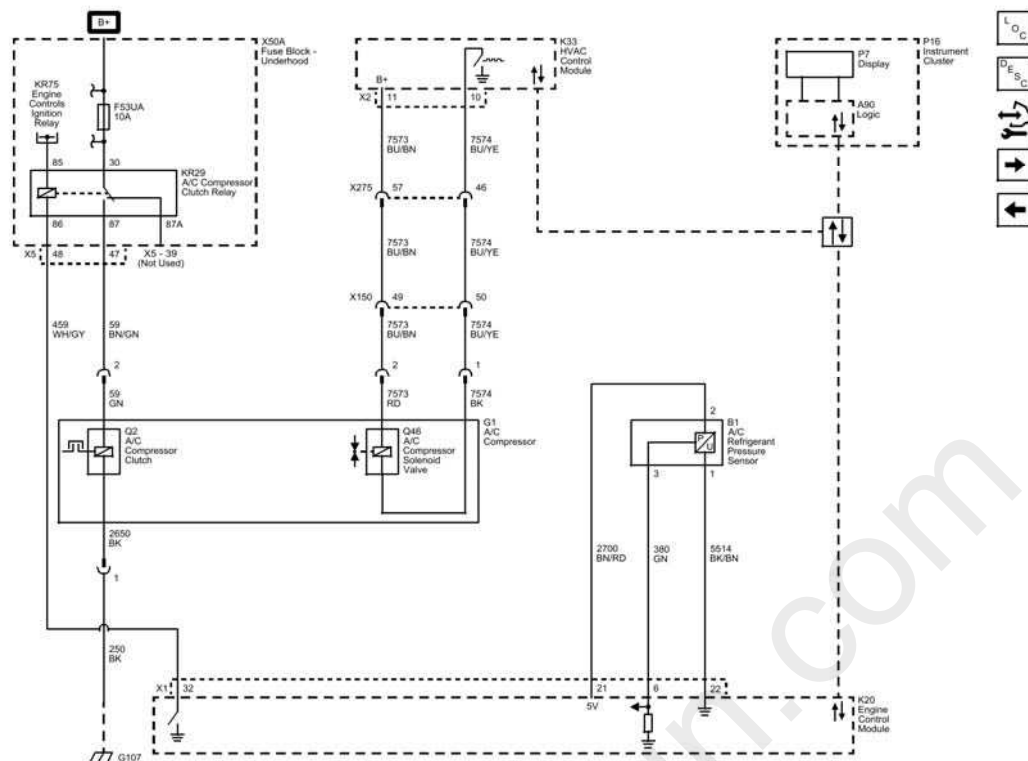


Fig. 2: A/C Compressor Controls
 Courtesy of GENERAL MOTORS COMPANY

Mode and Temperature Actuators

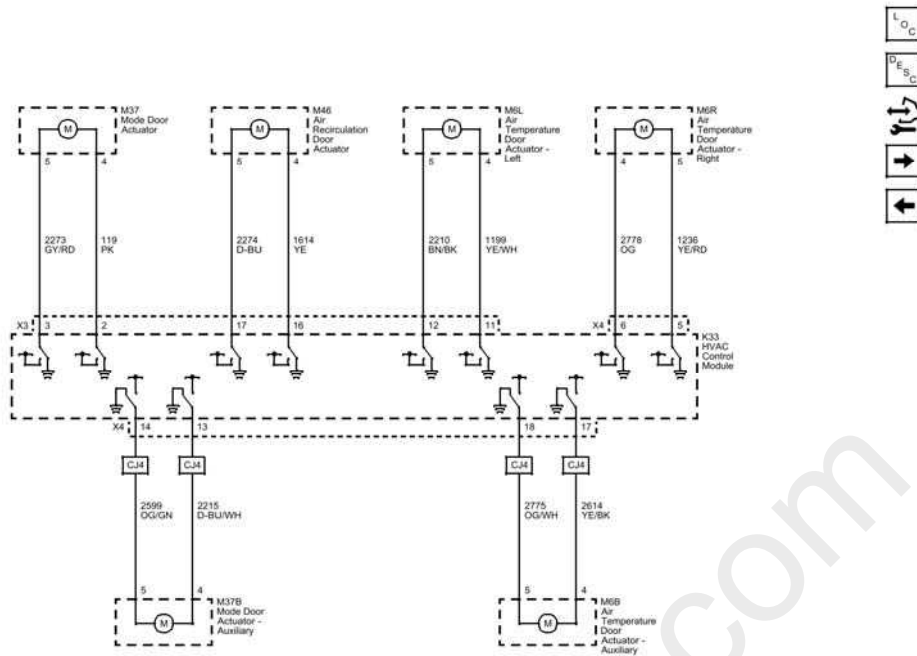


Fig. 3: Mode and Temperature Actuators
Courtesy of GENERAL MOTORS COMPANY

Actuator Position and Front Temperature Sensors

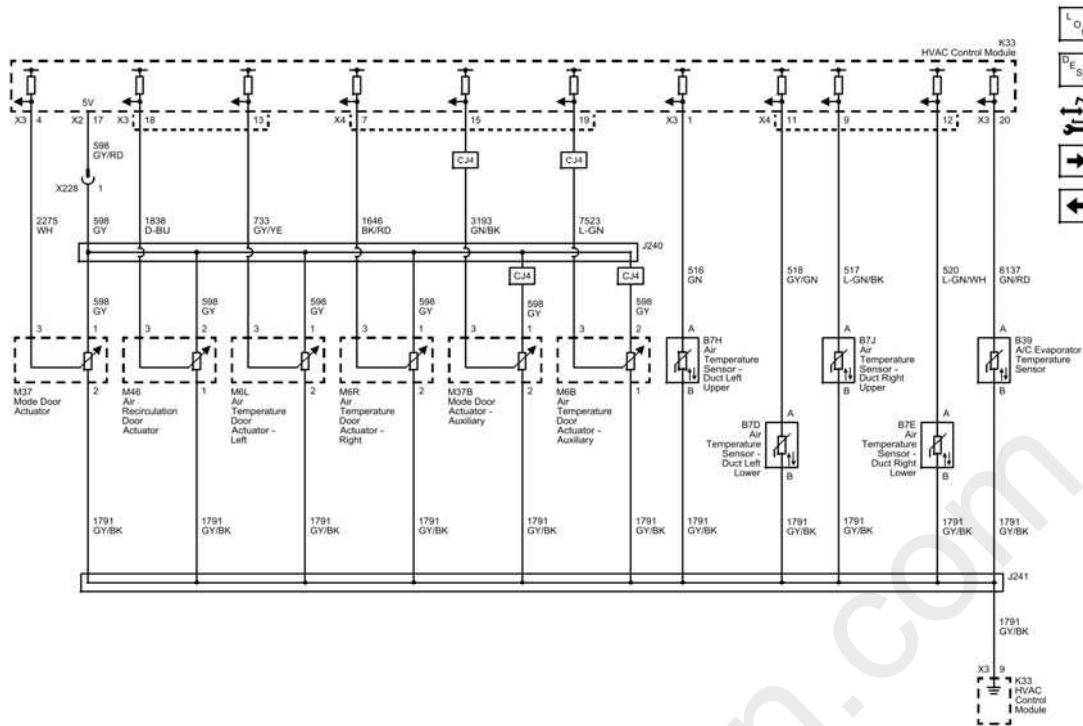


Fig. 4: Actuator Position and Front Temperature Sensors
Courtesy of GENERAL MOTORS COMPANY

Ambient Light/Sunload and Rear Temperature Sensors

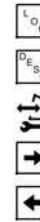
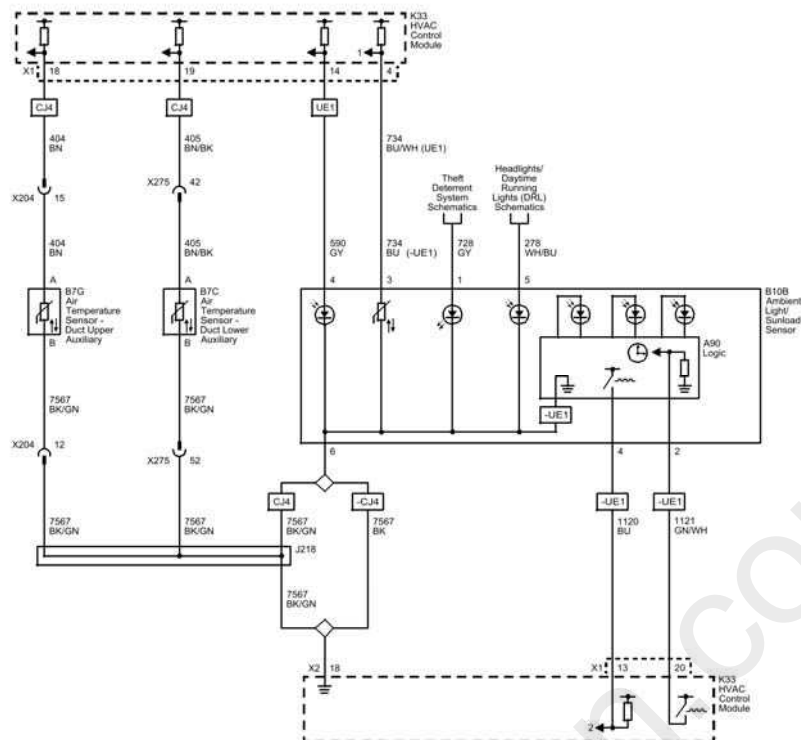


Fig. 5: Ambient Light/Sunload and Rear Temperature Sensors
Courtesy of GENERAL MOTORS COMPANY

Air Quality and Windshield Sensors

Scan Tool Name	Component Code / Schematic Name	Service Name	Repair Instruction Name
Passenger Compartment Humidity, Passenger Compartment Humidity Sensor Temperature, Windshield Temperature	B160 Windshield Temperature and Inside Moisture Sensor	Humidity/Windshield Temperature Sensor	<u>Inside Air Moisture and Windshield Temperature Sensor Replacement</u>
Air Recirculation Door	M46 Air Recirculation Door Actuator	Air Recirculation Door	<u>Air Inlet Valve Actuator Replacement (Fresh Air)</u>
Right Temperature Door	M6R Air Temperature Door Actuator - Right	Right Air Temperature Actuator	<u>Temperature Valve Actuator Replacement - Right Side</u>

Left Temperature Door	M6L Air Temperature Door Actuator - Left	Left Air Temperature Actuator	<u>Temperature Valve Actuator Replacement - Left Side (CJ4), Temperature Valve Actuator Replacement - Left Side (CJ2)</u>
Mode Door	M37 Mode Door Actuator	Mode Door Actuator	<u>Mode Valve Actuator Replacement (CJ4), Mode Valve Actuator Replacement (CJ2)</u>
Auxiliary Mode Door	M37B Mode Door Actuator - Auxiliary	Auxiliary Mode Door	<u>Mode Valve Actuator Replacement - Console (Left Side)</u>
Auxiliary Temperature Door	M6B Air Temperature Door Actuator - Auxiliary	Auxiliary Temperature Door	<u>Auxiliary Temperature Valve Actuator Replacement (CJ4)</u>
Upper Left Duct Air Temperature Sensor	B7H Air Temperature Sensor Duct - Left Upper	Duct Air Temperature Sensor-Upper Left	<u>Duct Air Temperature Sensor Replacement - Upper Left Side</u>
Lower Left Duct Air Temperature Sensor	B7D Air Temperature Sensor Duct - Left Lower	Duct Air Temperature Sensor-Lower Left	<u>Duct Air Temperature Sensor Replacement - Lower Left Side</u>
Upper Right Duct Air Temperature Sensor	B7J Air Temperature Sensor Duct - Right Upper	Duct Air Temperature Sensor-Upper Right	<u>Duct Air Temperature Sensor Replacement - Upper Right Side</u>
Lower Right Duct Air Temperature Sensor	B7E Air Temperature Sensor Duct - Right Lower	Duct Air Temperature Sensor-Lower Right	<u>Duct Air Temperature Sensor Replacement - Lower Right Side</u>
Upper Auxiliary Air Temperature Sensor	B7G Air Temperature Sensor Duct - Upper Auxiliary	Upper Auxiliary Air Temperature Sensor	<u>Duct Air Temperature Sensor Replacement - Upper (Front Floor Console CJ4)</u>
Lower Auxiliary Air Temperature Sensor	B7C Air Temperature Sensor Duct - Lower Auxiliary	Lower Auxiliary Air Temperature Sensor	<u>Duct Air Temperature Sensor Replacement - Lower (Right Floor Rear Air Outlet Duct)</u>
A/C Evaporator Temperature Sensor	B39 A/C Evaporator Temperature Sensor	Evaporator Temperature Sensor	<u>Evaporator Air Temperature Sensor Replacement</u>
Passenger Compartment Air Temperature Sensor	B10B Ambient Light/Sunload Sensor	Inside Air Temperature, Ambient Light and Sun Load Sensor	<u>Sun Load Temperature Sensor Replacement</u>
Air Quality Sensor	B108 Air Quality Sensor	Air Quality Sensor	<u>Ambient Air Quality Sensor Replacement</u>
			<u>Blower Motor</u>

Blower Motor	M8 Blower Motor	Blower Motor	<u>Replacement</u>
A/C High Side Pressure Sensor	B1 A/C Refrigerant Pressure Sensor	A/C Refrigerant Pressure Sensor	<u>Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement</u>
A/C Compressor Clutch	Q2 A/C Compressor Clutch	A/C Compressor Clutch	<u>Air Conditioning Clutch Assembly Replacement</u>
A/C Compressor Solenoid Valve	Q46 A/C Compressor Solenoid Valve	A/C Compressor Solenoid Valve	<u>Air Conditioning Compressor Replacement (LTG) , Air Conditioning Compressor Replacement (LFX) , Air Conditioning Compressor Replacement (LF3)</u>
Radio/HVAC Controls	A20 Radio/HVAC Controls	Radio/HVAC Controls	<u>Radio Control Assembly Replacement</u>
Auxiliary HVAC Controls	A34 HVAC Controls - Auxiliary	Auxiliary HVAC Controls	<u>Auxiliary Heater and Air Conditioning Control Replacement (CJ4)</u>
Remote Heater and Air Conditioning Control Module	K33 HVAC Control Module	HVAC Control Module	<u>Heater and Air Conditioning Remote Control Replacement</u>

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC B0163 (UE1)</u>	DTC B0163 Passenger Compartment Temperature Sensor Circuit
<u>DTC B0163, B0183, or B1405 (Without UE1)</u>	DTC B0163 Passenger Compartment Temperature Sensor Circuit DTC B0183 Solar Load Sensor Circuit DTC B1405 Control Module Voltage Reference Output 2 Circuit
<u>DTC B0173, B0178, B0509, B0514, B0519, B3583, or B3933</u>	DTC B0173 02 Upper Left Duct Air Temperature Sensor Circuit Short to Ground DTC B0173 05 Upper Left Duct Air Temperature Sensor Circuit High Voltage/Open DTC B0178 02 Lower Left Duct Air Temperature Sensor Circuit Short to Ground DTC B0178 05 Lower Left Duct Air Temperature Sensor Circuit High Voltage/Open DTC B0509 02 Upper Right Duct Air Temperature Sensor Circuit Short to Ground

	DTC B0509 05 Upper Right Duct Air Temperature Sensor Circuit High Voltage/Open DTC B0514 02 Lower Right Duct Air Temperature Sensor Circuit Short to Ground DTC B0514 05 Lower Right Duct Air Temperature Sensor Circuit High Voltage/Open DTC B0519 02 Rear Upper Duct Air Temperature Sensor Circuit Short to Ground DTC B0519 05 Rear Upper Duct Air Temperature Sensor Circuit High Voltage/Open DTC B3583 02 Rear Lower Duct Air Temperature Sensor Circuit Short to Ground DTC B3583 05 Rear Lower Duct Air Temperature Sensor Circuit High Voltage/Open DTC B3933 02 Air Conditioning Evaporator Temperature Sensor Circuit Short to Ground DTC B3933 05 Air Conditioning Evaporator Temperature Sensor Circuit High Voltage/Open
<u>DTC B018A, B048C, B048F, or B1395</u>	DTC B018A Windshield Temperature Sensor Circuit DTC B048C Humidity Sensor Humidity Circuit DTC B048F Humidity Sensor Temperature Circuit DTC B1395 Control Module Voltage Reference Output Circuit
<u>DTC B0183 (UE1)</u>	DTC B0183 Solar Load Sensor Circuit
<u>DTC B0193</u>	DTC B0193 01 Front Blower Motor Speed Circuit Short to Battery DTC B0193 06 Front Blower Motor Speed Circuit Low Voltage/Open
<u>DTC B0223, B0228, B0233, B0408, B0413, B0418, B0423, B1395, or B374A</u>	DTC B0223 Recirculation Control Circuit DTC B0228 Recirculation Position Feedback Circuit DTC B0233 Air Flow Control Circuit DTC B0408 Main Temperature Control Circuit DTC B0413 Main Temperature Position Feedback Circuit DTC B0418 Right Temperature Control Circuit DTC B0423 Right Temperature Position Feedback Circuit DTC B0428 Rear Temperature Control Circuit DTC B0433 Rear Temperature Position Feedback Circuit DTC B1395 Control Module Voltage Reference Output Circuit DTC B3531 Rear Air Flow Control Circuit DTC B374A Air Flow Control Position Feedback Circuit DTC B3782 Rear Air Flow Position Feedback Circuit
<u>DTC B3843</u>	DTC B3843 02 Air Quality Sensor Circuit Short to Ground DTC B3843 05 Air Quality Sensor Circuit High Voltage/Open DTC B3843 08 Air Quality Sensor Circuit Performance - Signal Invalid
<u>DTC B393B</u>	DTC B393B Air Conditioning Compressor Valve Control Circuit
<u>DTC P0532 or P0533</u>	DTC P0532 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit Low Voltage DTC P0533 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit High Voltage
<u>DTC P0645, P0646, or</u>	DTC P0645 Air Conditioning (A/C) Compressor Clutch Relay Control

P0647	Circuit
	DTC P0646 Air Conditioning (A/C) Compressor Clutch Relay Control Circuit Low Voltage
	DTC P0647 Air Conditioning (A/C) Compressor Clutch Relay Control Circuit High Voltage

DTC B0163 (UE1): PASSENGER COMPARTMENT TEMPERATURE SENSOR CIRCUIT

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 B0163

Passenger Compartment Temperature Sensor Circuit

For symptom byte information, refer to **Symptom Byte List**.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B0163 02	B0163 05	B0163 05	-
Low Reference	-	B0163 05, B0183 05	-	-

Circuit/System Description

The ambient light/sunload sensor integrates the sunload sensor and passenger compartment temperature sensor into a single assembly.

The solar sensor is connected to a low reference and a 5 V biased (pull up) signal circuit voltage from the HVAC control module. As the sunload increases, the sensor signal voltage decreases. The signal varies between 0.1 - 4.9 V and is provided to the HVAC control module.

The passenger compartment temperature sensor is a negative temperature coefficient thermistor. A signal and low reference circuit enable the sensor to operate. As the air temperature increases, the sensor resistance decreases. The sensor signal varies between 0-5 V.

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

B0163 02

The HVAC control module detects the sensor signal out of range. The signal voltage is less than 0.1 V for more than 50 ms.

B0163 05

The HVAC control module detects the sensor signal out of range. The signal voltage is greater than 4.9 V for more than 50 ms.

Action Taken When the DTC Sets

The system operates using a default value.

Conditions for Clearing the DTC

The sensor signal is within specified range between 0.1-4.9 V.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

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 and all vehicle systems OFF, disconnect the harness connector at the B10B Ambient Light/Sunload Sensor. It may take up to 10 min for all vehicle systems to power down.

NOTE: **The scan tool must be disconnected from the vehicle before performing the next test.**

2. Test for less than 10 ohms between the low reference circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify the scan tool Passenger Compartment Air Temperature (Unfiltered) parameter is less than -37°C (-35°F).
 - **If -37°C (-35°F) or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminal 3 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If less than -37°C (-35°F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal 3 and the low reference circuit terminal 6.
6. Verify the scan tool Passenger Compartment Air Temperature (Unfiltered) parameter is greater than 113°C (235°F).
 - **If 113°C (235°F) or less**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.

- **If greater than 113°C (235°F)**

7. Test or replace the B10B Ambient Light/Sunload Sensor.
8. Verify DTC B0163 does not set or the symptom does not occur while operating the vehicle within the Conditions for Running the DTC.
 - **If the DTC or symptom is not corrected.**

Replace the K33 HVAC Control Module.

- **If the DTC or symptom is corrected.**

9. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B0163, B0183, OR B1405 (WITHOUT UE1): PASSENGER COMPARTMENT TEMPERATURE SENSOR/SOLAR LOAD SENSOR/CONTROL MODULE VOLTAGE REFERENCE OUTPUT

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 B0163

Passenger Compartment Temperature Sensor Circuit

DTC B0183

Solar Load Sensor Circuit

DTC B1405

Control Module Voltage Reference Output 2 Circuit

For symptom byte information, refer to **Symptom Byte List** .

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Temperature Signal	B0163 02	B0163 05	B0163 05	1
Sunload Signal	B0183 05	B0183 02	B0183 02	1
Clock Signal	B1405 02	B1405 05	B1405 05	1
Low Reference	-	B0163 05, B0183 05	-	-
1. HVAC Malfunction				

Circuit/System Description

The ambient light/sunload sensor integrates the sunload and passenger compartment temperature functions within a single assembly.

The solar sensor uses 4 unique circuits as detailed below:

- Low reference circuit - This is a common ground for the ambient light/sunload sensor assembly.
- Temperature signal circuit - This is the signal circuit for the temperature sensor.
- Clock signal circuit - This has 2 functions, via a high side PWM signal, the HVAC control module supplies power to the sensor as well as a clock input for the sensor microprocessor.
- Sunload signal circuit - This is used as an output from the solar sensor to the HVAC control module to transmit sun heat (IR) intensity, elevation, and azimuth data.

The passenger compartment temperature sensor is a negative temperature coefficient thermistor. As the air temperature increases, the sensor resistance decreases. The sensor signal varies between 0-5 V.

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

Conditions for Running the DTC

- Ignition ON
- The HVAC control module is ON.

Conditions for Setting the DTC

B0163 02

The input signal is out of range. The HVAC control module detects voltage less than 0.1 V on the temperature signal circuit.

B0163 05

The input signal is out of range. The HVAC control module detects voltage greater than 4.9 V on the temperature signal circuit.

B0183 02

The input signal is out of range. The HVAC control module detects voltage less than 0.1 V on the solar sensor signal circuit.

B0183 05

The input signal is out of range. The HVAC control module detects voltage greater than 4.9 V on the solar sensor signal circuit.

B1405 02

The input signal is out of range. The HVAC control module detects voltage less than 10 V on the clock/power supply circuit.

B1405 05

The input signal is out of range. The HVAC control module detects a short to voltage or an open the clock/power supply circuit.

Action Taken When the DTC Sets

B0163 02, B0163 05, B0183 02, B0183 05

The system will use the last valid values as a default.

B1405 02, B1405 05

If no value is read at the time of fault, the HVAC control module uses 0 W/m² as intensity.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

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HVAC Schematics

Connector End View Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify DTCs B0163 and B0183 are not both set concurrently.

- **If both DTCs are set**

Refer to Low Reference Test.

- **If both DTCs are not set**

2. Verify DTC B0163, B0183, or B1405 is not set.

- **If one of the DTCs is set**

Refer to the appropriate diagnostic in Circuit/System Testing.

- **If none of the DTCs are set**

3. Verify the B10B Ambient Light/Sunload Sensor is accurate.

- **If the sensor is not accurate**

1. Perform the following Circuit/System Testing in the order listed below:

- Circuit/System Testing - Low Reference Test
- Circuit/System Testing - DTC B0163
- Circuit/System Testing - DTC B1405
- Circuit/System Testing - DTC B0183

- **If the sensor is accurate**

4. All OK.

Circuit/System Testing

Low Reference Test

NOTE: You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B10B Ambient

Light/Sunload Sensor. It may take up to 10 min for all vehicle systems to power down.

NOTE: **The scan tool must be disconnected from the vehicle before performing the next test.**

2. Test for less than 10 ohms between the low reference circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Test or replace the B10B Ambient Light/Sunload Sensor.

DTC B0163

NOTE: **You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the harness connector at the B10B Ambient Light/Sunload Sensor, ignition ON.
2. Verify the scan tool Passenger Compartment Air Temperature (Unfiltered) parameter is less than -37°C (-35°F).
 - **If -37°C (-35°F) or greater**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminal 3 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If less than -37°C (-35°F)**
3. Install a 3 A fused jumper wire between the signal circuit terminal 3 and the low reference circuit terminal 6.
4. Verify the scan tool parameter Passenger Compartment Air Temperature (Unfiltered) parameter is greater than 78°C (172°F).
 - **If 78°C (172°F) or less**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.

- If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 78°C (172°F)**
5. Test or replace the B10B Ambient Light/Sunload Sensor.

DTC B0183

NOTE: **You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the harness connector at the B10B Ambient Light/Sunload Sensor, ignition ON.
2. Test for 4.8-5.2 V between the signal circuit terminal 4 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than for 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**
3. Test or replace the B10B Ambient Light/Sunload Sensor.
4. Verify DTC B0183 did not reset.
 - **If DTC B0183 reset**

Replace the K33 HVAC Control Module.

- **If DTC B0183 did not reset**
5. All OK.

DTC B1405

NOTE: **You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.**

1. Ignition OFF, disconnect the harness connector at the B10B Ambient Light/Sunload Sensor, ignition ON.
2. Test for greater than 10 V between signal circuit terminal 2 and ground.

- **If less than 10 V**

1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
2. Test for infinite resistance between signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.

- **If 10 V or greater**

3. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
4. Test for less than 1 V between the signal circuit terminal 2 and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

5. Test or replace the B10B Ambient Light/Sunload Sensor.
6. Verify DTC B1405 did not reset.
 - **If DTC B1405 reset**

Replace the K33 HVAC Control Module.

- **If DTC B1405 did not reset**

7. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B0173, B0178, B0509, B0514, B0519, B3583, OR B3933: DUCT AIR TEMPERATURE SENSOR/EVAPORATOR 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 B0173 02

Upper Left Duct Air Temperature Sensor Circuit Short to Ground

DTC B0173 05

Upper Left Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B0178 02

Lower Left Duct Air Temperature Sensor Circuit Short to Ground

DTC B0178 05

Lower Left Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B0509 02

Upper Right Duct Air Temperature Sensor Circuit Short to Ground

DTC B0509 05

Upper Right Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B0514 02

Lower Right Duct Air Temperature Sensor Circuit Short to Ground

DTC B0514 05

Lower Right Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B0519 02

Rear Upper Duct Air Temperature Sensor Circuit Short to Ground

DTC B0519 05

Rear Upper Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B3583 02

Rear Lower Duct Air Temperature Sensor Circuit Short to Ground

DTC B3583 05

Rear Lower Duct Air Temperature Sensor Circuit High Voltage/Open

DTC B3933 02

Air Conditioning Evaporator Temperature Sensor Circuit Short to Ground

DTC B3933 05

Air Conditioning Evaporator Temperature Sensor Circuit High Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Upper Left Duct Air Temperature Sensor Signal	B0173 02	B0173 05	B0173 05	-
Lower Left Duct Air Temperature Sensor Signal	B0178 02	B0178 05	B0178 05	-
Upper Right Duct Air Temperature Sensor Signal	B0509 02	B0509 05	B0509 05	-
Lower Right Duct Air Temperature Sensor Signal	B0514 02	B0514 05	B0514 05	-
Rear Upper Duct Air Temperature Sensor Signal	B0519 02	B0519 05	B0519 05	-
Rear Lower Duct Air Temperature Sensor Signal	B3583 02	B3583 05	B3583 05	-
Air Conditioning Evaporator Temperature Sensor Signal	B3933 02	B3933 05	B3933 05	-
Front Temperature Sensor Low Reference	-	B0173 05, B0178 05, B0509 05, B0514 05, B3933 05	B0173 05, B0178 05, B0509 05, B0514 05, B3933 05	-
Rear Temperature Sensor Low Reference	-	B0519 05, B3583 05	B0519 05, B3583 05	-

Circuit/System Description

The air temperature sensors are a 2-wire negative temperature coefficient thermistor. The vehicle uses the following air temperature sensors:

- Air temperature sensor - left upper
- Air temperature sensor - left lower
- Air temperature sensor - right upper
- Air temperature sensor - right lower
- Air temperature sensor - rear upper (With CJ4)
- Air temperature sensor - rear lower (With CJ4)

- A/C evaporator temperature sensor

This sensor operates using signal and low reference circuits. As the air temperature surrounding the sensor increases, the sensor resistance decreases. The sensor is capable of reading temperatures ranging from -40 to +115°C (-40 to +240°F), with a signal voltage between 0-5 V. If the HVAC control module detects a malfunctioning sensor the software uses a default air temperature value. The default action ensures that the HVAC system can adjust the inside air temperature near the desired temperature until the condition is corrected.

Conditions for Running the DTC

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

Conditions for Setting the DTC

The HVAC control module detects the sensor signal out of range. The signal voltage is less than 0.1 V or greater than 4.9 V for more than 50 ms.

Action Taken When the DTC Sets

The system operates using a default value.

Conditions for Clearing the DTC

The sensor signal is within specified range between 0.1-4.9 V.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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Description and Operation

Automatic HVAC Description and Operation

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- **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

1. Ignition ON.
2. Verify the appropriate temperature sensor has a parameter displayed in HVAC scan tool information.
 - **If there is no scan tool parameter**

Refer to Circuit/System Testing - Without Scan Tool Support.

- **If there is a scan tool parameter**
3. Refer to Circuit/System Testing - With Scan Tool Support

Circuit/System Testing

With Scan Tool Support

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate temperature sensor. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 ohms between the low reference circuit terminal B and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify the appropriate scan tool temperature sensor parameter is less than -37°C (-35°F)
 - **If greater than -37°C (-35°F)**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminal A and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If -37°C (-35°F) or less**
5. Install a 3 A fused jumper wire between the signal circuit terminal A and the low reference circuit terminal B.
6. Verify the scan tool temperature sensor parameter is greater than 110°C (230°F).
 - **If less than 110°C (230°F)**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connector at the K33 HVAC Control Module, ignition ON.

2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Ignition OFF
4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If 110°C (230°F) or greater**
7. Test or replace the temperature sensor.

Without Scan Tool Support

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate temperature sensor. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 ohms between the low reference circuit terminal B and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Test for 4.8-5.2 V between the signal circuit terminal A and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**
4. Test or replace the temperature sensor.
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

6. Verify the DTC does not set.

- **If the DTC sets**

Replace the K33 HVAC Control Module.

- **If the DTC does not set**

7. All OK

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B018A, B048C, B048F, OR B1395: WINDSHIELD TEMPERATURE SENSOR/HUMIDITY SENSOR/CONTROL MODULE VOLTAGE REFERENCE

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 B018A

Windshield Temperature Sensor Circuit

DTC B048C

Humidity Sensor Humidity Circuit

DTC B048F

Humidity Sensor Temperature Circuit

DTC B1395

Control Module Voltage Reference Output Circuit

For symptom byte information, refer to **Symptom Byte List** .

Diagnostic Fault Information

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	B1395 03	1	B1395 07	-
Signal Terminal 2	B048C 02	B048C 05	B048C 05	-
Signal Terminal 4	B018A 02	B018A 05	B018A 05	-
Signal Terminal 5	B048F 02	B048F 05	B048F 05	-
Low Reference	-	B018A 05, B048C 05, B048F 05, B1395 03	-	-
1. Sensor Malfunction				

Circuit/System Description

The windshield temperature and inside moisture sensor includes the relative humidity sensor, windshield temperature sensor and humidity sensing element temperature sensor all in one assembly.

This sensor assembly provides information about:

- Relative humidity level at the windshield inside the vehicle
- Temperature of the windshield inside the vehicle
- Temperature of the humidity sensor element

The relative humidity sensor measures the relative humidity of the compartment side of the windshield. It also detects the temperature of the windshield surface on the compartment side. Both values are used as control inputs for the HVAC control module application to calculate the fog risk on windshield compartment side and ability to reduce fuel consumption by decreasing A/C compressor usage to a minimum without causing any fog. The sensor will also enable partial recirculation mode in order to improve heat-up performance of the passenger compartment under cold ambient temperature conditions without the risk of mist build-up on the windshield. The humidity sensor element temperature sensor supplies the temperature of the humidity sensor element. It is only needed if the thermal contact between the humidity sensing element and the inside windshield surface is not sufficient.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B018A 02, B048C 02, or B048F 02

The HVAC control module detects the sensor signal out of range. The signal voltage is less than 0.1 V for more than 50 ms.

B018A 05, B048C 05, B048F 05 or B1395 07

The HVAC control module detects the sensor signal out of range. The signal voltage is greater than 4.9 V for more than 50 ms.

B1395 03

The HVAC control module detects the 5 V reference voltage out of range. The 5 V reference voltage is less than 4.5 V for more than 50 ms.

B1395 07

The HVAC control module detects the 5 V reference voltage out of range. The 5 V reference voltage is greater than 5.5 V for more than 50 ms.

Action Taken When the DTC Sets

- The system will use the last valid values as default.
- If no value is read at the time of fault, the HVAC control module uses 60% for humidity.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B160 Windshield Temperature and Inside Moisture Sensor. It may take up to 10 min for all vehicle systems to power down.

NOTE: **The scan tool must be disconnected from the vehicle before performing the next test.**

2. Test for less than 10 ohms between the low reference circuit terminal 3 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the 5 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**
5. Verify the scan tool parameters listed below are less than -37°C (-35°F).
 - Windshield Temperature
 - Passenger Compartment Humidity Sensor Temperature
 - **If -37°C (-35°F) or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminals listed below and ground:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5

- If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If less than -37°C (-35°F)**
6. Install a 3 A fused jumper wire between the low reference circuit terminal 3 and each signal circuit terminal listed below:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 7. Verify the appropriate scan tool parameter listed below is greater than 114°C (238°F).
 - Windshield Temperature
 - Passenger Compartment Humidity Sensor Temperature
 - **If 114°C (238°F) or less**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminals listed below and ground:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 114°C (238°F)**
 8. Remove the jumper wire.
 9. Verify the scan tool Passenger Compartment Humidity parameter is greater than 95%.
 - **If 95% or less**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If greater than 95%**
 10. Install a 3 A fused jumper wire between the passenger compartment humidity signal circuit terminal 2 and the low reference circuit terminal 3.
 11. Verify the scan tool Passenger Compartment Humidity Sensor parameter is less than 5%.
 - **If 5% or greater**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.

- If less than 1 V
- 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
- **If less than 5%**
- 12. Test or replace the B160 Windshield Temperature and Inside Moisture Sensor.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B0183 (UE1): SOLAR LOAD SENSOR CIRCUIT

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

Solar Load Sensor Circuit

For symptom byte information, refer to **Symptom Byte List** .

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	B0183 02	B0183 05	B0183 05	-
Low Reference	-	B0163 05, B0183 05	-	-

Circuit/System Description

The ambient light/sunload sensor integrates the sunload sensor and passenger compartment temperature sensor into a single assembly.

The solar sensor is connected to a low reference and a 5 V biased (pull up) signal circuit voltage from the HVAC control module. As the sunload increases, the sensor signal voltage decreases. The signal varies between

0.1 - 4.9 V and is provided to the HVAC control module.

The passenger compartment temperature sensor is a negative temperature coefficient thermistor. A signal and low reference circuit enable the sensor to operate. As the air temperature increases, the sensor resistance decreases. The sensor signal varies between 0-5 V.

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

Conditions for Running the DTC

- Ignition ON.
- The HVAC Control Module is ON.

Conditions for Setting the DTC

B0183 02

The input signal is out of range. The voltage is less than 0.1 V.

B0183 05

The input signal is out of range. The voltage is greater than 4.9 V.

Action Taken When the DTC Sets

- The system will use the last valid values as default.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B10B Ambient Light/Sunload Sensor. It may take up to 10 min for all vehicle systems to power down.

NOTE: **The scan tool must be disconnected from the vehicle before performing the next test.**

2. Test for less than 10 ohms between the low reference circuit terminal 6 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Test for 4.8-5.2 V between the signal circuit terminal 4 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**

5. Test or replace the B10B Ambient Light/Sunload Sensor.
6. Verify DTC B0183 does not set or the symptom does not occur while operating the vehicle within the Conditions for Running the DTC.

- **If the DTC or symptom is not corrected.**

Replace the K33 HVAC Control Module.

- **If the DTC or symptom is corrected.**

7. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B0193: FRONT BLOWER MOTOR SPEED CIRCUIT

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 B0193 01

Front Blower Motor Speed Circuit Short to Battery

DTC B0193 06

Front Blower Motor Speed Circuit Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B0193 06	B0193 06	-	-
Control	B0193 06	B0193 06	B0193 01	-
Ground	-	B0193 06	-	-

Circuit/System Description

The blower motor speed control signal from the HVAC control module, battery positive and ground circuits enable the blower motor to operate. The blower motor control circuitry is integrated within the blower motor assembly. The HVAC control module provides a ground pulse width modulation (PWM) signal to the blower motor to request a specific motor speed. The blower motor translates the PWM signal and drives the motor accordingly.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B0193 01

The voltage at the HVAC control module output to the blower motor control module is always high.

B0193 06

The voltage at the HVAC control module output to the blower motor control module is always low or fluctuating.

Action Taken When the DTC Sets

The blower motor is inoperative.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

The current design of this motor does not allow for bench testing. The motor will not operate by simply applying power and ground.

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

Check for Preliminary Information or Technical Service Bulletins.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the M8 Blower Motor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuit terminal 1 and ground.
 - **If 10 ohms or greater**
 1. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify a test lamp illuminates between the B+ circuit terminal 3 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the B+ circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the M8 Blower Motor.
 - **If the test lamp illuminates**
5. Ignition OFF, remove the test lamp and disconnect the X2 harness connector at the K33 HVAC Control Module, ignition ON.
6. Test for less than 1 V between the M8 Blower Motor control circuit terminal 2 and ground.

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

7. Ignition OFF.
8. Test for infinite resistance between the control circuit and ground.
 - **If less than infinite resistance**

Repair the short to ground on the circuit.

- **If infinite resistance**

9. Test for less than 2 ohms in the control circuit end to end.
 - **If 2 ohms or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 ohms**

10. Replace the M8 Blower Motor.
11. Verify the symptom or DTC was corrected.
 - If the symptom or DTC was not corrected, replace the K33 HVAC Control Module.
 - If the symptom or DTC was corrected
12. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B0223, B0228, B0233, B0408, B0413, B0418, B0423, B1395, OR B374A: RECIRCULATION CONTROL/AIR FLOW CONTROL/CONTROL MODULE VOLTAGE REFERENCE

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 B0223

Recirculation Control Circuit

DTC B0228

Recirculation Position Feedback Circuit

DTC B0233

Air Flow Control Circuit

DTC B0408

Main Temperature Control Circuit

DTC B0413

Main Temperature Position Feedback Circuit

DTC B0418

Right Temperature Control Circuit

DTC B0423

Right Temperature Position Feedback Circuit

DTC B0428

Rear Temperature Control Circuit

DTC B0433

Rear Temperature Position Feedback Circuit

DTC B1395

Control Module Voltage Reference Output Circuit

DTC B3531

Rear Air Flow Control Circuit

DTC B374A

Air Flow Control Position Feedback Circuit

DTC B3782

Rear Air Flow Position Feedback Circuit

For symptom byte information refer to **Symptom Byte List** .

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5V Reference	B1395 03	B1395 07	B1395 07	-
Recirculation Actuator Position Signal	B0228 02	B0228 05	B0228 05	1
Main Temperature Actuator Position Signal	B0413 02	B0413 05	B0413 05	2
Right Temperature Actuator Position Signal	B0423 02	B0423 05	B0423 05	3
Rear Temperature Actuator Position Signal	B0433 02	B0433 05	B0433 05	6
Mode Actuator Position Signal	B374A 02	B374A 05	B374A 05	4
Rear Mode Actuator Position Signal	B3782 02	B3782 05	B3782 05	5
Recirculation Actuator Control 1	B0223 02	B0223 04	B0223 01	1
Recirculation Actuator Control 2	B0223 02	B0223 04	B0223 01	1
Main Temperature Actuator Control 1	B0408 02	B0408 04	B0408 01	2
Main Temperature Actuator Control 2	B0408 02	B0408 04	B0408 01	2
Right Temperature Actuator Control 1	B0418 02	B0418 04	B0418 01	3
Right Temperature Actuator Control 2	B0418 02	B0418 04	B0418 01	3
Rear Temperature Actuator Control 1	B0428 02	B0428 04	B0428 01	6
Rear Temperature Actuator Control 2	B0428 02	B0428 04	B0428 01	6
Rear Mode Actuator Control 1	B3531 02	B3531 04	B3531 01	5
Rear Mode Actuator Control 2	B3531 02	B3531 04	B3531 01	5
Mode Actuator Control 1	B0233 02	B0233 04	B0233 01	4
Mode Actuator Control 2	B0233 02	B0233 04	B0233 01	4
Low Reference	-	B0228 05	-	-
1. Air Recirculation Malfunction 2. Main Temperature Malfunction 3. Right Temperature Malfunction 4. Air Distribution Malfunction 5. Rear Air Distribution Malfunction 6. Rear Temperature Distribution Malfunction				

Circuit/System Description

The actuators are 5-wire bi-directional electric motors that incorporate a feedback potentiometer. Low reference, 5V reference, position signal, and 2 control circuits enable the actuator to operate. The control circuits use either a ground or 12 V value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 12 V. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 V. The HVAC control module reverses the polarity of the control circuits to move the actuator in the opposite direction. When the actuator shaft rotates, the potentiometer's sliding contact changes the door position signal between 0-5 V. When the module sets a commanded, or targeted, value, one of the control circuits is grounded, and the other is supplied 12 V. 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 the ground from the control circuit.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B0223, B0233, B0408, B0418, B0428, or B3531

The HVAC control module detects a short to ground, short to voltage, or an open on one of the control circuits.

B0228 02, B0413 02, B0423 02, B0433 02, B374A 02, or B3782 02

The HVAC control module detects the sensor signal out of range. The signal voltage is less than 0.1 V for more than 50 ms.

B0228 05, B0413 05, B0423 05, B0433 05, B374A 05, or B3782 05

The HVAC control module detects the sensor signal out of range. The signal voltage is greater than 4.9 V for more than 50 ms.

B1395 03

The HVAC control module detects the sensor reference voltage out of range. The reference voltage is less than 0.1 V for more than 50 ms.

B1395 07

The HVAC control module detects the sensor reference voltage out of range. The reference voltage is greater than 4.9 V for more than 50 ms.

Action Taken When the DTC Sets

B1395

- The affected output will be switched off for hardware protection.

- All actuators are deactivated.

B0223, B0228, B0233, B0408, B0413, B0418, B0423, B0428, B0433, B3531, B374A, or B3782

- The affected output will be switched off for hardware protection.
- The affected actuator is deactivated.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Perform the **Actuator Recalibration** procedure.
2. Verify the concern or DTC has been corrected.
 - **If the concern or DTC has not been corrected**
 1. Verify DTC B1395 is not set.
 - If DTC B1395 is set, refer to Circuit/System Testing - DTC B1395.
 - If DTC B1395 is not set, refer to Circuit/System Testing - DTC B0223, B0228, B0233, B0408, B0413, B0418, B0423, B0428, B0433, B3531, B374A, or B3782.

- **If the concern or DTC has been corrected**

3. All OK.

Circuit/System Testing

DTC B1395

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the components listed below. It may take up to 2 min for all vehicle systems to power down.
 - M37 Mode Door Actuator
 - M46 Air Recirculation Door Actuator
 - M6L Air Temperature Door Actuator - Left
 - M6R Air Temperature Door Actuator - Right
 - M37B Mode Door Actuator - Auxiliary
 - M6B Air Temperature Door Actuator - Auxiliary
2. Disconnect the harness connectors at the K33 HVAC Control Module.
3. Test for infinite resistance between the K33 HVAC Control Module 5 V reference circuit terminal 17 X2 and ground.
 - **If less than infinite resistance**

Repair the short to ground on the circuit.
 - **If infinite resistance**
4. Ignition ON.
5. Test for less than 1 V between the K33 HVAC Control Module 5 V reference terminal 17 X2 and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
6. Clear all DTCs.
7. Ignition OFF, connect the harness connectors at the K33 HVAC Control Module, ignition ON.
8. Verify DTC B1395 is not set.
 - **If the DTC is set.**

Replace the K33 HVAC Control Module.
 - **If the DTC is not set.**
9. Verify DTC B1395 does not set after connecting each of the components listed below one at a time and operating them through their full range.
 - M37 Mode Door Actuator
 - M46 Air Recirculation Door Actuator

- M6L Air Temperature Door Actuator - Left
- M6R Air Temperature Door Actuator - Right
- M37B Mode Door Actuator - Auxiliary
- M6B Air Temperature Door Actuator - Auxiliary
- **If the DTC sets after connecting one of the components**

Replace the actuator that was connected immediately before the DTC set.

- **If the DTC does not set**

10. All OK.

DTC B0223, B0228, B0233, B0408, B0413, B0418, B0423, B0428, B0433, B3531, B374A, or B3782

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate door actuator. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 ohms between ground and the low reference circuit terminal of the appropriate actuator below:
 - M37 Mode Door Actuator terminal 2
 - M46 Air Recirculation Door Actuator terminal 1
 - M6L Air Temperature Door Actuator - Left terminal 2
 - M6R Air Temperature Door Actuator - Right terminal 2
 - M37B Mode Door Actuator - Auxiliary terminal 2
 - M6B Air Temperature Door Actuator - Auxiliary terminal 1
 - **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If less than 10 ohms**
3. Ignition ON.
4. Test for 4.8-5.2 V between ground and the 5 V reference circuit terminal of the appropriate actuator listed below:
 - M37 Mode Door Actuator terminal 1
 - M46 Air Recirculation Door Actuator terminal 2
 - M6L Air Temperature Door Actuator - Left terminal 1
 - M6R Air Temperature Door Actuator - Right terminal 1
 - M37B Mode Door Actuator - Auxiliary terminal 1
 - M6B Air Temperature Door Actuator - Auxiliary terminal 2
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.

2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 ohms in the 5 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 5.2 V**
1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**
5. Test for 4.8-5.2 V between the signal circuit terminal 3 and ground.
 - **If less than 4.8 V**
1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If greater than 5.2 V**
1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **If between 4.8-5.2 V**
6. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
7. Test for less than 1 V between the control circuit terminals 4 and 5 and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**
- 8. Ignition OFF.
- 9. Test for infinite resistance between the control circuit terminals 4 and 5 and ground.
 - **If less than infinite resistance**

Repair the short to ground on the circuit.

- **If infinite resistance**

10. Test for less than 2 ohms in each control circuit end to end.

- **If 2 ohms or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 ohms**

11. Test or replace the actuator.

12. Verify the DTC or symptom is corrected while operating the HVAC system under the Conditions for Running the DTC.

- **If the DTC or symptom is not corrected**

Replace the K33 HVAC Control Module.

- **If the DTC or symptom is corrected**

13. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B3843: AIR QUALITY SENSOR CIRCUIT

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

Air Quality Sensor Circuit Short to Ground

DTC B3843 05

Air Quality Sensor Circuit High Voltage/Open

DTC B3843 08

Air Quality Sensor Circuit Performance - Signal Invalid

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	B3843 05	B3843 05	-	-
Signal	B3843 02	B3843 05	B3843 05	B3843 08
Ground	-	B3843 05	-	-

Circuit/System Description

The HVAC control module uses an air quality sensor to detect hydrocarbons. This sensor operates using an ignition voltage circuit, a ground circuit and a signal circuit.

This information is sent to the HVAC control module using a pulse width modulated (PWM) signal. It is used only when the automatic HVAC mode is requested by the customer.

When the HVAC module detects the concentration of pollutants exceeds a preset value, recirculation mode is commanded to keep the passenger compartment free of pollutants.

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.

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 Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B108 Air Quality Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 ohms between the ground circuit terminal 2 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is OK and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**

1. Ignition OFF, remove the test lamp.
2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the B108 Air Quality Sensor.
 - **If the test lamp illuminates**
5. Install a test lamp between the signal circuit terminal 3 and the ignition circuit terminal 1.

NOTE: **This connection may need to be in place for nearly 60 seconds before there is a change in the parameter.**

6. Verify the scan tool Air Quality Sensor parameter is greater than 95%.
 - **If the parameter is 95% or less**
 1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If the parameter is greater than 95%**
7. Remove the test lamp and Install a 3 A fused jumper wire between the signal circuit terminal 3 and the ground circuit terminal 2.

NOTE: **This connection may need to be in place for nearly 60 seconds before there is a change in the parameter.**

8. Verify the scan tool Air Quality Sensor parameter is less than 5%.
 - **If the parameter is 5% or greater**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF
 4. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If the parameter is less than 5%**
 - 9. Replace the B108 Air Quality Sensor.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

DTC B393B: AIR CONDITIONING COMPRESSOR VALVE CONTROL CIRCUIT

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 B393B

Air Conditioning Compressor Valve Control Circuit

For symptom byte information, refer to **Symptom Byte List** .

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	1	B393B 04	-	-
Control	B393B 04	B393B 04	B393B 0B	-
1. Solenoid Valve Malfunction				

Circuit/System Description

This A/C system uses a conventional clutch to engage and mechanically turn the compressor and a variable displacement solenoid valve to alter the amount of displacement created by the turning of the compressor. The HVAC control module provides both battery voltage and a pulse width modulated ground to the variable displacement solenoid valve. When the A/C switch is pressed, the HVAC control module grounds the variable displacement solenoid using a low side (PWM) signal in order to command the amount of compressor displacement. The performance of the A/C compressor is based on adjusted interior temperature and engine load.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B393B 04

A PWM greater than 10% is sent but no current is read back.

B393B 0B

Measured current is above threshold of 815 mA.

Action Taken When the DTC Sets

B393B 04

The A/C compressor is disabled.

B393B 0B

- The A/C compressor is disabled.
- Output will be switched off for hardware protection.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- Connector Repairs
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- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q46 A/C Compressor Solenoid Valve, ignition ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 2 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, remove the test lamp and disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the Q46 A/C Compressor Solenoid Valve B+ circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 ohms in the B+ circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If the test lamp illuminates**
3. Ignition OFF, connect a test lamp between the control circuit terminal 1 and the B+ circuit terminal 2, ignition ON.
4. Verify the test lamp turns ON and OFF when commanding the Q46 A/C Compressor Refrigerant Solenoid Valve On and Off with a scan tool.
 - **If the test lamp is always OFF**
 1. Ignition OFF, remove the test lamp and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the Q46 A/C Compressor Refrigerant Solenoid Valve control circuit terminal 1 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K33 HVAC Control Module.
 - **If the test lamp is always ON**
 1. Ignition OFF, remove the test lamp and disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the Q46 A/C Compressor Refrigerant Solenoid Valve control circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **If the test lamp turns ON and OFF**

5. Test or replace the G1 A/C Compressor.

Component Testing

A/C Compressor Solenoid Valve Test

1. Ignition OFF, disconnect the harness connector at the Q46 A/C Compressor Solenoid Valve.
2. Test for 7-15 ohms between B+ terminal 2 and control terminal 1.

- **If less than 7 ohms or greater than 15 ohms**

Replace the G1 A/C Compressor.

- **If between 7-15 ohms**

3. Test for infinite resistance between each terminal and the Q46 A/C Compressor Solenoid Valve housing/case.

- **If less than infinite resistance**

Replace the G1 A/C Compressor.

- **If infinite resistance**

4. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

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 Low Voltage

DTC P0533

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0532, P0641	P0532	P0533	-
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 V 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. The ECM may use this information to turn the cooling fans on as well as to monitor clutch engagement. The HVAC module will receive the A/C refrigerant pressure information from the ECM via serial data.

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0532

The ECM detects that the A/C pressure is less than 1 psi (0.25 V).

P0533

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

Action Taken When the DTC Sets

- The A/C compressor is disabled.
- The ECM will illuminate the malfunction indicator lamp (MIL).

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

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

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON
2. Verify the scan tool engine control module A/C High Side Pressure Sensor parameter is between 6.8 kPa (1 psi) and 2950 kPa (428 psi).
 - **If not between 6.8 kPa (1 psi) and 2950 kPa (428 psi)**

Refer to Circuit/System Testing

- **If between 6.8 kPa (1 psi) and 2950 kPa (428 psi)**
3. All OK

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B1 A/C Refrigerant Pressure Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 ohms between the low reference circuit terminal 1 and ground.

- **If 10 ohms or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 ohms in the low reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.
- **If less than 10 ohms**
- 3. Ignition ON.
- 4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 2 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 ohms in the 5 V reference circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
- **If between 4.8-5.2 V**
- 5. Verify the scan tool A/C High Side Pressure Sensor parameter is less than .25 V.
 - **If .25 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 3 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **If less than .25 V**
- 6. Install a 3 A fused jumper wire between the signal circuit terminal 3 and the 5 V reference circuit terminal 2.
- 7. Verify the scan tool A/C High Side Pressure Sensor parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 3 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance

3. Test for less than 2 ohms in the signal circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.
 - **If greater than 4.8 V**

8. Test or replace the B1 A/C Refrigerant Pressure Sensor.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for engine control module replacement, programming and setup

DTC P0645, P0646, OR P0647: AIR CONDITIONING (A/C) COMPRESSOR 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) Compressor Clutch Relay Control Circuit

DTC P0646

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

DTC P0647

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Coil Ignition	P0645	P0645	-	-
Relay Switch B+	1	1	-	-
Relay Coil Control	P0646	P0645	P0647	-
Relay Switch Control	1	1	1	-
Ground	-	1	-	-

1. A/C Compressor Malfunction

Circuit/System Description

When the A/C switch is pressed, the HVAC control module sends an A/C request message to the engine control module (ECM) via serial data. The ECM then grounds the A/C compressor clutch relay coil control circuit, closing the relay contacts. The closed relay contacts provide voltage to the compressor clutch causing it to engage.

Conditions for Running the DTC

- Engine is running.
- The HVAC control module is ON.
- The A/C switch is active.

Conditions for Setting the DTC

P0645 or P0646

The ECM detects a short to ground or an open at the A/C compressor clutch relay control circuit.

P0647

The ECM detects a short to voltage at the A/C compressor clutch relay control circuit.

Action Taken When the DTC Sets

P0645 or P0646

The A/C compressor is inoperative or always active. The A/C compressor solenoid is commanded to 0% displacement. This causes warm air from the ducts, even with unwanted clutch engagement.

P0647

The A/C compressor is inoperative.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the KR29 A/C Compressor Clutch Relay, ignition ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the B+ circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Disconnect the harness connector at the Q2 A/C Compressor Clutch.
 4. Test for infinite resistance between the control circuit terminal 87 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, test or replace the Q2 A/C Compressor Clutch.
 - **If the test lamp illuminates**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 85 and ground.

- **If the test lamp does not illuminate**

Refer to **Power Mode Mismatch** .

- **If the test lamp illuminates**

5. Connect a test lamp between the ignition circuit terminal 85 and the control circuit terminal 86.
6. Verify the test lamp turns ON and OFF when commanding the ECM A/C Compressor Clutch Relay On and Off with a scan tool.

- **If the test lamp is always OFF**

1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Ignition OFF.
4. Test for less than 2 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K20 Engine Control Module.

- **If the test lamp is always ON**

1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.

- **If the test lamp turns ON and OFF**

7. Verify a test lamp does not illuminate between the control circuit terminal 87 and ground.

- **If the test lamp illuminates**

Repair the short to voltage on the circuit.

- **If the test lamp does not illuminate**

8. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the Q2 A/C Compressor Clutch. It may take up to 2 min for all vehicle systems to power down.
9. Test for less than 10 ohms between the ground circuit terminal 1 and ground.

- **If 10 ohms or greater**

1. Ignition OFF.
2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**

10. Connect the harness connector at the Q2 A/C Compressor Clutch.
11. Ignition ON, connect a 10 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.
12. Verify the Q2 A/C Compressor Clutch is engaged.
 - **If the Q2 A/C Compressor Clutch does not engage**
 1. Ignition OFF, disconnect the harness connector at the Q2 A/C Compressor Clutch.
 2. Test for less than 2 ohms in the control circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, test or replace the Q2 A/C Compressor Clutch.
 - **If the Q2 A/C Compressor Clutch is engaged**
13. Test or replace the KR29 A/C Compressor Clutch Relay.

Component Testing

1. Ignition OFF, disconnect the KR29 A/C Compressor Clutch Relay.
2. Test for 60-180 ohms between terminals 85 and 86.
 - **If not between 60-180 ohms**

Replace the KR29 A/C Compressor Clutch Relay.
 - **If between 60-180 ohms**
3. Test for infinite resistance between the terminals listed below:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - **If less than infinite resistance**

Replace the KR29 A/C Compressor Clutch Relay.
 - **If infinite resistance**
4. Install a 15 A fused jumper wire between terminal 86 and 12 V. Install a jumper wire between terminal 85 and ground.
5. Test for less than 2 ohms between terminals 30 and 87.
 - **If 2 ohms or greater**

Replace the KR29 A/C Compressor Clutch Relay.
 - **If less than 2 ohms**
6. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for engine control module replacement, programming and setup

SYMPTOMS - HVAC SYSTEMS - AUTOMATIC

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

1. Perform the **Diagnostic System Check - Vehicle** before using the HVAC System Malfunction procedure 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

NOTE: **Shutting one or more outlets may adversely affect the Automatic HVAC system by producing erroneous duct air temperature sensor readings in the duct connecting to the closed outlet. Where possible, always operate the Automatic HVAC system with all outlets open.**

- Inspect for aftermarket devices which may 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 may cause the symptom.
- Verify the A/C compressor 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 **HVAC System Malfunction** in order to diagnose the symptom.

HVAC SYSTEM 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 Aids

Check the following mechanical fault sources:

- Air distribution box
- Air distribution hoses/air distribution ducts

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

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

Special Tools

- R-134a - **J43600** ACR Air Conditioning Service Center

Circuit/System Verification

NOTE: **Check for bulletins before proceeding.**

1. Ignition ON.
2. Verify every applicable scan tool Switch parameter changes when pressing the appropriate switch on the A20 Radio/HVAC Controls.
 - **If any parameter does not change**

Replace the A20 Radio/HVAC Controls.
 - **If all parameters change**
3. Verify every applicable scan tool Switch parameter changes when pressing the appropriate switch on the A34 HVAC Controls - Auxiliary.
 - **If any parameter does not change**

Replace the A34 HVAC Controls - Auxiliary.
 - **If all parameters change**
4. Verify the blower motor operates properly with the blower motor switch in each speed position.
 - **If the blower motor does not operate properly in each speed position**

Refer to **DTC B0193**.
 - **If the blower motor operates properly in each speed position**
5. Verify the Air Quality Sensor parameter changes while introducing hydrocarbons from a suitable source into the vicinity of the B108 Air Quality Sensor.
 - **If the Air Quality Sensor parameter does not change**

Refer to **DTC B3843**.
 - **If the Air Quality Sensor parameter changes**
6. Verify the HVAC doors listed below move when pressing the appropriate switch.
 - Driver Temperature
 - Passenger Temperature
 - Mode
 - Recirculation

- Auxiliary Mode
- Auxiliary Temperature
- **If any HVAC door does not move**

Refer to **DTC B0223, B0228, B0233, B0408, B0413, B0418, B0423, B1395, or B374A.**

- **If all HVAC doors move**

7. Install the **J43600** ACR Air Conditioning Recharge Service Center.
8. Verify the high side pressure reading on the Air Conditioning Service Center is within 10% of the scan tool ECM A/C High Side Pressure Sensor parameter.
 - **If the reading is not within 10%**

Refer to **DTC P0532 or P0533.**

- **If the reading is within 10%**

9. Verify the A/C High Side Pressure Sensor parameter is between 269-2929 kPa (39-425 PSI).
 - **If the reading is not between 269-2929 kPa (39-425 PSI)**

Refer to **Air Conditioning (A/C) System Performance Test (R-134a)** , **Air Conditioning (A/C) System Performance Test (R-1234yf)** .

- **If the reading is between 269-2929 kPa (39-425 PSI)**

10. Verify the scan tool parameters listed below are within 10% of ambient temperature.

- Lower Left Duct Air Temperature Sensor
- Upper Left Duct Air Temperature Sensor
- Lower Right Duct Air Temperature Sensor
- Upper Right Duct Air Temperature Sensor
- A/C Evaporator Temperature Sensor
- Lower Auxiliary Duct Air Temperature Sensor
- Upper Auxiliary Duct Air Temperature Sensor
- **If not within 10% of ambient temperature**

Refer to **DTC B0173, B0178, B0509, B0514, B0519, B3583, or B3933.**

- **If within 10% of ambient temperature**

11. Verify the scan tool parameters listed below are within 10% of actual conditions.

- Passenger Compartment Humidity
- Passenger Compartment Humidity Sensor Temperature
- Passenger Compartment Windshield Temperature
- **If not within 10% of actual conditions**

Refer to **DTC B018A, B048C, B048F, or B1395.**

- **If within 10% of actual conditions**
- 12. Engine ON, A/C system ON.
- 13. Verify cool air flows from the ducts with the temperature control in the coldest position.
 - **If the air is not cool**
 - 1. Verify the Q2 A/C Compressor Clutch is engaged.
 - If the Q2 A/C Compressor Clutch is not engaged, refer to **Air Conditioning Compressor Malfunction**.
 - If the Q2 A/C Compressor Clutch is engaged, refer to **Air Conditioning (A/C) System Performance Test (R-134a)** , **Air Conditioning (A/C) System Performance Test (R-1234yf)** , and **DTC B393B**.
 - **If the air is cool**
- 14. Verify warm air flows from the ducts with the temperature control in the warmest position.
 - **If the air is not warm**
 - Refer to **Heating Performance Diagnostic** .
 - **If the air is warm**
- 15. Engine OFF, ignition ON.
- 16. Verify the scan tool Sunload parameter changes while covering the B10B Ambient Light/Sunload Sensor with a shop towel and changes when shining a bright light on it.
 - **If the Sunload parameter does not change**
 - Refer to **DTC B0183 (UE1)**, if the vehicle is equipped with RPO UE1 or **DTC B0163, B0183, or B1405 (Without UE1)** if the vehicle is not equipped with RPO UE1.
 - **If the Sunload parameter changes**
- 17. Verify the actual inside air temperature, using a thermometer, is less than 3°C (5°F) difference from the scan tool Inside Passenger Compartment Air Temp. Sensor parameter.
 - **If greater than a 3°C (5°F) difference**
 - Refer to **DTC B0163 (UE1)**, if the vehicle is equipped with RPO UE1 or **DTC B0163, B0183, or B1405 (Without UE1)** if the vehicle is not equipped with RPO UE1.
 - **If less than a 3°C (5°F) difference**
- 18. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

AIR CONDITIONING COMPRESSOR MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

The A/C compressor uses a conventional belt driven magnetic clutch to engage and mechanically turn the compressor. When the A/C switch is pressed, the HVAC control module sends an A/C request message to the ECM via serial data. If specific criteria is met, the ECM then grounds the A/C compressor clutch relay control circuit, which will switch the A/C compressor clutch relay. With the relay contacts closed, battery voltage is supplied to the permanently grounded A/C compressor clutch. The A/C compressor clutch will then be activated.

This A/C system utilizes a variable displacement solenoid valve to alter the amount of displacement created by the turning of the compressor. The HVAC control module provides both battery voltage and a pulse width modulated ground to the variable displacement solenoid valve. When the A/C switch is pressed, the HVAC control module grounds the variable displacement solenoid using a (PWM) signal in order to determine the amount of compressor displacement. The performance of the A/C compressor is regulated based on the adjusted interior temperature.

Diagnostic Aids

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

- Battery voltage is between 9-18 V.
- Engine coolant temperature is less than 124°C (255°F).
- Engine speed is greater than 600 RPM.
- Engine speed is less than 5 500 RPM.
- A/C high side pressure is between 269-2 929 kPa (39-425 PSI).
- Throttle position is less than 100%.
- Evaporator temperature is greater than 3°C (38°F).
- ECM does not detect excessive torque load.
- ECM does not detect insufficient idle quality.
- The ambient temperature is above 1°C (34°F).
- Blower motor is ON.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX - SEDAN

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

NOTE: Refer to **HVAC System Malfunction** before performing this procedure.

1. Ignition ON, press and release the A/C Switch.
2. Verify the HVAC control module scan tool A/C Request Signal parameter changes between Active and Inactive.
 - **If the parameter does not change**

Replace the A20 Radio/HVAC Controls.
 - **If the parameter changes**
3. Set A/C system to coolest setting with blower ON.
4. Press and release the A/C switch several times.
5. Verify the ECM scan tool A/C Request Signal parameter changes between Active and Inactive.
 - **If the parameter does not change**

Replace the K33 HVAC Control Module.
 - **If the parameter changes**
6. Verify the A/C compressor clutch engages when commanding the ECM A/C Relay output function On and Off with a scan tool.
 - **If the A/C compressor clutch does not engage**

Refer to **DTC P0645, P0646, or P0647**

- **If the A/C compressor clutch engages**

7. Engine ON.

8. Verify the HVAC control module scan tool A/C Compressor Refrigerant Solenoid Valve Command parameter changes with varying cooling loads.

- **If the parameter does not change**

Refer to **DTC B393B**

- **If the parameter does change**

9. All OK.

Repair Instructions

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

- **HVAC Component Replacement Reference**
- **Control Module References** for HVAC control module replacement, programming and setup

AFTERBLOW ENABLING

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

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

1. Connect the Scan Tool.
2. Turn ON the ignition, with the engine OFF.
3. Build the vehicle with the scan tool.
4. Select Module Diagnosis.
5. Select Remote Heater and Air Conditioning Control Module.
6. Select Configuration/Reset Functions.
7. Select HVAC Afterblow Configuration.

When afterblow has been enabled by the scan tool the blower motor will operate at 68% blower speed, following the sequence below up to 5 times. This could last up to an hour:

1. The blower motor will be OFF for 7-11 minutes.
2. The blower motor will RUN for 25-30 seconds.

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

- The engine must be turned off for at least 30 min.
- The outside air temperature must be at least 21°C (70°F).

- The A/C compressor must have operated for more than 2 minutes before shut down during the latest key cycle.
- The system voltage must be at least 12 V.

ACTUATOR RECALIBRATION

HVAC Control Module Replacement

When replacing or disconnecting the HVAC control module, it will be necessary to perform a recalibration process. When installing or reconnecting the HVAC control module, be sure to perform the following:

Preferred Method (with Scan Tool)

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

1. Ignition OFF.
2. Disconnect the scan tool.
3. Install/connect the HVAC control module.
4. Connect all previously disconnected components.
5. Start the vehicle.
6. With the scan tool, initiate the HVAC Actuators Learn feature of the HVAC control module Special Functions menu.
7. Operate system and verify that no DTCs have set as current DTCs.
8. If DTC B101E 4B is set after attempting the actuator recalibration procedure, perform the following:
 1. Verify which actuator does not have a scan tool learn status parameter status of complete.
 2. Verify the unlearned actuator is physically rotating - A common cause of DTC B101E 4B is an actuator that is electrically OK but fails to physically rotate (e.g. stripped gears).
 3. If the unlearned actuator is not physically rotating, replace the actuator, otherwise replace the HVAC control module.

Alternate Method (without Scan Tool)

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

1. Clear all DTCs.
2. Ignition OFF.
3. Install/connect the HVAC control module.
4. Connect all previously disconnected components.
5. Remove the HVAC control module fuse for a minimum of 10 s.

6. Install the HVAC control module fuse.
7. Start the vehicle.
8. Wait 40 s for the HVAC control module to self-calibrate.

Actuator Replacement

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

Preferred Method (with Scan Tool)

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

1. Clear all DTCs.
2. Ignition OFF.
3. Install the HVAC actuator.
4. Connect all previously disconnected components.
5. Start the vehicle.
6. With the scan tool, initiate the HVAC Actuators Relearn feature of the HVAC control module Special Functions menu.
7. Operate system and verify that no DTCs have set as current DTCs.
8. If DTC B101E 4B is set after attempting the actuator recalibration procedure, perform the following:
 1. Verify which actuator does not have a scan tool learn status parameter status of complete.
 2. Verify the unlearned actuator is physically rotating - A common cause of DTC B101E 4B is an actuator that is electrically OK but fails to physically rotate (e.g. stripped gears).
 3. If the unlearned actuator is not physically rotating, replace the actuator, otherwise replace the HVAC control module.

Alternate Method (without Scan Tool)

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

1. Clear all DTCs.
2. Ignition OFF.
3. Install the HVAC actuator.
4. Connect all previously disconnected components.
5. Remove the HVAC control module fuse for a minimum of 10 s.
6. Install the HVAC control module fuse.

7. Start the vehicle.
8. Wait 40 s for the HVAC control module to self-calibrate.

REPAIR INSTRUCTIONS

HEATER AND AIR CONDITIONING REMOTE CONTROL REPLACEMENT

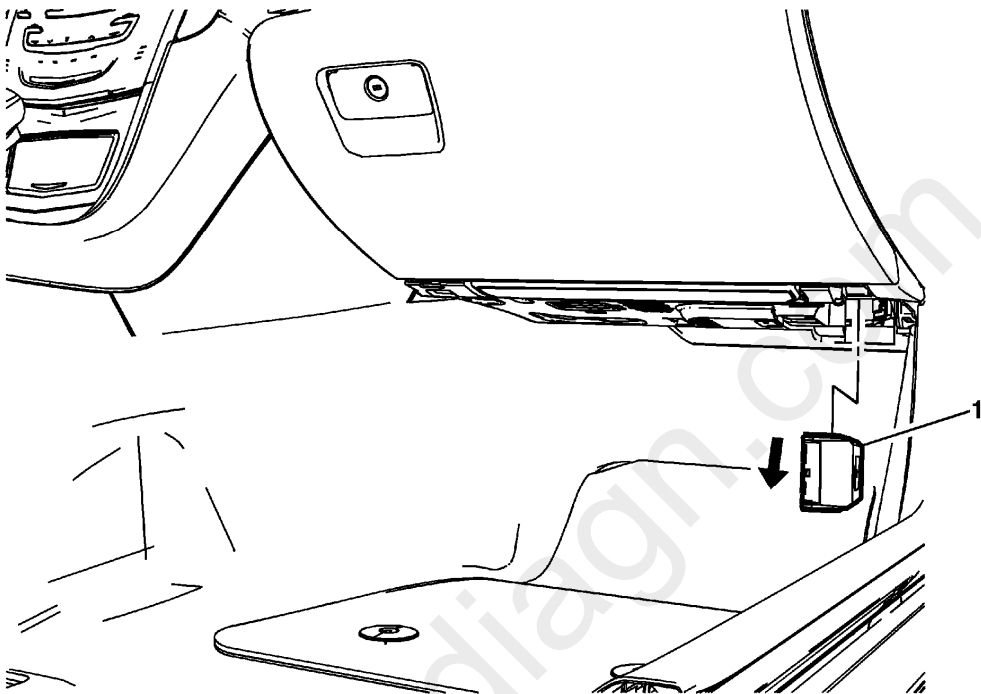


Fig. 7: Heater and Air Conditioning Remote Control
 Courtesy of GENERAL MOTORS COMPANY

Heater and Air Conditioning Remote Control Replacement

Call out	Component Name
Preliminary Procedure Remove the right side instrument panel insulator hole cover. Refer to <u>Instrument Panel Insulator Hole Cover Replacement</u> .	
NOTE: When removing the instrument panel lower trim panel insulator for any reason, it is required that the connector to the HVAC module be disconnected. If the vehicle battery has NOT been disconnected, when reinstalling or reconnecting the module, the BROWN J2 connector must be connected last. Once all the parts are all in place, check and clear all DTCs in the HVAC module.	
	Heater And Air Conditioning Remote Control Module
	Procedures

- | | |
|---|--|
| 1 | <ol style="list-style-type: none"> 1. Disconnect the heater and air conditioning remote control module connectors. 2. Perform the HVAC system control module programming and setup procedure. <p>Refer to <u>HVAC System Control Module Programming and Setup</u> .</p> <ol style="list-style-type: none"> 3. Perform the actuator re-calibration procedure. <p>Refer to <u>Actuator Recalibration</u>.</p> |
|---|--|

HEATER AND AIR CONDITIONING CONTROL TEMPERATURE ROD REPLACEMENT (CJ2)

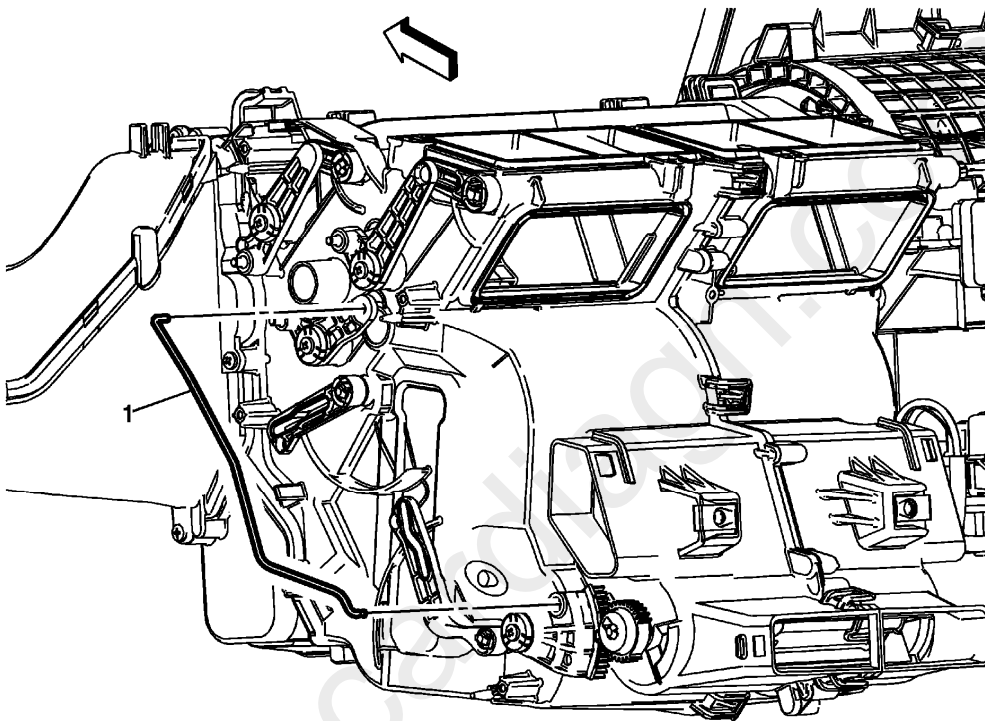


Fig. 8: Heater and Air Conditioning Control Temperature Rod (CJ2)
 Courtesy of GENERAL MOTORS COMPANY

Heater and Air Conditioning Control Temperature Rod Replacement (CJ2)

Callout	Component Name
Preliminary Procedure	
Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ2)</u> .	
1	Heater and Air Conditioning Control Temperature Rod

AUXILIARY HEATER AND AIR CONDITIONING CONTROL REPLACEMENT (CJ4)

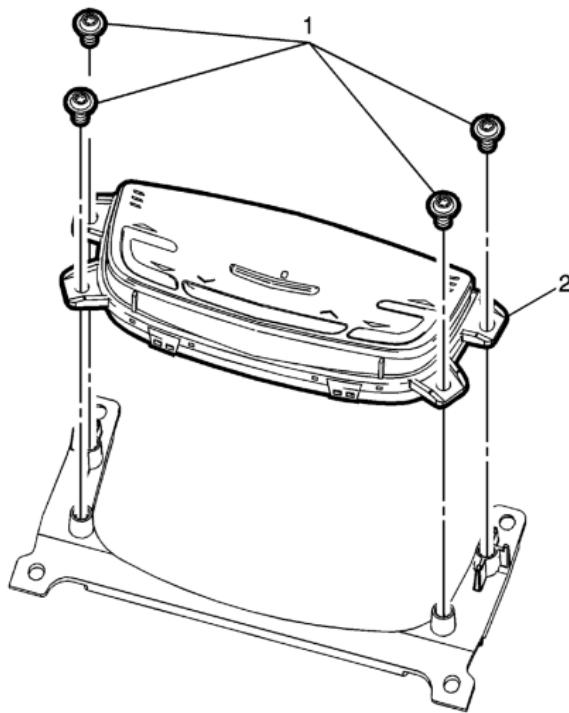


Fig. 9: Auxiliary Heater and Air Conditioning Control (CJ4)
Courtesy of GENERAL MOTORS COMPANY

Auxiliary Heater and Air Conditioning Control Replacement (CJ4)

Call out	Component Name
Preliminary Procedure Remove the front floor console bracket. Refer to <u>Front Floor Console Bracket Replacement</u> .	
1	Auxiliary Heater and Air Conditioning Control Fastener (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .
2	Auxiliary Heater and Air Conditioning Control Procedure Disconnect the auxiliary heater and air conditioning control electrical connector.

VENT VALVE LEVER REPLACEMENT

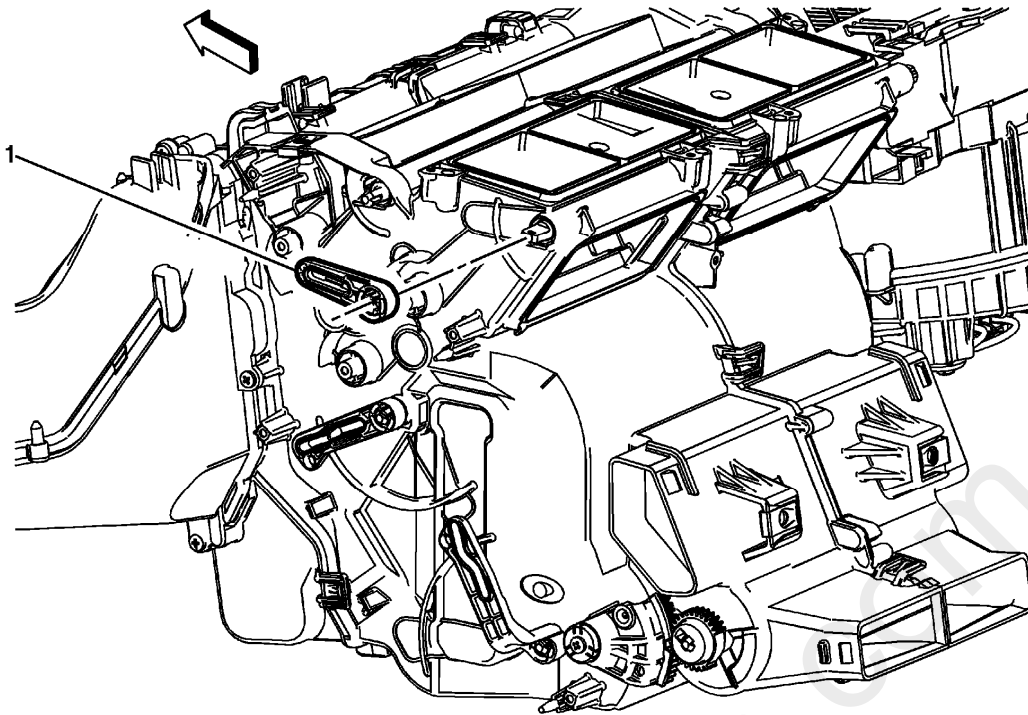


Fig. 10: Vent Valve Lever
 Courtesy of GENERAL MOTORS COMPANY

Vent Valve Lever Replacement

Callout	Component Name
Preliminary Procedure Remove the face sub mode control cam actuator lever. Refer to <u>Mode Control Cam Actuator Lever Replacement (CJ4)</u> , <u>Mode Control Cam Actuator Lever Replacement (CJ2)</u> .	
1	Vent Valve Lever

AIR INLET VALVE ACTUATOR REPLACEMENT (FRESH AIR)

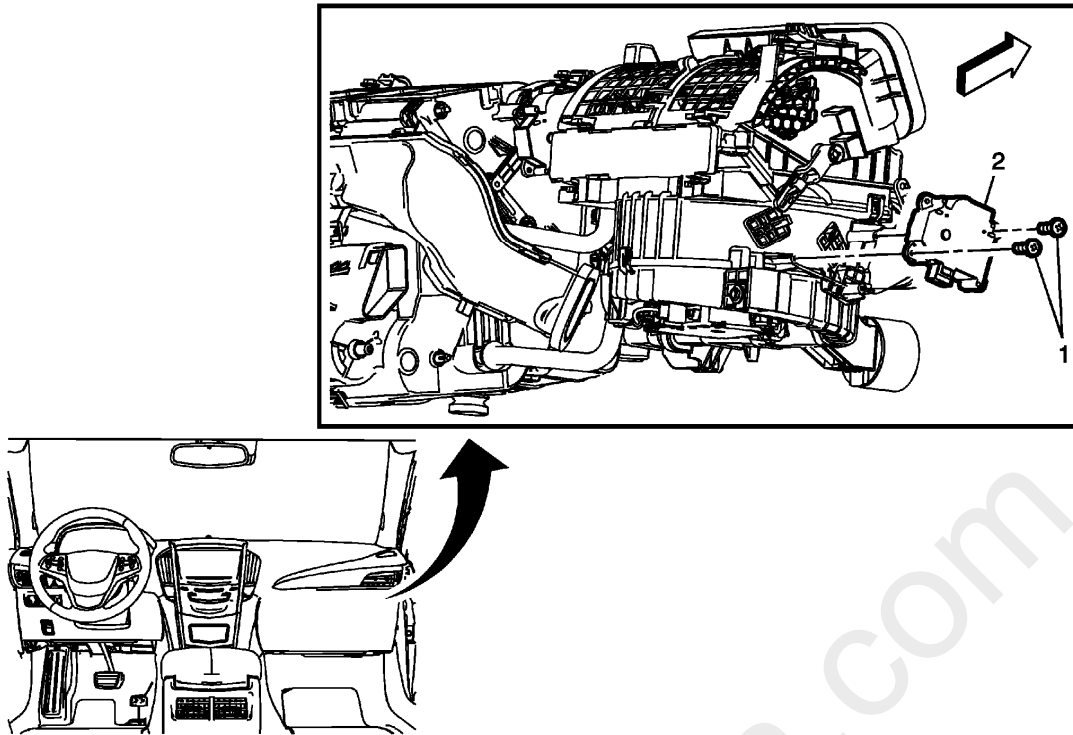


Fig. 11: Air Inlet Valve Actuator (Fresh Air)
 Courtesy of GENERAL MOTORS COMPANY

Air Inlet Valve Actuator Replacement (Fresh Air)

Callout	Component Name
Preliminary Procedures 1. Remove the instrument panel compartment assembly. Refer to <u>Instrument Panel Compartment Replacement</u> . 2. Remove the radio receiver assembly. Refer to <u>Radio Replacement</u> . 3. Disconnect the electrical connectors.	
1	Air Inlet Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Air Inlet Valve Actuator - Fresh Air Procedures 1. Disconnect the fresh air inlet valve actuator connector. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>.

MODE VALVE ACTUATOR GEAR REPLACEMENT (CJ4)

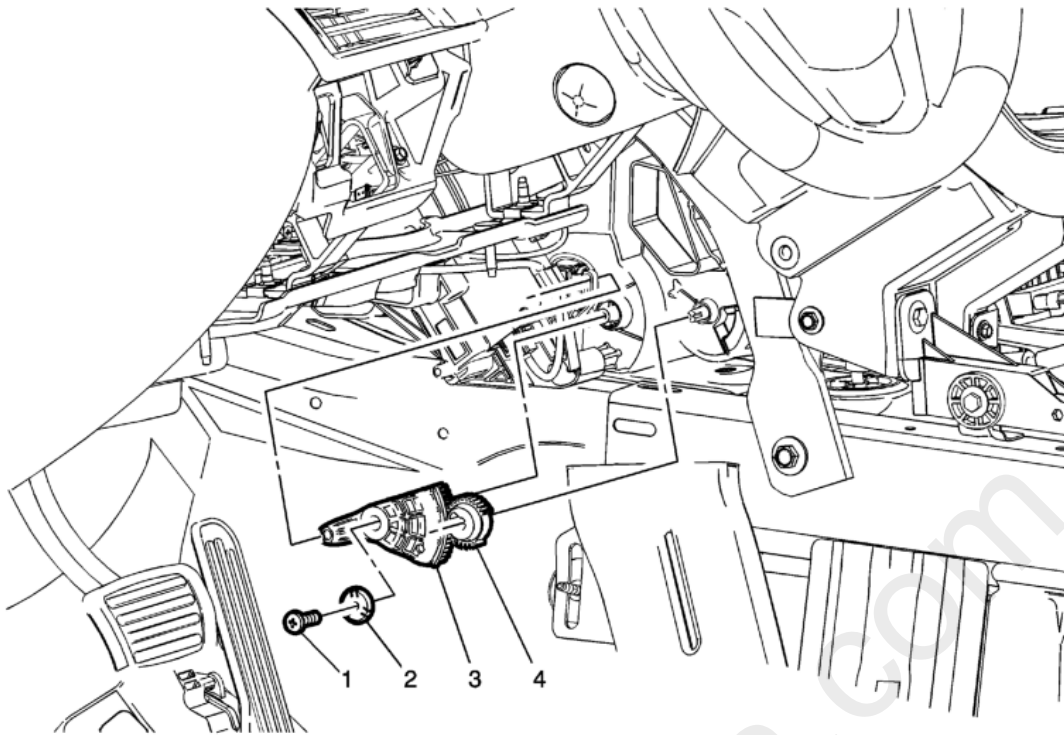


Fig. 12: Mode Valve Actuator Gear (CJ4)
Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Gear Replacement (CJ4)

Call out	Component Name
Preliminary Procedures	
1. Remove the drivers side instrument panel lower trim panel insulator. Refer to <u>Instrument Panel Lower Trim Panel Insulator Replacement - Left Side</u> . 2. Remove the instrument panel knee bolster assembly. Refer to <u>Instrument Panel Knee Bolster Replacement</u> . 3. Remove the left side front floor console side trim panel. Refer to <u>Front Floor Console Side Trim Panel Replacement - Left Side</u> . 4. Pull the driver side carpet back to gain access to the mode valve actuator gears. 5. Remove the left side floor rear air outlet duct adaptor. Refer to <u>Floor Rear Air Outlet Duct Replacement - Left Side</u> .	
1	Mode Valve Actuator Gear Fastener CAUTION: Refer to <u>Fastener Caution</u> .
2	Mode Valve Actuator Gear Washer
	Mode Valve Actuator Gear - Mid Link
Procedure	

3	1. Maneuver the mid link mode valve gear out of the console mode valve actuator cam. 2. Align the mid link mode valve gear wider female tooth, to the wider rear mode door valve actuator gear male tooth.
4	Mode Valve Actuator Gear - Rear Door Procedure 1. Unlatch the mode valve actuator gear detent, and slide door side mode valve actuator gear off. 2. Align the mid link mode valve gear wider female tooth, to the wider rear mode door valve actuator gear male tooth.

MODE VALVE ACTUATOR GEAR REPLACEMENT (CJ2)

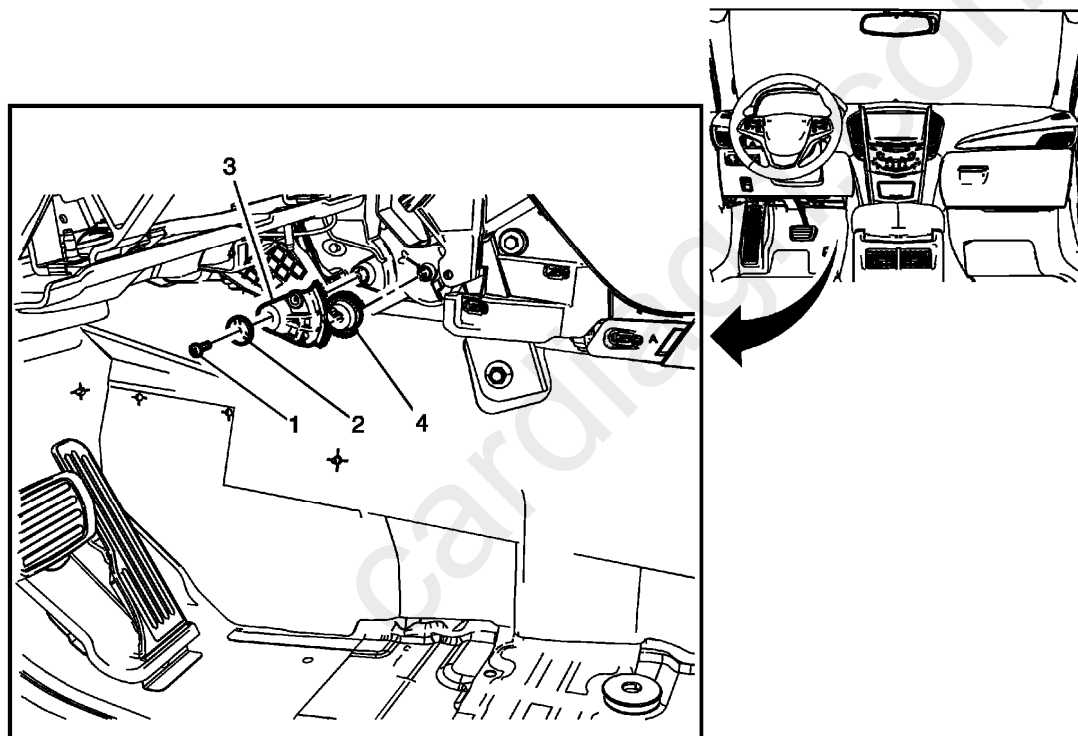


Fig. 13: Mode Valve Actuator Gear (CJ2)
 Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Gear Replacement (CJ2)

Call out	Component Name
Preliminary Procedures	
1.	Remove the drivers side instrument panel lower trim panel insulator. Refer to <u>Instrument Panel Lower Trim Panel Insulator Replacement - Left Side</u> .
2.	Remove the instrument panel knee bolster assembly. Refer to <u>Instrument Panel Knee Bolster</u>

Replacement .

3. Remove the left side front floor console side trim panel. Refer to **Front Floor Console Side Trim Panel Replacement - Left Side .**
4. Remove the left side floor rear air outlet duct. Refer to **Floor Rear Air Outlet Duct Replacement - Left Side .**
- 5.

1	Mode Valve Actuator Gear Fastener CAUTION: Refer to <u>Fastener Caution .</u>
2	Mode Valve Actuator Gear Washer
3	Mode Valve Actuator Gear - Rod Side Procedure 1. Disconnect the heater and air conditioning control temperature rod. 2. Align the rod side mode valve actuator gear wider female tooth, to the wider mode door valve actuator gear male tooth.
4	Mode Valve Actuator Gear - Door Side Procedure 1. Unlatch the mode valve actuator gear detent, and slide door side mode valve actuator gear off. 2. Align the rod side mode valve actuator gear wider female tooth, to the wider mode door valve actuator gear male tooth.

MODE VALVE ACTUATOR REPLACEMENT (CJ4)

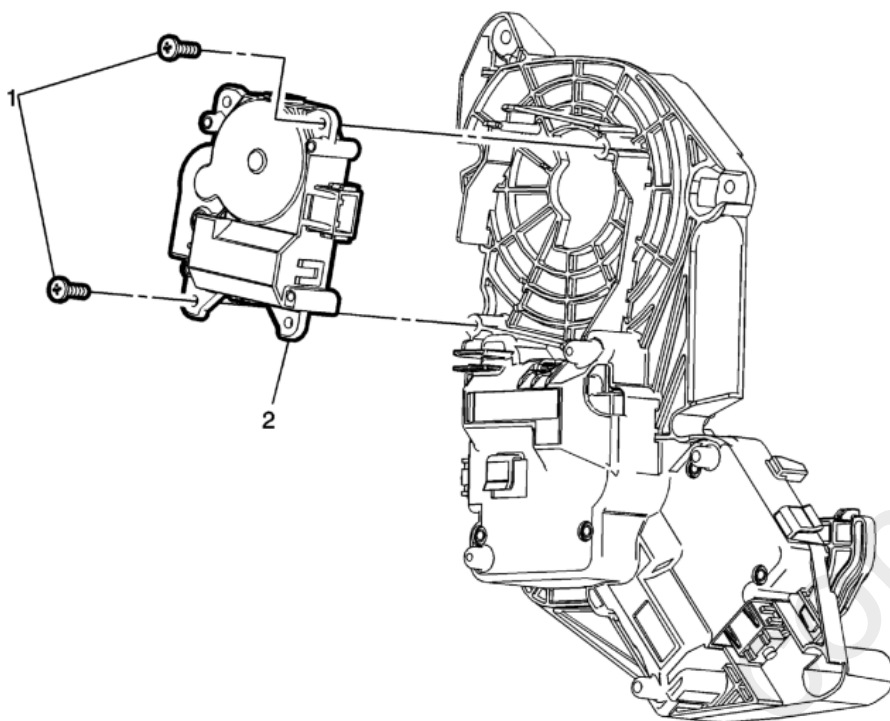


Fig. 14: Mode Valve Actuator (CJ4)
 Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Replacement (CJ4)

Callout	Component Name
Preliminary Procedure Remove the mode control cam. Refer to <u>Mode Control Cam Replacement (CJ4)</u> .	
1	Mode Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Mode Valve Actuator Procedure Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> .

MODE VALVE ACTUATOR REPLACEMENT (CJ2)

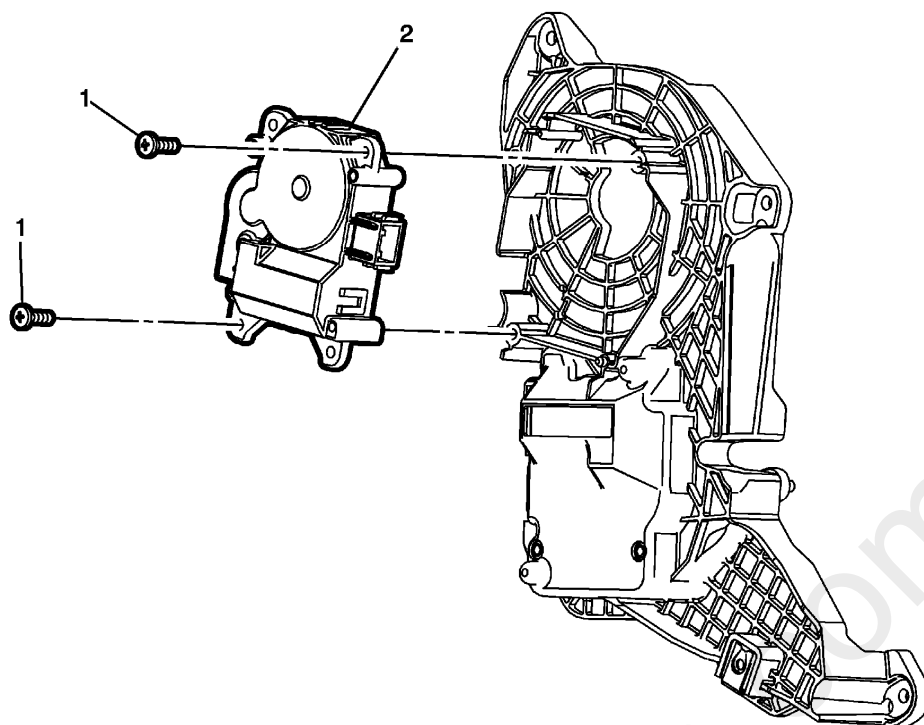


Fig. 15: Mode Valve Actuator (CJ2)
 Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Replacement (CJ2)

Callout	Component Name
Preliminary Procedure Remove the mode control cam. Refer to Mode Control Cam Replacement (CJ2) .	
1	Mode Valve Actuator Fastener (Qty: 2) CAUTION: Refer to Fastener Caution .
2	Mode Valve Actuator Procedure Perform the actuator calibration procedure. Refer to Actuator Recalibration .

MODE CONTROL CAM REPLACEMENT (CJ4)

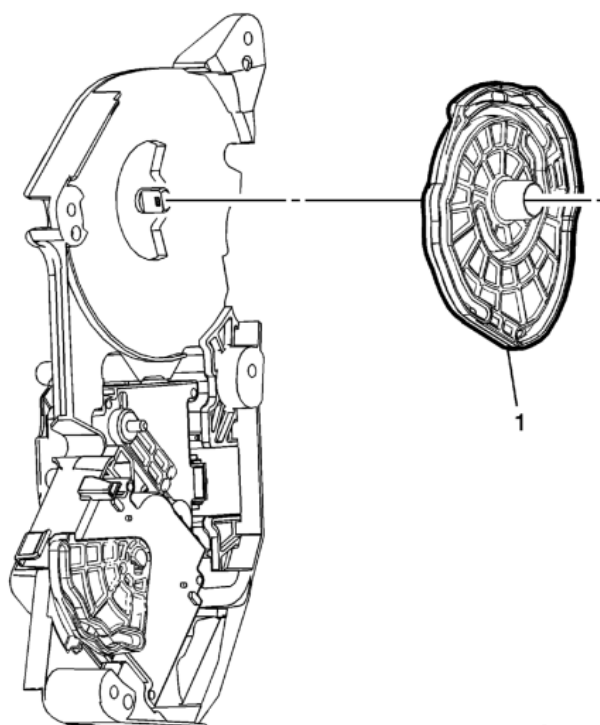


Fig. 16: Mode Control Cam (CJ4)

Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Replacement (CJ4)

Callout	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ4)</u> .	
1	Mode Control Cam Procedure Going through the center of the mode control cam, release the mode control cam detent using the appropriate tool to remove the cam from the mode valve actuator.

MODE CONTROL CAM REPLACEMENT (CJ2)

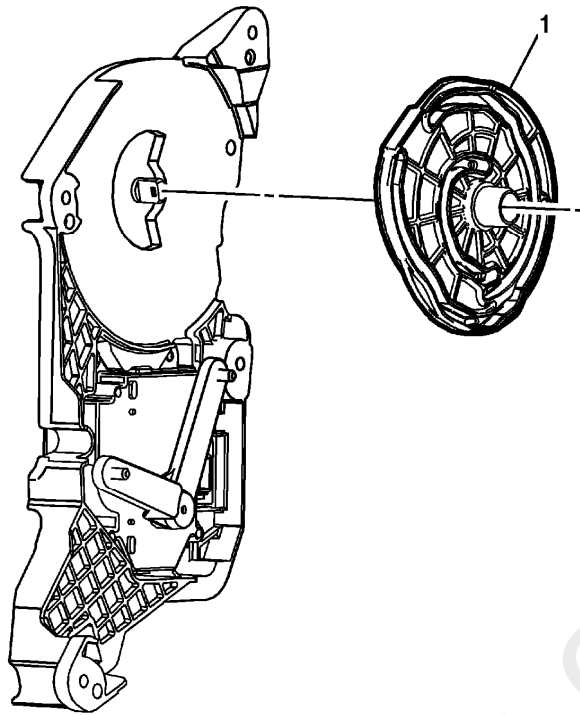


Fig. 17: Mode Control Cam (CJ2)

Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Replacement (CJ2)

Callout	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ2)</u> .	
1	Mode Control Cam Procedure Going through the center of the mode control cam, release the mode control cam detent using the appropriate tool to remove the cam from the mode valve actuator.

MODE CONTROL CAM COVER REPLACEMENT (CJ4)

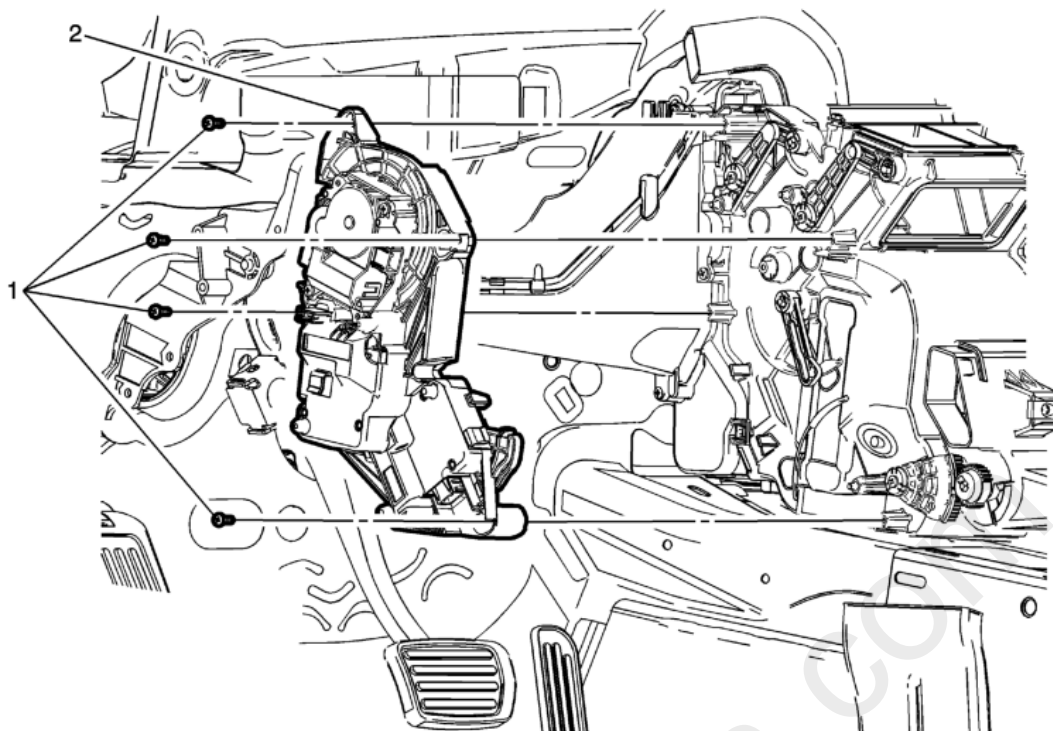


Fig. 18: Mode Control Cam Cover (CJ4)
 Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Cover Replacement (CJ4)

Call out	Component Name
Preliminary Procedure	
Remove the air distributor lower duct assembly. Refer to <u>Air Distributor Lower Duct Replacement</u> .	
1	Heater and Air Conditioning Mode Control Cam Cover Fastener (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .
2	Heater and Air Conditioning Mode Control Cam Cover Procedures 1. Disconnect the actuator electrical connectors. 2. Remove the mode control valve actuator. Refer to <u>Mode Valve Actuator Replacement (CJ4)</u>. 3. Remove the temperature valve actuator. Refer to <u>Temperature Valve Actuator Replacement - Left Side (CJ4)</u>. 4. Transfer all the necessary components. 5. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>.

MODE CONTROL CAM COVER REPLACEMENT (CJ2)

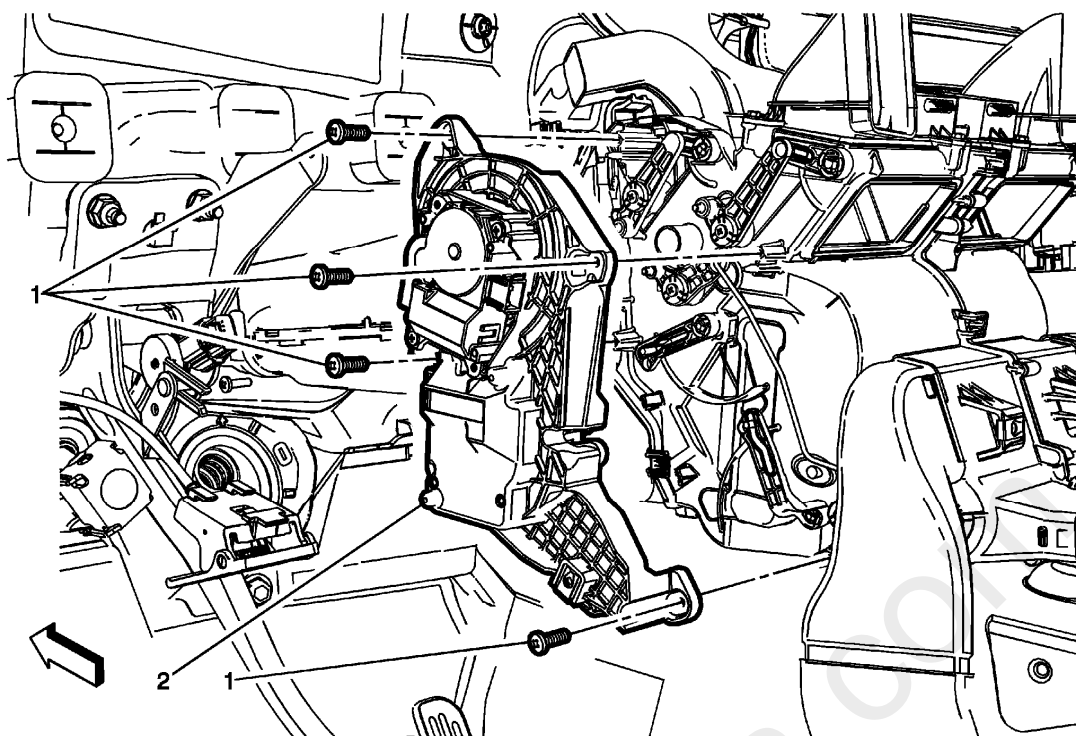


Fig. 19: Mode Control Cam Cover (CJ2)
 Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Cover Replacement (CJ2)

Callout	Component Name
Preliminary Procedure	
Remove the air distributor lower duct assembly. Refer to <u>Air Distributor Lower Duct Replacement</u> .	
1	Heater and Air Conditioning Mode Control Cam Cover Fastener (Qty: 4) CAUTION: Refer to <u>Fastener Caution</u> .
2	Heater and Air Conditioning Mode Control Cam Cover Procedures 1. Disconnect the actuator electrical connectors. 2. Remove the mode control valve actuator. Refer to <u>Mode Valve Actuator Replacement (CJ2)</u>. 3. Remove the temperature valve actuator. Refer to <u>Temperature Valve Actuator Replacement - Left Side (CJ2)</u>. 4. Transfer all the necessary components.

MODE CONTROL CAM ACTUATOR LEVER REPLACEMENT (CJ4)

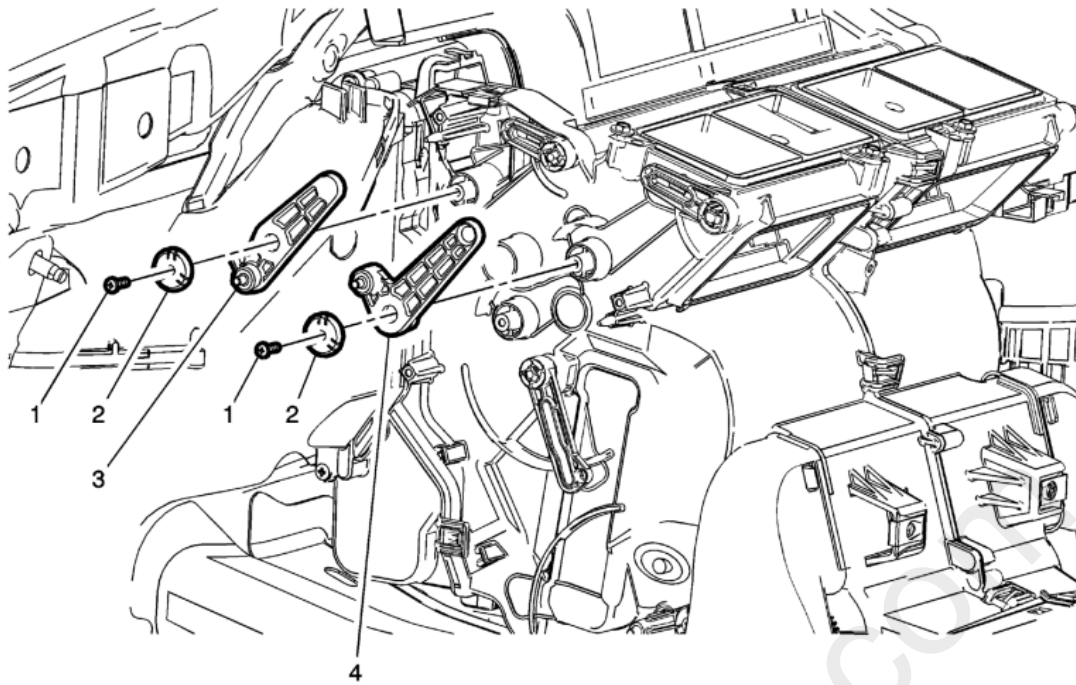


Fig. 20: Mode Control Cam Actuator Lever (CJ4)
 Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Actuator Lever Replacement (CJ4)

Call out	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ4)</u> .	
1	Mode Control Cam Actuator Lever Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Mode Control Cam Actuator Lever Washer (Qty: 2)
3	Mode Control Cam Actuator Lever - Defroster Sub
4	Mode Control Cam Actuator Lever - Face Sub

MODE CONTROL CAM ACTUATOR LEVER REPLACEMENT (CJ2)

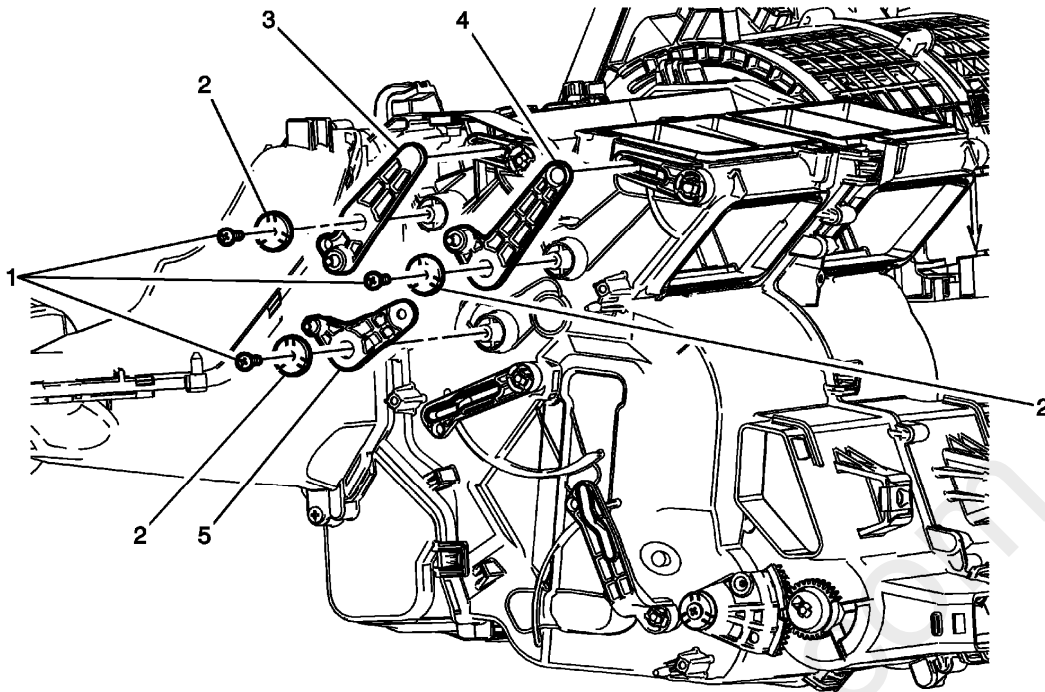


Fig. 21: Mode Control Cam Actuator Lever (CJ2)
 Courtesy of GENERAL MOTORS COMPANY

Mode Control Cam Actuator Lever Replacement (CJ2)

Callout	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ2)</u> .	
1	Mode Control Cam Actuator Lever Fastener (Qty: 3) CAUTION: Refer to <u>Fastener Caution</u> .
2	Mode Control Cam Actuator Lever Washer (Qty: 3)
3	Mode Control Cam Actuator Lever - Defroster Sub
4	Mode Control Cam Actuator Lever - Face Sub
5	Mode Control Cam Actuator Lever - Rear Mode Sub Procedures Remove the heater and air conditioning control temperature rod. Refer to <u>Heater and Air Conditioning Control Temperature Rod Replacement (CJ2)</u> .

DEFROSTER VALVE LEVER REPLACEMENT

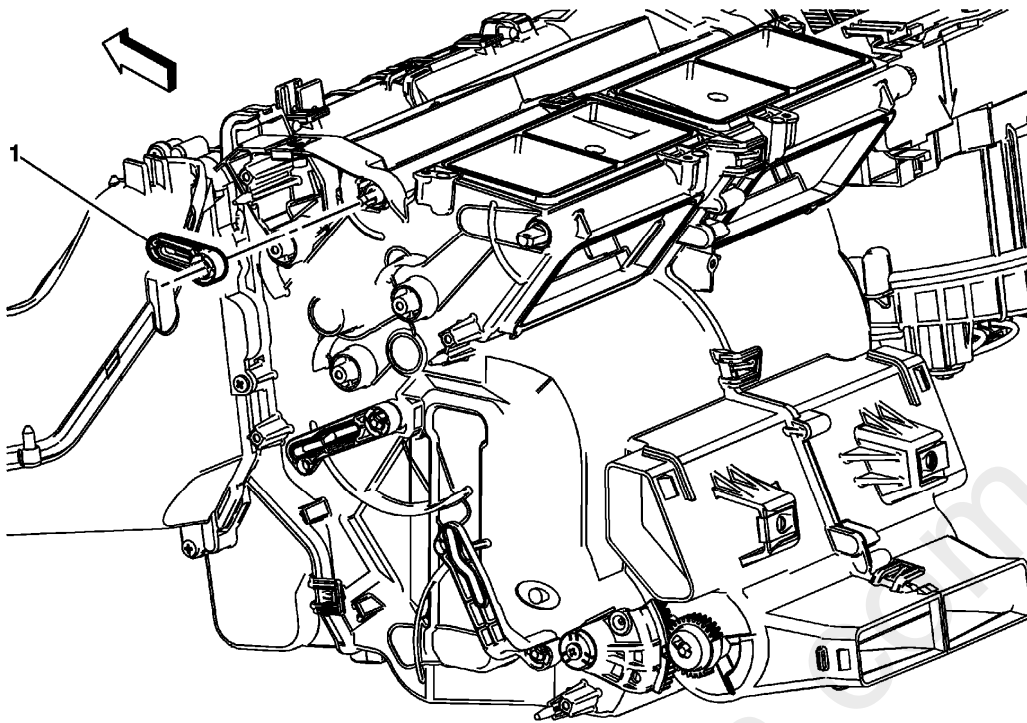


Fig. 22: Defroster Valve Lever
 Courtesy of GENERAL MOTORS COMPANY

Defroster Valve Lever Replacement

Callout	Component Name
Preliminary Procedure	
Remove the defrost sub lever. Refer to <u>Mode Control Cam Actuator Lever Replacement (CJ4)</u> , <u>Mode Control Cam Actuator Lever Replacement (CJ2)</u> .	
1	Defroster Valve Lever

TEMPERATURE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE

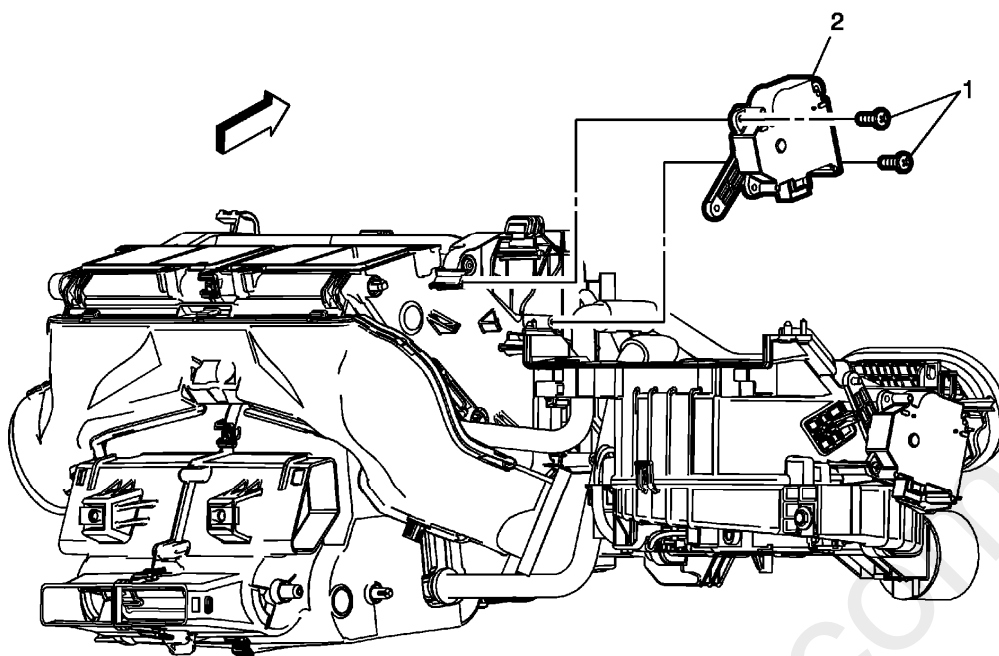


Fig. 23: Temperature Valve Actuator - Right Side
 Courtesy of GENERAL MOTORS COMPANY

Temperature Valve Actuator Replacement - Right Side

Callout	Component Name
Preliminary Procedure	
Remove the fresh air inlet housing assembly. Refer to <u>Air Inlet Housing Replacement</u> .	
1	Right Side Temperature Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Temperature Valve Actuator - Right Side Procedures 1. Disconnect the right side temperature valve actuator connector. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> .

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE (CJ4)

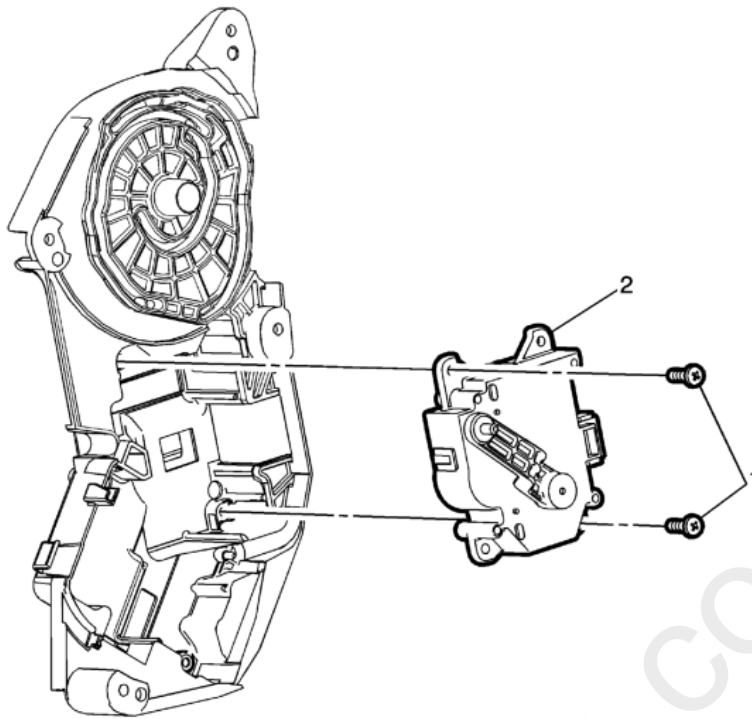


Fig. 24: Temperature Valve Actuator - Left Side (CJ4)
 Courtesy of GENERAL MOTORS COMPANY

Temperature Valve Actuator Replacement - Left Side (CJ4)

Call out	Component Name
Preliminary Procedure Remove the console mode valve actuator. Refer to <u>Mode Valve Actuator Replacement - Console (Left Side)</u> .	
1	Temperature Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Temperature Valve Actuator - Left Side Procedure Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> .

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE (CJ2)

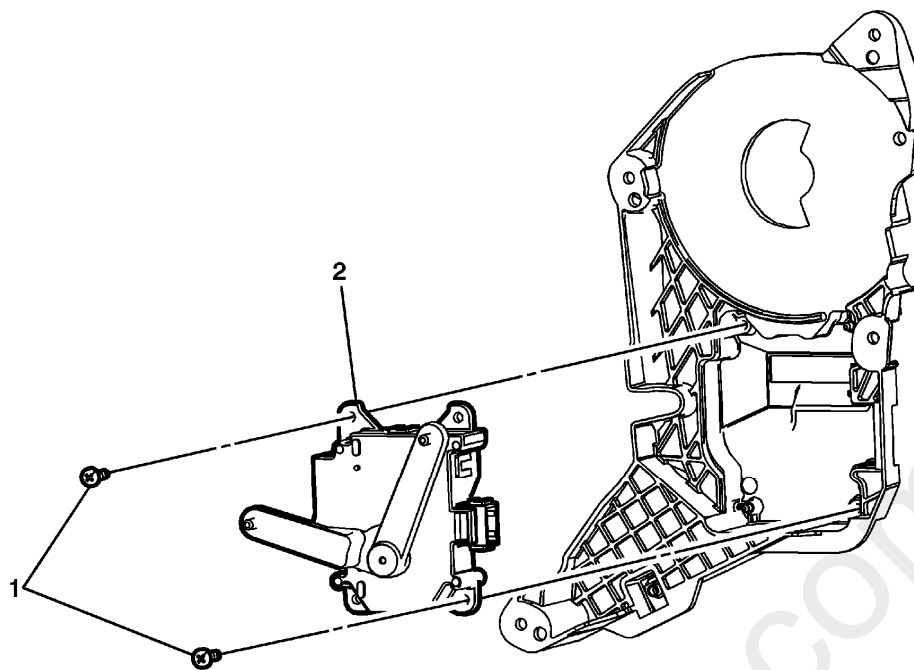


Fig. 25: Temperature Valve Actuator - Left Side (CJ2)

Courtesy of GENERAL MOTORS COMPANY

Temperature Valve Actuator Replacement - Left Side (CJ2)

Callout	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ2)</u> .	
1	Temperature Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Temperature Valve Actuator - Left Side Procedures 1. Disconnect the left side temperature valve actuator connector. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>.

AUXILIARY TEMPERATURE VALVE ACTUATOR REPLACEMENT (CJ4)

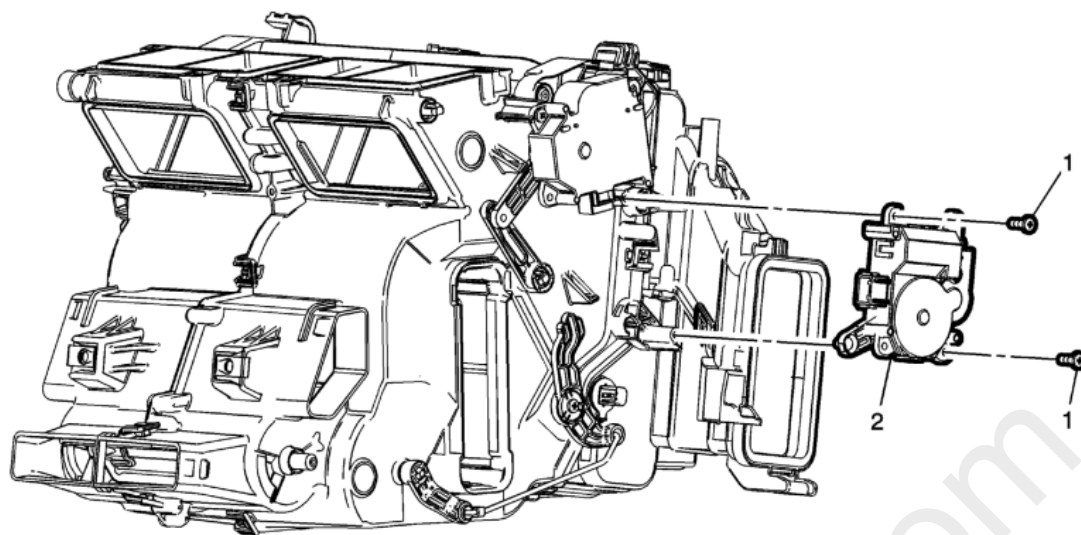


Fig. 26: Auxiliary Temperature Valve Actuator (CJ4)

Courtesy of GENERAL MOTORS COMPANY

Auxiliary Temperature Valve Actuator Replacement (CJ4)

Call out	Component Name
Preliminary Procedure Remove the heater core assembly. Refer to <u>Heater Core Replacement</u> .	
1	Auxiliary Temperature Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Auxiliary Temperature Valve Actuator Procedures 1. Disconnect the auxiliary temperature valve actuator electrical connector. 2. Align the auxiliary temperature valve actuator lever pin into the heater lever guide. 3. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>.

MODE VALVE ACTUATOR REPLACEMENT - CONSOLE (LEFT SIDE)

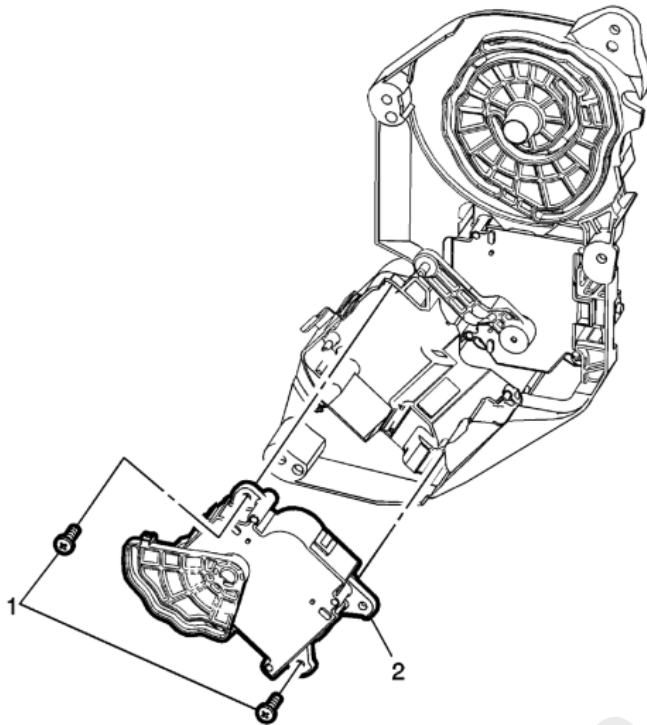


Fig. 27: Mode Valve Actuator - Console (Left Side)
 Courtesy of GENERAL MOTORS COMPANY

Mode Valve Actuator Replacement - Console (Left Side)

Callout	Component Name
Preliminary Procedure Remove the heater and air conditioning mode control cam cover assembly. Refer to <u>Mode Control Cam Cover Replacement (CJ4)</u> , <u>Mode Control Cam Cover Replacement (CJ2)</u> .	
1	Mode Valve Actuator Fastener (Qty: 2) CAUTION: Refer to <u>Fastener Caution</u> .
2	Mode Valve Actuator - Console Left Side Procedure Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> .

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER (FRONT FLOOR CONSOLE CJ4)

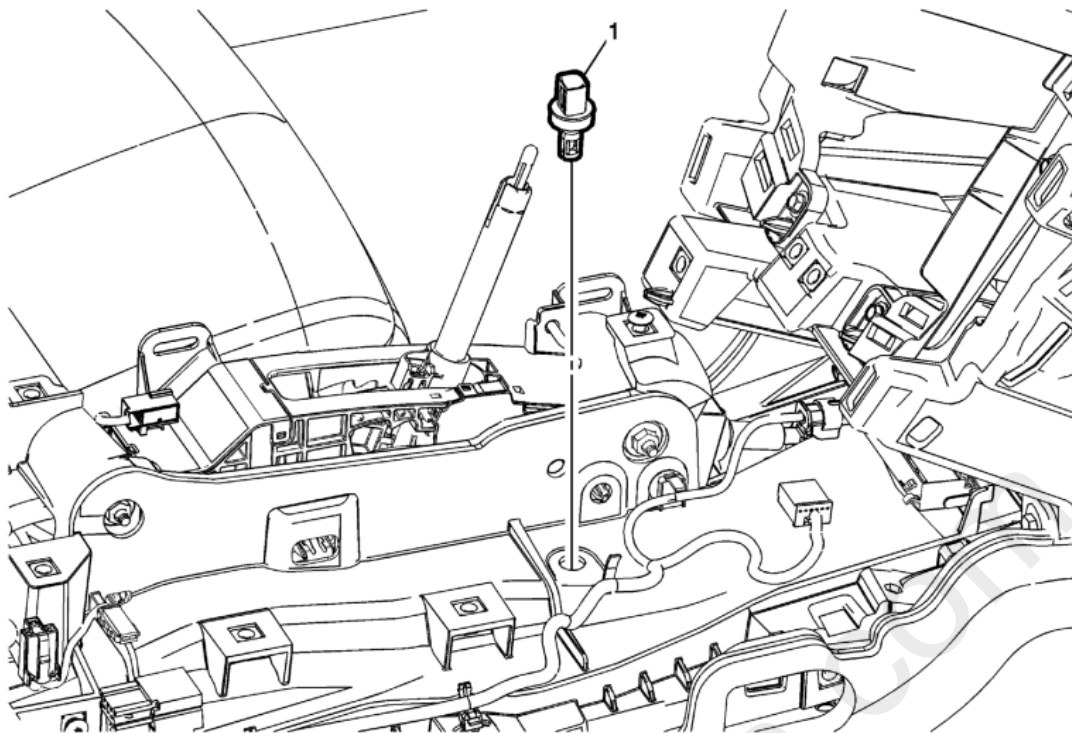


Fig. 28: Duct Air Temperature Sensor - Upper (Front Floor Console CJ4)
Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Upper (Front Floor Console CJ4)

Call out	Component Name
Preliminary Procedure Remove the front floor console cup holder plate assembly. Refer to <u>Front Floor Console Cup Holder Plate Replacement</u> .	
1	Duct Air Temperature Sensor - Upper Front Floor Console Outlet Duct Procedures 1. Disconnect the upper front floor console outlet duct air temperature sensor electrical connector. 2. Twist and pull the upper front floor console outlet duct air temperature sensor out of front floor console air outlet duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER RIGHT SIDE

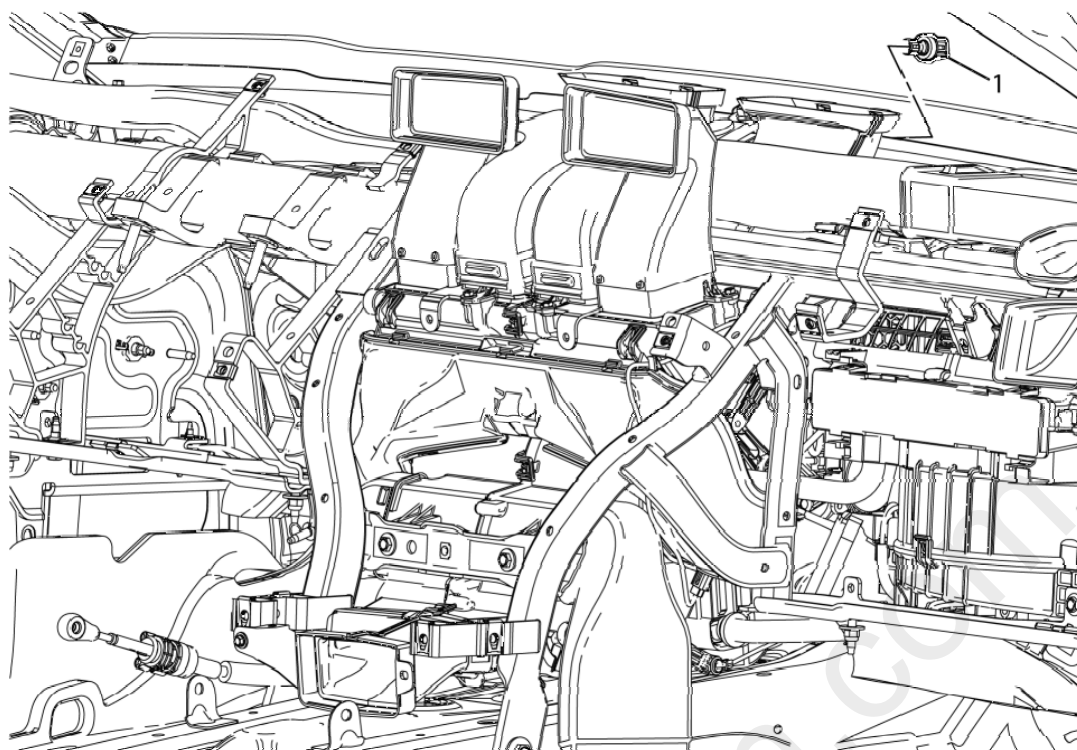


Fig. 29: Duct Air Temperature Sensor - Upper Right Side
 Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Upper Right Side

Call out	Component Name
Preliminary Procedure	
Remove the instrument carrier assembly. Refer to <u>Instrument Carrier Replacement</u> .	
1	Duct Air Temperature Sensor - Upper Right Side Procedures 1. Disconnect the right upper duct air temperature sensor connector. 2. To remove the right upper duct air temperature sensor, pull the right upper duct air temperature sensor out of the right air distributor duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER LEFT SIDE

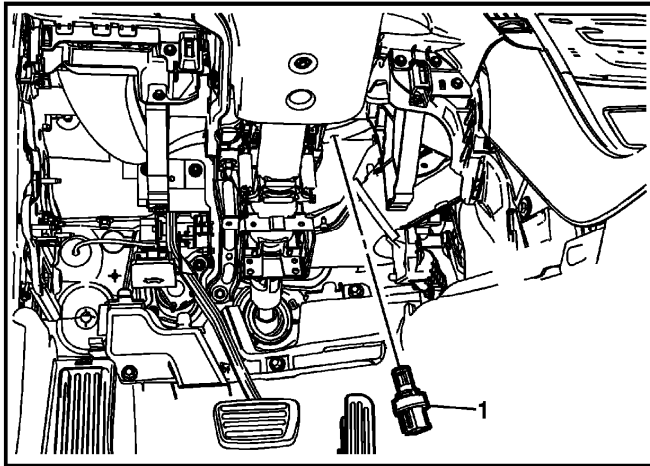


Fig. 30: Duct Air Temperature Sensor - Upper Left Side
 Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Upper Left Side

Callout	Component Name
Preliminary Procedures Remove the instrument panel driver knee bolster. Refer to <u>Instrument Panel Knee Bolster Replacement</u> .	
1	Duct Air Temperature Sensor - Upper Left Side Procedures 1. Disconnect the left upper duct air temperature sensor connector. 2. To remove the left upper duct air temperature sensor, pull the left upper duct air temperature sensor out of the left side air distributor duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER (RIGHT FLOOR REAR AIR OUTLET DUCT)

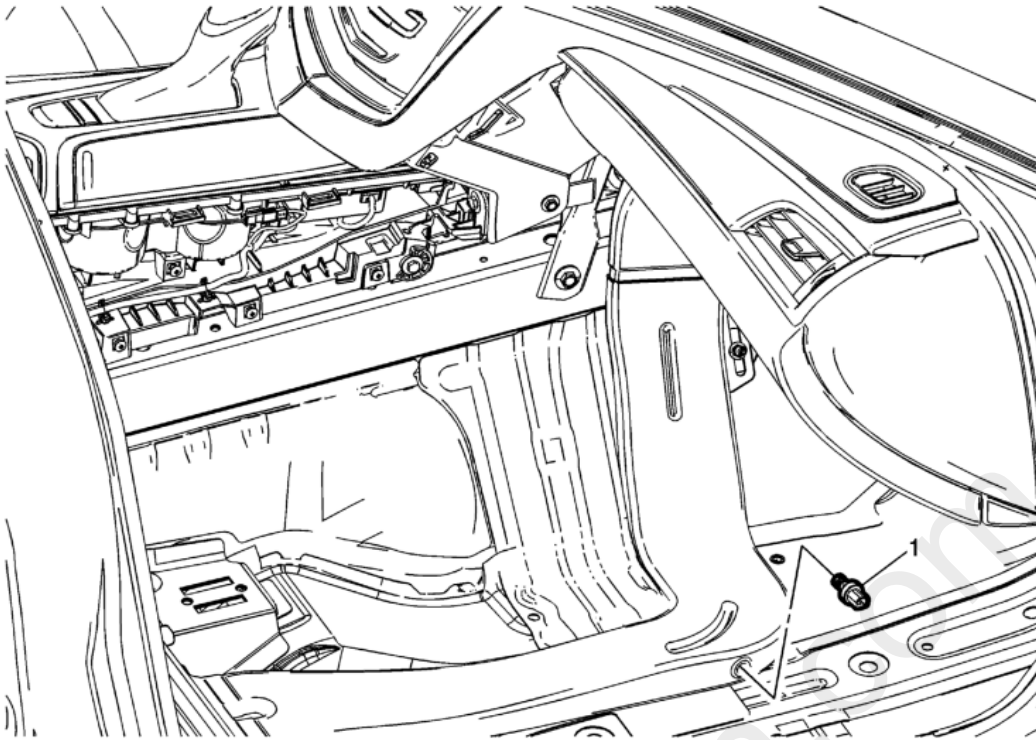


Fig. 31: Duct Air Temperature Sensor - Lower (Right Floor Rear Air Outlet Duct)
Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Lower (Right Floor Rear Air Outlet Duct)

Call out	Component Name
Preliminary Procedures 1. Remove the right front floor mat. 2. Open the VIN plate opening access cover.	
1	Duct Air Temperature Sensor - Lower Right Floor Rear Air Outlet Duct Procedures 1. Disconnect the lower right floor rear air outlet duct air temperature sensor electrical connector. 2. Twist and pull the lower right floor rear air outlet duct air temperature sensor out of right floor rear air outlet duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER LEFT SIDE

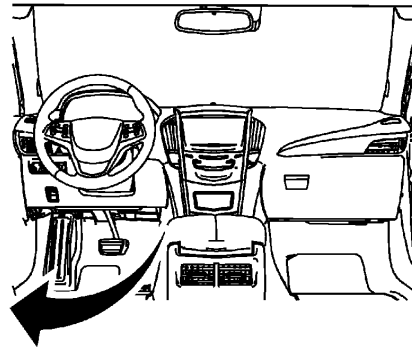
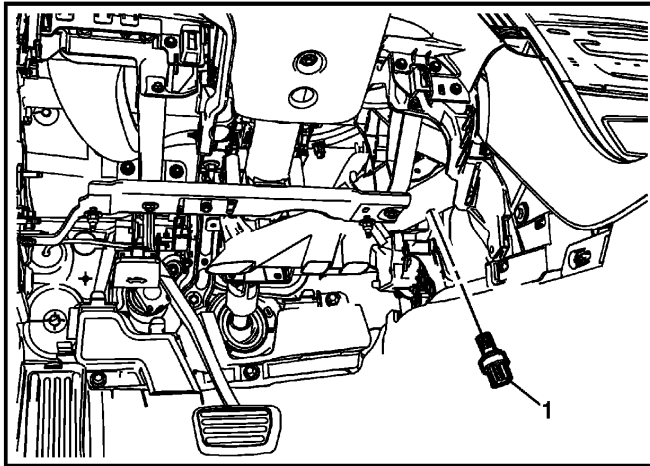


Fig. 32: Duct Air Temperature Sensor - Lower Left Side
 Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Lower Left Side

Callout	Component Name
Preliminary Procedures Remove the instrument panel knee bolster assembly. Refer to <u>Instrument Panel Knee Bolster Replacement</u> .	
1	Duct Air Temperature Sensor - Lower Left Side Procedures 1. Disconnect the left lower duct air temperature sensor connector. 2. To remove the left lower duct air temperature sensor, pull the left lower duct air temperature sensor out of the air distributor lower duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER RIGHT SIDE

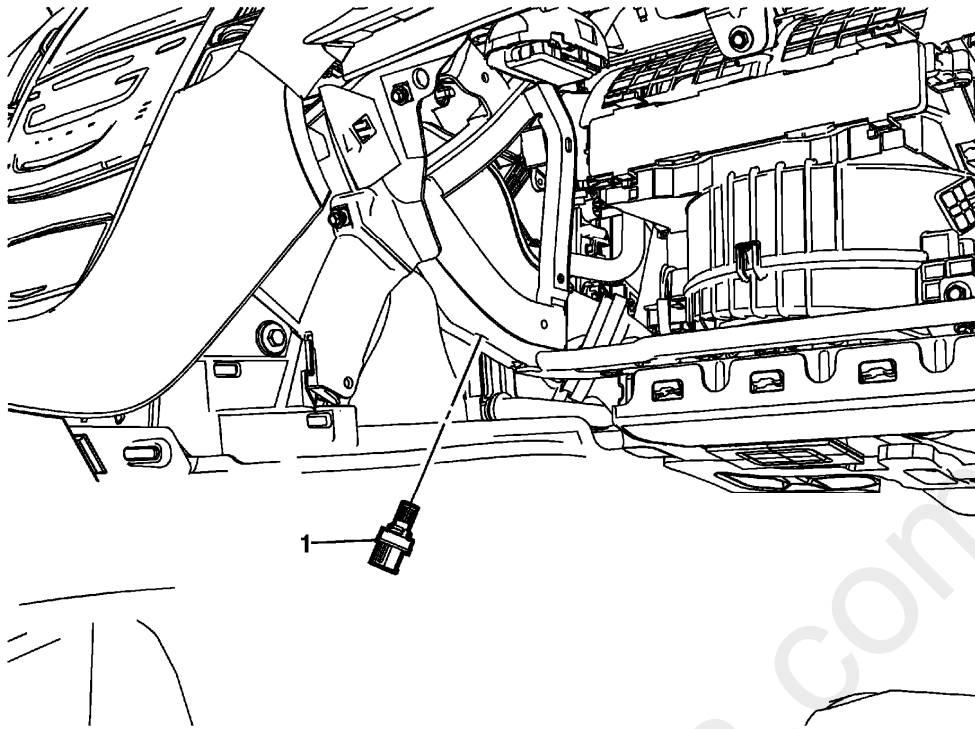


Fig. 33: Duct Air Temperature Sensor - Lower Right Side
 Courtesy of GENERAL MOTORS COMPANY

Duct Air Temperature Sensor Replacement - Lower Right Side

Call out	Component Name
Preliminary Procedures	
1. Remove the right side instrument panel lower center trim panel. Refer to <u>Instrument Panel Lower Center Trim Panel Replacement (Right Side)</u> , <u>Instrument Panel Lower Center Trim Panel Replacement (Left Side)</u> . 2. Pull back the right front floor carpet away from the center floor console.	
1	Duct Air Temperature Sensor - Lower Right Side Procedures 1. Disconnect the right lower duct air temperature sensor electrical connector. 2. To remove the right lower duct air temperature sensor, pull the right lower duct air temperature sensor out of the air distributor lower duct.

AMBIENT AIR QUALITY SENSOR REPLACEMENT

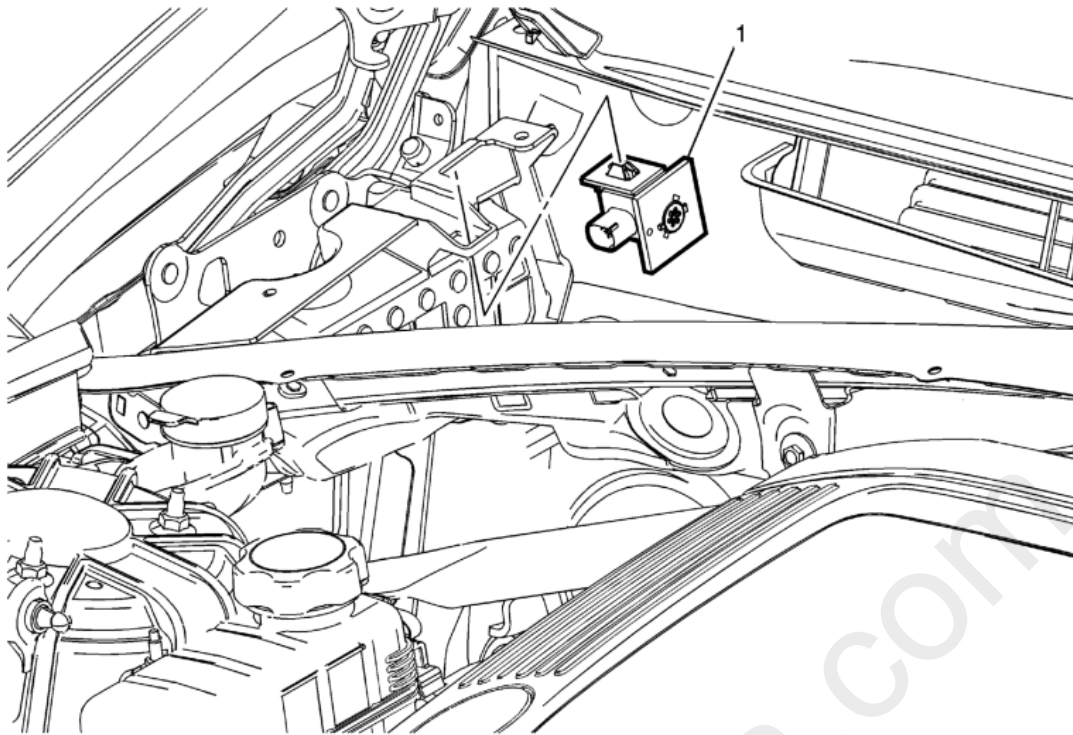


Fig. 34: Ambient Air Quality Sensor
 Courtesy of GENERAL MOTORS COMPANY

Ambient Air Quality Sensor Replacement

Call out	Component Name
Preliminary Procedure	
Remove the air inlet grille panel assembly. Refer to <u>Air Inlet Grille Panel Replacement</u> .	
1	Ambient Air Quality Sensor Procedures 1. Un-snap the ambient air quality sensor from the plenum side panel assembly. 2. Disconnect the ambient air quality sensor electrical connector.

EVAPORATOR AIR TEMPERATURE SENSOR REPLACEMENT

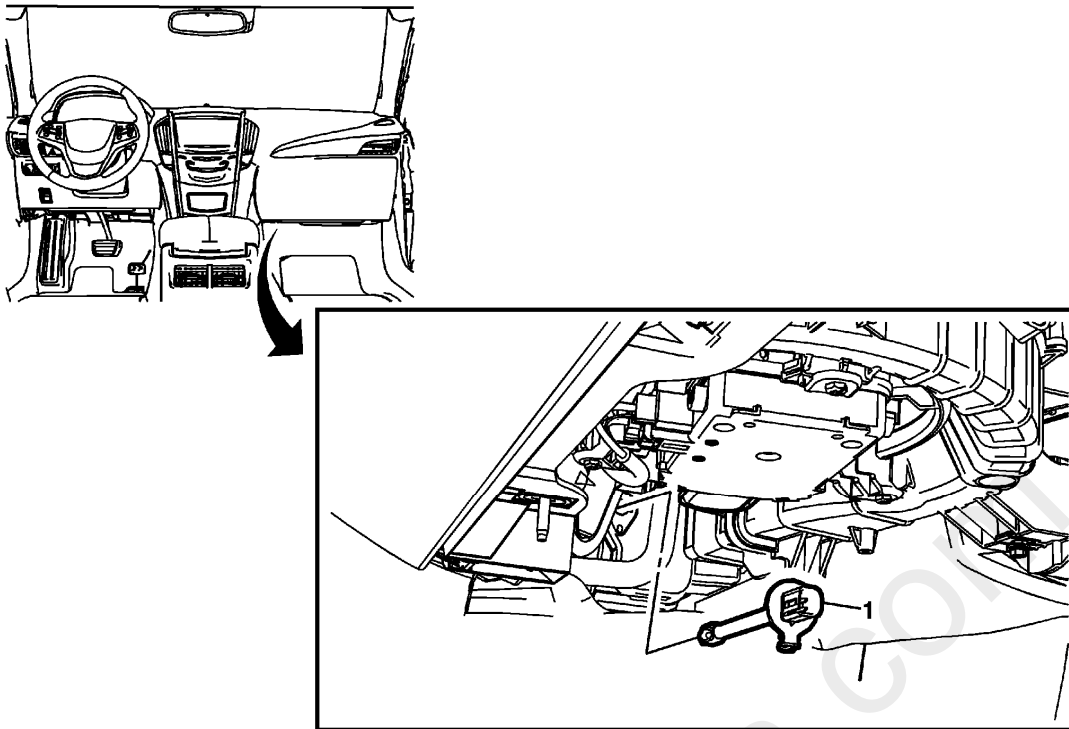


Fig. 35: Evaporator Air Temperature Sensor
 Courtesy of GENERAL MOTORS COMPANY

Evaporator Air Temperature Sensor Replacement

Callout	Component Name
Preliminary Procedures	
1. Remove the passenger side instrument panel lower air bag module. Refer to <u>Instrument Panel Lower Airbag Replacement - Passenger Side</u> . 2. Remove the right front floor air outlet duct. Refer to <u>Floor Front Air Outlet Duct Replacement - Right Side</u> .	
1	Air Conditioning Evaporator Air Temperature Sensor Procedures 1. Disconnect the air conditioning evaporator air temperature sensor connector. 2. To remove the air conditioning evaporative temperature sensor, release the locking tab, and turn the air conditioning evaporative temperature sensor counter clock wise a quarter of a turn.

INSIDE AIR MOISTURE AND WINDSHIELD TEMPERATURE SENSOR REPLACEMENT

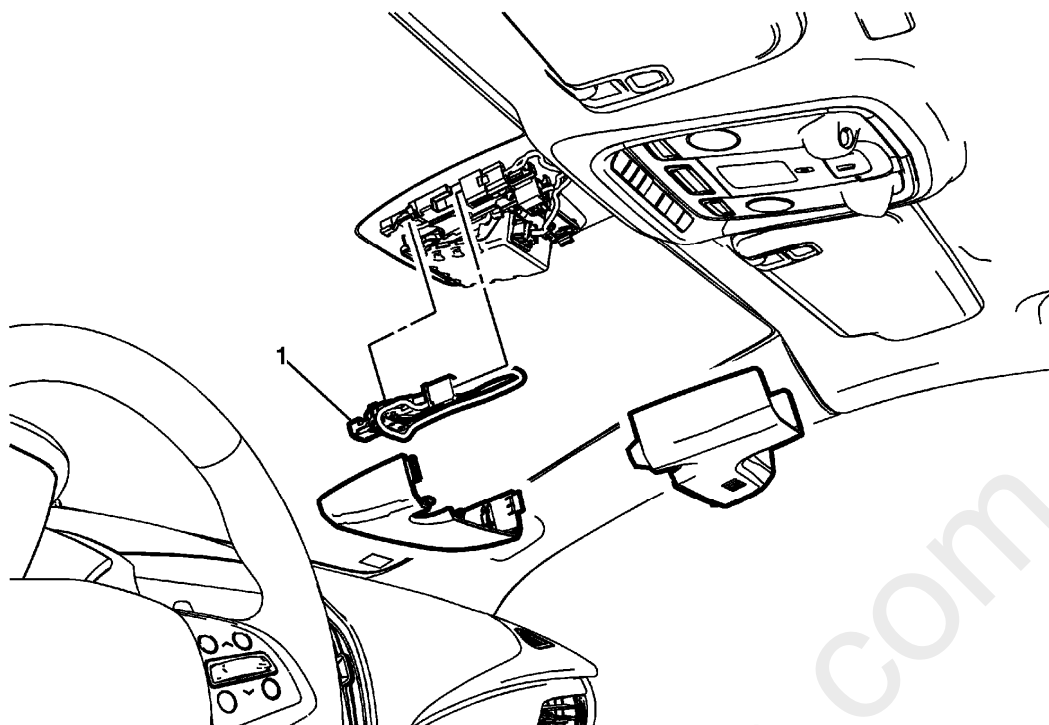


Fig. 36: Inside Air Moisture and Windshield Temperature Sensor
Courtesy of GENERAL MOTORS COMPANY

Inside Air Moisture and Windshield Temperature Sensor Replacement

Callout	Component Name
Preliminary Procedure	
Remove the inside rearview mirror. Refer to <u>Inside Rearview Mirror Replacement</u> .	
1	Inside Air Moisture and Windshield Temperature Sensor
	Procedures 1. Unlatch the inside air moisture and windshield temperature sensor, from the inside rear view mirror support bracket. 2. Disconnect the inside air moisture and windshield temperature sensor connector.

SUN LOAD TEMPERATURE SENSOR REPLACEMENT

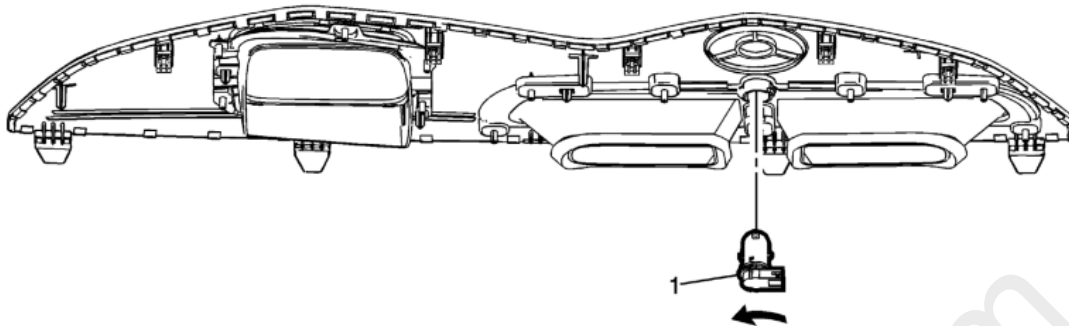


Fig. 37: Sun Load Temperature Sensor
 Courtesy of GENERAL MOTORS COMPANY

Sun Load Temperature Sensor Replacement

Call out	Component Name
Preliminary Procedure	
Remove the instrument panel extension. Refer to <u>Instrument Panel Extension Replacement</u> .	
1	Sun Load Temperature Sensor Procedures 1. Disconnect the sun load temperature sensor electrical connector. 2. Turn the sun load temperature sensor a quarter of a turn counter clockwise to remove.

DESCRIPTION AND OPERATION

AUTOMATIC HVAC DESCRIPTION AND OPERATION

The air temperature and the air delivery description and operation are divided into eight areas:

- HVAC Control Components
- Air Speed (Front)
- Air Speed (Rear)
- Air Delivery (Front)

- Air Delivery (Rear)
- Heating and A/C Operation
- Recirculation Operation
- Automatic Operation
- Engine Coolant
- A/C Cycle

HVAC Control Components

Radio/HVAC Control

The Radio/HVAC control contains all switches, which are required to control the functions of HVAC and serve as interface between the operator and the HVAC control module. The selected values are passed to the HVAC control module via LIN-Bus.

HVAC Control Module

The HVAC control module is a GMLAN device that interfaces between the operator and the HVAC system to maintain and control desired air temperature and air distribution settings. The battery positive voltage circuit provides power that the HVAC control module uses for keep alive memory. If the battery positive voltage circuit loses power, all HVAC DTCs and settings will be erased from keep alive memory. The body control module (BCM), which is the vehicle mode master, provides a device ON-Signal. The HVAC control module provides blower, air delivery mode and air temperature settings.

The HVAC control module supports the following features:

Feature	Availability
Afterblow	Available if reprogrammed by the technician
Purge	Yes
Personalization	Yes
Actuator Calibration	Yes

Mode Actuator

The actuator is a 5-wire bi-directional electric motor that incorporates a feedback potentiometer. Low reference, 5V reference, position signal, and 2 control circuits enable the actuator to operate. The control circuits use either a 0 or 12 V value to coordinate the actuator movement. When the actuator is at rest, both control circuits have a value of 0 V. In order to move the actuator, the HVAC control module grounds one of the control circuits while providing the other with 12 V. 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 V. 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 Actuators

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

Recirculation Actuator

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

Blower Motor

The blower motor speed is controlled by increasing or decreasing the voltage drop on the ground side of the blower motor speed control circuit. The HVAC control module provides a low side pulse width modulation (PWM) signal to the blower motor via the blower motor speed control circuit. As the requested blower speed increases, the HVAC control module increases the amount of time that the speed signal is modulated to ground. As the requested blower speed decreases, the HVAC control module decreases the amount of time that the signal is modulated to ground.

Duct Temperature Sensors

The air temperature sensors are 2-wire negative temperature co-efficient thermistors. The sensors operate within a temperature range of -40 to +85°C (-40 to +185°F). The sensors are installed in the air distribution ducts and measure the temperature of the air that streams from the ducts. The HVAC control module uses these values to calculate the mixed air flap position.

Evaporator Temperature Sensor

The evaporator temperature sensor is a 2-wire negative temperature co-efficient thermistor. The sensor operates within a temperature range of -40 to +85°C (-40 to +185°F). The sensor is installed at the evaporator and

measures its temperature. If the temperature drops under 3°C (38°F), the compressor will be switched off in order to prevent a frozen evaporator.

A/C Refrigerant Pressure Sensor

The A/C refrigerant pressure sensor is a 3-wire piezoelectric pressure transducer. A 5 V reference voltage, low reference, and signal circuits enable the sensor to operate. The A/C pressure signal can be between 0.2-4.8 V. When the A/C refrigerant pressure is low, the signal value is near 0 V. When the A/C refrigerant pressure is high, the signal value is near 5 V. The engine control module (ECM) converts the voltage signal to a pressure value. When pressure is too high or too low, the ECM will not allow the A/C compressor clutch to engage.

A/C Compressor

This A/C system uses a conventional clutch to engage and mechanically turn the compressor, and a variable displacement solenoid valve to alter the amount of displacement created by the turning of the compressor. The HVAC control module provides both battery voltage and a pulse width modulated ground to the variable displacement solenoid valve. When the A/C switch is pressed, the HVAC control module grounds the variable displacement solenoid using a (PWM) signal in order to determine the amount of compressor displacement. The performance of the A/C compressor is based on adjusted interior temperature and engine load.

Windshield Temperature and Inside Moisture Sensor

The windshield temperature and inside moisture sensor includes the relative humidity sensor, windshield temperature sensor and humidity sensing element temperature sensor.

This sensor assembly provides information about:

- Relative humidity level at windshield (compartment side)
- Temperature of the windshield inside (compartment side)
- Temperature of the humidity sensor element

The relative humidity sensor measures the relative humidity of the compartment side of the windshield. It also detects the temperature of the windshield surface on the passenger compartment side. Both values are used as control inputs for the HVAC control module application to calculate the fog risk on windshield compartment side and ability to reduce fuel consumption by decreasing A/C compressor power to a minimum without causing any fog. The sensor will also enable partial recirculation mode in order to improve heat-up performance of the passenger compartment under cold ambient temperature conditions without the risk of mist build-up on the windshield. The humidity sensor element temperature sensor supplies the temperature of the humidity sensor element. It is only needed if the thermal contact between the humidity sensing element and the inside windshield surface is not sufficient.

Ambient Light/Sunload Sensor

The ambient light/sunload sensor includes the sunload sensor and passenger compartment temperature sensor.

This sensor assembly provides information about:

- Sun heat intensity
- Elevation
- Azimuth
- Passenger compartment temperature

The sunload sensor is connected to ground and to a 12 V clocked power supply through the HVAC control module. This clocked power supply is to power the sensor electronics and to work as a clock generator to the sunload sensor micro controller. The sensor uses a pulse signal for data identification and transferring the sun intensity measurement. At each positive transition from the clocked supply input, the sunload sensor micro controller will shift channels enabling new intensity measurement on the signal output to the HVAC control module. The signal voltage varies between 0-4 V.

The passenger compartment temperature sensor is a negative temperature co-efficient thermistor. A signal and low reference circuit enables the sensor to operate. As the air temperature increases, the sensor resistance decreases. The sensor signal varies between 0-5 V.

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.

Air Speed

The blower control switch is part of the Radio/HVAC control. The selected value of the blower switch position is sent to the HVAC control module via LIN-Bus.

The blower motor control module is an interface between HVAC control module and blower motor. The blower motor control module regulates supply voltage and ground circuits to blower motor. The HVAC control module provides a PWM signal to the blower motor control module in order to command the desired blower motor speed. The blower motor control module supplies battery voltage to the blower motor and uses the blower motor ground as a low side control to adjust the blower motor speed. The voltage amounts between 2-13 V and changes linear to the height of the PWM signal.

Afterblow

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

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 blower motor will perform the following sequence up to 5 times. This could last up to an hour:

1. The blower motor will be OFF for 7-11 minutes.
2. The blower motor will RUN for 25-30 seconds.

Air Delivery

The HVAC control module controls the distribution of air by the use of recirculation and mode door actuator. The modes that may be selected are:

- Defrost
- Defog
- Panel
- Floor

The desired air distribution mode can be selected with the air distribution switches at the Radio/HVAC control. The Radio/HVAC control delivers the values to the HVAC control module via LIN-Bus. The HVAC control module controls the mode door actuator so that it drives the flap to the calculated position. Depending on the position of the flap, air is distributed through various ducts leading to the outlets in the dash. Turning the mode flap to the defrost position, the HVAC control module will move the recirculation actuator to outside air, reducing window fogging. When defrost is selected, the blower motor will be activated, regardless of the coolant temperature. The HVAC control module enables a high volume of air delivered to the front defrost vents. A/C is available in all modes.

The rear window defogger does not affect the HVAC system.

Heating and A/C Operation

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

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

When the A/C switch or the AUTO switch is pressed, the Radio/HVAC control sends a signal to the HVAC control module via LIN-Bus. The HVAC control module evaluates this signal and sends an A/C request signal to the ECM via CAN-Bus. The ECM checks all preconditions before releasing and if all conditions are met sends a release signal back to the HVAC control module. The A/C compressor is activated by the HVAC control module. The HVAC control module supplies battery voltage to the A/C compressor. When the A/C switch is pressed, the HVAC control module provides a pulse width modulation (PWM) signal to the A/C compressor in order to command the performance of the A/C compressor. The performance of the A/C

compressor is regulated using adjusted interior temperature and engine load.

The following conditions must be met in order to activate the A/C compressor:

- Battery voltage is between 9-18 V
- Engine coolant temperature is less than 124°C (255°F)
- Engine speed is greater than 600 RPM
- Engine speed is less than 5 500 RPM
- A/C high side pressure is between 269-2 929 kPa (39-425 PSI)
- Throttle position is less than 100%
- Evaporator temperature is greater than 3°C (38°F)
- ECM does not detect immoderate torque load
- ECM does not detect insufficient idle quality
- The ambient temperature is above 1°C (34°F)

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

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

The air streams into the passenger compartment through the heater core and the evaporator core. The air temperature actuator drives the mixed air flap to direct the airflow. If the interior temperature should be increased, the mixed air flap is put into the position in which more air streams through the heater core. If the interior temperature should be decreased, the mixed air flap is put into the position in which more air streams through the evaporator core.

Recirculation Operation

The recirculation switch is integrated into the Radio/HVAC control. The selected recirculation switch position is sent to the HVAC control module via LIN-Bus. The HVAC control module controls the air intake using the recirculation actuator. In recirculation mode the recirculation flap opens in order to circulate the air within the vehicle. In fresh air mode the recirculation flap is closed in order to route outside air into the vehicle.

In automatic mode the values of the windshield temperature and inside moisture sensor are used as control inputs for the HVAC control module application to calculate the fog risk on passenger compartment side of the windshield compartment side. The A/C compressor and the defrost mode are activated to prevent or remove fog on the passenger compartment side of the windshield.

Automatic Operation

In automatic operation, the HVAC control module maintains 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 actuator.

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

1. The auto switch must be activated.
2. The air temperature switch must not be in either the full hot or full cold position.

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

- Monitors the following sensors:
 - Ambient air temperature sensor
 - Lower left duct air temperature sensor
 - Lower right duct air temperature sensor
 - Upper left duct air temperature sensor
 - Upper right duct air temperature sensor
 - Windshield temperature and inside moisture sensor
 - Ambient light/sunload sensor
- Regulate the blower motor speed
- Position the air temperature actuators
- Position the mode door actuator
- Position the recirculation actuator
- Request A/C operation
- Control of the A/C compressor

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 stays on high speed and the air temperature actuators stay in the full heat position.

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

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

In automatic mode the values of the windshield temperature and inside moisture sensor are used as control inputs for the HVAC control module application to calculate the fog risk on the passenger compartment side of the windshield and ability to reduce fuel consumption by decreasing A/C compressor power to a minimum without causing any fog. The A/C compressor and the defrost mode are activated to prevent or remove fog on the passenger compartment side of the windshield. The sensor will also enable partial recirculation mode in order to improve heat-up performance of the passenger compartment under cold ambient temperature conditions without the risk of mist build-up on the windshield.

Engine Coolant

Engine coolant is the essential element of the heating system. The thermostat controls the normal engine operating coolant temperature. The thermostat also creates a restriction for the cooling system that promotes a positive coolant flow and helps prevent cavitation.

Coolant enters the heater core through the inlet heater hose, in a pressurized state. The heater core is located inside the HVAC control module. The ambient air drawn through the HVAC control module absorbs the heat of the coolant flowing through the heater core. Heated air is distributed to the passenger compartment, through the HVAC control module, for passenger comfort. Opening or closing the air temperature flap controls the amount of heat delivered to the passenger compartment. The coolant exits the heater core through the return heater hose and recirculates back to the engine cooling system.

A/C Cycle

Refrigerant is the key element in an air conditioning system. There are currently two approved Environmental Protection Agency refrigerants. They are R134a and R-1234yf, and either one could be used in this vehicle. R-1234yf is a newly EPA approved refrigerant, and it will require the use of an updated Air Conditioning Refrigerant Recovery/Recharge Cart/System. Refer to **Refrigerant Recovery and Recharging (R-134a)** , **Refrigerant Recovery and Recharging (R-1234yf)** for correct tool usage. Both refrigerants are very low temperature gases that can transfer the undesirable heat and moisture from the passenger compartment to the outside air.

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

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

The condenser is located in front of the radiator for maximum heat transfer. The condenser is made of aluminum tubing and aluminum cooling fins, which allows rapid heat transfer for the refrigerant. The semi-cooled liquid refrigerant exits the condenser and flows to the Receiver/Dehydrator(R/D).

The R/D contains desiccant that absorbs moisture that may be in the refrigerant system. The R/D also acts as a storage vessel to ensure that a steady flow of liquid reaches the thermal expansion valve. The refrigerant exits the R/D and flows through the liquid line to the thermal expansion valve.

The thermal expansion valve is located at the front of dash and attaches to the evaporator inlet and outlet pipes. The thermal expansion valve is the dividing point for the high and the low pressure sides of the A/C system. As the refrigerant passes through the thermal expansion valve, the pressure on the refrigerant is lowered. The thermal expansion valve also meters the amount of liquid refrigerant that can flow into the evaporator.

Refrigerant exiting the thermal expansion valve flows into the evaporator core in a low pressure, liquid state.

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

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

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