

FASTENER SPECIFICATIONS

NOTE:

Application	Specification
	Metric (English)
Air Inlet Valve Actuator Fastener	1.3 N.m (12 lb in)
Auxiliary Heater and Air Conditioning Control Bolt	2.0 N.m (18 lb in)
Front Floor Console Rear Air Valve Actuator Fastener	1.3 N.m (12 lb in)
Heater and Air Conditioning Mode Control Cam Cover Bolt	2.0 N.m (18 lb in)
Mode Valve Actuator Motor Fastener	1.3 N.m (12 lb in)
Mode Valve Actuator Screw	1.3 N.m (12 lb in)
Mode Valve Lever Fastener	1.5 N.m (13 lb in)
Temperature Valve Actuator Fastener	1.3 N.m (12 lb in)

HVAC WIRING SCHEMATICS

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

A/C Compressor Controls (HP9)

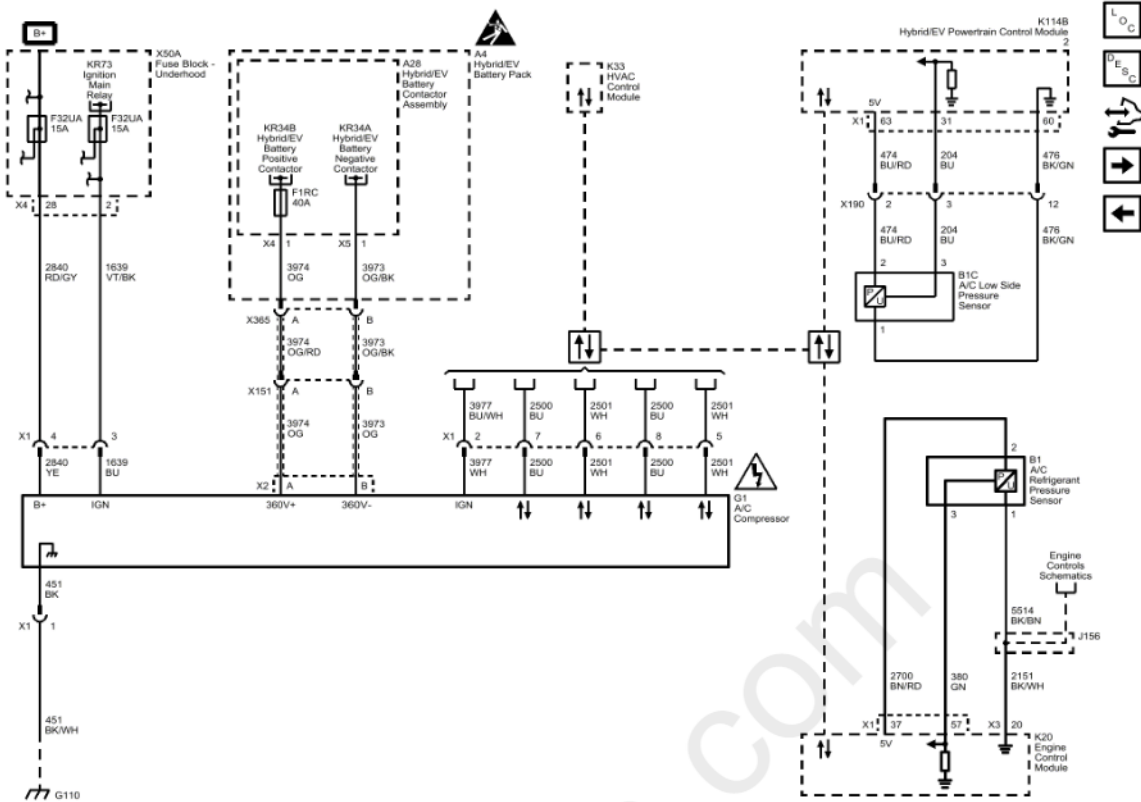


Fig. 2: A/C Compressor Controls (HP9)
Courtesy of GENERAL MOTORS COMPANY

A/C Compressor Controls (KL9)

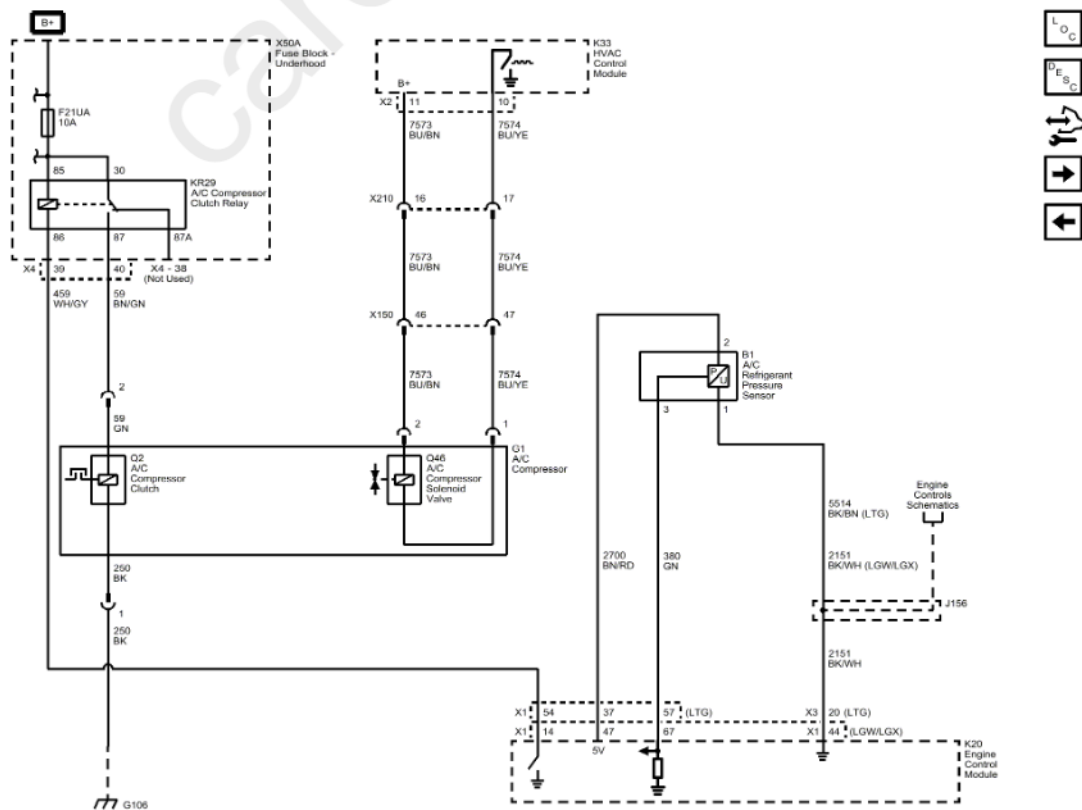


Fig. 3: A/C Compressor Controls (KL9)
 Courtesy of GENERAL MOTORS COMPANY

Blower Motor

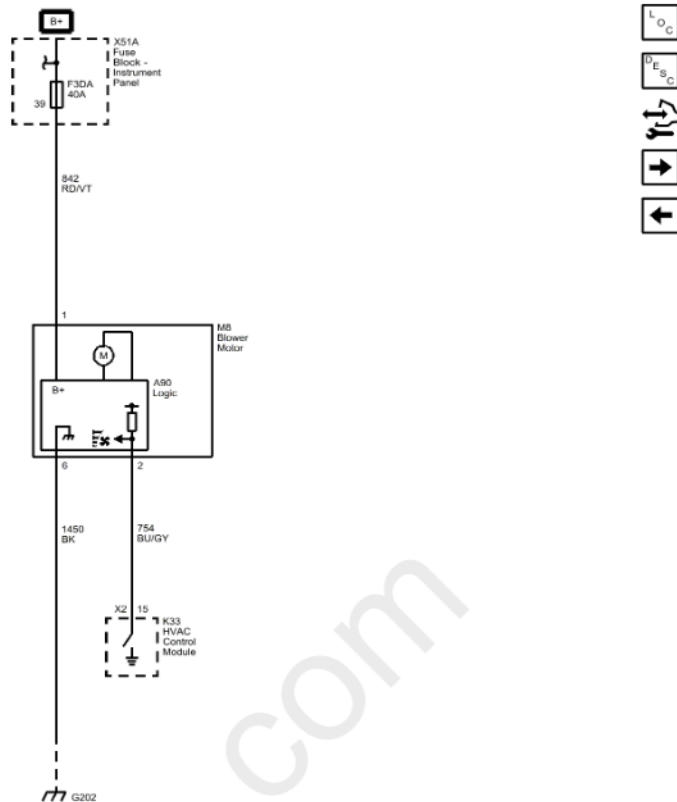


Fig. 4: Blower Motor
 Courtesy of GENERAL MOTORS COMPANY

Temperature and Mode Doors - Front (1 of 2)

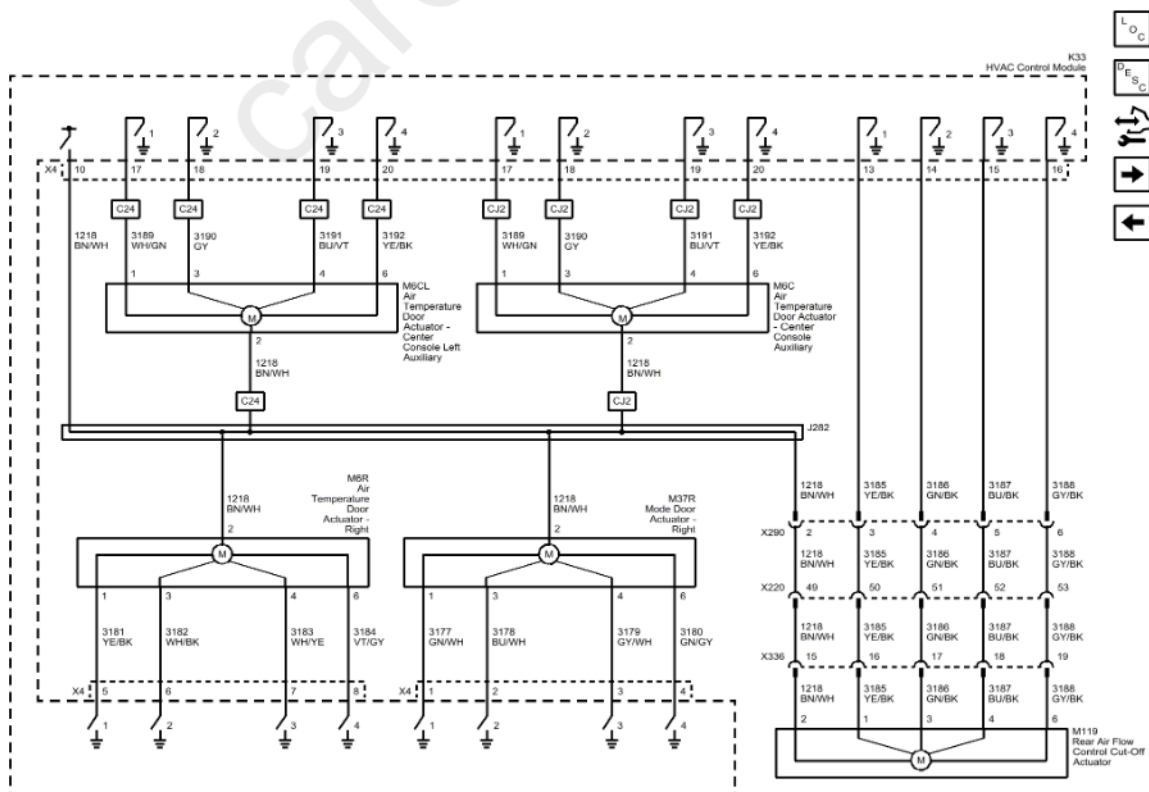


Fig. 5: Temperature and Mode Doors - Front (1 of 2)
Courtesy of GENERAL MOTORS COMPANY

Temperature and Mode Doors - Front (2 of 2)

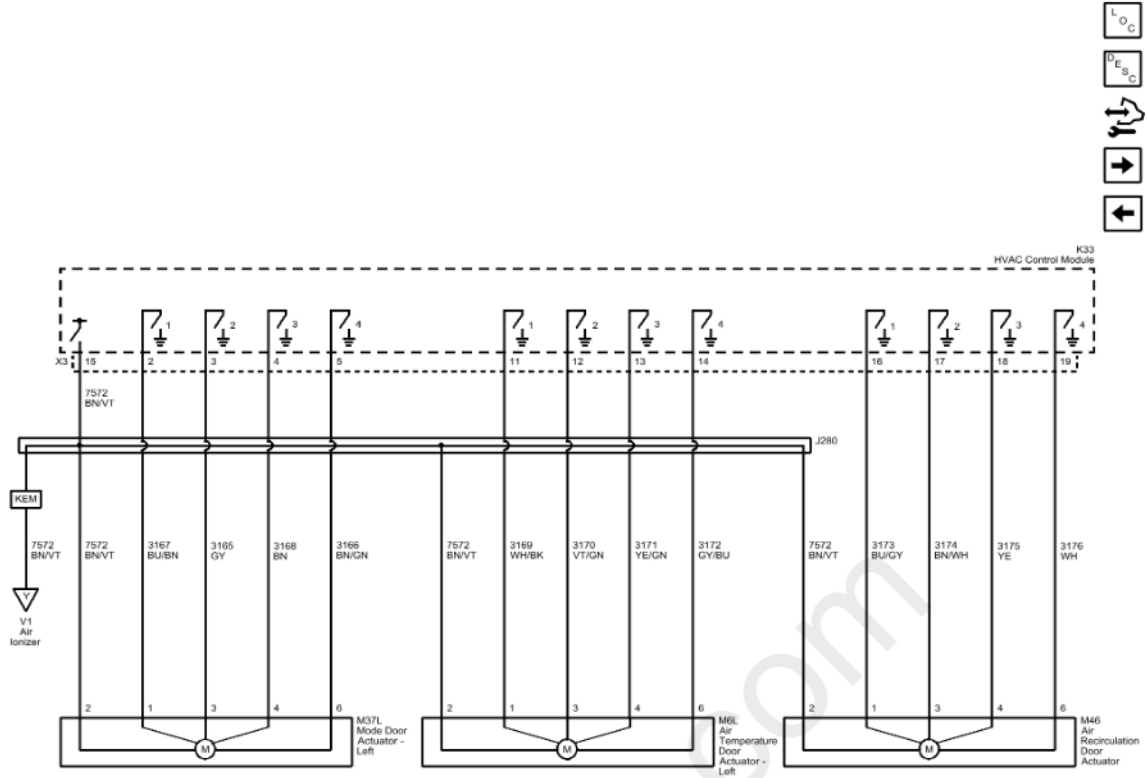
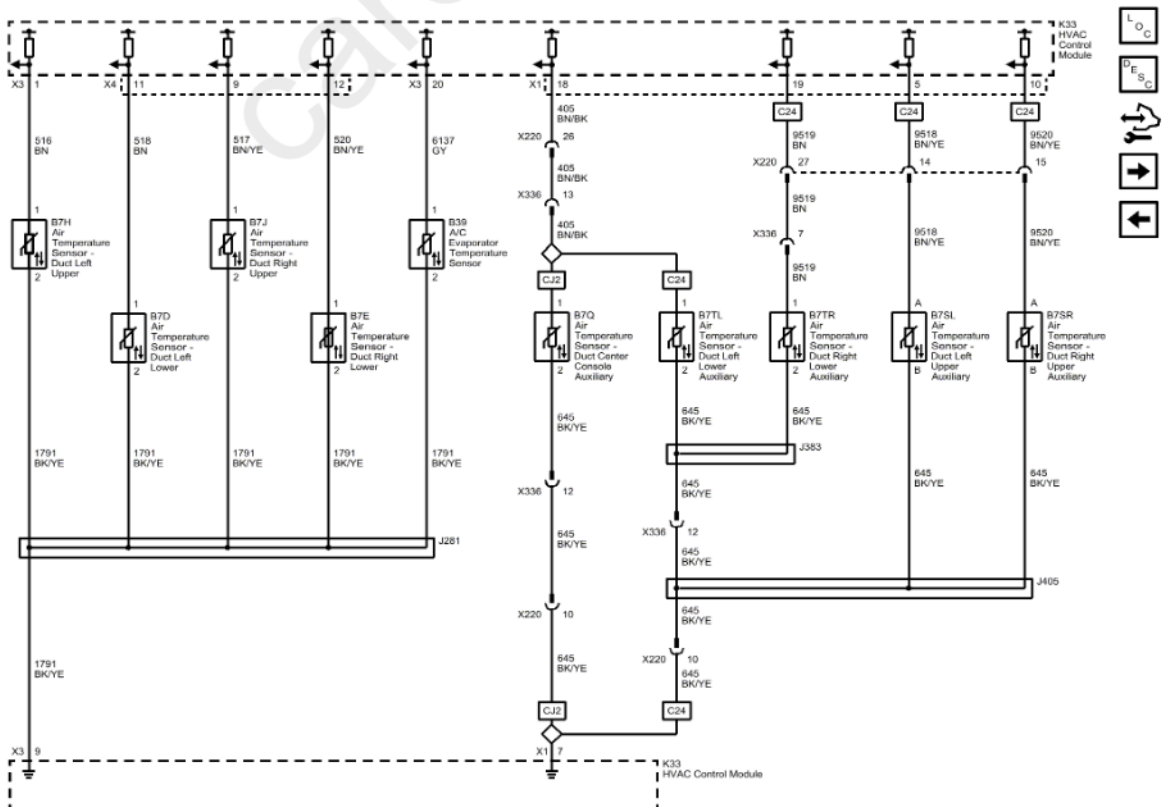


Fig. 6: Temperature and Mode Doors - Front (2 of 2)
Courtesy of GENERAL MOTORS COMPANY

Temperature Sensors



Air Quality Sensor and Ambient Light/Sunload Sensor



Controls and Temperature/Mode Doors - Auxiliary (C24)

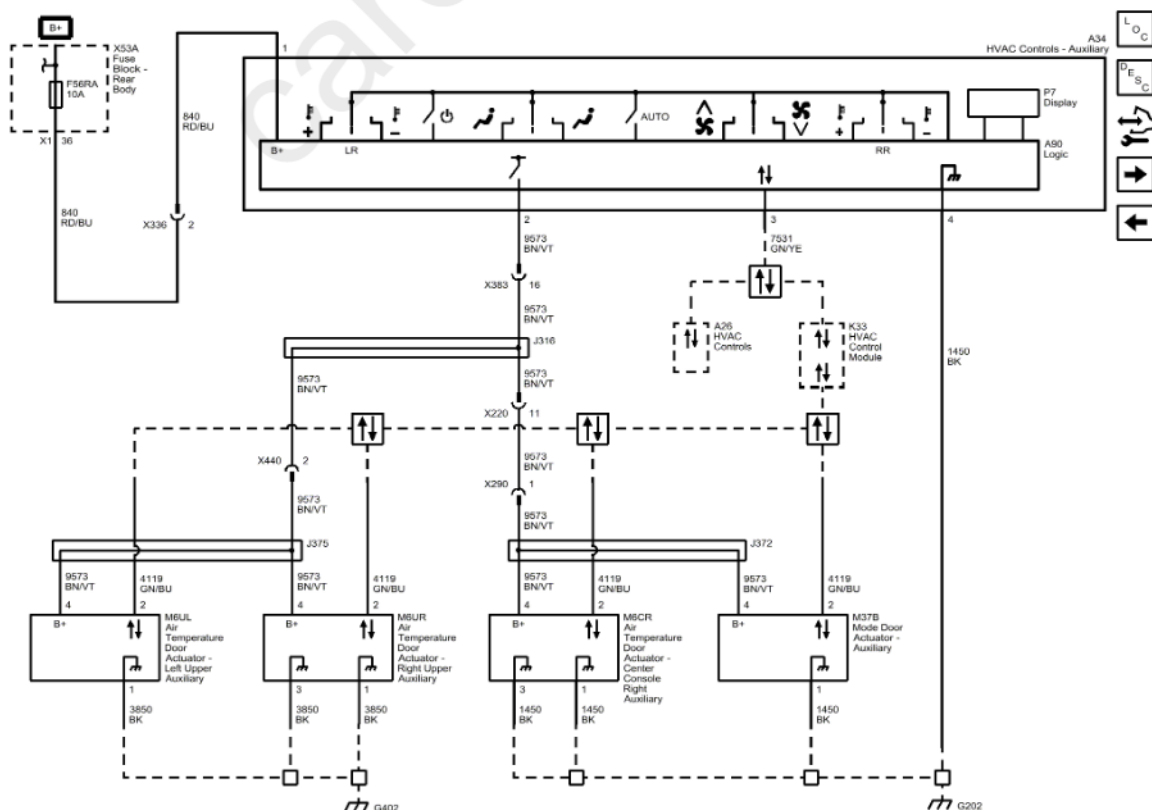


Fig. 9: Controls and Temperature/Mode Doors - Auxiliary_(C24)
 Courtesy of GENERAL MOTORS COMPANY

Blower Motor - Auxiliary (C24)

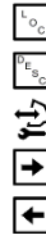
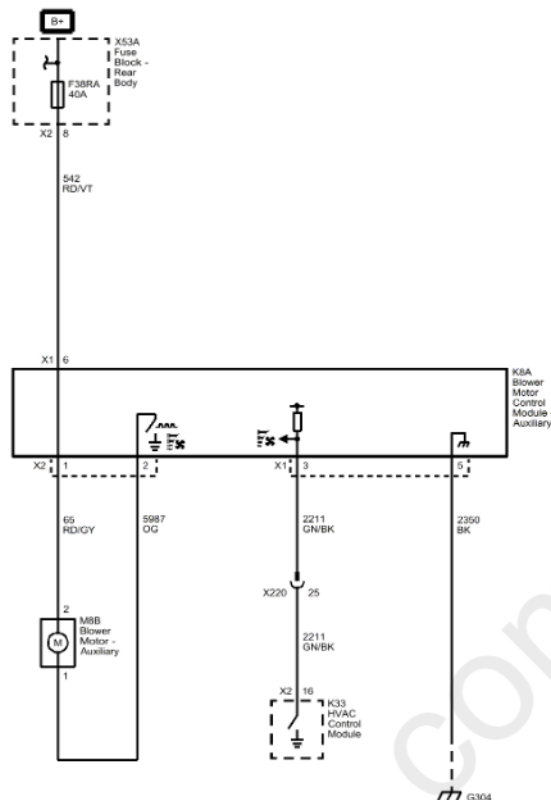


Fig. 10: Blower Motor - Auxiliary_(C24)
 Courtesy of GENERAL MOTORS COMPANY

Heater Coolant Pump (KL9)

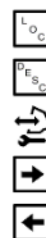
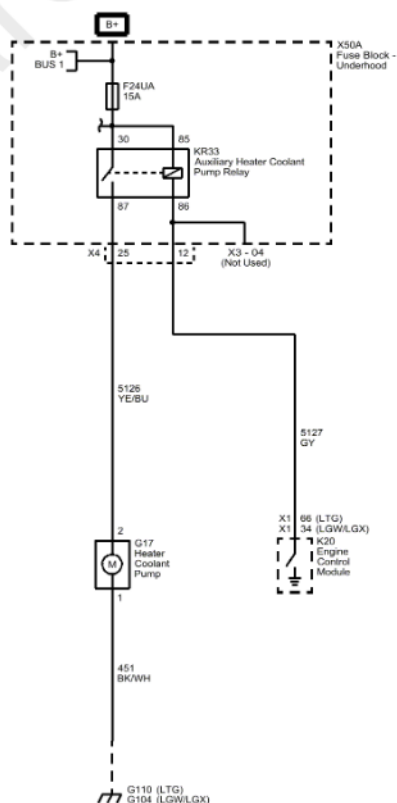


Fig. 11: Heater Coolant Pump (KL9)
Courtesy of GENERAL MOTORS COMPANY

Heater Coolant Circulation (HP9)

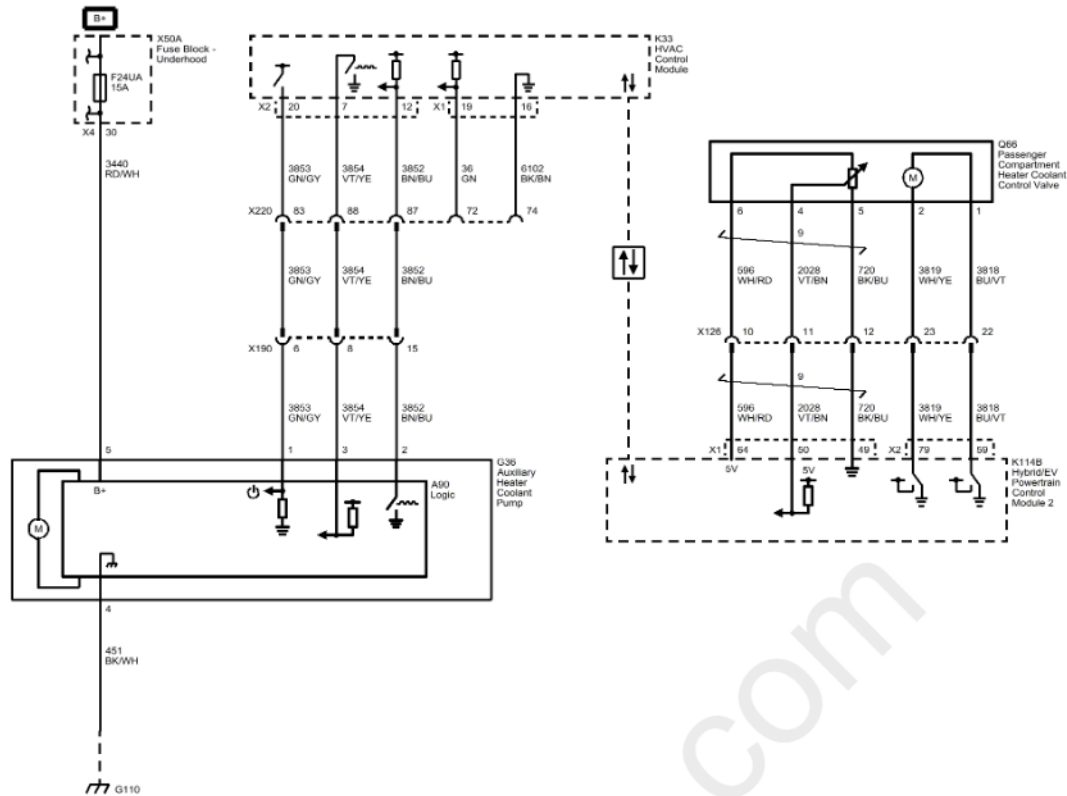


Fig. 12: Heater Coolant Circulation (HP9)
Courtesy of GENERAL MOTORS COMPANY

Coolant Heater (HP9)

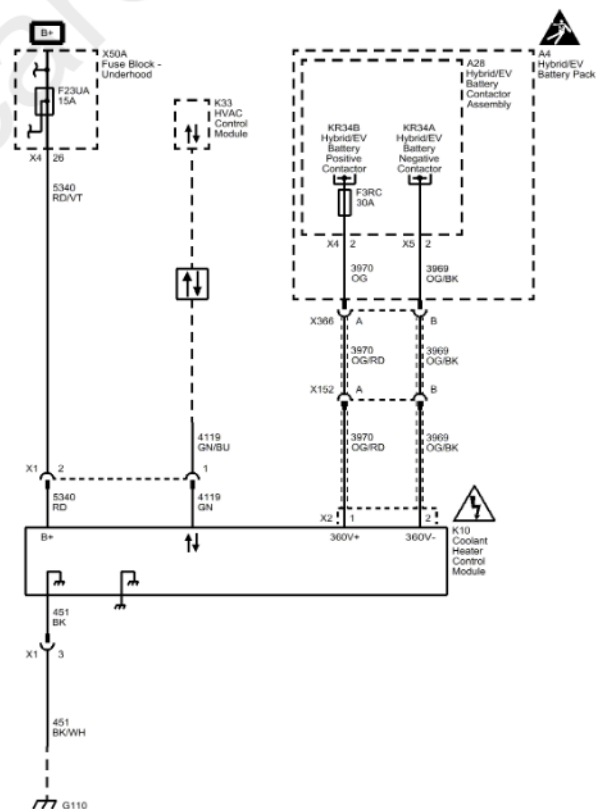


Fig. 13: Coolant Heater (HP9)
 Courtesy of GENERAL MOTORS COMPANY

Air Ionizer (KEM)

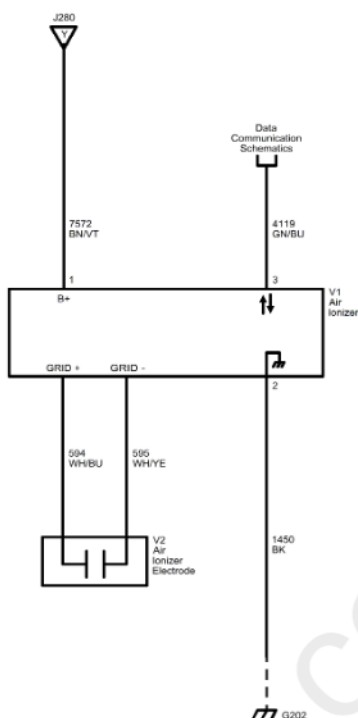


Fig. 14: Air Ionizer (KEM)
 Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

HVAC COMPONENT REPLACEMENT REFERENCE

Component	Repair Instruction
A26 HVAC Controls	Heater and Air Conditioning User Interface Control Replacement
A34 HVAC Controls - Auxiliary	Auxiliary Heater and Air Conditioning Control Replacement
B1 A/C Refrigerant Pressure Sensor	Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (LTG) Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (LGW, LGX) Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (LTG with HP9 High Pressure) Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (LTG with HP9 Low Pressure)
B108 Air Quality Sensor	Ambient Air Quality Sensor Replacement
B10B Ambient Light/Sunload Sensor	Sun Load, Ambient Light and Charge Indicator Sensor Replacement
B160 Windshield Temperature and Inside Moisture Sensor	Windshield Outside Moisture/Ambient Light and Humidity Sensor Replacement
B39 A/C Evaporator Temperature Sensor	Evaporator Air Temperature Sensor Replacement
B7D Air Temperature Sensor - Duct Left Lower	Duct Air Temperature Sensor Replacement - Lower Left Side
B7E Air Temperature Sensor - Duct Right Lower	Duct Air Temperature Sensor Replacement - Lower Right Side

Component	Repair Instruction
B7H Air Temperature Sensor - Duct Left Upper	<u>Duct Air Temperature Sensor Replacement - Upper Left Side</u>
B7J Air Temperature Sensor - Duct Right Upper	<u>Duct Air Temperature Sensor Replacement - Upper Right Side</u>
B7SL Air Temperature Sensor - Duct Left Upper Auxiliary	<u>Auxiliary Duct Air Temperature Sensor Replacement (Left Side)</u> <u>Auxiliary Duct Air Temperature Sensor Replacement (Right Side)</u>
B7SR Air Temperature Sensor - Duct Right Upper Auxiliary	<u>Auxiliary Duct Air Temperature Sensor Replacement (Left Side)</u> <u>Auxiliary Duct Air Temperature Sensor Replacement (Right Side)</u>
B7TL Air Temperature Sensor - Duct Left Lower Auxiliary	<u>Duct Air Temperature Sensor Replacement - Rear Left Side (Floor Front Console)</u>
B7TR Air Temperature Sensor - Duct Right Lower Auxiliary	<u>Duct Air Temperature Sensor Replacement - Rear Right Side (Floor Front Console)</u>
G1 A/C Compressor	<u>Air Conditioning Compressor Replacement (LTG)</u> <u>Air Conditioning Compressor Replacement (LGW, LGX)</u>
G17 Heater Coolant Pump	<u>Heater Coolant Pump Replacement (LTG without HP9)</u> <u>Heater Coolant Pump Replacement (LGW)</u> <u>Heater Coolant Pump Replacement (LGX)</u> <u>Heater Coolant Pump Replacement (LTG with HP9)</u>
K33 HVAC Control Module	<u>Heater and Air Conditioning Remote Control Replacement</u>
K8A Blower Motor Control Module - Auxiliary	<u>Auxiliary Blower Motor Control Replacement</u>
M37B Mode Door Actuator - Auxiliary	<u>Front Floor Console Rear Air Valve Actuator Replacement (Mode)</u>
M37L Mode Door Actuator - Left	<u>Mode Valve Actuator Replacement - Left Side</u>
M37R Mode Door Actuator - Right	<u>Mode Valve Actuator Replacement - Right Side</u>
M46 Air Recirculation Door Actuator	<u>Air Inlet Valve Actuator Replacement (Fresh Air)</u>
M6CR Air Temperature Door Actuator - Center Console Right Auxiliary	<u>Temperature Valve Actuator Replacement - Right Side (CJ2 C24)</u> <u>Temperature Valve Actuator Replacement - Right Side (Floor Front Console C24)</u>
M6L Air Temperature Door Actuator - Left	<u>Temperature Valve Actuator Replacement - Left Side (CJ2 C24)</u> <u>Temperature Valve Actuator Replacement - Left Side (Floor Console CJ2 C24)</u>
M6R Air Temperature Door Actuator - Right	<u>Temperature Valve Actuator Replacement - Right Side (CJ2 C24)</u> <u>Temperature Valve Actuator Replacement - Right Side (Floor Front Console C24)</u>
M6UL Air Temperature Door Actuator - Left Upper Auxiliary	<u>Auxiliary Temperature Valve Actuator Replacement (Right Side)</u> <u>Auxiliary Temperature Valve Actuator Replacement (Left Side)</u>
M6UR Air Temperature Door Actuator - Right Upper Auxiliary	<u>Auxiliary Temperature Valve Actuator Replacement (Right Side)</u> <u>Auxiliary Temperature Valve Actuator Replacement (Left Side)</u>
M8 Blower Motor	<u>Blower Motor Replacement</u>
M8B Blower Motor - Auxiliary	<u>Auxiliary Blower Motor Replacement</u>
MODE DOOR ACTUATOR - LEFT REAR	<u>Front Floor Console Rear Air Valve Actuator Replacement (Mode)</u>
Q2 A/C Compressor Clutch	<u>Air Conditioning Compressor Replacement (LTG)</u> <u>Air Conditioning Compressor Replacement (LGW, LGX)</u>
Q46 A/C Compressor Solenoid Valve	<u>Air Conditioning Compressor Replacement (LTG)</u> <u>Air Conditioning Compressor Replacement (LGW, LGX)</u>
Q66 Passenger Compartment Heater Coolant Control Valve	<u>Heater Water Bypass Valve Replacement (LTG with HP9)</u>

Component	Repair Instruction
V1 Air Ionizer	Passenger Compartment Air Filter Module Replacement (KEM)

DTC B0163 OR B0183: SOLAR LOAD SENSOR/PASSENGER COMPARTMENT TEMPERATURE SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC B0163

Passenger Compartment Temperature Sensor Circuit

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
Sensor Signal Terminal 1	B0183 02	B0183 05	B0183 05	1
Sensor Signal Terminal 4	B0163 02	B0163 05	B0163 05	1
Low Reference	-	B0163 05, B0183 05	-	-
1. HVAC Malfunction				

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 or B0183 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 or B0183 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 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

COMPONENT CONNECTOR END VIEWS - INDEX

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.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the signal circuits listed below and ground.
 - Sunload signal circuit terminal 1.
 - Temperature signal circuit terminal 4.
 - **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 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , 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**
 5. Test or replace the B10B Ambient Light/Sunload Sensor.
 6. Verify the DTC 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 control module replacement, programming and setup.

DTC B0173, B0178, B0509, B0514, B0519, B051F, B3583 OR B375A-B375C: AIR 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 B0173

Upper Left Duct Air Temperature Sensor Circuit

DTC B0178

Lower Left Duct Air Temperature Sensor Circuit

DTC B0509

Upper Right Duct Air Temperature Sensor Circuit

DTC B0514

Lower Right Duct Air Temperature Sensor Circuit

DTC B0519

Rear Upper Duct Air Temperature Sensor Circuit

DTC B051F

Left Rear Upper Duct Air Temperature Sensor Circuit

DTC B3583

Rear Lower Duct Air Temperature Sensor Circuit

DTC B375A

Right Rear Lower Duct Air Temperature Sensor Circuit

DTC B375B

Left Rear Console Duct Air Temperature Sensor Circuit

DTC B375C

Right Rear Upper Duct Air Temperature Sensor Circuit

Symptom Byte 02 - Short to Ground

Symptom Byte 05 - 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	-
Left Rear Upper Duct Air Temperature Sensor Signal	B051F 02	B051F 05	B051F 05	-
Rear Lower Duct Air Temperature Sensor Signal	B3583 02	B3583 05	B3583 05	-
Right Rear Lower Duct Air Temperature Sensor	B375A 02	B375A 05	B375A 05	-
Left Rear Console Duct Air Temperature Sensor Signal	B375B 02	B375B 05	B375B 05	-
Right Rear Upper Duct Air Temperature Sensor Signal	B375C 02	B375C 05	B375C 05	-
Low Reference	-	B0173 05, B0178 05, B0509 05, B0514 05, B0519 05, B051F 05, B3583 05, B375A 05, B375B 05, B375C05*	-	-

*One or more DTCs may set dependent upon fault location

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 (CJ2 and C24)
- Air temperature sensor - left lower (CJ2 and C24)
- Air temperature sensor - right upper (CJ2 and C24)
- Air temperature sensor - right lower (CJ2 and C24)
- Air temperature sensor - right rear lower (C24)
- Air temperature sensor - right rear upper (C24)
- Air temperature sensor - left rear lower (C24)
- Air temperature sensor - left rear upper (C24)
- Air temperature sensor - left rear console (CJ2 and C24)
- Air temperature sensor - right rear console (C24)

This sensor operates using signal and low reference circuits. As the air temperature surrounding the sensor increases, the sensor resistance decreases. The HVAC control module sends a 5 V reference to the sensor and the sensor varies the 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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[Control Module References](#) for scan tool information

Circuit/System Testing

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 50 Ω between the low reference circuit terminal 2 and ground.

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

- **If 50 Ω or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If less than 50 Ω**
3. Ignition ON.
 4. Verify the appropriate scan tool temperature sensor parameter is less than -37 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (-35 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$)
 - **If greater than -37 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (-35 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$)**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal 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 -37 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (-35 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) or less**
 5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2.
 6. Verify the scan tool temperature sensor parameter is greater than 77 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (170 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$).
 - **If less than 77 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (170 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$)**
 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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If 77 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{C}$ (170 $\tilde{\text{A}}$, $\hat{\text{A}}^{\circ}\text{F}$) or greater**
 7. Test or replace the appropriate temperature sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for 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

Front Blower Motor Speed 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+	B0193 06	B0193 06	-	-
Control	B0193 06	B0193 06	B0193 01	1
Ground	-	B0193 01	-	-
1. HVAC Malfunction				

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 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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- [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 M8 Blower Motor. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Verify a test lamp illuminates between the B+ 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 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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**
4. Remove the test lamp.
5. Ignition ON. Test for less than 1 V between the control circuit terminal 2 and ground.
 - **If 1 V or greater**
 1. Ignition OFF, disconnect the X2 harness connector at the K33 HVAC 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, replace the K33 HVAC Control Module
 - **If less than 1 V**
6. Ignition OFF. It may take up to 10 min for all vehicle systems to power down.

7. Test for infinite resistance between the control circuit terminal 2 and ground.

- **If less than infinite resistance**

1. Disconnect the X2 harness connector at the K33 HVAC 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 K33 HVAC Control Module

- **If infinite resistance**

8. Ignition OFF, connect the harness connector at the M8 Blower Motor. Ignition ON.

NOTE: Verify the ignition is OFF before connecting the blower motor or incorrect test results may occur.

9. While backprobing terminal 2 at the M8 Blower Motor, test for greater than 1 V between control circuit and ground.

- **If less than 1 V**

Replace the M8 Blower Motor.

- **If 1 V or greater**

10. Verify the voltage decreases and increases while using the controls to change the blower speed selection.

- **If the voltage does not decrease and increase as the blower speed selection is changed**

1. Ignition OFF, disconnect the X2 harness connector at the K33 HVAC Control Module.

2. Test for less than 2 Ω in the control circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K33 HVAC Control Module.

- **If the voltage decreases and increases as the blower speed selection is changed**

11. Replace the M8 Blower Motor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B0208: REAR 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 B0208

Rear Blower Motor Speed 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+	B0208 06	B0208 06	-	-
Control	B0208 06	B0208 06	B0208 01	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ground	-	B0208 06	-	-

Circuit/System Description

The auxiliary blower motor control module is an interface between the HVAC control module and the auxiliary blower motor. The auxiliary blower motor control module has 4 circuits: a B+ input, a signal input from the HVAC control module, a B+ output to the auxiliary blower motor and a low side pulse width modulation (PWM) output. The HVAC control module provides a low side (PWM) signal to the auxiliary blower motor control module in order to request the auxiliary blower motor speed. The auxiliary blower motor control module grounds the auxiliary blower motor using a low side PWM signal in order to vary the auxiliary blower motor speed.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B0208 01

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

B0208 06

The voltage at the HVAC control module output to the auxiliary 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

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

If the motor operates properly please reinstall it and check for Preliminary Information or Technical Service Bulletins.

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 X1 harness connector at the K8A Blower Motor Control Module - Auxiliary. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 5 and ground.
 - **If 10 Ω or greater**
 1. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the B+ circuit terminal 6 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 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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 terminal 6 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Disconnect the X2 harness connector at the K8A Blower Motor Control Module - Auxiliary and disconnect the harness connector at the M8B Blower Motor - Auxiliary.
 4. Test for infinite resistance between the M8B Blower Motor - Auxiliary control circuit terminal B and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, test or replace the M8B Blower Motor - Auxiliary.
 - **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 K8A Blower Motor Control Module - Auxiliary control circuit terminal 3 X1 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 Ω in the control circuit end to end.

- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 Ω**

10. Connect the harness connectors at the K8A Blower Motor Control Module - Auxiliary and the K33 HVAC Control Module and disconnect the harness connector at the M8B Blower Motor - Auxiliary, ignition ON and blower ON.
11. Verify a test lamp illuminates between the B+ circuit terminal B and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, disconnect the X2 harness connector at the K8A Blower Motor Control Module - Auxiliary.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω replace the K8A Blower Motor Control Module - Auxiliary.
 - **If the test lamp illuminates**
12. Connect a test lamp between the control circuit terminal A and the B+ circuit terminal B.
13. Verify the test lamp becomes progressively brighter as the blower speed is increased and progressively dimmer as the blower speed is decreased.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, disconnect the X2 harness connector at the K8A Blower Motor Control Module - Auxiliary, ignition ON.
 2. Test for less than 1 V between the M8B Blower Motor - Auxiliary control circuit terminal A 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 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 4. Replace the K8A Blower Motor Control Module - Auxiliary.
 5. 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
 6. All OK.
 - **If the test lamp illuminates, but does not change in brightness**
 1. Ignition OFF, disconnect the X2 harness connector at the K8A Blower Motor Control Module - Auxiliary.
 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 K8A Blower Motor Control Module - Auxiliary.
 - **If the test lamp changes in brightness as the blower speed is changed**
14. Test or replace the M8B Blower Motor - Auxiliary.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B0223, B0233, B023A, B0278, B0408, B0418, B0428 OR B3531: AIR FLOW CONTROL/TEMPERATURE CONTROL

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 B0223

Left Recirculate Position Command 1 Circuit

DTC B0233

Air Flow Control Circuit - Mode

DTC B023A

HVAC Actuators Supply Voltage

DTC B0278

Right Front Air Flow Mode 2 Control

DTC B0408

Front Temperature Control Circuit

DTC B0418

Right Temperature Control Circuit

DTC B0428

Rear Temperature Control Circuit

DTC B3531

Rear Air Flow Control Circuit

Symptom Byte 01 - Short to Battery

Symptom Byte 02 - Short to Ground

Symptom Byte 04 - Open

Symptom Byte 06 - Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Actuator 12 V Supply terminal 15 X3	B023A 02, B0223 06, B0233 06, B0408 06, B040A	B0223 06, B0233 06, B0408 06, B040A, *	-	-
Actuator 12 V Supply terminal 10 X4	B023A02, B0278 06, B0418 06, B0428 06, B3531 06	B0278 06, B0418 06, B0428 06, B3531 06*	-	-
Driver Air Temperature Actuator Control	B0408 02	B0408 04, B0408 06	B0408 01	-
Driver Mode Actuator Control	B0233 02	B0233 04, B0233 06	B0233 01	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Passenger Air Temperature Actuator Control	B0418 02	B0418 04, B0418 06	B0418 01	-
Passenger Mode Actuator Control	B0278 02	B0278 04, B0278 06	B0278 01	-
Rear Console Air Flow Actuator Control	B3531 02	B3531 04, B3531 06	B3531 01	-
Rear Console Temperature Actuator Control	B0428 02	B0428 04, B0428 06	B0428 01	-
Recirculation Actuator Control	B0223 02	B0223 04, B0223 06	B0223 01	-
*One or more DTCs may set dependent upon fault location				

Circuit/System Description

Doors in the HVAC case assembly are used to control air flow. The HVAC control module operates the doors through the use of actuators, with one actuator being used for each door. Each actuator is a 5-wire stepper motor.

With the switches and dials on the HVAC controls, air temperature door position, mode door position and recirculation door position can be selected. The selected values are passed to the HVAC control module via serial data.

The HVAC control module supplies a 12 V reference voltage to the stepper motors and energizes the 4 stepper motor control circuits with a pulsed ground signal. The stepper motors move the appropriate doors into the calculated positions, in order to reach the selected setting.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B023A 02

The stepper motor supply output is shorted to ground.

B0223 01, B0233 01, B0278 01, B0408 01, B0418 01, B0428 01 or B3531 01

At least one of the stepper motor control circuits is shorted to voltage when the motor starts moving. Faults are not detected when the motor is already running or a target position is already reached.

B0223 02, B0233 02, B0278 02, B0408 02, B0418 02, B0428 02 or B3531 02

At least one of the stepper motor control circuits is shorted to ground or open when the motor starts moving. Faults are not detected when the motor is already running or a target position is already reached.

B0223 04, 06, B022A 06, B0233 04, B0233 06, B0408 04, B0408 06, B0418 04, B0418 06, B0428 04, B0428 06, B3531 04 or B3531 06

At least one of the stepper motor control circuits is open or has high resistance when the motor starts moving. Faults are not detected when the motor is already running or a target position is already reached.

Action Taken When the DTC Sets

B023A 02

- The affected output will be switched off for hardware protection.
- All stepper motors are deactivated.

B0223, B022A, B0233, B0408, B0418, B0428 or B3531

- The affected control will be switched off for hardware protection.
- The affected stepper motor is deactivated.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

During diagnosis, it is important to verify that the air control door and any associated components (linkage, cams, gears, etc.) operate properly. Inspect for any conditions that may limit or prevent the air control door from moving smoothly or moving through its full range of travel. Any mechanical issues should be corrected first, before proceeding with electrical diagnosis.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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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 B023A is not set.
 - If DTC B023A is set, refer to Circuit/System Testing - DTC B023A.
 - If DTC B023A is not set, refer to Circuit/System Testing - DTC B0223, B0233, B0278, B0408, B0418, B0428 or B3531.
 - **If the concern or DTC has been corrected**
3. All OK.

Circuit/System Testing

DTC B023A

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.

- M37B Mode Door Actuator- Auxiliary
- M37L Mode Door Actuator- Left
- M37R Mode Door Actuator- Right
- M46 Air Recirculation Door Actuator
- M6B Air Temperature Door Actuator - Auxiliary
- M6L Air Temperature Door Actuator - Left
- M6R Air Temperature Door Actuator - Right
- V1 Air Ionizer

2. Disconnect the X3 and X4 harness connectors at the K33 HVAC Control Module.

3. Test for infinite resistance between the K33 HVAC Control Module 12 V reference circuit terminal 15 X3 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 12 V reference circuit terminal 15 X3 and ground.

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **If less than 1 V**

6. Connect the X3 and X4 harness connectors at the K33 HVAC Control Module, ignition ON.

7. Clear all DTCs.

8. Verify DTC B023A is not set.

- **If the DTC is set.**

Replace the K33 HVAC Control Module.

- **If the DTC is not set.**

9. Verify DTC B023A does not set after connecting each of the components listed below one at a time and operating them through their full range.

- M37B Mode Door Actuator- Auxiliary
- M37L Mode Door Actuator- Left
- M37R Mode Door Actuator- Right
- M46 Air Recirculation Door Actuator
- M6B Air Temperature Door Actuator - Auxiliary
- M6L Air Temperature Door Actuator - Left
- M6R Air Temperature Door Actuator - Right
- V1 Air Ionizer
- **If the DTC sets**

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

- **If the DTC does not set**

10. All OK.

DTC B0223, B0233, B0278, B0408, B0418, B0428 or B3531

1. Ignition OFF, disconnect the harness connector at the appropriate door actuator, ignition ON.

2. Verify a test lamp flashes when connected between the 12 V reference circuit terminal 2 and ground.

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

1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC Control Module.
2. Test for less than 2 Ω in the 12 V control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
- **If the test lamp flashes**
3. Connect a test lamp between each control circuit listed below and B+.
 - Control Circuit - terminal 1
 - Control Circuit - terminal 3
 - Control Circuit - terminal 4
 - Control Circuit - terminal 6
4. Command the appropriate door actuator in both directions.
5. Verify the test lamp turns ON and then OFF during at least one of the directional commands.
 - **If the test lamp is always ON**
 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 control circuit 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 is always OFF**
 1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC 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 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If the test lamp turns ON and then OFF**
6. Test or replace the door actuator.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B040A: PASSENGER COMPARTMENT AIR FRESHENER 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 B040A

Passenger Compartment Air Freshener Control Circuit

For symptom byte information, refer to [Symptom Byte List](#).

Circuit/System Description

The HVAC module communicates with the air ionizer via serial data. This DTC indicates a fault in the air ionizer. The air ionizer may continue to operate normally when this DTC is set.

Conditions for Running the DTC

- Ignition RUN / Vehicle ON.
- The system voltage is at least 9.5 V and no more than 15.5 V.

Conditions for Setting the DTC

The air ionizer reports an internal malfunction to the HVAC control module.

Action Taken when the DTC Sets

The air ionizer is inoperative.

Conditions for Clearing the DTC

The air ionizer reports a normal operation status to the HVAC control module.

Diagnostic Aids

- This DTC may be stored as a history DTC without affecting the operation of the air ionizer.
- If stored only as a history DTC and not retrieved as a current DTC, do not replace the air ionizer.
- If this DTC is retrieved as both a current and history DTC, replace the air ionizer.

Reference Information

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B040A is not set.
 - **If DTC B040A is set**
Replace the V1 Air Ionizer.
 - **If DTC B040A is not set**
3. All OK.

Repair Instructions

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

HVAC Component Replacement Reference

DTC B042A, B042C, B042D OR B374B: TEMPERATURE 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 B042A

Right Rear Console Temperature Control Circuit

DTC B042C

Left Rear Upper Temperature Control Circuit

DTC B042D

Right Rear Upper Temperature Control Circuit

DTC B374B

Rear Air Flow Shut-Off Control Circuit

Symptom Byte 39 - Internal Malfunction

Symptom Byte 4B - Calibration Not Learned

Circuit/System Description

The actuators used for the rear seat HVAC system are stepper motors controlled via serial data. The HVAC control module sends a LIN serial data message to request the appropriate actuator to move to the calculated position to achieve the desired setting.

Conditions for Running the DTC

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

Conditions for Setting the DTC

B042A 39, B042C 39, B42D 39 or B357B 39

The actuator reports an internal malfunction to the HVAC control module.

B042A 4B, B042C 4B, B42D 4B or B357B 4B

The actuator reports to the HVAC control module that its end stops have not been calibrated.

Action Taken When the DTC Sets

The affected actuator will be disabled for hardware protection.

Conditions for Clearing the DTC

B042A 39, B042C 39, B42D 39 or B357B 39

The actuator reports a normal operation status to the HVAC control module.

B042A 4B, B042C 4B, B42D 4B or B357B 4B

The actuator reports to the HVAC control module that has calibrated successfully.

Diagnostic Aids

During diagnosis, it is important to verify that the air control door and any associated components (linkage, cams, gears, etc.) operate properly. Inspect for any conditions that may limit or prevent the air control door from moving smoothly or moving through its full range of travel. Any mechanical issues should be corrected first, before proceeding with electrical diagnosis.

Reference Information

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTC B042A 4B, B042C 4B, B42D 4B or B357B 4B is not set.
 - **If the DTC is set**
 1. Perform the **Actuator Recalibration** procedure.
 2. Verify the DTC does not set.
 - If the DTC sets,

Replace the appropriate actuator.
 - If the DTC does not set
3. All OK.
 - **If the DTC is not set**
3. Verify DTC Verify DTC B042A 39, B042C 39, B42D 39 or B357B 39 is not set.
 - **If the DTC is set**

Replace the appropriate actuator.
 - **If the DTC is not set**
4. All OK

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B0468, B046B OR B046C: AUXILIARY HEATER COOLANT PUMP

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 B0468

Auxiliary Heater Coolant Pump Circuit

DTC B046B

Auxiliary Heater Coolant Pump Feedback Circuit

DTC B046C

Auxiliary Heater Coolant Pump Enable 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+	B046B 00	B046B 00	-	-
Control Terminal 1	B046C 02	B0468 06, B046B 00, B046C 05	B046C 05	-
Control Terminal 3	B0468 06	B0468 06	B0468 01	-
Signal	B046B 00	B046B 00	B046B 00	-
Ground	-	B046B 00	-	-

Circuit/System Description

The auxiliary heater coolant pump is controlled with a pulse-width modulated control sent from the HVAC control module to the auxiliary heater coolant pump. The higher the duty cycle on the control the higher the pump speed. An enable signal from the HVAC control module to the auxiliary heater coolant pump provides overall control of the pump. When voltage is present, the pump can operate. The auxiliary heater coolant pump provides a hard-wired pulse-width modulated feedback signal to the HVAC control module. During normal operation, this feedback signal provides pump speed information.

Conditions for Running the DTC

B0468 01

- The 12 V battery system voltage is greater than 9 V.
- Vehicle ON.
- The HVAC system is turned ON.

B0468 06

- The 12 V battery system voltage is greater than 9 V.
- Vehicle ON.

- The HVAC system is turned ON.

B046B 00

- The 12 V battery system voltage is greater than 9 V.
- Vehicle ON.
- The HVAC system is turned ON.

B046C 02

- The 12 V battery system voltage is greater than 9 V.
- Vehicle ON.
- The HVAC system is turned ON.

B046C 05

- The 12 V battery system voltage is greater than 9 V.
- Vehicle ON.
- The HVAC system is turned ON.

Conditions for Setting the DTC

B0468 01

Requested PWM is not zero and the feedback from the Auxiliary Heater is always High.

B0468 06

Feedback from the auxiliary heater voltage is always low or floating.

B046B 00

PWM duty cycle/ frequency out of range

B046C 02

PWM duty cycle/ frequency out of range

B046C 05

PWM duty cycle/ frequency out of range

Action Taken When the DTC Sets

The auxiliary heater coolant pump is disabled.

Conditions for Clearing the DTC

B0468 01

Feedback of auxiliary heater output corresponds with requested PWM signal.

B0468 06

Feedback of auxiliary heater output corresponds with requested PWM signal.

B046B 00

PWM duty cycle / frequency is within defined range

B046C 02

Requested status of the output is ON and feedback shows normal operation

B046C 05

Requested status of the output is OFF and feedback shows normal operation

Diagnostic Aids

A DTC B0468 may cause a DTC B046B or DTC B046C to set.

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Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the G36 Auxiliary Heater Coolant Pump. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 4 and ground.
 - **If 5 Ω or greater**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 5 Ω**
3. Vehicle ON.
4. Verify a test lamp illuminates between the B+ circuit terminal 5 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Vehicle OFF, remove the test lamp.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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. Vehicle 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 G36 Auxiliary Heater Coolant Pump.
 - **If the test lamp illuminates**

5. Connect a test lamp between the control circuit terminal 1 and the ground circuit terminal 4, vehicle ON and HVAC system OFF.
6. Verify the test lamp turns ON and OFF when commanding the K33 HVAC Control Module Auxiliary Coolant Pump Speed Command On and Off with a scan tool.
 - **If the test lamp is always OFF**
 1. Vehicle OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC 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
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If the test lamp is always ON**
 1. Vehicle OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC Control Module, vehicle in Service Mode.
 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, replace the K33 HVAC Control Module.
 - **If the test lamp turns ON and OFF**
7. Vehicle OFF, remove the test lamp and disconnect the harness connector at the K33 HVAC Control Module, vehicle in Service Mode.
8. Test for less than 1 V between the circuits listed below and ground:
 - G36 Auxiliary Heater Coolant Pump control circuit terminal 3
 - G36 Auxiliary Heater Coolant Pump signal circuit terminal 2
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
9. Vehicle OFF.
10. Test for infinite resistance between the circuits listed below and ground:
 - G36 Auxiliary Heater Coolant Pump control circuit terminal 3
 - G36 Auxiliary Heater Coolant Pump signal circuit terminal 2
 - **If less than infinite resistance**

Repair the short to ground on the circuit.
 - **If infinite resistance**
11. Test for less than 2 Ω between the circuit terminals listed below:
 - G36 Auxiliary Heater Coolant Pump circuit terminal 3 and K33 HVAC Control Module circuit terminal 7 X2
 - G36 Auxiliary Heater Coolant Pump circuit terminal 2 and K33 HVAC Control Module circuit terminal 12 X2
 - **If 2 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 2 Ω**
12. Replace the G36 Auxiliary Heater Coolant Pump.
13. Verify the DTC 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.**

14. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC B048E: AUXILIARY HEATER SYSTEM

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 B048E 00

Auxiliary Heater System Malfunction

DTC B048E 39

Auxiliary Heater System Internal Malfunction

DTC B048E 58

Auxiliary Heater System Incorrect Reaction After Event

DTC B048E 5A

Auxiliary Heater System Plausibility Failure

Circuit/System Description

The coolant heater control module is a high voltage electric heater. High voltage is supplied from the hybrid/EV battery pack. A fused battery input, ground and LIN serial data from the HVAC control module are used to control the operation of the coolant heater control module.

The HVAC control module requests heater operation if the coolant temperature is low and additional heat is required to meet the desired settings of the HVAC system.

The coolant heater control module monitors itself during operation and if a fault is detected a message is sent to the HVAC control module. The HVAC control module then sets the DTC.

Conditions for Running the DTC

- 12 V battery system voltage is greater than 10.2 V.
- The HVAC control module is ON.
- The electrical auxiliary heater is commanded ON.

Conditions for Setting the DTC

B048E 00

- The coolant heater control module reports a recoverable fault for greater than 30 seconds.
- The condition is present for 3 consecutive ignition cycles
- The HVAC control module sets the DTC on the fourth ignition cycle

B048E 39

- The coolant heater control module reports an internal malfunction for greater than 30 seconds.
- The condition is present for 3 consecutive ignition cycles
- The HVAC control module sets the DTC on the fourth ignition cycle

B048E 58

- The coolant heater control module reports a limited operation status for greater than 10 minutes.
- The condition is present for 3 consecutive ignition cycles
- The HVAC control module sets the DTC on the fourth ignition cycle

B048E 5A

- The HVAC control module determines the coolant temperature reported by the coolant heater control module is not rational based on the vehicle operating conditions for greater than 10 minutes.
- The condition is present for 3 consecutive ignition cycles
- The HVAC control module sets the DTC on the fourth ignition cycle

Action Taken When the DTC Sets

- The DIC displays the Service Heater Soon message
- The coolant heater is inoperative or operates in a limited state.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Diagnostic Aids

- Verify the cooling system is full before performing diagnostics. A low or aerated coolant condition may cause this DTC to set.
- Insufficient or no coolant flow through the coolant heater due to a restriction, blockage or coolant pump malfunction may cause this DTC to set.
- Insufficient or no voltage from the Hybrid/EV battery may cause this DTC to set.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information

NOTE: Check for bulletins before proceeding.

1. Verify that no other DTCs are set.

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).

- **If no other DTCs are set**

2. Verify that DTC B048E 39 is not set.

- **If DTC B048E 39 is set**

Replace the K10 Coolant Heater Control Module

- **If DTC B048E 39 is not set**

3. Verify that DTC B048E 00 is not set.

- **If DTC B048E 00 is set**

Refer to Circuit/System Testing

- **If DTC B048E 00 is not set**

4. Verify the cooling system is filled to the proper level.

- **If the cooling system is not filled to the proper level**

1. Diagnose and correct the cause of the improper coolant level.

2. Fill the cooling system to the proper level. Refer to [Cooling System Draining and Filling \(Static without HP9\)](#), [Cooling System Draining and Filling \(GE 47716 without HP9\)](#), [Cooling System Draining and Filling \(Static LTG with HP9\)](#) and/or [Cooling System Draining and Filling \(GE 47716 LTG with HP9\)](#).

3. Clear DTCs and re-evaluate the concern.

- **If the cooling system is filled to the proper level**

5. Verify the scan tool ECM Engine Coolant Temperature sensor parameter is within 5Å,Å°C (9Å,Å°F) of the Ambient Air Temperature sensor parameter.

- **If the ECM Engine Coolant Temperature sensor parameter is NOT within 5Å,Å°C (9Å,Å°F) of the Ambient Air Temperature sensor parameter**

Allow the engine to cool until the ECM Engine Coolant Temperature sensor parameter is within 5Å,Å°C (9Å,Å°F) of the Ambient Air Temperature sensor parameter.

- **If the ECM Engine Coolant Temperature sensor parameter is within 5Å,Å°C (9Å,Å°F) of the Ambient Air Temperature sensor parameter**

6. Verify the G36 Auxiliary Heater Coolant Pump operates when commanding the Auxiliary Coolant Pump On and Off with a scan tool.

- **If the G36 Auxiliary Heater Coolant Pump does not operate**

Refer to [Auxiliary Heater Coolant Pump Malfunction](#).

- **If the G36 Auxiliary Heater Coolant Pump operates**

7. Vehicle ON, HVAC system set to hot, blower set to high. Command the Passenger Compartment Heater Coolant Control Solenoid Valve to bypass.

8. Verify the scan tool parameter Coolant Heater Control Module Status displays only Normal Running.

- **If the scan tool parameter Coolant Heater Control Module Status displays only Limited Operation**

1. Verify the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is less than 60Å,Å°C (140Å,Å°F) and the parameter Coolant Heater Current is greater than 15 A.

- If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is less than 60Â°,Â°C (140Â°,Â°F) and the parameter Coolant Heater Current is less than 15 A, replace the K10 Coolant Heater Control Module
- If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is less than 60Â°,Â°C (140Â°,Â°F) and the parameter Coolant Heater Current is greater than 15 A, refer to step 10.
- **If the scan tool parameter Coolant Heater Control Module Status switches between Limited Operation and Normal Running.**

Refer to step 12

- **If the scan tool parameter Coolant Heater Control Module Status displays only Normal Running**

9. Continue to operate the system for 10 min.

10. Verify the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is within 5Â°,Â°C (9Â°,Â°F) of parameter Desired Heater Core Outlet Coolant temperature.

- **If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is not within 5Â°,Â°C (9Â°,Â°F) of parameter Desired Heater Core Outlet Coolant temperature.**

Replace the K10 Coolant Heater Control Module

- **If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is within 5Â°,Â°C (9Â°,Â°F) of parameter Desired Heater Core Outlet Coolant temperature.**

11. Vehicle OFF. Inspect the cooling system for restrictions or blockages in coolant flow. Refer to **Heating Performance Diagnostic** .

- **If restrictions or blockages in coolant flow are found.**

1. Diagnose and correct the cause of the restrictions or blockage.
2. Verify the G36 Auxiliary Heater Coolant Pump operates.
3. Clear DTCs and re-evaluate the concern.

- **If no restrictions or blockages are found**

12. Vehicle ON, engine running, HVAC system set to hot, blower set to high. Command the Passenger Compartment Heater Coolant Control Solenoid Valve to link.

13. Verify the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is equal to Engine Coolant Temperature.

- **If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is not equal to Engine Coolant Temperature**

1. Verify there are no ECM engine coolant temperature related DTCs

- If ECM engine coolant temperature DTCs are present, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** , then clear DTCs and re-evaluate the concern.
- If no ECM engine coolant temperature DTCs are present, replace the K10 Coolant Heater Control Module.

- **If the scan tool parameter Coolant Heater Control Module Inlet Coolant Temperature is equal to Engine Coolant Temperature.**

14. All OK.

Circuit/System Testing

NOTE: Perform Circuit/System Verification before Circuit/System Testing.

1. Vehicle OFF, disable the high voltage at the K10 Coolant Heater Control Module. Refer to **High Voltage Disabling** .

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal

Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Failure to follow the procedures exactly as written may result in serious injury or death.

2. Disconnect the X366 harness connector at the A4 Hybrid/EV Battery Pack and the X2 harness connector at the K10 Coolant Heater Control Module. Refer to [High Voltage Connectors](#).
3. Verify the inline harness connector X152 is properly connected.
4. Test for less than 2 Ω end to end between the 300-Volt Positive and Negative Cable circuit terminals listed below:
 - A4 Hybrid/EV Battery Pack harness connector terminal A X366 and K10 Coolant Heater Control Module harness connector terminal A X2.
 - A4 Hybrid/EV Battery Pack harness connector terminal B X366 and K10 Coolant Heater Control Module harness connector terminal B X2.
 - **If 2 Ω or greater**
Replace the 300-Volt Positive and Negative Cable.
 - **If less than 2 Ω**
5. Replace the G1 A/C Compressor.
6. Operate the vehicle within the conditions for running the DTC. Verify the DTC does not set.
 - **If the DTC sets**
Replace the A28 Hybrid/EV Battery Contactor Assembly.
 - **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 control module replacement, programming and setup.

DTC B1020: AUXILIARY ELECTRONIC CONTROL UNIT (ECU) PERFORMANCE

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 B1020

Auxiliary Electronic Control Unit (ECU) Performance

For symptom byte information, refer to [Symptom Byte List](#).

Circuit/System Description

The HVAC module communicates with the HVAC controls via serial data. This DTC indicates a fault in the HVAC controls. The HVAC controls may continue to respond normally to faceplate functions when this DTC is set.

Conditions for Running the DTC

- Ignition is ON or in the ACC position.
- The system voltage is at least 9.5 V and no more than 15.5 V.
- All the above conditions are present for greater than 10 s.

Conditions for Setting the DTC

The HVAC module receives an improper status response indicating an internal ECU fault in the HVAC controls.

Action Taken when the DTC Sets

No action is taken.

Conditions for Clearing the DTC

- A current DTC clears when the HVAC module receives a proper status response message back from the HVAC controls assembly.
- A history DTC clears after 50 malfunction-free ignition cycles.

Diagnostic Aids

- This DTC may be stored as a history DTC without affecting the operation of the HVAC controls.
- If stored only as a history DTC and not retrieved as a current DTC, do not replace the HVAC controls.
- If this DTC is retrieved as both a current and history DTC, replace the HVAC controls.

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. Ignition ON.
2. Verify DTC B1020 is not set.

- If DTC B1020 is set

Replace the A26 HVAC Controls.

- If DTC B1020 is not set

3. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

[Control Module References](#) for HVAC controls replacement, programming and setup.

DTC B269A, B269C OR B269D: HEATER COOLANT PUMP 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 B269A

Heater Coolant Pump Control Circuit Open

DTC B269C

Heater Coolant Pump Control Circuit Low

DTC B269D

Heater Coolant Pump Control Circuit High

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Coil B+	B269A	B269A	-	-
Relay Switch B+	B269A	B269A	-	-
Relay Coil Control	B269C	B269A	B269D	-
Relay Switch Control	B269A	1	2	-
Component Ground	-	1	-	-
1. Coolant Pump inoperative 2. Coolant Pump operates continuously				

Circuit/System Description

The primary purpose of the heater core coolant pump is to circulate engine coolant through the HVAC heater core when heat is required in the cabin for comfort. This normally happens when the vehicle is in an Auto Stop and the mechanical pump is not spinning. If the HVAC control module has determined heat is needed for the cabin, a request is sent via serial data to the engine control module to turn the pump ON. The engine control module controls the auxiliary coolant pump relay via the heater core coolant pump relay control circuit. The heater core coolant pump relay supplies voltage to the heater core coolant pump.

Conditions for Running the DTC

- The 12 V battery voltage is greater than or equal to 9 V.
- The auxiliary heater coolant pump enable is commanded.

Conditions for Setting the DTC

The engine control module detects the auxiliary heater coolant pump relay enable circuit is open, shorted to voltage or shorted to ground.

Action Taken When the DTC Sets

DTCs B269A, B269C and B269D are type B DTCs.

Conditions for Clearing the DTC

DTCs B269A, B269C and B269D are type B DTCs.

Reference Information

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HVAC Schematics

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the KR33 Auxiliary Heater Coolant Pump 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 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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 G17 Heater Coolant Pump.
4. Test for infinite resistance between the G17 Heater Coolant Pump control circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If greater than infinite resistance, test or replace the G17 Heater Coolant Pump.
- **If the test lamp illuminates**
3. Verify a test lamp illuminates between the B+ circuit terminal 85 and ground.

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

1. Ignition OFF, remove the test lamp.
2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.

- **If the test lamp illuminates**

4. Connect a test lamp between the B+ circuit terminal 85 and the control circuit terminal 86.
5. Verify the test lamp turns ON and OFF when commanding the Engine Control Module Auxiliary Coolant Pump On and Off with a scan tool.

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

1. Ignition OFF, remove the test lamp, disconnect the X1 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 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

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

1. Ignition OFF, remove the test lamp, disconnect the X1 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**

6. 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**

7. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the G17 Heater Coolant Pump. It may take up to 2 min for all systems to power down.
8. Test for less than 10 Ω between the G17 Heater Coolant Pump control terminal 1 and ground.

- **If 10 Ω or greater**

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

- **If less than 10 Ω**

9. Connect the harness connector at the G17 Heater Coolant Pump.

10. Ignition ON, connect a 15 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.

11. Verify the G17 Heater Coolant Pump is activated.

- **If the G17 Heater Coolant Pump does not activate**

1. Ignition OFF, remove the jumper wire.
2. Test for less than 2 Ω in the control circuit terminal 87 end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , test or replace the G17 Heater Coolant Pump.

- **If the G17 Heater Coolant Pump activates**

12. Test or replace the KR33 Auxiliary Heater Coolant Pump Relay.

Relay Test

1. Ignition OFF, disconnect the KR33 Auxiliary Heater Coolant Pump Relay.
2. Test for 60-180 Ω between terminals 85 and 86.

- **If less than 60 Ω or greater than 180 Ω**

Replace the KR33 Auxiliary Heater Coolant Pump Relay.

- **If between 60-180 Ω**

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 KR33 Auxiliary Heater Coolant Pump Relay.

- **If infinite resistance**

4. Install a 10 A fused jumper wire between relay terminal 85 and 12 V. Install a jumper wire between relay terminal 86 and ground.
5. Test for less than 2 Ω between terminals 30 and 87.

- **If 2 Ω or greater**

Replace the KR33 Auxiliary Heater Coolant Pump Relay.

- **If less than 2 Ω**

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [Heater Coolant Pump Replacement \(LTG without HP9\)](#) [Heater Coolant Pump Replacement \(LGW\)](#) [Heater Coolant Pump Replacement \(LGX\)](#) [Heater Coolant Pump Replacement \(LTG with HP9\)](#)
- [Control Module References](#) for 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
Air Quality Sensor Ignition	-	B3843 05	-	-
Air Quality Sensor Signal	B3843 02	B3843 05	B3843 05	B3843 08
Air Quality Sensor 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 mode is requested by the customer.

When the signal to 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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- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Verify that DTC B3843 08 is not set.
 - **If DTC B3843 08 is present**
Replace the B108 Air Quality Sensor.
 - **If DTC B3843 08 is not present**
2. Verify that DTC B3843 02 or B3843 05 is not set.
 - **If DTC B3843 02 or B3843 05 is present**
Refer to Circuit/System Testing.
 - **If DTC B3843 02 and B3843 05 are not present**
3. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B108 Air Quality Sensor.
2. Test for less than 5 Ω between the ground circuit terminal 2 and ground.
 - **If greater than 5 Ω**
Repair the open/high resistance in the circuit.
 - **If less than 5 Ω**
3. Ignition ON, verify that 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.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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.
 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**
4. Verify the scan tool Air Quality Sensor parameter is greater than 95%.
 - **If less than 95%**
 1. Ignition OFF, disconnect the X1 harness connector at the K33 HVAC Control Module.
 2. Ignition ON, 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 greater than 95%**
5. Install a 3 A fused jumper wire between the signal circuit terminal 3 and the ground circuit terminal 2. Verify the scan tool Air Quality Sensor parameter is less than 5%.

- **If greater than 5%**

1. Ignition OFF, disconnect the X1 harness connector at the K33 HVAC Control Module.
2. Ignition ON, test for less than 1 V between the signal circuit and ground.
 - If greater than 1 V, repair the short to voltage on the circuit.
 - If less than 1 V
3. Ignition OFF, test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module

- **If less than 5%**

6. Replace the B108 Air Quality Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for HVAC control module replacement, programming and setup

DTC B3933: A/C EVAPORATOR 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 B3933 02

A/C Evaporator Temperature Sensor Circuit Short to Ground

DTC B3933 05

A/C Evaporator Temperature Sensor Circuit High Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Evaporator Temperature Sensor Signal	B3933 02	B3933 05	B3933 05	-
Low Reference	-	B3933 05	-	-

Circuit Description

The evaporator air temperature sensor is a 2-wire negative temperature coefficient thermistor. The HVAC control module provides a low reference circuit and signal circuit. The HVAC control module determines the voltage drop across the sensor, which is proportional to temperature. As the air temperature increases, the sensor resistance decreases and the voltage signal decreases. As the air temperature decreases, the sensor resistance increases and the voltage signal increases.

Conditions for Running the DTC

The ignition 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 DTC will become history if the HVAC control module no longer detects a failure.
- The history DTC will clear after 100 fault-free ignition cycles.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B39 A/C Evaporator Temperature Sensor.
2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.
 - **If greater than 5 Ω**
 1. Disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
 - **If less than 5 Ω**
3. Ignition ON, turn the HVAC system ON.
4. Test for 4.8-5.2 V between the signal circuit terminal 1 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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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 0.3 V between the signal circuit and ground.

- If greater than 0.3 V, repair the short to voltage on the circuit.
- If less than 0.3 V, replace the K33 HVAC Control Module.

• **If within 4.8-5.2 V**

5. Replace the B39 A/C Evaporator Temperature Sensor and verify the DTC does not reset.

• **If DTC resets**

Replace the K33 HVAC Control Module.

• **If DTC does not reset**

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for 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+	B393B 0B	B393B 04	-	-
Control	B393B 04	B393B 04	B393B 0B	-

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 switched 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.

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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Automatic HVAC Description and Operation

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

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q46 A/C Compressor Solenoid Valve. Connect a test light between terminals 1 and 2 of the harness connector. Ignition ON.
2. Verify the test light turns on and off when commanding the Q46 A/C Compressor Solenoid Valve ON and OFF with the scan tool.
 - **If the test light does not turn ON and OFF**
 1. Ignition OFF, disconnect the X2 harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between ground and each control circuit terminal listed below:
 - terminal 10
 - terminal 11
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for infinite resistance between ground and each control circuit terminal listed below:

- terminal 10
 - terminal 11
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
5. Test for less than 2 Ω in each of the control circuits end to end listed below:
- Q46 A/C Compressor Solenoid Valve terminal 1 and K33 HVAC Control Module terminal 10
 - Q46 A/C Compressor Solenoid Valve terminal 2 and K33 HVAC Control Module terminal 11
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K33 HVAC Control Module.
- **If the test light turns ON and OFF**
3. Test the Q46 A/C Compressor Solenoid Valve 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 Ω between B+ terminal 2 and control terminal 1.
 - **If less than 7 Ω or greater than 15 Ω**
Replace the G1 A/C Compressor.
 - **If between 7-15 Ω**
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 control module replacement, programming and setup.

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

- DTCs P0532 and P0533 are Type B DTCs
- 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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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

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 Ω between the low reference circuit terminal 1 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

- **If less than 10 Ω**

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 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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 25V.

- **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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , 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 P0534: AIR CONDITIONING (A/C) REFRIGERANT CHARGE

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 P0534

Air Conditioning (A/C) Refrigerant Charge Low

Circuit/System Description

The AC compressor function is to provide refrigerant flow in the AC refrigerant loop to help cool down and dehumidify the cabin and help maintain the battery temperature. Rather than a more-typical pulley, the A/C compressor uses a 3-phase alternating current, high voltage electric motor to operate. It has an on-board inverter that takes High Voltage direct current from the vehicle's High Voltage Battery and inverts it to alternating current for the motor. The AC compressor shall be activated when any of the three following events occur:

- The customer selects ECO or Comfort.
- The HVAC system is fan only but the customer selects defrost mode
- The High Voltage Battery Thermal System requests the AC compressor on to help maintain the battery temperature

The Hybrid Powertrain control module 2 (HPCM2) uses values from the A/C refrigerant pressure transducers, ambient air temperature sensor, cabin climate control request, battery cell temperature

sensors, battery coolant temperature sensors and battery coolant pumps to determine the speed at which the compressor will operate. This message is sent from the HPCM2 to the A/C compressor control module via serial data message.

Conditions for Running the DTC

DTC P0534 Case 1

- The 12V battery system voltage is equal to or greater than 10.25V.
- The air conditioning compressor control module has 300V.
- The A/C compressor motor is running for at least 30 s.
- Must be in battery active cooling mode for at least 1 min
- The following DTCs must not be set: P0071, P0072, P0073. P0074, P0606, P151C, P2516, P2517, P2518

DTC P0534 Case 2

- The 12V battery system voltage is equal to or greater than 10.25 V.
- The AC compressor is off for more than 240 s.
- Outside air temperature is greater than 15 Å , $\text{Å}^{\circ}\text{C}$ (59 Å , $\text{Å}^{\circ}\text{F}$).
- The following DTCs must not be set: P0071, P0072, P0073. P0074, P0606, P151C, P2516, P2517, P2518

DTC P0534 Case 3

- The 12V battery system voltage is equal to or greater than 10.25V.
- The AC compressor is on for more than 240 s.
- Outside air temperature is greater than 5 Å , $\text{Å}^{\circ}\text{C}$ (41 Å , $\text{Å}^{\circ}\text{F}$).
- The following DTCs must not be set: P0071, P0072, P0073. P0074, P0606, P151C, P2516, P2517, P2518

Conditions for Setting the DTC

DTC P0534 Case 1

The difference between the hybrid/EV battery pack coolant outlet temperature and hybrid/EV battery pack coolant inlet temperature within the evaluation period of up to 300 s is less than a calibrated amount of 3 Å , $\text{Å}^{\circ}\text{C}$ to 5 Å , $\text{Å}^{\circ}\text{C}$ degrees. The required temperature difference requirement is based on outside air temperature and whether the cabin blower is on or off.

DTC P0534 Case 2

Low side pressure is less than 150 kPa (21.75 PSI) for outside air temperature greater than 20 Å , $\text{Å}^{\circ}\text{C}$ (68 Å , $\text{Å}^{\circ}\text{F}$).

DTC P0534 Case 3

Low side pressure is less than 100 kPa (14.50 PSI) for outside air temperature greater than 5 Å , $\text{Å}^{\circ}\text{C}$ (41 Å , $\text{Å}^{\circ}\text{F}$).

Action Taken When the DTC Sets

Active cooling mode for the battery may be disabled.

Conditions for Clearing the DTC

P0534 is a type B DTC.

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

Special Tools

GE-48800 CoolTech A/C Recharge Machine

[Diagnostic Aids](#)

P1EC3 is the hybrid/EV battery pack heater circuit fault DTC. It diagnoses three different circuit faults (short-ground, short-battery, open circuit); one of these, short to ground, could cause the hybrid/EV battery pack heater to activate and could cause P0534 to set. Diagnose P1EC3 before diagnosing P0534.

The Circuit/System Testing procedure below diagnoses the vehicle for DTC P0534 in the following manner:

- Verify the A/C pressure sensors are working correctly and the refrigerant charge is correct.
- Verify the hybrid/EV battery pack coolant outlet temperature and hybrid/EV battery pack coolant inlet temperature sensors are working correctly and accurately.
- Verify the A/C system is operating correctly.
- Verify there are no restrictions in the battery cooling system.
- Verify the hybrid/EV battery pack coolant control valve is operating correctly.
- Verify the drive motor battery coolant cooler is working correctly.
- Verify the battery energy control module is working correctly.

A malfunction in any of the systems/components listed above may cause DTC P0534 to set.

[Circuit/System Verification](#)

1. Verify that DTC P1EC3, P0C47, P1E8C or P1E8D is not set.

- **If any of the DTC's are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If the DTC's are not set**

2. Verify that DTC P0534 is not set.

- **If the DTC is set**

Refer to Circuit/System Testing.

- If the DTC is not set

3. All OK.

Circuit/System Testing

1. Install the **GE-48800** CoolTech A/C Recharge Machine, vehicle in Service Mode.

NOTE: The following conditions listed below must be met before performing this procedure.

- Vehicle must have had a cool down period of at least 2 hours in a cool area to allow A/C pressures and temperatures to equalize.
- Ensure the high voltage battery is charged to at least 50% to prevent the engine from starting.
- Ensure the vehicle hood is open with the hood latch closed to prevent the engine from starting.

2. Verify the low side pressure reading on the Air Conditioning Service Center is within 3% of the scan tool A/C Low Side Pressure Sensor parameter.

- If the reading is not within 3%

Refer to [DTC P151C or P2516-P2518](#).

- If the reading is within 3%

3. Verify the high side pressure reading on the Air Conditioning Service Center is within 3% of the scan tool A/C High Side Pressure Sensor parameter.

- If the reading is not within 3%

Refer to [DTC P0532 or P0533](#).

- If the reading is within 3%

4. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 parameter is within 3% of ambient temperature.

- If the reading is not within 3%

Refer to [DTC P0C43-P0C46](#).

- If the reading is within 3%

5. Verify the A/C System is operating correctly, refer to [Air Conditioning \(A/C\) System Performance Test](#).

6. Vehicle ON, A/C ON.

7. Perform the Hybrid/EV Battery Pack Active Cooling command function with a scan tool.

8. Verify the scan tool Hybrid/EV Battery Pack Coolant Pump Speed parameter is greater than 90%

- If the parameter is not 100%

Refer to [Hybrid/EV Battery Pack Coolant Pump Malfunction](#)

- If the parameter is 100%

9. Verify both the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor parameters drop at least 6Å, Å°C (11Å, Å°F) after 20 min.

NOTE: Hybrid/EV Battery Pack Coolant Temperature Sensor parameters and ambient air temperature must be above 18Å, Å°C (64Å, Å°F) before performing the next procedure.

- If the parameters do not drop at least 6Å, Å°C (11Å, Å°F)

1. Pinch off or restrict the coolant valve to radiator hose and the coolant valve bypass hose.

2. Verify both the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor parameters drop at least 6Å,Å°C (11Å,Å°F) after 20 min.

- If the parameters do not drop at least 6Å,Å°C (11Å,Å°F), replace the Drive Motor Battery Coolant Cooler.
- If the parameters drop at least 6Å,Å°C (11Å,Å°F), replace the Q65 Hybrid/EV Battery Pack Coolant Control Valve.

- **If the parameters drop at least 6Å,Å°C (11Å,Å°F)**

10. Clear all codes in the K114B Hybrid Powertrain Control Module 2 using a scan tool.

11. Verify DTC P0534 does not set while operating the HVAC system under the Conditions for Running the DTC.

- **If the DTC is set**

Replace the K114B Hybrid Powertrain Control Module 2.

- **If the DTC is not set**

12. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

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

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 $2\ \Omega$ in the B+ circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, 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. Verify a test lamp illuminates between the B+ circuit terminal 85 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than $2\ \Omega$ in the B+ circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - **If the test lamp illuminates**
4. Connect a test lamp between the B+ circuit terminal 85 and the control circuit terminal 86.
5. 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 $2\ \Omega$ in the control circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, 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**
6. 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**

7. 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.
8. Test for less than 10 Ω between the ground circuit terminal 1 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
9. Connect the harness connector at the Q2 A/C Compressor Clutch.
10. Ignition ON, connect a 10 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.
11. 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 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , test or replace the Q2 A/C Compressor Clutch.
 - **If the Q2 A/C Compressor Clutch is engaged**
12. 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 Ω between terminals 85 and 86.
 - **If not between 60-180 Ω**

Replace the KR29 A/C Compressor Clutch Relay.
 - **If between 60-180 Ω**
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 85 and 12 V. Install a jumper wire between terminal 86 and ground.
5. Test for less than 2 Ω between terminals 30 and 87.
 - **If 2 Ω or greater**

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

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)

- [Control Module References](#) for control module replacement, programming and setup.

DTC P0D69-P0D7F: A/C COMPRESSOR

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 P0D69

A/C Compressor Motor Voltage Sensor Performance

DTC P0D6A

A/C Compressor Motor Voltage Sensor Circuit High Voltage

DTC P0D6B

A/C Compressor Motor Voltage Sensor Circuit Low Voltage

DTC P0D71

Electric A/C Compressor Control Module Internal Temperature Sensor Performance

DTC P0D72

Electric A/C Compressor Control Module Internal Temperature Sensor Circuit High Voltage

DTC P0D73

Electric A/C Compressor Control Module Internal Temperature Sensor Circuit Low Voltage

DTC P0D76

Electric A/C Compressor Control Module Output Driver Temperature Sensor Performance

DTC P0D77

Electric A/C Compressor Control Module Output Driver Temperature Sensor Circuit High Voltage

DTC P0D78

Electric A/C Compressor Control Module Output Driver Temperature Sensor Circuit Low Voltage

Circuit/System Description

The AC compressor function is to provide refrigerant flow in the AC refrigerant loop to help cool down the cabin, help dehumidify the air in a defrost mode and help maintain the battery temperature. Rather than a more-typical pulley, the A/C compressor uses a 3-phase alternating current, high voltage electric motor to operate. It has an on-board inverter that takes High Voltage direct current from the vehicle's High Voltage Battery and inverts it to alternating current for the motor. The AC compressor shall be activated when any of the three following events occur:

- The customer pushes the AC button
- The HVAC control, in AUTO mode, requests the electric AC compressor on to help in cooling the cabin or removing moisture in the defrost mode
- The High Voltage Battery Thermal System requests the AC compressor on to help maintain the battery temperature

The Hybrid Powertrain control module 2 uses values from the A/C refrigerant pressure transducers, A/C refrigerant thermistor, duct temperature sensors, ambient air temperature sensor, passenger compartment temperature sensor, evaporator temperature sensor, battery cell temperature sensors, battery coolant temperature sensors and battery coolant pumps to determine the speed at which the compressor will operate. This speed request message is sent from the Hybrid/EV Powertrain Control Module 2 to the A/C compressor control module via serial data message.

Conditions for Running the DTC

DTC P0D69

- 12 V battery system voltage is greater than 10.2 V.
- Main HV battery contactors must be closed.
- DTCs P0AA4, P0ABB, P0ABC, P0ABD, P0AD9, P0C78, P0D5E, P0D6A; P0D6B, P1EC3, P2534, P2535, P3061, U0111, U016B or U185A must not be set.

DTC P0D6A

- 12 V battery system voltage is above 10.2 V.
- Main HV battery contactors must be closed.
- DTCs P2534, P2535, P3061 or U016B must not be set.

DTC P0D6B

- 12 V battery system voltage is above 10.2 V.
- Main HV battery contactors must be closed.
- DTCs P0AA4, P0AD9, P0C78, P0D5E, P1EC3, P2534, P2535, P3061 or U016B must not be set.

DTC P0D71 or P0D76

- 12 V battery system voltage is above 10.2 V.
- Vehicle is in Run Mode or Charging Mode
- Compressor has been off for more than 2 hours
- Outside air temperature is greater than -7°C (19°F)
- DTCs P0071, P0072, P0073, P0074, P0D72, P0D73, P0D77, P0D78, P2534, P2535 or U016B must not be set

DTC P0D72, P0D73, P0D77 or P0D78

- 12 V battery system voltage is above 10.2 V.
- DTCs P2534, P2535 or U016B must not be set

Conditions for Setting the DTC

DTC P0D69

A/C compressor motor voltage is greater than 30 V.

DTC P0D6A

The A/C compressor high voltage input sensor value is greater than 527.25 V for 1 second.

DTC P0D6B

The A/C compressor high voltage input sensor value is less than 27.75 V for 1 second.

DTC P0D71

The A/C compressor processor temperature sensor value is greater than 22°C (72°F).

AND

The difference between the A/C compressor processor temperature sensor value and the outside air temperature value is greater than 22Å,Å°C (72Å,Å°F).

DTC P0D72

A/C compressor processor temperature sensor value is less than -40Å,Å°C (-40Å,Å°F) for 6 seconds.

DTC P0D73

A/C compressor processor temperature sensor value is greater than 150Å,Å°C (302Å,Å°F) for 6 seconds.

DTC P0D76

The A/C compressor temperature sensor value is greater than 22Å,Å°C (72Å,Å°F).

AND

The difference between the A/C compressor temperature sensor value and the outside air temperature value is greater than 22Å,Å°C (72Å,Å°F).

DTC P0D77

A/C compressor temperature sensor value is less than -40Å,Å°C (-40Å,Å°F) for 6 seconds.

DTC P0D78

A/C compressor temperature sensor value is greater than 150Å,Å°C (302Å,Å°F) for 6 seconds.

Action Taken When the DTC Sets

The A/C compressor is disabled.

Conditions for Clearing the DTC

These are all type B DTC's

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that DTC P0071, P0072, P0073, P0074, P0AA4, P0ABB, P0ABC, P0ABD, P0AD9, P0C78, P0D5E, P1EC3, P2534, P2535, P3061, U0111, U016B or U185A are not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

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

3. Verify that DTC P0D6B is not set.

- **If DTC P0D6B is set**

Refer to Circuit/System Testing

- **If DTC P0D6B is not set**

4. Verify that DTC P0D69, P0D6A, P0D71, P0D72, P0D73 or P0D74 are not set.

- **If any of the DTCs are set**

1. Program the G1 A/C Compressor and the K114B Hybrid/EV Powertrain Control Module 2 with the latest software calibration.

2. Verify the DTC's do not set

- If any of the DTC's set, replace the affected control module.
- If none of the DTC's are set

3. All OK.

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

5. All OK.

Circuit/System Testing

NOTE: Perform Circuit/System Verification before Circuit/System Testing.

1. Vehicle OFF, disable the high voltage at the G1 A/C Compressor. Refer to [High Voltage Disabling](#) .

WARNING: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage component or connection. Personal Protection Equipment (PPE) and proper procedures must be followed.

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.
- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Failure to follow the procedures exactly as written may result in serious injury or death.

2. Disconnect the X4 and X5 harness connectors at the A28 Hybrid/EV Battery Contactor Assembly and the X2 harness connector at the G1 A/C Compressor. Refer to [High Voltage Connectors](#) .
3. Verify the inline harness connector X151 is properly connected.
4. Test for less than 2 Ω end to end between the 300-Volt Positive and Negative Cable circuit terminals listed below:
 - A4 Hybrid/EV Battery Pack harness connector terminal A X365 and G1 A/C Compressor harness connector terminal A X2.

- A4 Hybrid/EV Battery Pack harness connector terminal B X365 and G1 A/C Compressor harness connector terminal B X2.
- **If 2 Ω or greater**

Replace the 300-Volt Positive and Negative Cable.

- **If less than 2 Ω**

5. Replace the G1 A/C Compressor.

6. Operate the vehicle within the conditions for running the DTC. Verify the DTC does not set.

- **If the DTC sets**

Replace the A28 Hybrid/EV Battery Contactor Assembly.

- **If the DTC does not set**

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [High Voltage Battery Disconnect Relay Replacement](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC P151C OR P2516-P2518: AIR CONDITIONING (A/C) REFRIGERANT LOW SIDE 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 each diagnostic category.

DTC Descriptors

DTC P151C

Air Conditioning (A/C) Refrigerant Low Side Pressure Sensor Not Plausible

DTC P2516

Air Conditioning (A/C) Refrigerant Low Side Pressure Sensor Performance

DTC P2517

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

DTC P2518

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0CE5 00, P0CE6 00, P0606 00, P2517 00, P26A6 00, P2681 00	P2516 00 P2517 00	P0CE7 00, P0606 00, P2518 00, P26A7 00	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
A/C Low Pressure Sensor Signal	P2516 00 P2517 00	P2517 00	P0CE5 00, P0CE7 00, P0606 00, P2518 00, P26A5 00, P26A9 00	P2516 00
Low Reference	-	P2517 00	-	-

Circuit/System Description

The Hybrid/EV Powertrain Control Module 2 monitors the low side refrigerant pressure through the A/C pressure sensor. The Hybrid/EV Powertrain Control Module 2 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 Hybrid/EV Powertrain Control Module 2 to vary. When the pressure is high, the signal voltage is high. When the pressure is low, the signal voltage is low.

Conditions for Running the DTC

P151C

- Vehicle ON
- 12 V battery system voltage above 10.25 V.
- Hybrid/EV Powertrain Control Module 2 is awake and communicating.
- None of these DTCs may be active: P2517, P2518, P0073; P0072; P0071, P0119; P0118; P0117; P0116, P0531, P0532; P0533, P0606.
- Outside Air Temperature raw and corrected values must have had a chance to settle out. Once this occurs these variables are assigned a status of valid. May need to have some time driving in EV mode.
- Engine coolant temperature must be within 15 degrees of outside air temperature.
- Outside Air Temperature between 0Å, Å°C (32Å, Å°F) and 25Å, Å°C (77Å, Å°F).
- AC compressor must have been off for an hour since the last time the AC compressor was on.
- High side refrigerant pressure reading must be between 0 kPa and 675 kPa.

P2516

- Vehicle ON
- 12 V battery system voltage above 10.25 V.
- Hybrid/EV Powertrain Control Module 2 is awake and communicating.
- None of these DTCs may be active: P2517, P2518, P0073; P0072; P0071, P0119; P0118; P0117; P0116, P0606.
- Engine coolant temperature must be within 15 degrees of outside air temperature.
- AC compressor must have been off for an hour since the last time the AC compressor was on.
- AC compressor must be turned on for one minute. (This may require the service technician to select an HVAC mode that causes the AC compressor to run).

P2517 or P2518

- Vehicle ON
- 12 V battery system voltage above 10.25 V.
- Hybrid/EV Powertrain Control Module 2 is awake and communicating.

Conditions for Setting the DTC

DTC P151C

- The A/C low side Refrigerant Pressure reading and the A/C high side Refrigerant Pressure reading differ by more than 200 kPa (29 psi).
- Loss of HVAC Control Module communication

DTC P2516

The difference between the A/C low side pressure Sensor before compressor on and after compressor on changes less than 50 kPa (7 psi) over a 15 second period.

DTC P2517

The Hybrid/EV Powertrain Control Module 2 detects a short to ground or open at the A/C low side pressure sensor signal circuit.

DTC P2518

The Hybrid/EV Powertrain Control Module 2 detects a short to voltage at the A/C low side pressure sensor signal circuit.

Action Taken When the DTC Sets

These are type B DTCs.

Conditions for Clearing the DTC

These are type B DTCs.

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 Verification

1. Vehicle in Service Mode.
2. Verify that DTCs U0140 and U184B are not set.

- **If any of the DTCs are set**

Refer to **DTC U0100-U02FF** or **DTC U184B**.

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

3. Refer to Circuit/System Testing.

Circuit/System Testing

1. Vehicle OFF, all vehicle systems OFF, scan tool disconnected and key removed from vehicle, disconnect the harness connector at the B1C A/C Low Side Pressure Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 1 and ground.
 - **If 10 Ω or greater**
 1. Vehicle OFF, disconnect the harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
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. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the terminals listed below and ground.
 - Terminal 63
 - Terminal 64
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the 5 V reference circuit terminal 63 end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 5.2 V**
 1. Vehicle OFF, disconnect the harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 2. Test for less than 1 V between the terminals listed below and ground.
 - Signal circuit terminal 25
 - Signal circuit terminal 31
 - Signal circuit terminal 50
 - 5 V reference circuit terminal 63
 - 5 V reference circuit terminal 64
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If between 4.8-5.2 V**
5. Verify the scan tool Hybrid/EV Powertrain Control Module 2 A/C Low Side Pressure Sensor parameter is less than 0.1 V.
 - **If 0.1 V or greater**
 1. Vehicle OFF, disconnect the harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 0.1 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 Low Side Pressure Sensor parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Vehicle OFF, remove the jumper wire and disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 4.8 V**
8. Test or replace the B1C A/C Low Side Pressure Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC P154F: ELECTRIC A/C COMPRESSOR MOTOR INPUT CURRENT - POSITIVE CONTACTOR STATE

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 P154F

Electric A/C Compressor Motor Input Current - Positive Contactor State Not Plausible

Circuit/System Description

The hybrid powertrain control module 2 receives serial data messages from the A/C compressor. If the electrical current reported by the compressor is not logical based on the currently commanded state, the hybrid powertrain control module 2 sets the DTC.

Conditions for Running the DTC

- Vehicle ON
- 12 V battery system voltage above 10.2 V.
- Hybrid/EV Powertrain Control Module 2 is awake and communicating.
- None of these DTCs are set: P0532, P0533, P0AA4, P0ABB, P0ABC, P0ABD, P0AD9, P0C78, P0D5E, P0D6A, P0D6B, P15CA, P1EC3, P1F0A, P1F0C, P1F0D, P2534, P2535, P3061, U0111, U016B or U185A.
- The time since the high voltage contactors have been commanded opened or closed is greater than 1 s.
- Hybrid/EV Powertrain Control Module 2 monitors the data from the A/C compressor every 250 ms when the above conditions are met.

Conditions for Setting the DTC

DTC P154F is a Type B DTC.

Condition 1

- The high voltage battery contactors are commanded open.
- Electrical current is reported via serial data from the A/C compressor.

Condition 2

- The high voltage battery contactors are commanded closed.
- The A/C compressor is commanded OFF (0 RPM).
- Electrical current is reported via serial data from the A/C compressor.

OR

- The RPM reported via serial data from the A/C compressor is greater than 60 RPM.

Condition 3

- The high voltage battery contactors are commanded closed.
- The high voltage battery is between 300-410 V.
- The A/C compressor is commanded ON.
- The RPM reported via serial data from the A/C compressor is between 1000-8600 RPM.
- The A/C refrigerant high side pressure reported via serial data from the ECM is between 200-2300 kPa (29-334 PSI).
- Electrical current reported via serial data from the A/C compressor is less than 0.2 A or greater than 27 A.

Action Taken When the DTC Sets

DTC P154F is a Type B DTC.

Conditions for Clearing the DTC

DTC P154F is a Type B DTC.

Diagnostic Aids

These DTCs may be set during a stall.

Reference Information

Schematic Reference

Hybrid/EV Controls Schematics

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Verification

1. Verify DTCs P0532, P0533, P0AA4, P0ABB, P0ABC, P0ABD, P0AD9, P0C78, P0D5E, P0D6A, P0D6B, P15CA, P1EC3, P1F0A, P1F0C, P1F0D, P2534, P2535, P3061, U0111, U016B or U185A. are not set.
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).

- If none of the DTCs are set

2. Replace the G1 A/C Compressor.

3. Verify DTC P154F does not set while operating the vehicle within the Conditions for Running the DTC.

- If the DTCs sets

Replace the K114B Hybrid/EV Powertrain Control Module 2.

- If the DTCs does not set

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

HVAC Component Replacement Reference

[Control Module References](#) for control module replacement, programming and setup.

DTC P156A-P156C: AIR CONDITIONING (A/C) PRESSURE

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 P156A

Air Conditioning (A/C) Pressure Too High when A/C Off

DTC P156B

Air Conditioning (A/C) Pressure Too Low when A/C On

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0452, P0532, P0641	P0532	P0453, P0533, P0641	-
Signal	P0532	P0532	P0533	P156A, P156B
Low Reference	-	P0533	-	-

Circuit/System Description

The engine control module monitors the high side refrigerant pressure through the high side A/C refrigerant pressure sensor. The engine control module 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 engine control module to vary. When the pressure is high, the signal voltage is high. When the pressure is low, the signal voltage is low. When pressure is high, the engine control module commands the cooling fans on.

If the engine control module detects the refrigerant pressure sensor signal is not logical based on the current operating conditions, the engine control module sets the DTC.

Conditions for Running the DTC

P156A

- Vehicle ON
- None of these DTCs are set: P0532, P0533 or U016B
- The compressor has been OFF for more than 20s.
- The ECM monitors the A/C high side pressure every 100 ms when the above conditions are met.

P156B

- Vehicle ON
- None of these DTCs are set: P0532, P0533 or U016B
- The compressor has been ON for more than 10 s.
- The ECM monitors the A/C high side pressure every 100 ms when the above conditions are met.

Conditions for Running the DTC

P156A

- P156A is a type B DTC
- The ECM detects the A/C high side pressure is too high based on the current operating conditions.

P156B

- P156B is a type B DTC
- The ECM detects the A/C high side pressure is too low based on the current operating conditions.

Action Taken When the DTC Sets

P156A and P156B are type B DTCs

Conditions for Clearing the DTC

P156A and P156B are type B DTCs

Diagnostic Aids

A malfunction within the refrigerant system causing can cause these DTCs to set.

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 Verification

1. Ignition ON.
2. Verify no other DTCs are set.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If no other DTCs are set**
3. Install the appropriate Air Conditioning Service Center.
4. 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%**
5. Refer to [Air Conditioning \(A/C\) System Performance Test](#) .

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

DTC P15C6 OR P15C8-P15CB: ELECTRIC A/C COMPRESSOR

Diagnostic Instructions

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

DTC Descriptor

DTC P15C6

Electric A/C Compressor Speed Request Signal Message Counter Incorrect

DTC P15C8

Electric A/C Compressor Data Message Counter Incorrect

DTC P15C9

Electric A/C Compressor Status Message Counter Incorrect

DTC P15CA

Electric A/C Compressor Sensors Signal Message Counter Incorrect

DTC P15CB

Electric A/C Compressor Sensors Status Message Counter Incorrect

Circuit/System Description

The hybrid powertrain control module 2 receives serial data messages from the A/C compressor. If the message counter from the A/C compressor is not incrementing based on the currently commanded state, the hybrid powertrain control module 2 sets the DTC.

Conditions for Running the DTC

- Vehicle ON
- 12 V battery system voltage above 10.2 V.
- Hybrid/EV Powertrain Control Module 2 is awake and communicating.
- None of these DTCs are set: P2534, P2535 or U016B
- The A/C compressor is active.
- Hybrid/EV Powertrain Control Module 2 monitors the data from the A/C compressor every 100 ms when the above conditions are met.

Conditions for Setting the DTC

The hybrid powertrain control module 2 detects the message counter from the A/C compressor is not being updated.

Action Taken When the DTC Sets

DTCs P15C6, P15C8, P15C9, P15CA and P15CB are Type B DTCs.

Conditions for Clearing the DTC

DTCs P15C6, P15C8, P15C9, P15CA and P15CB are Type B DTCs.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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- [Hybrid/EV Cooling System Description and Operation](#)

Electrical Information Reference

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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Verify DTCs P2534, P2535 or U016B are not set.

- **If DTC P2534, P2535 or U016B are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If DTC P2534, P2535 or U016B are not set**

2. Replace the G1 A/C Compressor.

3. Verify DTCs P15C6, P15C8, P15C9, P15CA or P15CB do not set while operating the vehicle within the Conditions for Running the DTC.

- If any of the DTCs are set

Replace the K114B Hybrid/EV Powertrain Control Module 2.

- If none of the DTCs are set

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

[HVAC Component Replacement Reference](#)

[Control Module References](#) for control module replacement, programming and setup.

DTC P1F0A-P1F0D: ELECTRIC A/C COMPRESSOR MOTOR

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 P1F0A

A/C Compressor Motor Speed Performance

DTC P1F0C

Electric A/C Compressor Control Module A/C Compressor Motor Current Feedback Circuit Low Voltage

DTC P10FD

Electric A/C Compressor Control Module A/C Compressor Motor Current Feedback Circuit High Voltage

Circuit/System Description

The A/C compressor function is to provide refrigerant flow in the A/C refrigerant loop to help cool down the cabin, help dehumidify the air in a defrost mode and help maintain the battery temperature. Rather than a more-typical pulley, the A/C compressor uses a 3-phase alternating current, high voltage electric motor to operate. It has an on-board inverter that takes High Voltage direct current from the vehicle's High voltage battery and inverts it to alternating current for the motor. The A/C compressor shall be activated when any of the three following events occur:

- The customer pushes the AC button
- The HVAC control, in AUTO mode, requests the electric A/C compressor on to help in cooling the cabin or removing moisture in the defrost mode
- The High Voltage Battery Thermal System requests the A/C compressor on to help maintain the battery temperature

The Hybrid/EV powertrain control module 2 uses values from the A/C refrigerant pressure transducers, A/C refrigerant thermistor, duct temperature sensors, ambient air temperature sensor, passenger compartment temperature sensor, evaporator temperature sensor, battery cell temperature sensors, battery coolant temperature sensors and battery coolant pumps to determine the speed at which the compressor will operate. This message is sent from the Hybrid/EV powertrain control module 2 to the A/C compressor control module via serial data message.

A/C Compressor has a motor start up procedure that can take a variable length of time to run to bring the motor up to requested speed. Length of time is dependent on external conditions such as underhood

temperature and high side pressure. In hotter conditions, the motor start up time will be longer. The A/C compressor control module monitors an internal parameter known as the DC link current which is based off DC input current. It is not possible to measure this parameter externally.

Conditions for Running the DTC

DTC P1F0A

- 12 V battery system voltage is above 10.25 V.
- Vehicle is in Run Mode or Charging Mode
- Compressor is in start up mode

DTC P1F0C

- 12 V battery system voltage is above 10.25 V.
- Vehicle is in Run Mode or Charging Mode
- Compressor is in start up mode

DTC P1F0D

- 12 V battery system voltage is above 10.25 V.
- Vehicle is in Run Mode or Charging Mode
- Compressor is in start up mode

Conditions for Setting the DTC

DTC P1F0A

- A/C compressor control module temperature is greater than 85°C (185°F) and compressor motor speed does not reach to 1800 RPM within 20 s after the start of spinning
- A/C compressor control module temperature is less than or equal to 85°C and A/C compressor motor speed does not reach to 1800 RPM.

DTC P1F0C

A/C compressor control module DC link Current is less than 2.5 A for 6 s

DTC P1F0D

A/C compressor control module DC link Current is greater than 36.7 A for 6 s

Action Taken When the DTC Sets

The A/C compressor control module is disabled but will retry once the compressor speed request goes to 0 RPM and a new speed request greater than 0 RPM is sent.

Conditions for Clearing the DTC

These are type B DTC's

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](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify that DTCs P0F0A-P1F0D are not set.
 - **If any of the DTCs are set**
 1. Program the G1 A/C Compressor and the K114B Hybrid/EV Powertrain Control Module 2 with the latest software calibration.
 2. Verify the DTCs do not set
 - If any of the DTCs set, replace the affected control module.
 - If none of the DTCs are set
 3. All OK.
 - **If none of the DTCs are set**
3. All OK.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC P15C5, P2682, P2683, P26A5-P26A7, P26A9, P26AD OR P26AE: ENGINE COOLANT BYPASS VALVE

[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 P15C5 00

Engine Coolant Bypass Valve Position Sensor Range/ Performance - Unexpected Position Change Detected

DTC P2682 00

Engine Coolant Bypass Valve Control Circuit 1 Low Voltage

DTC P2683 00

Engine Coolant Bypass Valve Control Circuit 1 High Voltage

DTC P26A5 00

DTC P26A6 00

Engine Coolant Bypass Valve Position Sensor Circuit Low Voltage

DTC P26A7 00

Engine Coolant Bypass Valve Position Sensor Circuit High Voltage

DTC P26A9 00

Engine Coolant Bypass Valve Position Sensor Stop/ Minimum Stop Performance

DTC P26AD 00

Engine Coolant Bypass Valve Control Circuit 2 Low Voltage

DTC P26AE 00

Engine Coolant Bypass Valve Control Circuit 2 High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Valve Control Circuit 1	P2682 00	P2683 00, P26A9 00	P2683 00	-
Valve Control Circuit 2	P26AD 00	P26AE 00, P26A900	P26AE 00	-
Coolant Valve Position Sensor 5 V Reference	P26A6 00	P26A6 00	P26A7 00	-
Coolant Valve Position Sensor Signal	P26A5 00, P26A6 00	P26A500, P26A7 00	P26A5 00, P26A7 00	P15C5 00, P26A5 00, P26A900
Coolant Valve Position Sensor Low Reference	-	P26A7 00	-	-

Circuit/System Description

The passenger compartment heater coolant control valve regulates the engine coolant flow into the cabin heater loop depending on engine coolant temperature and ambient temperature conditions. The passenger compartment heater coolant control valve has two positions: ByPass or Link. In the ByPass position, the coolant in the engine loop and heater loop are separated and in the link position the coolant circulates through both loops. The valve movement is controlled by a bidirectional motor. A 50% duty cycle is a normal duty cycle. A 75% duty cycle represents a valve commanded to the link position. A 25% duty cycle represents a valve commanded to the ByPass position. The passenger compartment heater coolant control valve uses an internal position sensor that sends a signal to the hybrid powertrain control module 2 to determine the valve position.

When the engine coolant temperature heats up, a valve learn procedure takes place. The hybrid powertrain control module 2 commands the valve to the link position and records the voltage coming back from the position sensor. Then the hybrid powertrain control module 2 commands the valve back to the bypass position and records the voltage coming back from the position sensor. The voltage values in both the link and bypass positions must fall within calibrated ranges.

Conditions for Running the DTC**P15C5**

- 12 V battery system voltage is greater than or equal to 10.2 V.

- The propulsion system is active.
- None of the following DTCs are set: P2682, P2683, P26A5, P26A6, P26A7, P26A9, P26AD or P26AE.
- The valve control command is stop.

P2682

- 12 V battery system voltage is greater than 10.2 V.
- The valve control 1 command is low.

P2683

- 12 V battery system voltage is greater than 10.2 V.
- The valve control 1 command is high or stop.

P26A5

- 12 V battery system voltage is greater than or equal to 10.2 V.
- The propulsion system is active.
- None of the following DTCs are set: P2682, P2683, P26A6, P26A7, P26AD or P26AE.
- The valve control command is stop.

P26A6 and P26A7

12 V battery system voltage is greater than 10.2 V.

P26A9

- 12 V battery system voltage is greater than 10.2 V.
- The propulsion system is active.
- None of the following DTCs are set: P0116, P0117, P0118, P0119, P2682, P2683, P26A6, P26A7, P26AD, P26AE.
- The coolant temperature is above 58°C (136°F).

P26AD

- 12 V battery system voltage is greater than 10.2 V.
- The valve control 2 command is low.

P26AE

- 12 V battery system voltage is greater than 10.2 V.
- The valve control 2 command is high or stop.

Conditions for Setting the DTC

P15C5

The hybrid powertrain control module 2 has detected the valve feedback has drifted out of the commanded position when the valve command is stop.

P2682

The hybrid powertrain control module 2 has detected a short to ground on the valve drive 1 circuit.

P2683

The hybrid powertrain control module 2 has detected a short to voltage or an open on the valve drive 1 circuit.

P26A5

The hybrid powertrain control module 2 has detected the valve feedback has exceeded the valid range.

P26A6

The hybrid powertrain control module 2 has detected a short to ground on feedback circuit. The feedback signal is less than 5% (0.25 V).

P26A7

The hybrid powertrain control module 2 has detected a short to voltage on feedback circuit. The feedback signal is greater than 95% (4.25 V).

P26A9

- The valve has not reached the commanded position, valve position relearn was attempted and the valve still does not reach the commanded position.

OR

- An open circuit condition exists on either of the valve control circuits.

P26AD

The hybrid powertrain control module 2 has detected a short to ground on the valve drive 2 circuit.

P26AE

The hybrid powertrain control module 2 has detected a short to voltage or an open on the valve drive 2 circuit.

Action Taken When the DTC Sets

DTCs P15C5, P2682, P2683, P26A5, P26A6, P26A7 P26A9, P26AD and P26AD are type B DTCs.

Conditions for Clearing the DTC

DTCs P15C5, P2682, P2683, P26A5, P26A6, P26A7 P26A9, P26AD and P26AD are type B DTCs.

Reference Information

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that DTC P0116, P0117, P0118 or P0119 is not set.
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If none of the DTCs are set**
3. Refer to Circuit/System testing.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the Q66 Passenger Compartment Heater Coolant Control Valve. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 5 Ω between the low reference circuit terminal 5 and ground.
 - **If 5 Ω or greater**
 1. Disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 5 Ω**
3. Vehicle in Service Mode.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 6 and ground.
 - **If less than 4.8 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 5.2 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If between 4.8-5.2 V**
5. Verify the scan tool Hybrid Powertrain Control Module 2, Passenger Compartment Heater Coolant Control Solenoid Valve Feedback parameter is greater than 95%.
 - **If less than 95%**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the signal circuit terminal 50 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 95%**

6. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the low reference circuit terminal 5.
7. Verify the scan tool Passenger Compartment Heater Coolant Control Solenoid Valve Feedback parameter is less than 10%.
 - **If 10% or greater**
 1. Vehicle OFF, remove the jumper wire and disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 2. Test for less than 1 V between the signal circuit terminal 50 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Vehicle OFF.
 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10%**
 - 8. Vehicle OFF, remove the jumper wire.
 - 9. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.
 - 10. Test for less than 1 V between each control circuit listed below and ground:
 - Q66 Passenger Compartment Heater Coolant Control Valve terminal 1
 - Q66 Passenger Compartment Heater Coolant Control Valve terminal 2
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
 - 11. Vehicle OFF.
 - 12. Test for infinite resistance between each control circuit listed below and ground:
 - Q66 Passenger Compartment Heater Coolant Control Valve terminal 1
 - Q66 Passenger Compartment Heater Coolant Control Valve terminal 2
 - **If less than infinite resistance**

Repair the short to ground on the circuit.
 - **If infinite resistance**
 - 13. Test for less than 2 Ω in each control circuit end to end.
 - **If 2 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 2 Ω**
 - 14. Replace the Q66 Passenger Compartment Heater Coolant Control Valve.
 - 15. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
 - **If the DTC sets**

Replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the DTC does not set**
 - 16. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for the 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

- Inspect for aftermarket devices which may affect the operation of the HVAC System. Refer to [Checking Aftermarket Accessories](#).

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 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 \(with CJ2\)](#)[HVAC System Malfunction \(with C24\)](#)[HVAC System Malfunction \(CJ2 with HP9\)](#) in order to diagnose the symptom.

HVAC SYSTEM MALFUNCTION (WITH CJ2)

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

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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System 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 A26 HVAC Controls.
 - **If any parameter does not change**
Replace the A26 HVAC Controls.
 - **If all parameters change**
3. 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**
4. Verify the HVAC doors listed below move when operating the appropriate control.
 - Driver Temperature
 - Passenger Temperature
 - Mode
 - Recirculation
 - **If any HVAC door does not move**

Refer to [DTC B0223, B0233, B023A, B0278, B0408, B0418, B0428 or B3531](#).

- **If all HVAC doors move**

5. Install the appropriate ACR Air Conditioning Service Center, ignition ON

6. Verify the high side pressure on the gauge is within 10% of the scan tool A/C High Side Pressure Sensor parameter.

- **If the A/C High Side Pressure Sensor parameter is not within 10%**

Refer to [DTC P0532 or P0533](#).

- **If the A/C High Side Pressure Sensor parameter is within 10%**

7. 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](#)

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

8. 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
- Left Rear Lower Duct Air Temperature Sensor
- **If not within 10% of ambient temperature**

Refer to [DTC B0173, B0178, B0509, B0514, B0519, B051F, B3583 or B375A-B375C](#).

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

9. Verify the A/C Evaporator Temperature Sensor scan tool parameter is within 10% of ambient temperature.

- **If not within 10% of ambient temperature**

Refer to [DTC B3933](#).

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

10. Engine ON, A/C system ON.

11. 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](#) and [DTC B393B](#).

- **If the air is cool**

12. Engine OFF, ignition ON.

13. Verify the scan tool Sunload parameter changes while covering the B10B Ambient Light/Sunload Sensor with a shop towel or other suitable item.

- **If the Sunload parameter does not change**

Refer to [DTC B0163 or B0183](#).

- **If the Sunload parameter changes**

14. Verify the actual inside air temperature, using a thermometer, is less than 3Å,Å°C (5Å,Å°F) difference from the scan tool Inside Passenger Compartment Air Temp. Sensor parameter.

- **If greater than a 3Å,Å°C (5Å,Å°F) difference**

Refer to [DTC B0163 or B0183](#).

- **If less than a 3A, A°C (5A, A°F) difference**

15. Verify the G17 Heater Coolant Pump turns On and Off when commanded with a scan tool.

- **If the G17 Heater Coolant Pump does not turn On and Off**

Refer to [DTC B269A, B269C or B269D](#).

- **If the G17 Heater Coolant Pump does turn On and Off**

16. 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**

17. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

HVAC SYSTEM MALFUNCTION (WITH C24)

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

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Electrical Information 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

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 A26 HVAC Controls.
 - **If any parameter does not change**
Replace the A26 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 rear blower motor operates properly with the blower motor switch in each speed position.
 - **If the rear blower motor does not operate properly in each speed position**
Refer to [DTC B0208](#).
 - **If the rear blower motor operates properly in each speed position**
6. Verify the HVAC doors listed below move when operating the appropriate control.
 - Driver Temperature
 - Passenger Temperature
 - Rear Console Temperature- Left
 - Driver Mode
 - Passenger Mode
 - Recirculation
 - **If any HVAC door does not move**
Refer to [DTC B0223, B0233, B023A, B0278, B0408, B0418, B0428 or B3531](#).
 - **If all HVAC doors move**
7. Verify the HVAC doors listed below move when operating the appropriate control.
 - Rear Temperature - Left Upper
 - Rear Temperature - Right Upper
 - Rear Console Temperature - Right
 - Rear Mode
 - **If any HVAC door does not move**
Refer to [DTC B042A, B042C, B042D or B374B](#).
 - **If all HVAC doors move**
8. Install the appropriate ACR Air Conditioning Service Center, ignition ON
9. Verify the high side pressure on the gauge is within 10% of the scan tool A/C High Side Pressure Sensor parameter.

- If the A/C High Side Pressure Sensor parameter is not within 10%

Refer to [DTC P0532 or P0533](#).

- If the A/C High Side Pressure Sensor parameter is within 10%

10. 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](#)

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

11. 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
- Left Rear Lower Duct Air Temperature Sensor
- Left Rear Upper Duct Air Temperature Sensor
- Right Rear Lower Duct Air Temperature Sensor
- Right Rear Upper Duct Air Temperature Sensor
- If not within 10% of ambient temperature

Refer to [DTC B0173, B0178, B0509, B0514, B0519, B051F, B3583 or B375A-B375C](#).

- If within 10% of ambient temperature

12. Verify the A/C Evaporator Temperature Sensor scan tool parameter is within 10% of ambient temperature.

- If not within 10% of ambient temperature

Refer to [DTC B3933](#).

- If within 10% of ambient temperature

13. Engine ON, A/C system ON.

14. 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](#) and [DTC B393B](#).

- If the air is cool

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 or other suitable item.

- If the Sunload parameter does not change

Refer to [DTC B0163 or B0183](#).

- If the Sunload parameter changes

17. Verify the actual inside air temperature, using a thermometer, is less than 3 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{C}$ (5 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{F}$) difference from the scan tool Inside Passenger Compartment Air Temp. Sensor parameter.

- If greater than a 3 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{C}$ (5 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{F}$) difference

Refer to [DTC B0163 or B0183](#).

- If less than a 3 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{C}$ (5 $\tilde{\text{A}}$, $\hat{\text{A}}$ $^{\circ}\text{F}$) difference

18. Verify the G17 Heater Coolant Pump turns On and Off when commanded with a scan tool.

- **If the G17 Heater Coolant Pump does not turn On and Off**

Refer to [DTC B269A, B269C or B269D](#).

- **If the G17 Heater Coolant Pump does turn On and Off**

19. 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**

20. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for control module replacement, programming and setup.

HVAC SYSTEM MALFUNCTION (CJ2 WITH HP9)

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](#)

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: Check for bulletins before proceeding.

1. Vehicle in Service Mode.
2. Verify every applicable scan tool switch parameter changes when pressing the appropriate switch on the A26 HVAC Controls.
 - **If any parameter does not change**
Replace the A26 HVAC Controls.
 - **If all parameters change**
3. 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**
4. Verify the HVAC doors listed below move when operating the appropriate control.
 - Driver Temperature
 - Passenger Temperature
 - Mode
 - Recirculation
 - **If any HVAC door does not move**
Refer to [DTC B0223, B0233, B023A, B0278, B0408, B0418, B0428 or B3531](#).
 - **If all HVAC doors move**
5. Install the appropriate ACR Air Conditioning Service Center, Vehicle in Service Mode
6. Verify the high side pressure on the gauge is within 10% of the scan tool A/C High Side Pressure Sensor parameter.
 - **If the A/C High Side Pressure Sensor parameter is not within 10%**
Refer to [DTC P0532 or P0533](#).
 - **If the A/C High Side Pressure Sensor parameter is within 10%**
7. 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](#)
 - **If the reading is between 269-2929 kPa (39-425 PSI)**
8. Verify the low side pressure on the gauge is within 10% of the scan tool A/C Low Side Pressure Sensor parameter.
 - **If the A/C Low Side Pressure Sensor parameter is not within 10%**
Refer to [DTC P151C or P2516-P2518](#).
 - **If the A/C Low Side Pressure Sensor parameter is within 10%**
9. 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
 - Left Rear Lower Duct Air Temperature Sensor
 - **If not within 10% of ambient temperature**
Refer to [DTC B0173, B0178, B0509, B0514, B0519, B051F, B3583 or B375A-B375C](#).

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

10. Verify the A/C Evaporator Temperature Sensor scan tool parameter is within 10% of ambient temperature.

- **If not within 10% of ambient temperature**

Refer to [DTC B3933](#).

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

11. Verify the scan tool Sunload parameter changes while covering the B10B Ambient Light/Sunload Sensor with a shop towel or other suitable item.

- **If the Sunload parameter does not change**

Refer to [DTC B0163 or B0183](#).

- **If the Sunload parameter changes**

12. Verify the actual inside air temperature, using a thermometer, is less than 3Å,Å°C (5Å,Å°F) difference from the scan tool Inside Passenger Compartment Air Temp. Sensor parameter.

- **If greater than a 3Å,Å°C (5Å,Å°F) difference**

Refer to [DTC B0163 or B0183](#).

- **If less than a 3Å,Å°C (5Å,Å°F) difference**

13. Vehicle ON, A/C system ON.

14. Verify cool air flows from the ducts with the temperature control in the coldest position.

- **If the air is not cool**

Refer to [Air Conditioning \(A/C\) System Performance Test](#)

- **If the air is cool**

15. Engine OFF, Vehicle in Service Mode.

16. Verify the G36 Auxiliary Heater Coolant Pump turns On and Off when commanded with a scan tool.

- **If the G36 Auxiliary Heater Coolant Pump does not turn On and Off**

Refer to [DTC B269A, B269C or B269D](#).

- **If the G36 Auxiliary Heater Coolant Pump turns On and Off**

17. Vehicle ON, verify the K10 Coolant Heater Control Module is operating properly.

- **If the K10 Coolant Heater Control Module is not operating properly**

Refer to [DTC B048E](#)

- **If the K10 Coolant Heater Control Module is operating properly**

18. 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**

19. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- [HVAC Component Replacement Reference](#)
- [Control Module References](#) for 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 Å , $\text{Å}^{\circ}\text{C}$ (255 Å , $\text{Å}^{\circ}\text{F}$).
- 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 Å , $\text{Å}^{\circ}\text{C}$ (38 Å , $\text{Å}^{\circ}\text{F}$).
- ECM does not detect excessive torque load.
- ECM does not detect insufficient idle quality.
- The ambient temperature sensor senses above 1 Å , $\text{Å}^{\circ}\text{C}$ (34 Å , $\text{Å}^{\circ}\text{F}$).
- Blower motor is ON.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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Electrical Information Reference

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

Scan Tool Reference

Circuit/System Verification

NOTE: Refer to [HVAC System Malfunction \(with CJ2\)](#), [HVAC System Malfunction \(with C24\)](#) and/or [HVAC System Malfunction \(CJ2 with HP9\)](#) before performing this procedure.

1. Ignition ON, press and release the A/C Switch.
2. Verify the HVAC control module scan tool A/C Switch parameter changes between Active and Inactive.
 - **If the parameter does not change**
Replace the A26 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 and disengages 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 or disengage as commanded**
Refer to [DTC P0645, P0646 or P0647](#)
 - **If the A/C compressor clutch engages and disengages as commanded**
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

AUXILIARY HEATER COOLANT PUMP 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.

DTC Descriptors

DTC B0468

DTC B046B

Auxiliary Heater Coolant Pump Feedback Circuit

DTC B046C

Auxiliary Heater Coolant Pump Enable 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+	B046B 00	B046B 00	-	-
Control Terminal 1	B046C 02	B0468 06, B046B 00, B046C 05	B046C 05	-
Control Terminal 3	B0468 06	B0468 06	B0468 01	-
Signal	B046B 00	B046B 00	B046B 00	-
Ground	-	B046B 00	-	-

Circuit/System Description

The auxiliary heater coolant pump is controlled with a pulse-width modulated control sent from the HVAC control module to the auxiliary heater coolant pump. The higher the duty cycle on the control the higher the pump speed. An enable signal from the HVAC control module to the auxiliary heater coolant pump provides overall control of the pump. When voltage is present, the pump can operate. The auxiliary heater coolant pump provides a hard-wired pulse-width modulated feedback signal to the HVAC control module. During normal operation, this feedback signal provides pump speed information.

Diagnostic Aids

A DTC B0468 may cause a DTC B046B or DTC B046C to set.

Reference Information

Schematic Reference

HVAC Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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. Vehicle in Service Mode.
2. Verify the G36 Auxiliary Heater Coolant Pump operates when commanding the Auxiliary Coolant Pump On and Off with a scan tool.

- **If the G36 Auxiliary Heater Coolant Pump does not operate**

Refer to **DTC B0468, B046B or B046C**.

- **If the G36 Auxiliary Heater Coolant Pump operates**

3. All OK.

Repair Instructions

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

AFTERBLOW ENABLING

Afterblow is a feature that dries the evaporator core by operating the blower motor after the engine is turned off. This aids in reducing 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 by using the scan tool via the HVAC special functions menu.

Use the following procedure to enable the afterblow feature:

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 Diagnostics.
5. Select HVAC Control Module.
6. Select Configuration/Reset Functions.
7. Select HVAC Afterblow Configuration.

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

- The engine must be turned OFF.
- The outside air temperature must be at least 11°C (52°F) when the compressor was last operating before the engine was turned OFF.
- The A/C compressor must have operated for more than 2 minutes before the engine was turned OFF.
- The system voltage must be above 12 V.

Once the above conditions have been met, the blower motor will operate at a low blower speed, following the sequence below up to 5 times:

1. The blower motor will be OFF for 7-11 minutes.
2. The blower motor will operate for 20-60 seconds.

ACTUATOR RECALIBRATION

Preferred Method (with Scan Tool)

NOTE: Do not operate any HVAC controls while the HVAC control module is calibrating as this may interrupt the process. If interrupted, improper HVAC performance will result.

1. Using a scan tool, perform the HVAC Actuators Learn in the HVAC Control Module.
2. Follow the scan tool directions to complete the procedure.
3. Operate the system and verify that no DTCs have set as current DTCs.

4. 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 operate any HVAC controls while the HVAC control module is calibrating as this may interrupt the process. If interrupted, improper HVAC performance will result.

1. Ignition OFF/ Vehicle OFF.
2. Remove the HVAC control module fuse for a minimum of 10 s.
3. Install the HVAC control module fuse.
4. Start the vehicle.
5. Wait 40 s for the HVAC control module to self-calibrate.

REPAIR INSTRUCTIONS

WIRE TO WIRE REPAIR - HVAC

Special Tools

- EL-38125-10 Splice Sleeve Crimping Tool (non GMNA)
- J-38125-5A Ultra Torch Special Tool
- J-38125-8 Splice Sleeve Crimping Tool (GMNA)

For equivalent regional tools, refer to [Special Tools](#).

WARNING: In order to reduce the risk of personal injury, loss of high voltage isolation to ground and higher system impedance, do not attempt to repair any HV wiring, connector or terminal that is damaged. High voltage coaxial type cables are not repairable. Never attempt to repair a coaxial type cable. The entire cable/harness or component must be replaced. In order to maintain system integrity and personal safety, never attempt to repair any high voltage wiring, cables or terminals. Performing this procedure on high voltage circuits may result in serious injury or death.

NOTE: If the wiring harness internal to the transmission is damaged, the wiring harness must be replaced. The use of splice sleeves in an attempt to repair the internal transmission wires, connectors or terminals could result in performance issues.

NOTE: Do not splice wires in Door Harness Grommets.

NOTE: The DuraSeal splice sleeves have the following 2 critical features:

- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except high voltage and specialty cables. Use DuraSeal splice sleeves where there are special requirements such as

moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm ² / (AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19300089	Red (1) or Red/Green (1)	Red (2)	0.22-0.8/(18-26)
Blue 19168447	Blue (2)	Blue (3)	1.0-2.0/(14-16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0-5.0/(10-12)

1. Open the harness by removing any tape:

NOTE: You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

- Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
 - Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
 - Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches or connectors.

3. Strip the insulation:

- When adding a length of wire to the existing harness, use the same size wire as the original wire.
 - Perform one of the following items in order to find the correct wire size:
 - Find the wire on the schematic and convert to regional wiring gauge size.
 - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
 - Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
 - Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
 - If the wire is damaged, repeat this procedure after removing the damaged section.
4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice procedure.
 5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.
 6. The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

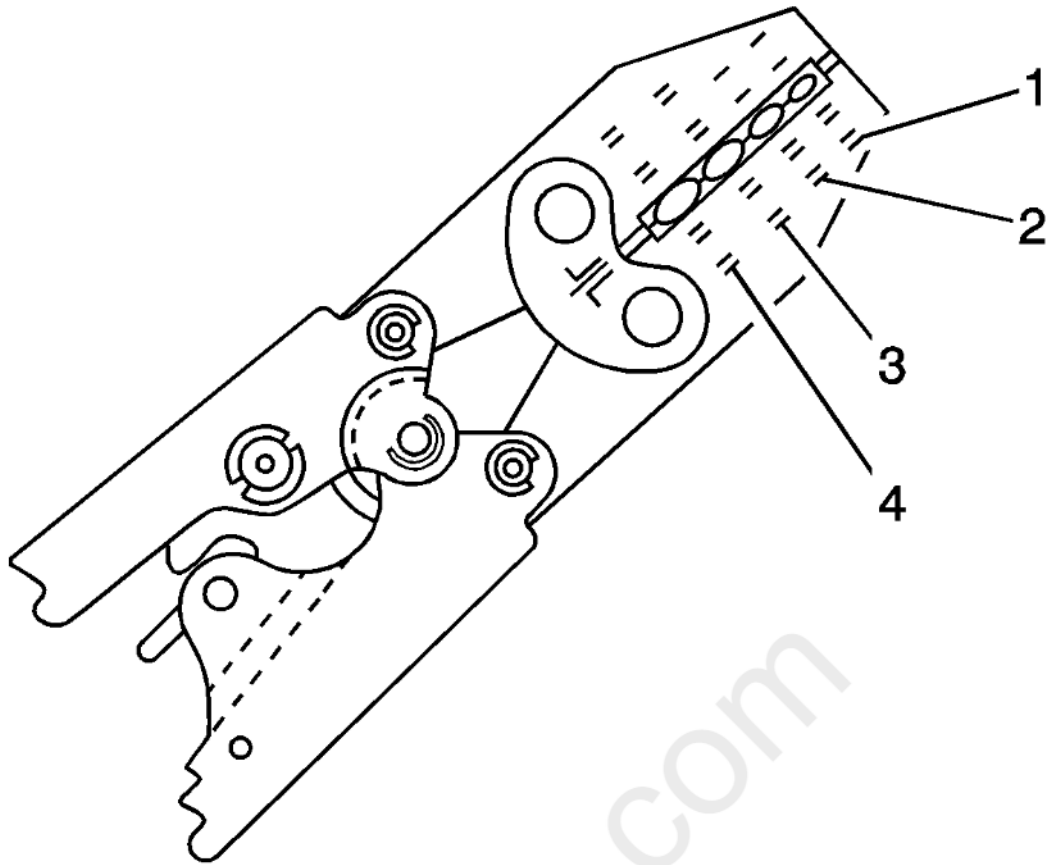


Fig. 15: Crimping Tool

Courtesy of GENERAL MOTORS COMPANY

7. The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

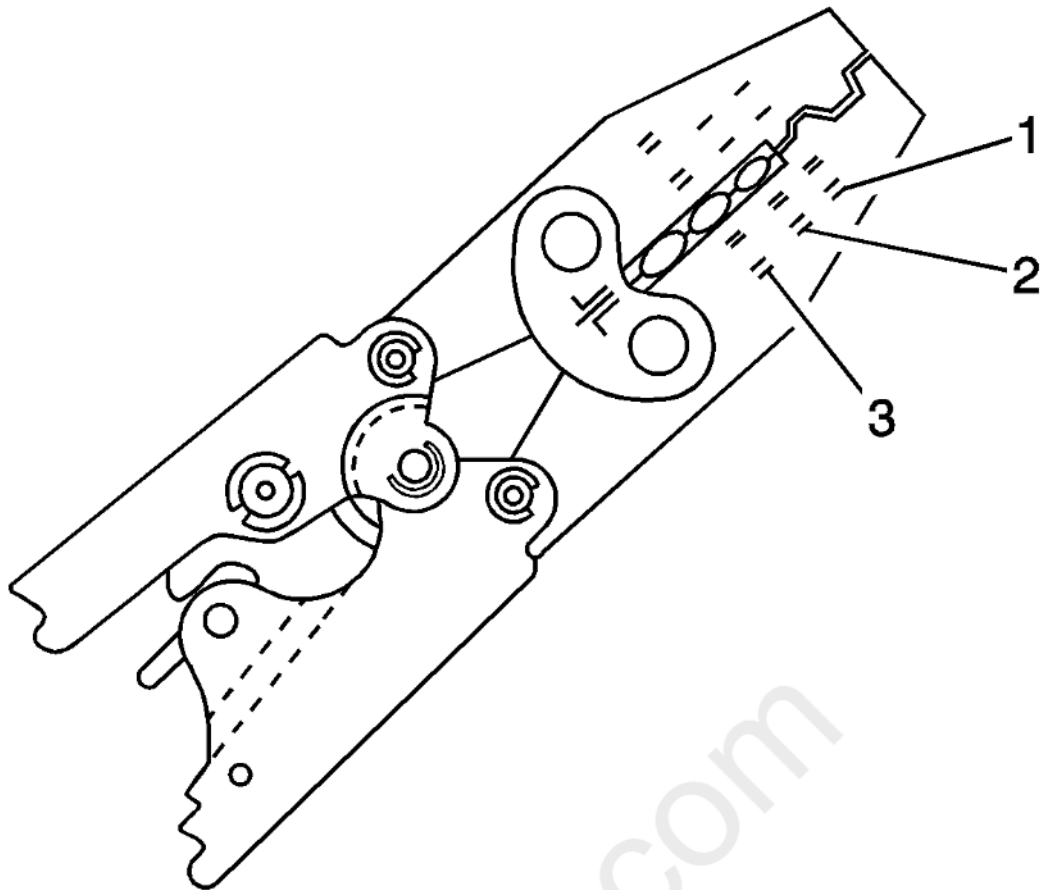


Fig. 16: Identifying Splice Crimp Tool Nests Terminal Identification

Courtesy of GENERAL MOTORS COMPANY

8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).
9. Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.

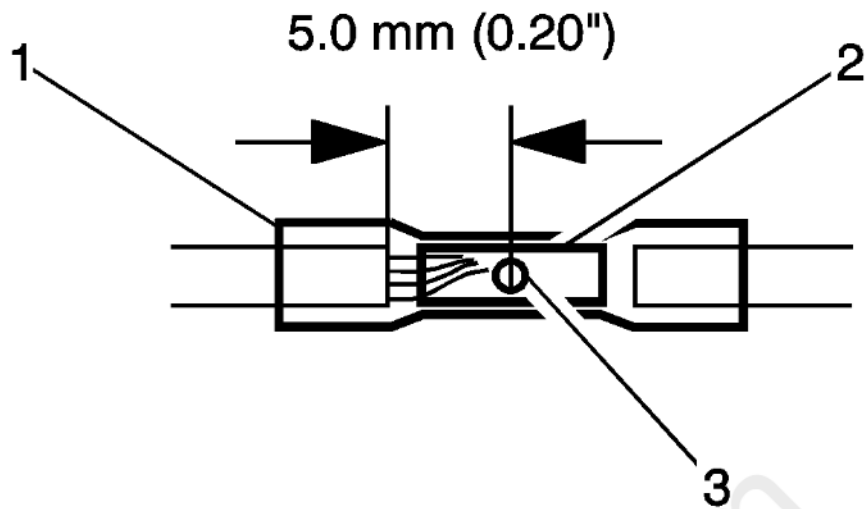


Fig. 17: Identifying Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

10. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.



Fig. 18: Crimped Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

11. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

12. Using the heat torch, apply heat to the crimped area of the barrel.



Fig. 19: Crimped Duraseal Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

Weatherpack™ Wiring Repair

NOTE: Some replacement pigtail connectors may be delivered without the terminated leads installed into the connector. For Weatherpack™ connectors, all terminated leads included in the package should to be installed into the connector. If the connector end view shows that a terminal is not occupied, the extra terminated lead(s) need to be installed and the end(s) sealed using a DuraSeal splice sleeve and taped back into the harness.

1. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

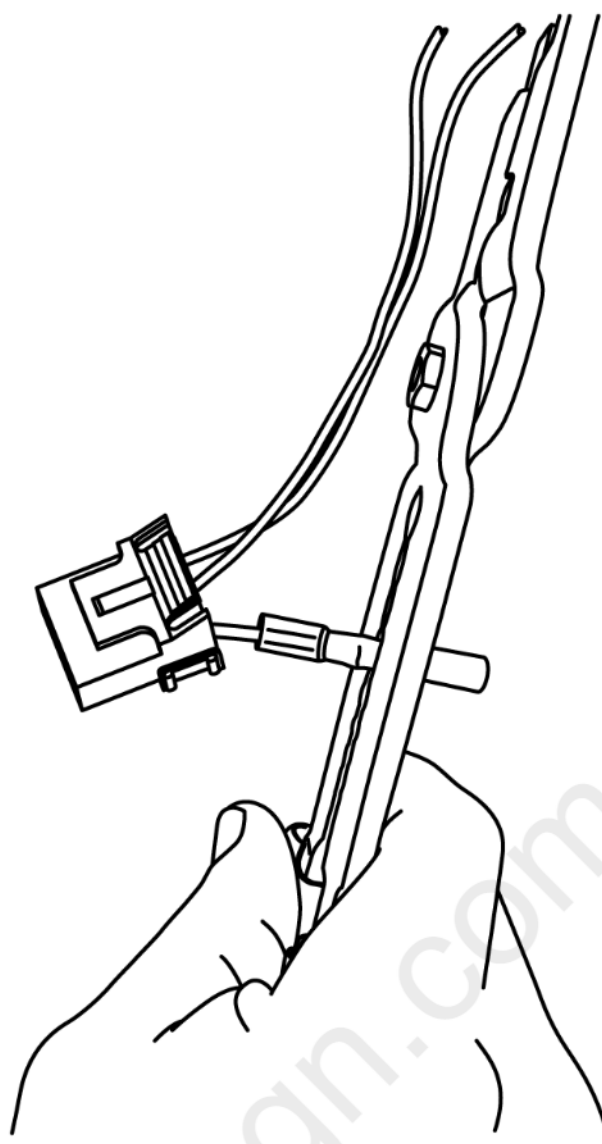


Fig. 20: Tightly Close Handles Of Crimp Tool
Courtesy of GENERAL MOTORS COMPANY

2. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Holding the DuraSEAL with one hand gently tug on the wire to ensure it is crimped in the DuraSeal.

3. Using the heat torch, apply heat to the crimped area of the barrel.
4. Start in the middle and gradually move the heat barrel to the open ends of the tubing:

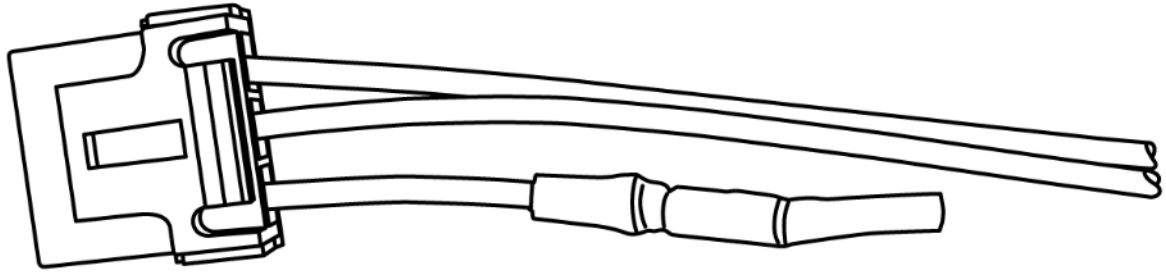


Fig. 21: Heat To Crimped Area Of Barrel

Courtesy of GENERAL MOTORS COMPANY

- The tubing will shrink completely as the heat is moved along the insulation.
- A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

5. Tape the extra terminated lead(s) back into the harness.



Fig. 22: Taping Extra Terminated Leads Back Into Harness
Courtesy of GENERAL MOTORS COMPANY

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.
3. Gradually move the heat from the center to the open end of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
4. Replace any reflective tape and clips that may have been removed during the repair.

CONNECTOR RECONNECTION - HVAC

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to [Special Tools](#) .

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Loose, corroded or painted terminal stud/fastener
- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- A terminal not seated all the way into the connector body
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.
- Wiring which has been pinched, cut or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to [**Inducing Intermittent Fault Conditions**](#) in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to [**Testing for Electrical Intermittents**](#) for test procedures to detect intermittent open, high resistance, short to ground and short to voltage conditions.
- Refer to [**Scan Tool Snapshot Procedure**](#) for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease/lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Power Distribution Schematics](#).
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point (screw or stud). Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to [Circuit Testing](#) and [Ground Distribution Schematics](#).

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection or high electrical load

- Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to [Inducing Intermittent Fault Conditions](#) in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to [Checking Aftermarket Accessories](#) .
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:
 - A new service control module is installed.
 - A control module from another vehicle is installed.
 - Revised software/calibration files have been released for this vehicle.
- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to [Control Module References](#) for replacement, setup and programming.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.**

HEATER AND AIR CONDITIONING USER INTERFACE CONTROL REPLACEMENT

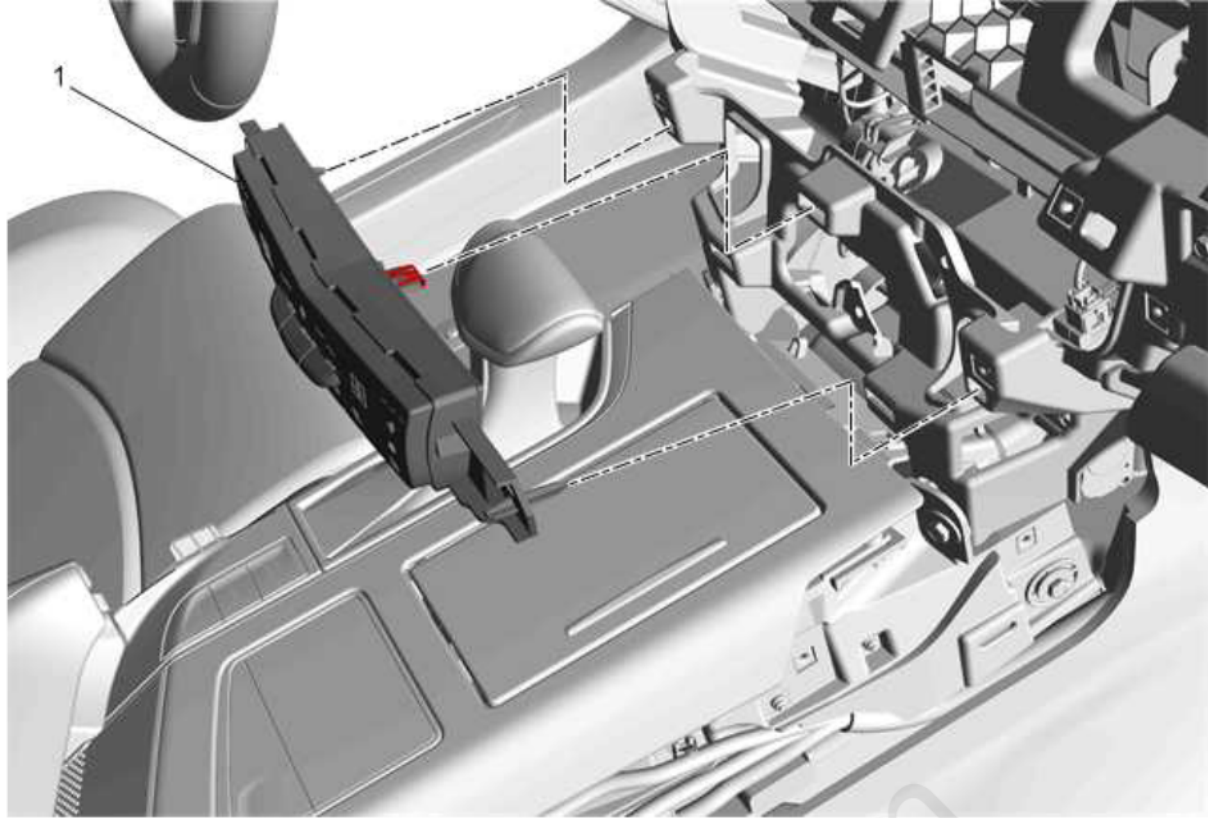


Fig. 23: Heater and Air Conditioning User Interface Control

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Instrument Panel Trim Plate Replacement</u>	
1	Heater and Air Conditioning User Interface Control Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

HEATER AND AIR CONDITIONING REMOTE CONTROL REPLACEMENT

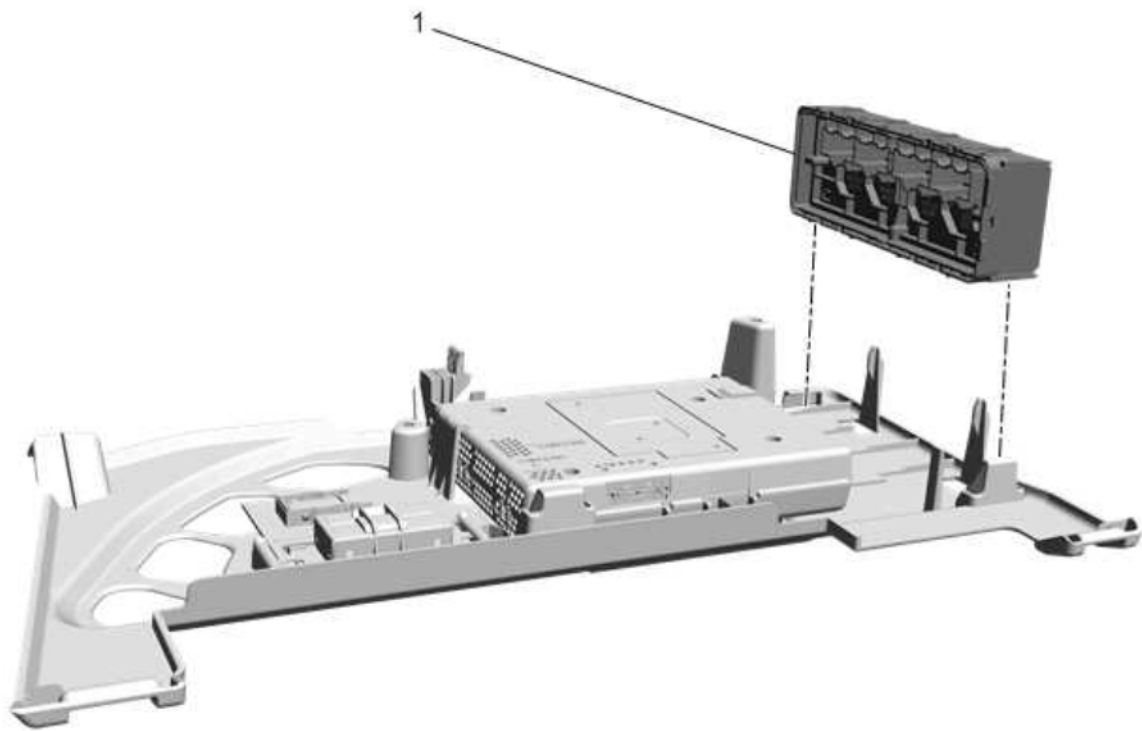


Fig. 24: Heater and Air Conditioning Remote Control

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Instrument Panel Lower Trim Panel Insulator Replacement - Right Side</u> - Disconnect the heater and air conditioning remote control connectors. NOTE: When removing the instrument panel lower trim panel insulator for any reason, it is required that the connectors to the heater and air conditioning remote control be disconnected. If the vehicle battery has NOT been disconnected, when reinstalling or reconnecting the remote control, the BROWN J2 connector must be connected last. Once all the parts are all in place, check and clear all DTCs in the heater and air conditioning remote control.	
1	Heater and Air Conditioning Remote Control Procedure - Release the retaining tabs. - Perform the necessary programming and setup procedure: <u>Control Module References</u> - Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> - Clear the DTCs from the heater and air conditioning remote control module.

AIR CONDITIONING WIRING HARNESS REPLACEMENT (C24)

Removal Procedure

- Instrument Panel Tie Bar (1) Remove - **Instrument Panel Tie Bar Replacement**

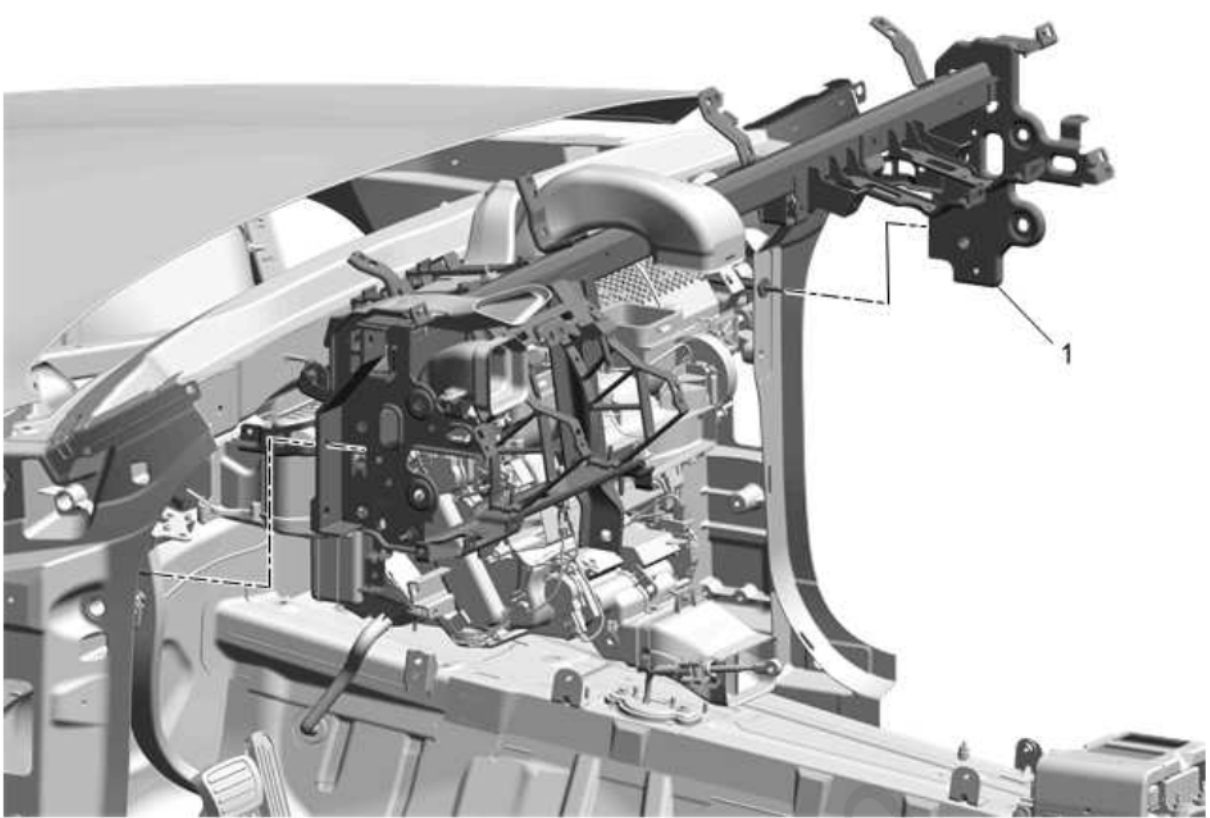


Fig. 25: Instrument Panel Tie Bar Assembly
 Courtesy of GENERAL MOTORS COMPANY

2. Note the routing of the air conditioning wiring harness.

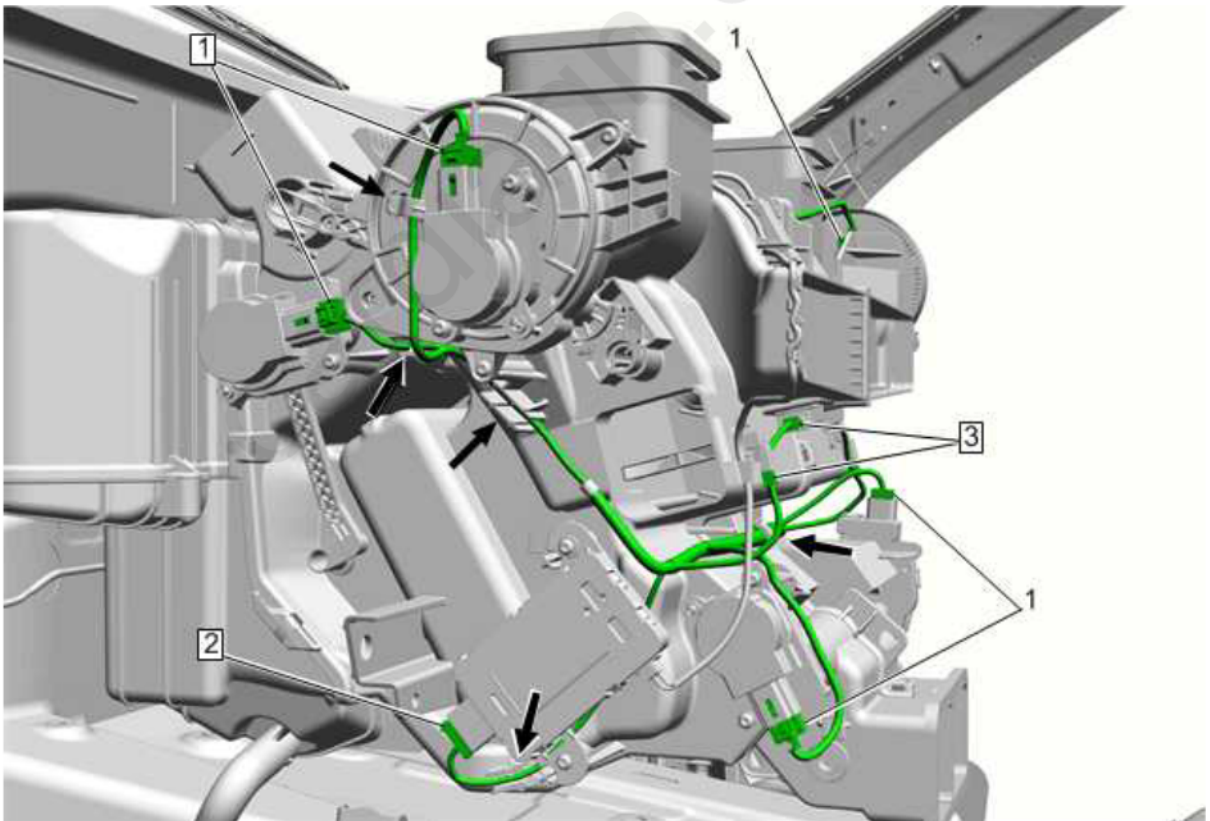


Fig. 26: Air Conditioning Wiring Harness Routing And Electrical Connectors
 Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the five valve actuator electrical connectors (1).
4. Disconnect the passenger compartment air filter module connector (2).
5. Disconnect the two duct air temperature sensor electrical connectors (3).
6. Detach the air conditioning wiring harness from the heater and air conditioning evaporator and blower module, indicated by the arrows.
7. Disconnect the three valve actuator electrical connectors (1).

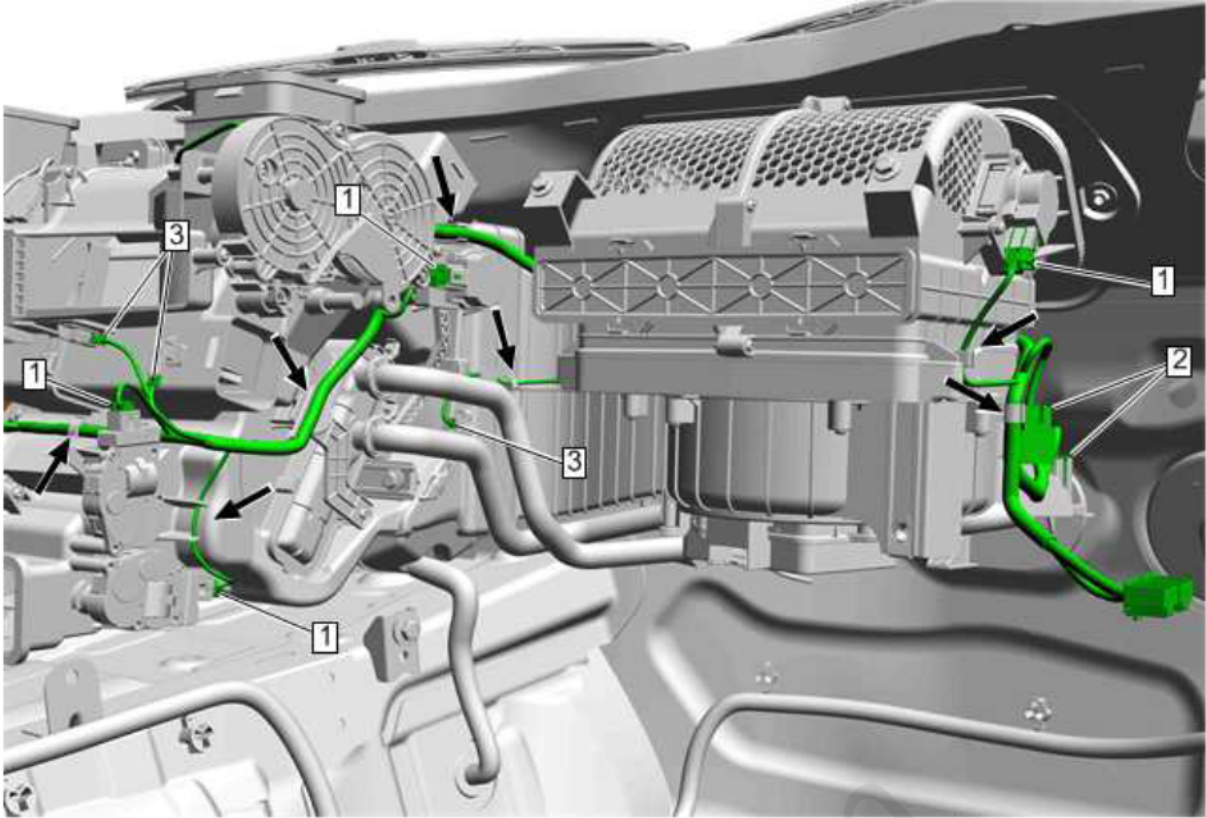


Fig. 27: Air Conditioning Wiring Harness Routing And Electrical Connectors
 Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the two electrical connectors (2) from the heater and air conditioning evaporator and blower module.
9. Disconnect the three duct air temperature sensor electrical connectors (3).
10. Detach the air conditioning wiring harness from the heater and air conditioning evaporator and blower module, indicated by the arrows.
11. Air Conditioning Wiring Harness (1) » Remove

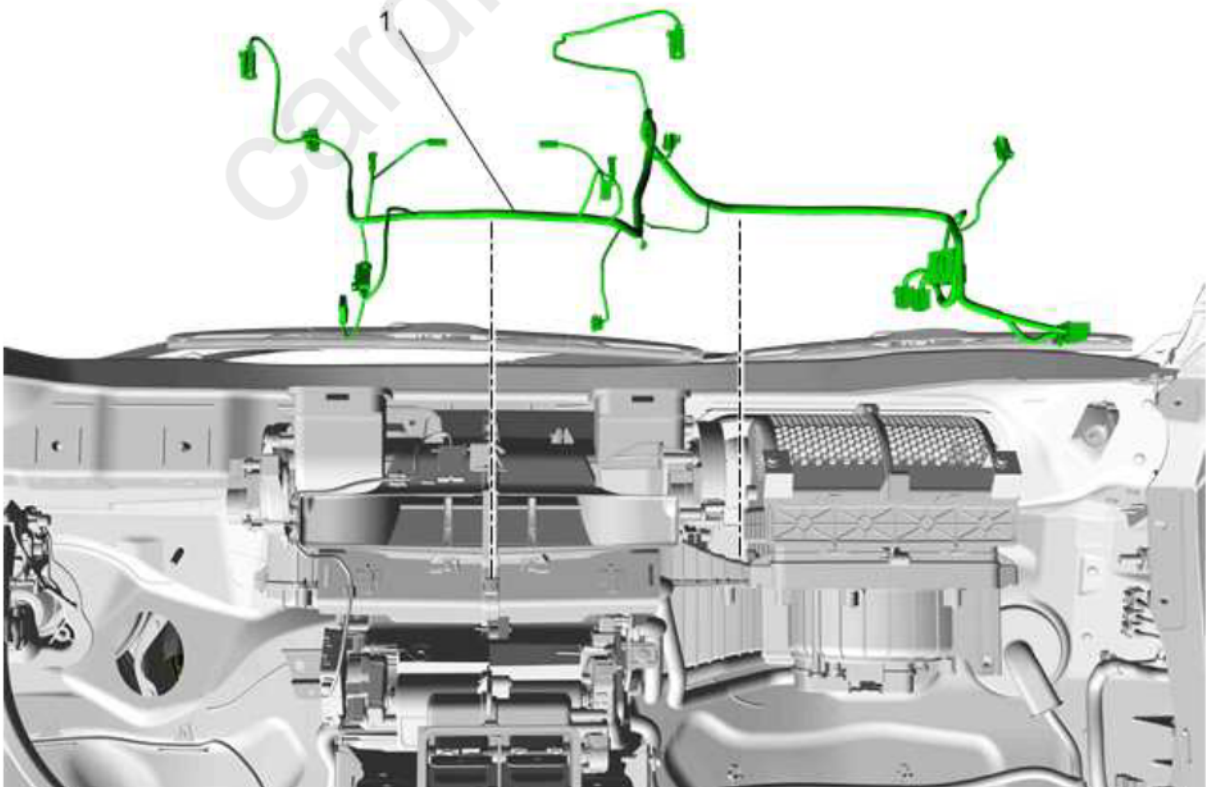


Fig. 28: Air Conditioning Wiring Harness
 Courtesy of GENERAL MOTORS COMPANY

1. Air Conditioning Wiring Harness (1)A,A» Install

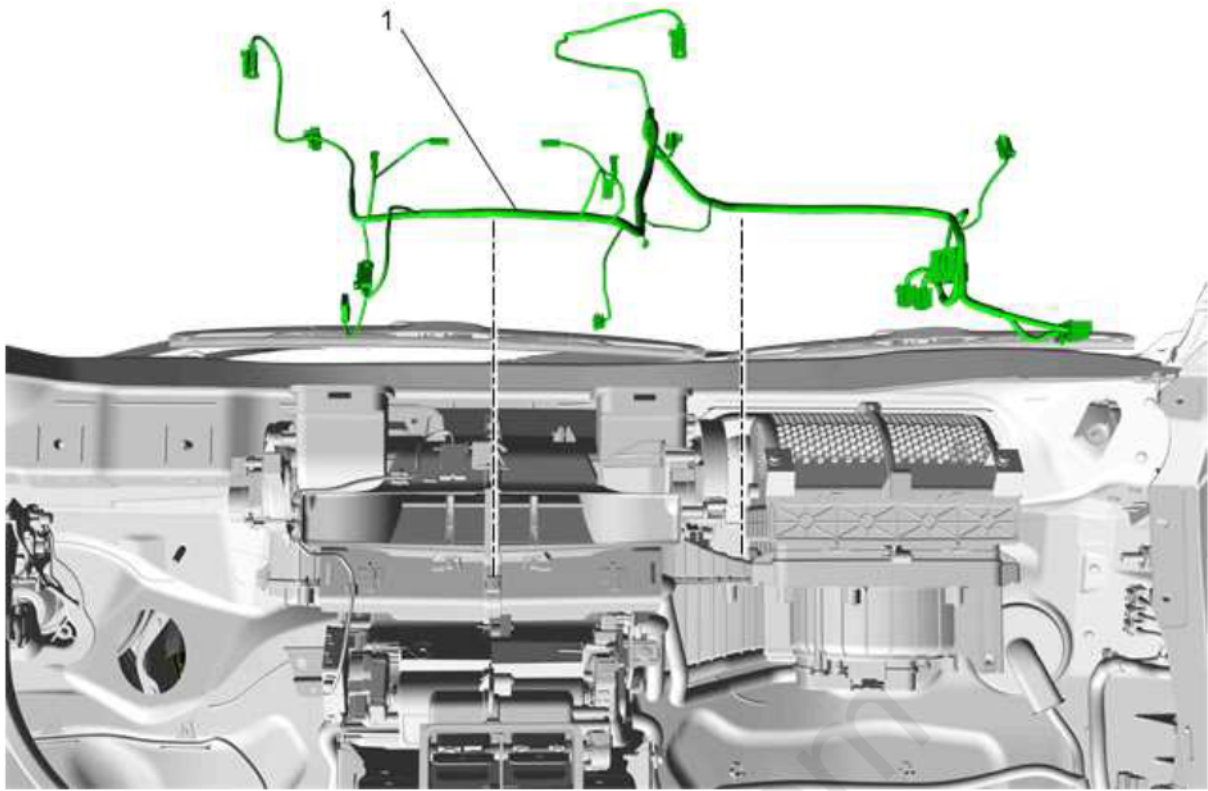


Fig. 29: Air Conditioning Wiring Harness
Courtesy of GENERAL MOTORS COMPANY

2. Attach the air conditioning wiring harness to the heater and air conditioning evaporator and blower module, indicated by the arrows.

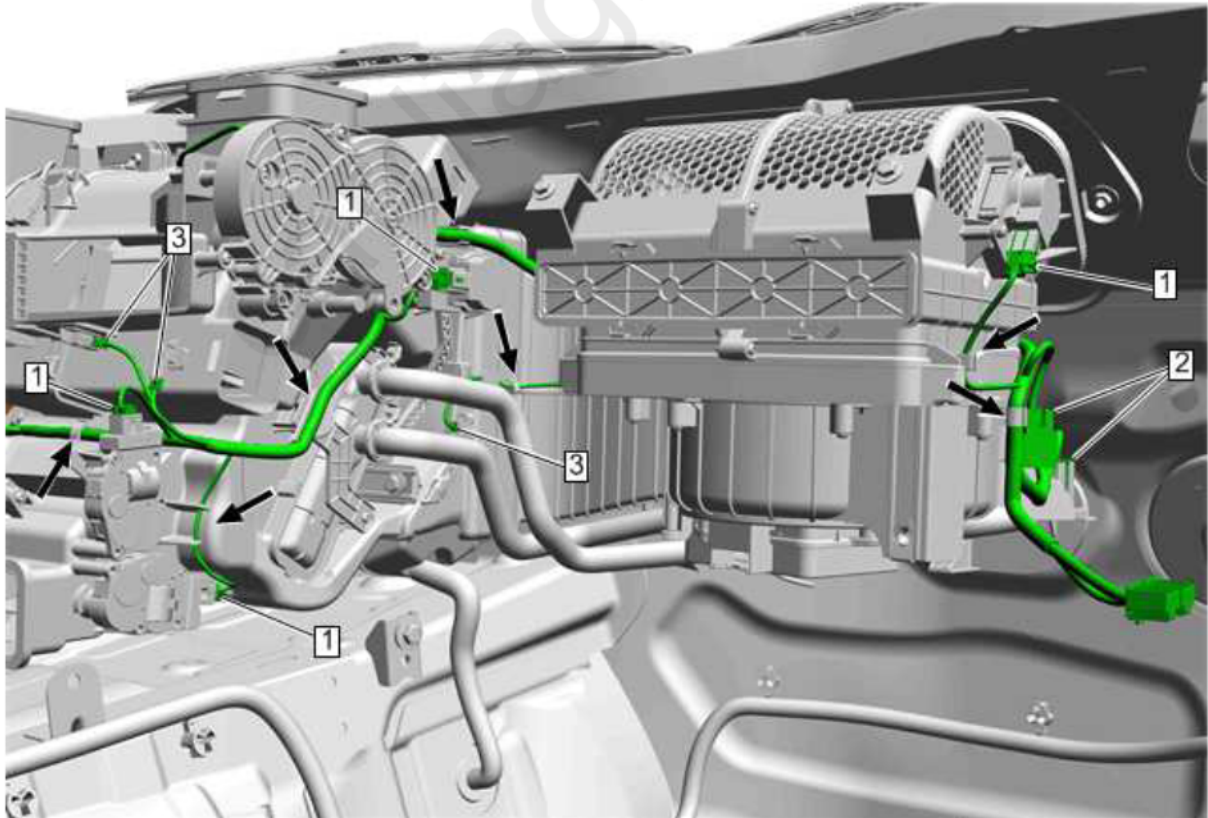


Fig. 30: Air Conditioning Wiring Harness Routing And Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

3. Connect the three duct air temperature sensor electrical connectors (3).
4. Connect the two electrical connectors (2) to the heater and air conditioning evaporator and blower module.
5. Connect the three valve actuator electrical connectors (1).

6. Attach the air conditioning wiring harness to the heater and air conditioning evaporator and blower module, indicated by the arrows.

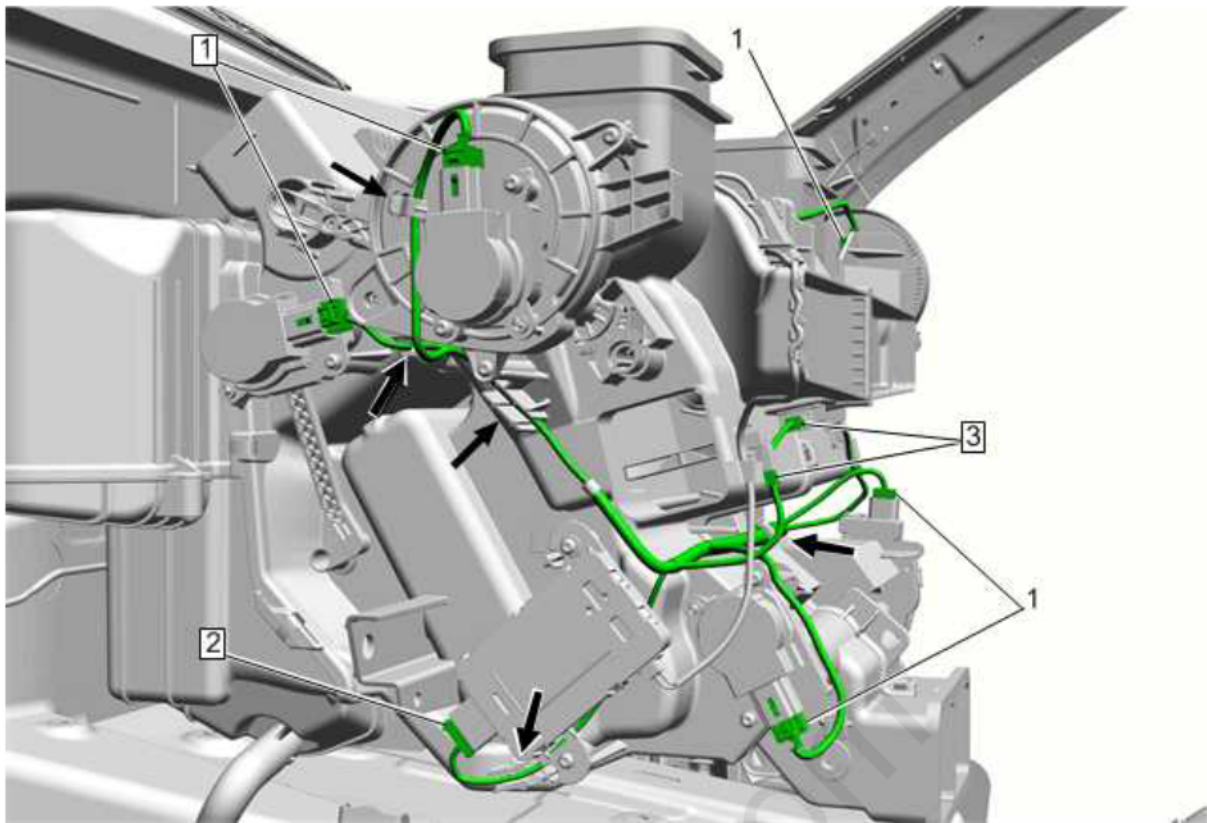


Fig. 31: Air Conditioning Wiring Harness Routing And Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

7. Connect the two duct air temperature sensor electrical connectors (3).
8. Connect the passenger compartment air filter module electrical connector (2).
9. Connect the five valve actuator electrical connectors (1).
10. Instrument Panel Tie Bar (1) - Install - **Instrument Panel Tie Bar Replacement**

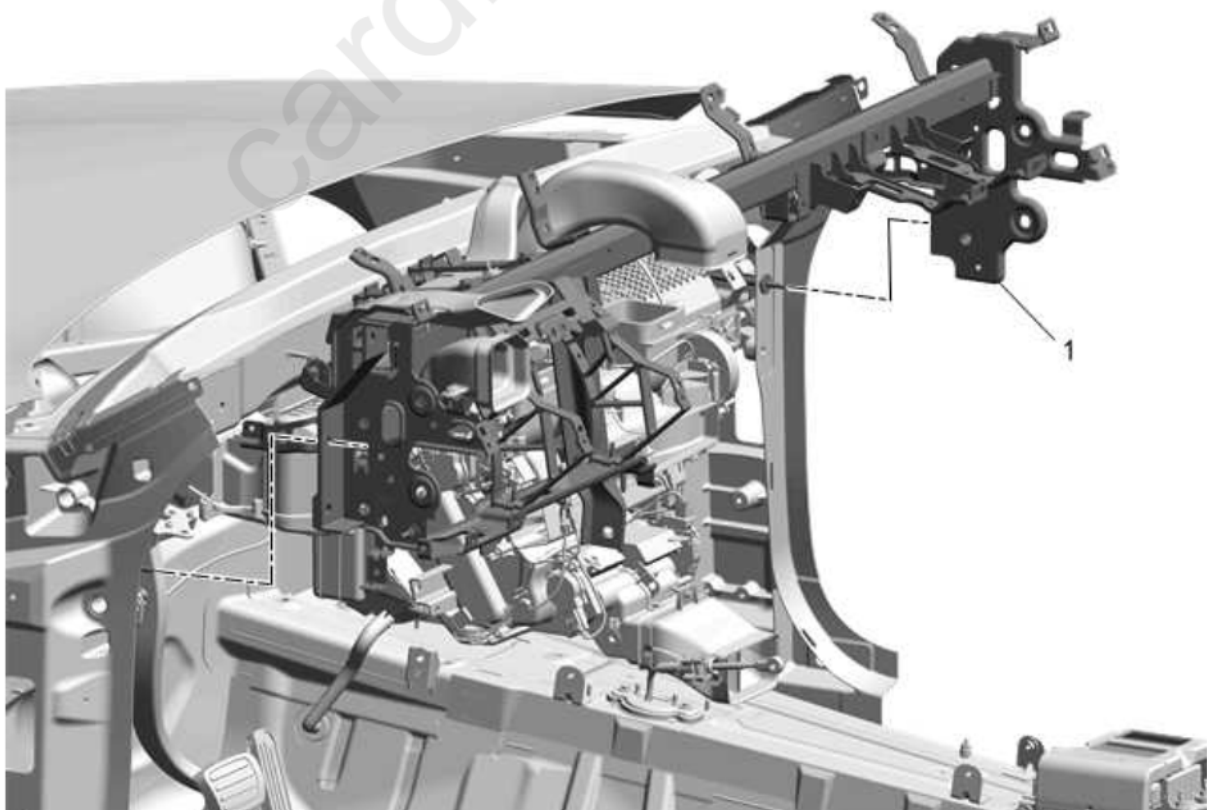


Fig. 32: Instrument Panel Tie Bar Assembly
Courtesy of GENERAL MOTORS COMPANY

Removal Procedure

1. Instrument Panel Tie Bar (1) Remove - [Instrument Panel Tie Bar Replacement](#)

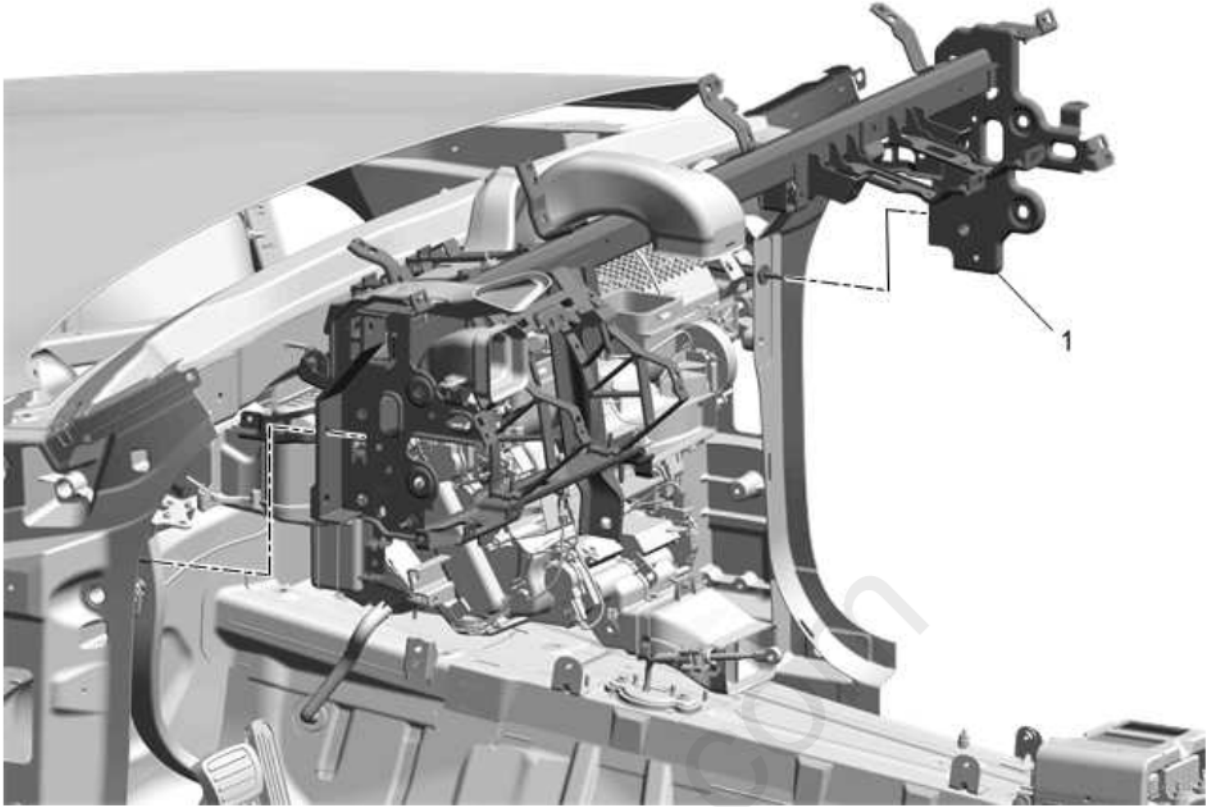


Fig. 33: Instrument Panel Tie Bar Assembly
Courtesy of GENERAL MOTORS COMPANY

2. Note the routing of the air conditioning wiring harness.

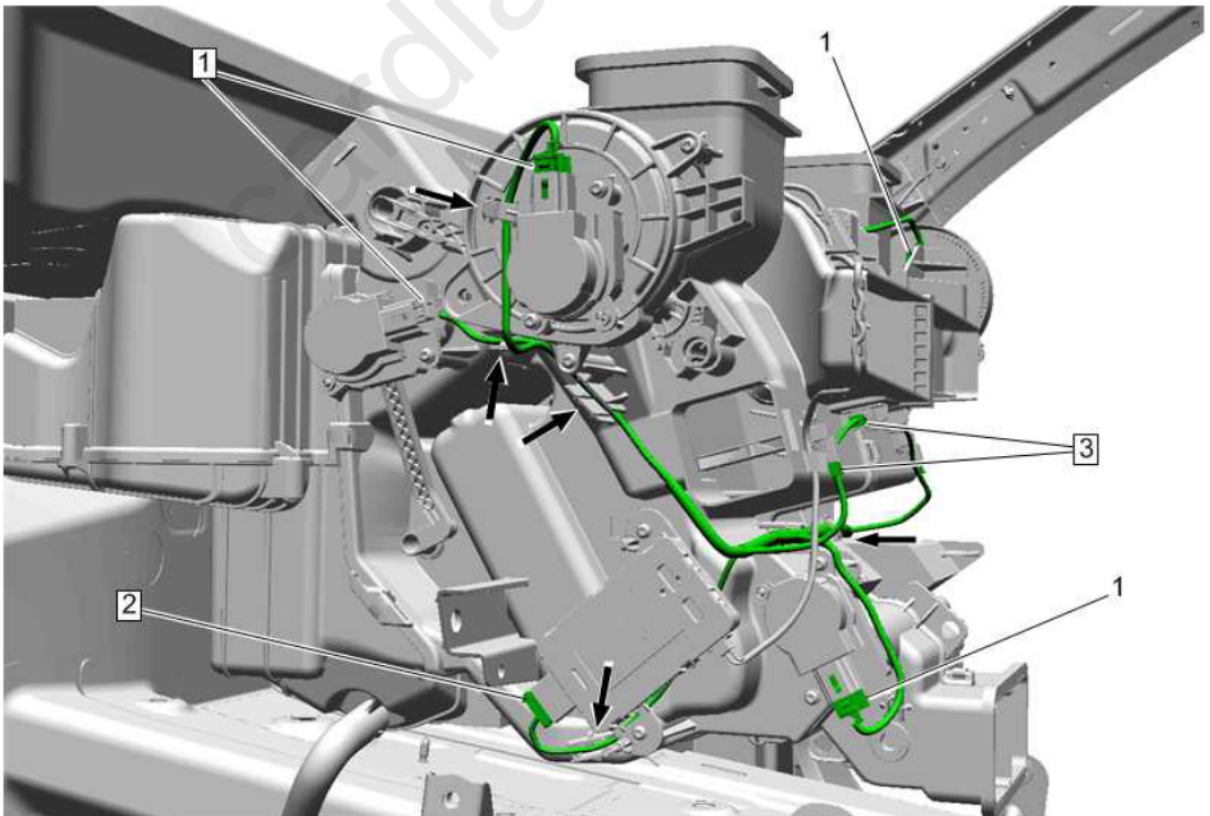


Fig. 34: Air Conditioning Wiring Harness And Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the valve actuator connectors (1) [4x].

4. Disconnect the passenger compartment air filter module connector (2).
5. Disconnect the duct air temperature sensor (3) [2x].
6. Detach the air conditioning wiring harness from the heater and air conditioning evaporator and blower module, indicated by the arrows.
7. Disconnect the valve actuator connectors (1) [2x].

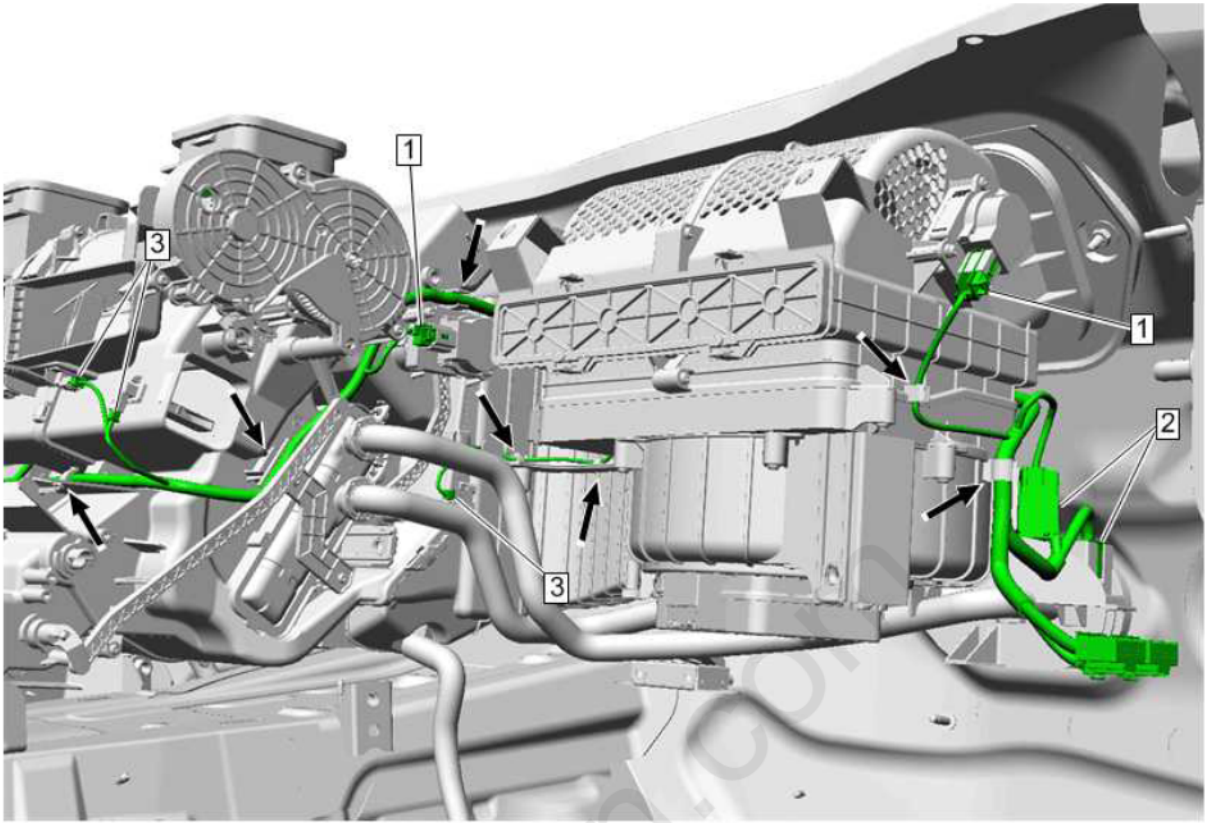


Fig. 35: Air Conditioning Wiring Harness And Electrical Connectors
Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the electrical connectors (2) [2x] from the heater and air conditioning evaporator and blower module.
9. Disconnect the duct air temperature sensor (3) [3x].
10. Detach the air conditioning wiring harness from the heater and air conditioning evaporator and blower module, indicated by the arrows.
11. Air Conditioning Wiring Harness (1) Remove

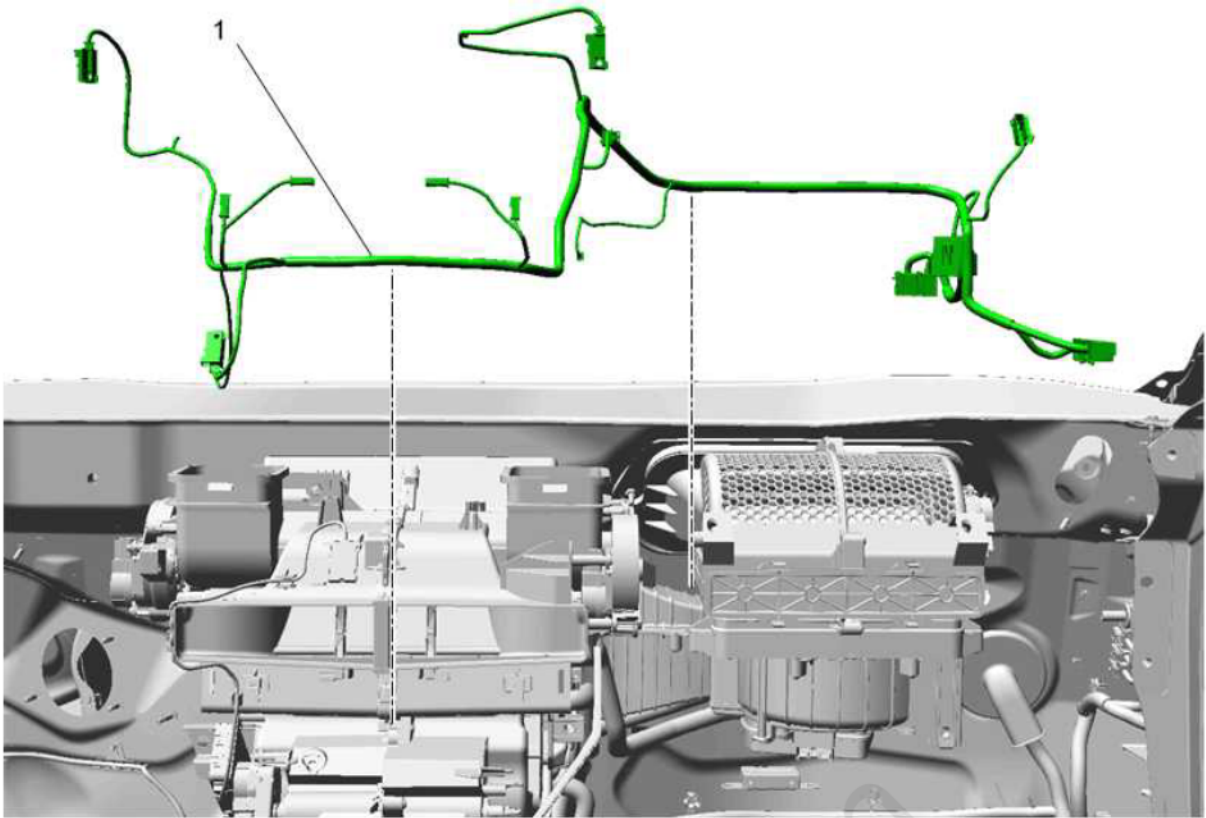


Fig. 36: Air Conditioning Wiring Harness
 Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. Air Conditioning Wiring Harness (1) » Install

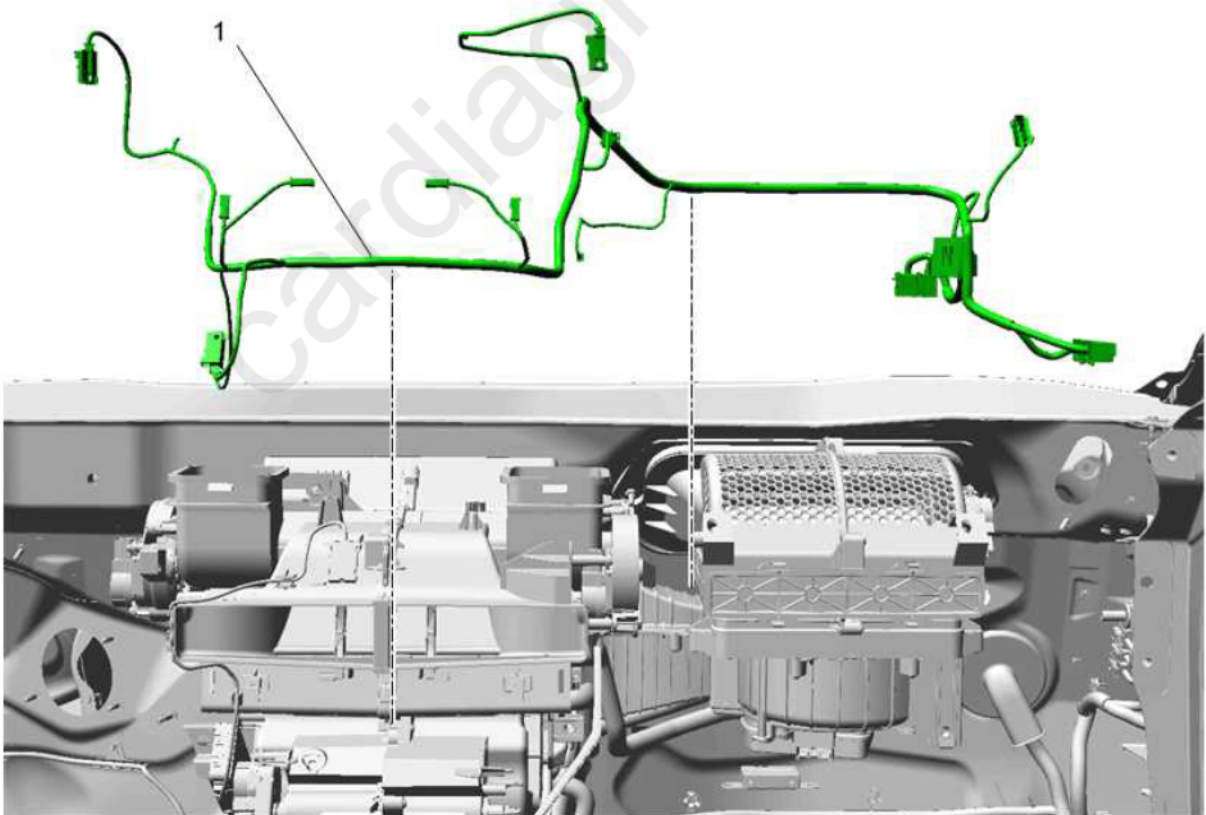


Fig. 37: Air Conditioning Wiring Harness
 Courtesy of GENERAL MOTORS COMPANY

2. Attach the air conditioning wiring harness to the heater and air conditioning evaporator and blower module, indicated by the arrows.

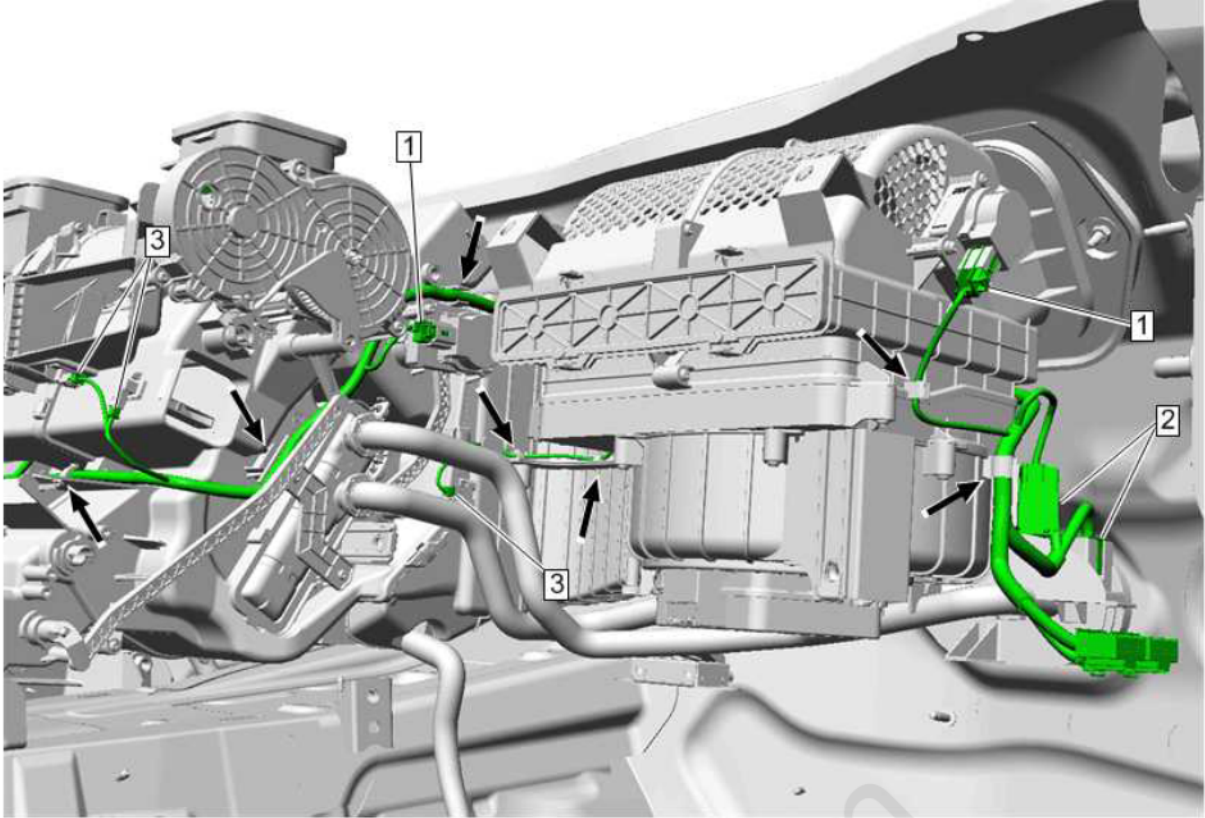


Fig. 38: Air Conditioning Wiring Harness And Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

3. Connect the duct air temperature sensor (3) [3x].
4. Connect the electrical connectors (2) [2x] to the heater and air conditioning evaporator and blower module.
5. Connect the valve actuator connectors (1) [2x].
6. Attach the air conditioning wiring harness to the heater and air conditioning evaporator and blower module, indicated by the arrows.

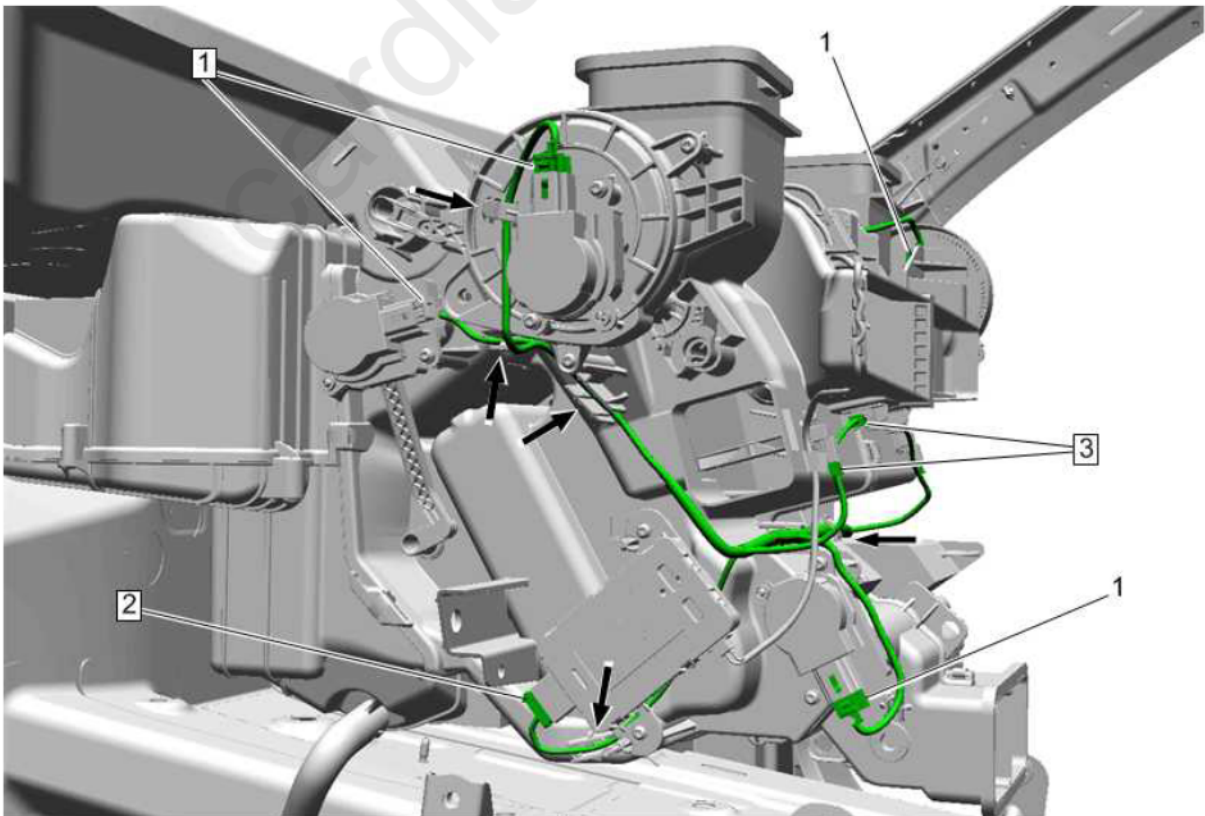


Fig. 39: Air Conditioning Wiring Harness And Electrical Connectors

Courtesy of GENERAL MOTORS COMPANY

7. Connect the duct air temperature sensor (3) [2x].

8. Connect the passenger compartment air filter module connector (2).
9. Connect the valve actuator connectors (1) [4x].
10. Instrument Panel Tie Bar (1)» Install - [Instrument Panel Tie Bar Replacement](#)

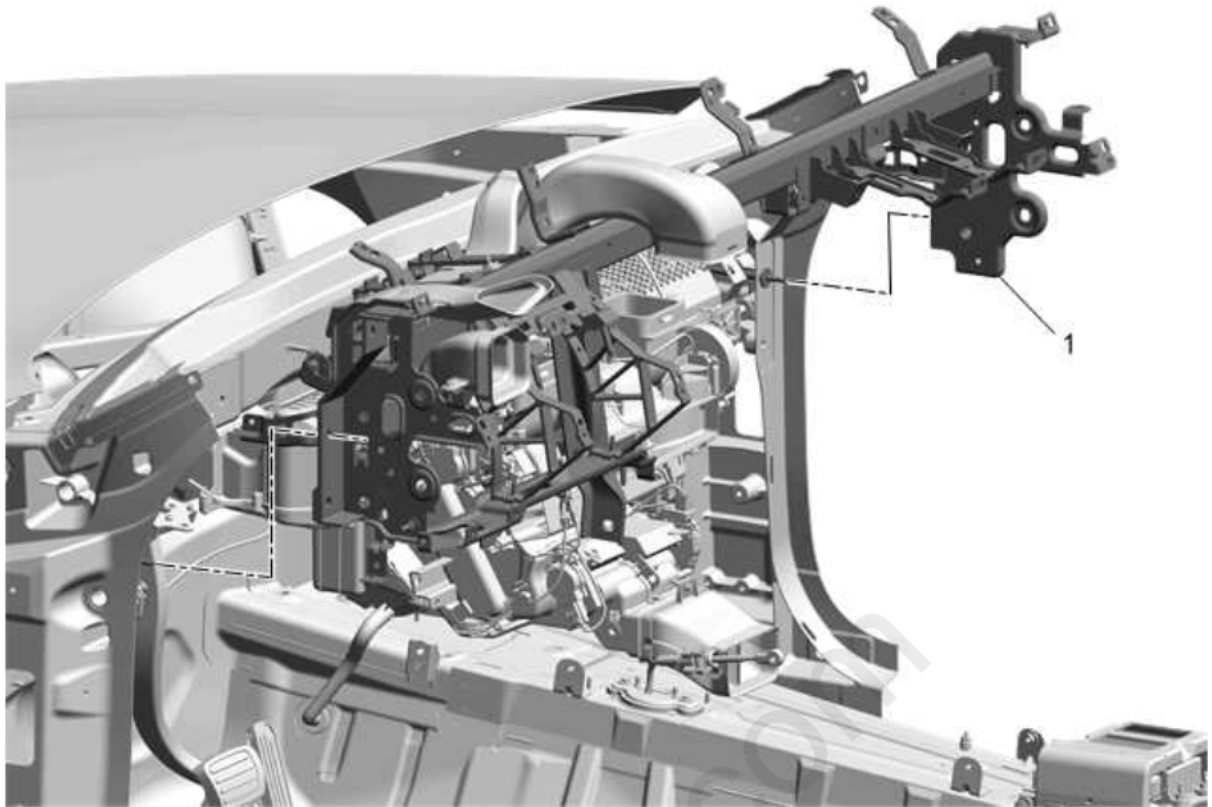


Fig. 40: Instrument Panel Tie Bar Assembly
 Courtesy of GENERAL MOTORS COMPANY

AUXILIARY HEATER AND AIR CONDITIONING CONTROL REPLACEMENT

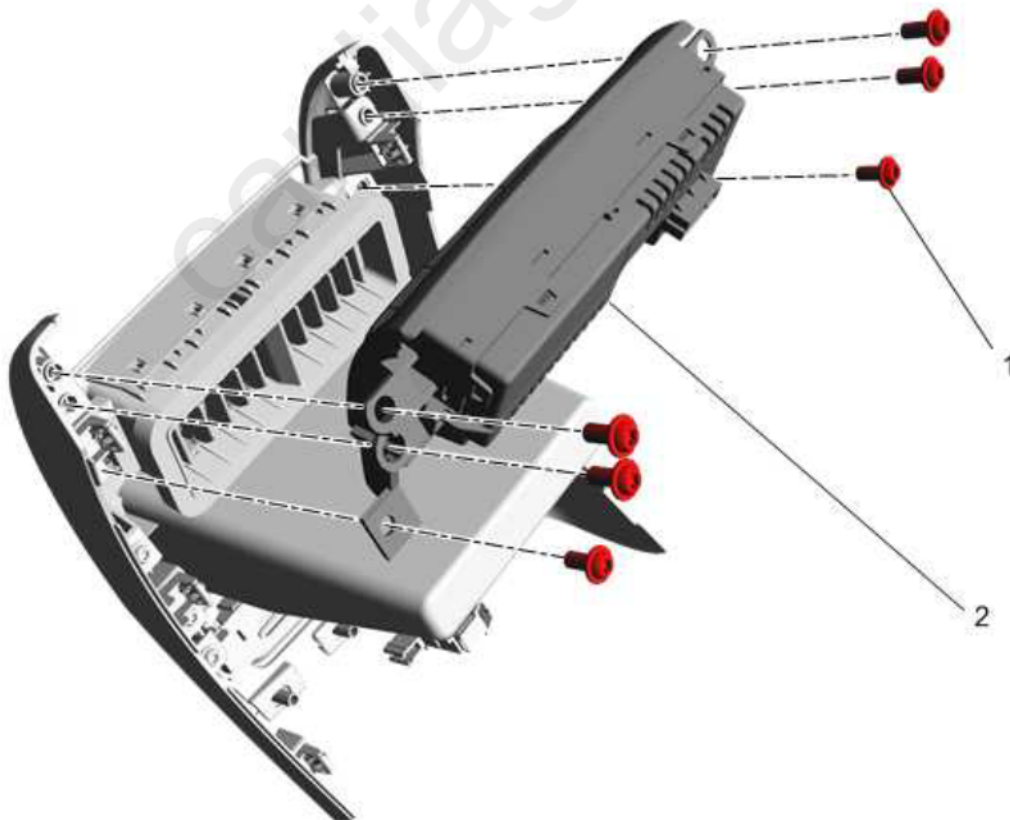


Fig. 41: Auxiliary Heater and Air Conditioning Control
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
Preliminary Procedure Front Floor Console Rear Trim Panel Replacement	
1	Auxiliary Heater and Air Conditioning Control Bolt [6x] CAUTION: Refer to Fastener Caution . Tighten 2.0 N.m (18 lb in)
2	Auxiliary Heater and Air Conditioning Control

MODE VALVE LEVER REPLACEMENT

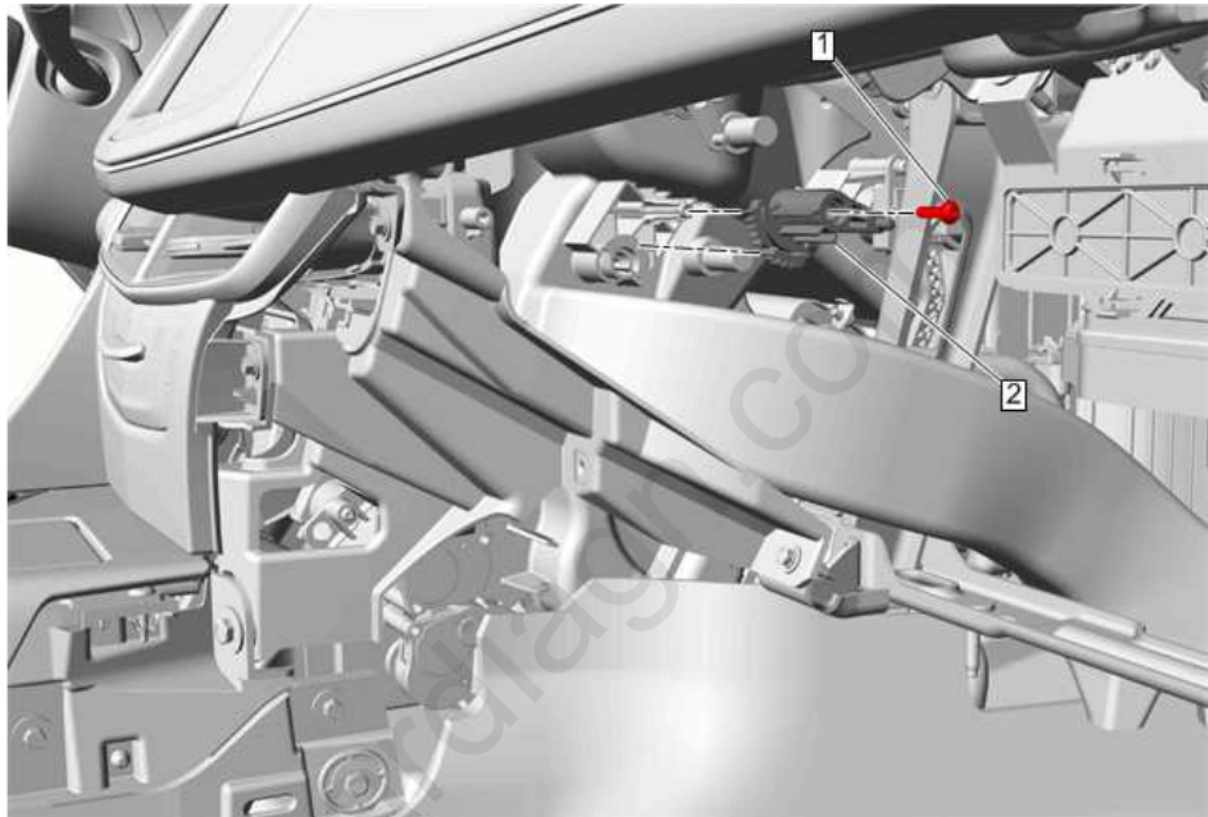


Fig. 42: Mode Valve Lever

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Mode Control Cam Cover Replacement	
1	Mode Valve Lever Fastener CAUTION: Refer to Fastener Caution . Tighten 1.5 N.m (13 lb in)
2	Mode Valve Lever Procedure Mode Control Cam Alignment

AIR INLET VALVE ACTUATOR REPLACEMENT (FRESH AIR)

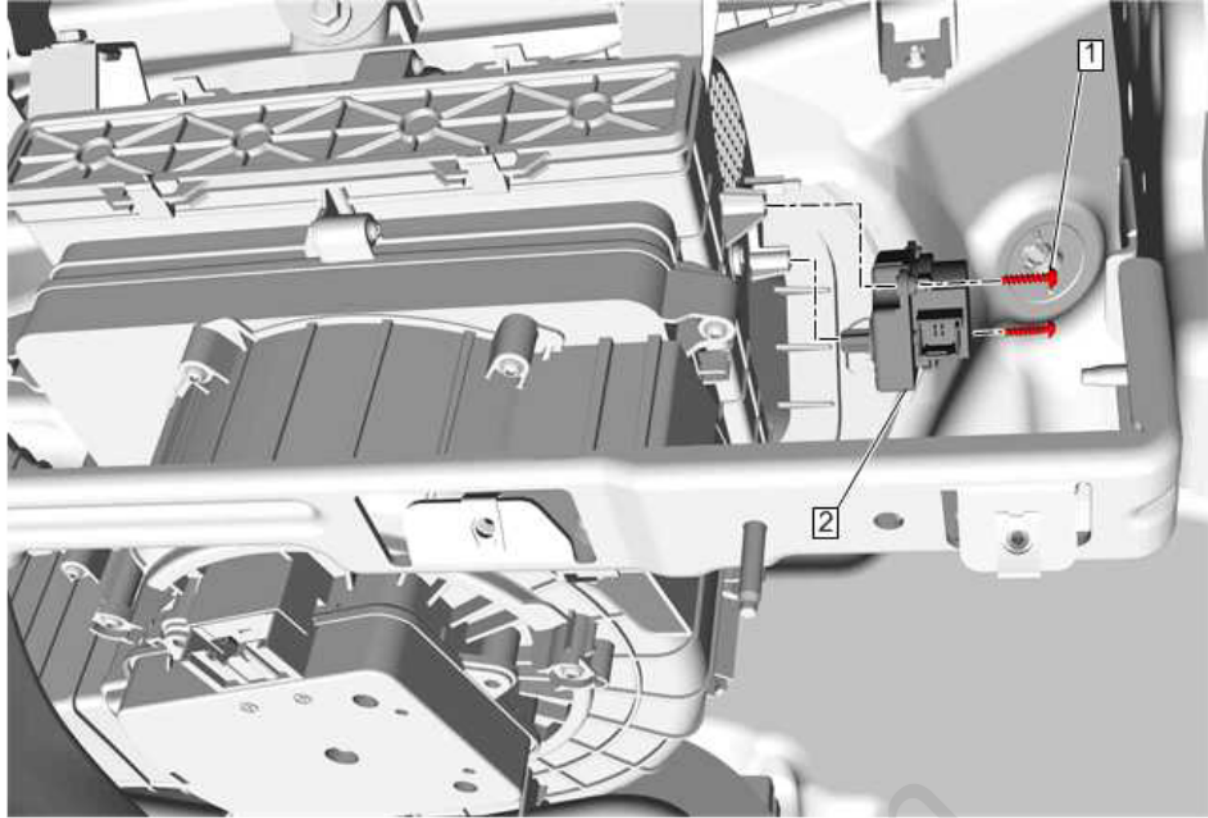


Fig. 43: Air Inlet Valve Actuator (Fresh Air)
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Instrument Panel Compartment Replacement	
1	Air Inlet Valve Actuator Fastener CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Air Inlet Valve Actuator Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module. 3. Perform the actuator calibration procedure. Refer to Actuator Recalibration

MODE VALVE ACTUATOR GEAR REPLACEMENT

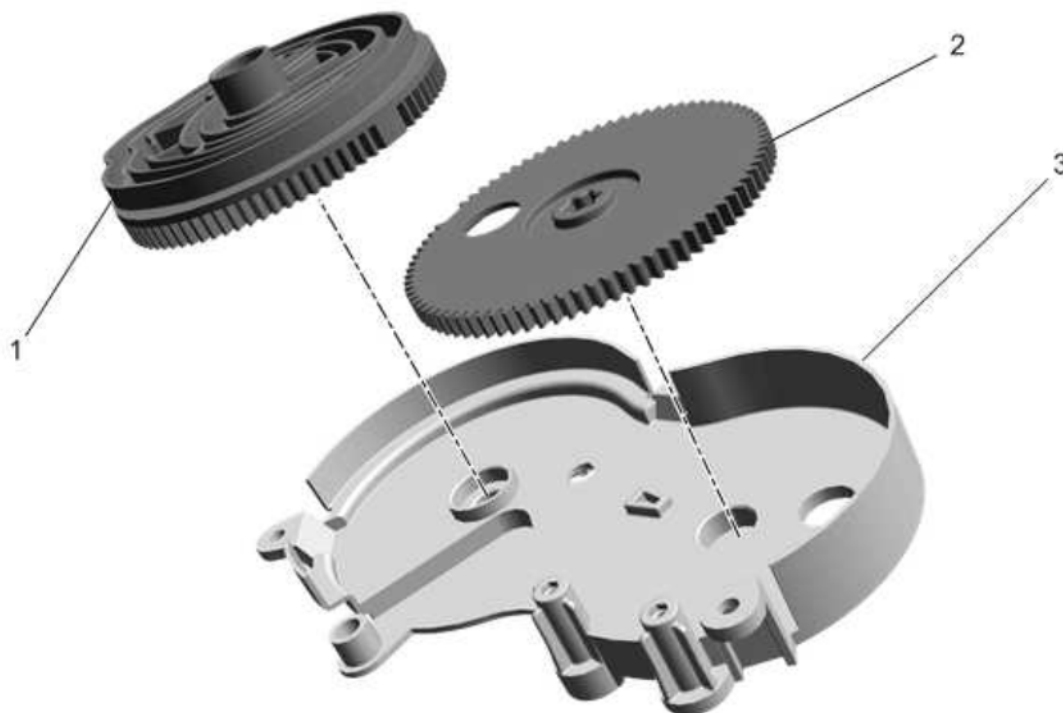


Fig. 44: Mode Valve Actuator Gear

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Mode Valve Actuator Replacement - Right Side</u>	
1	Mode Valve Cam Procedure Inspect the mode valve cam and replace as needed.
2	Mode Valve Actuator Gear Procedure Inspect the mode valve actuator gear and replace as needed.
3	Mode Control Cam Cover Procedure 1. Inspect the mode control cam cover and replace as needed. 2. <u>Mode Control Cam Alignment</u>

MODE VALVE ACTUATOR REPLACEMENT - LEFT SIDE

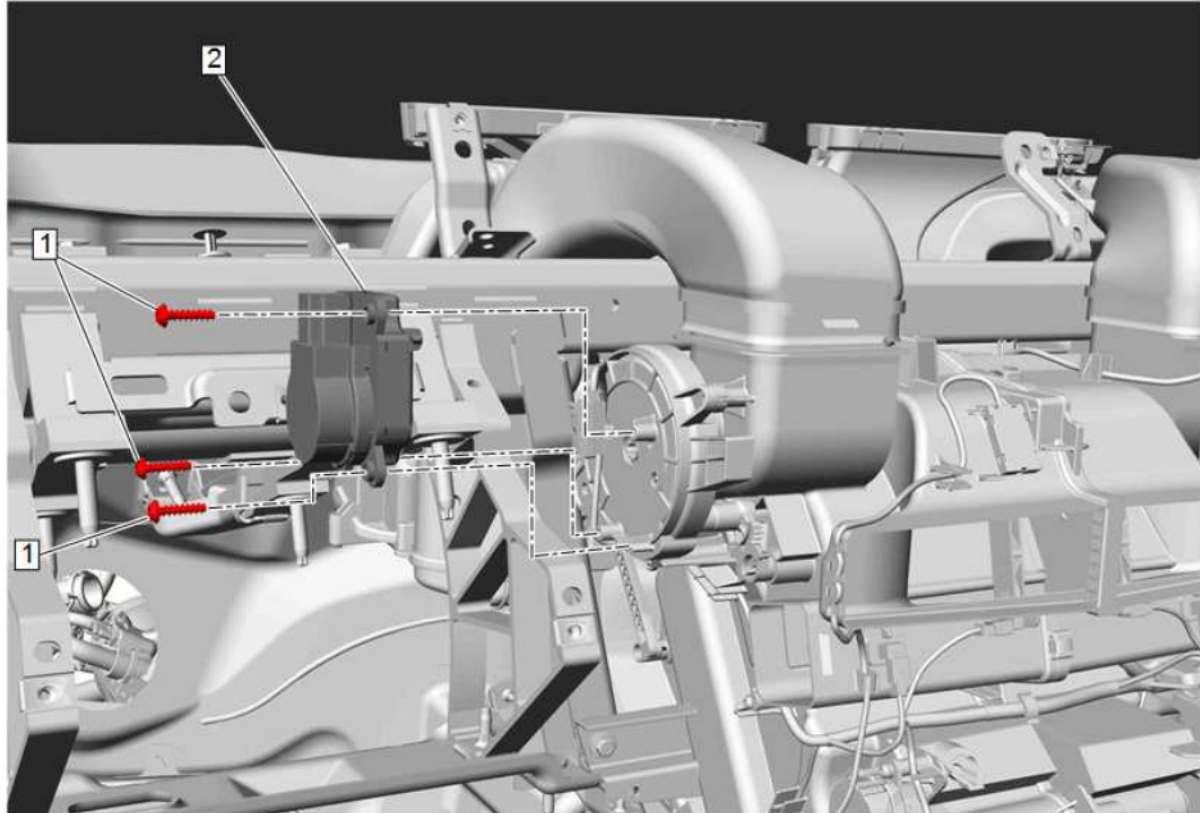


Fig. 45: Mode Valve Actuator - Left Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Instrument Panel Carrier Replacement (UQH) Instrument Panel Carrier Replacement (UQA)	
1	Mode Valve Actuator Screw [2x] CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Mode Valve Actuator - Left Side Procedure Disconnect the electrical connector.

MODE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE

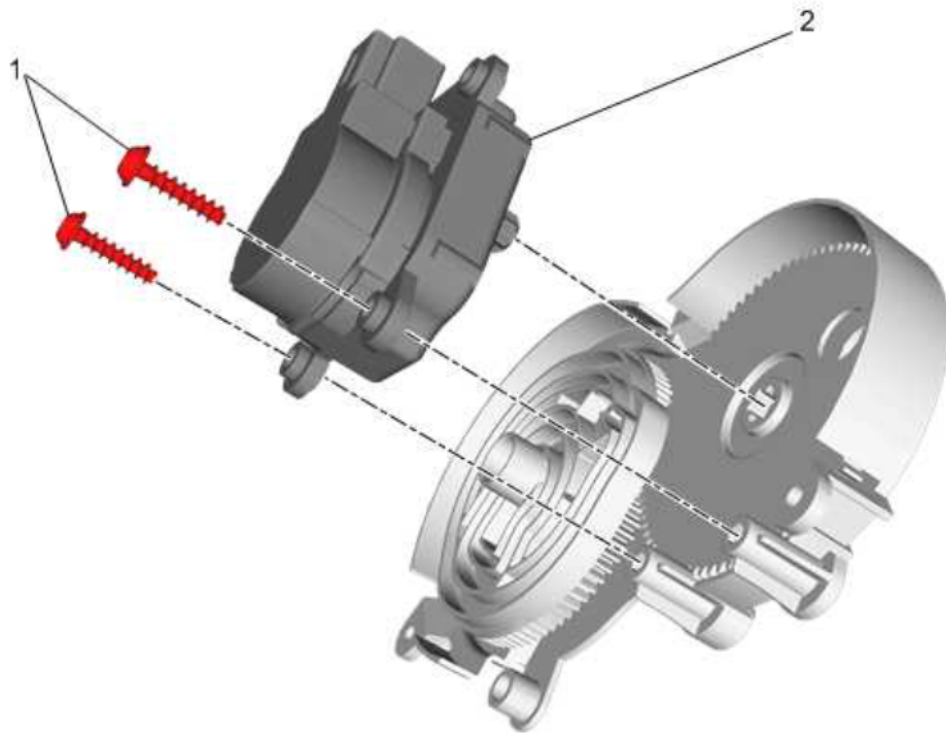


Fig. 46: Mode Valve Actuator - Right Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Mode Control Cam Cover Replacement	
1	Mode Valve Actuator Motor Fastener [2x] CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Mode Valve Actuator Procedure Mode Control Cam Alignment

MODE CONTROL CAM COVER REPLACEMENT

Removal Procedure

1. Instrument Panel Compartment [2x] » Remove - **Instrument Panel Compartment Replacement**

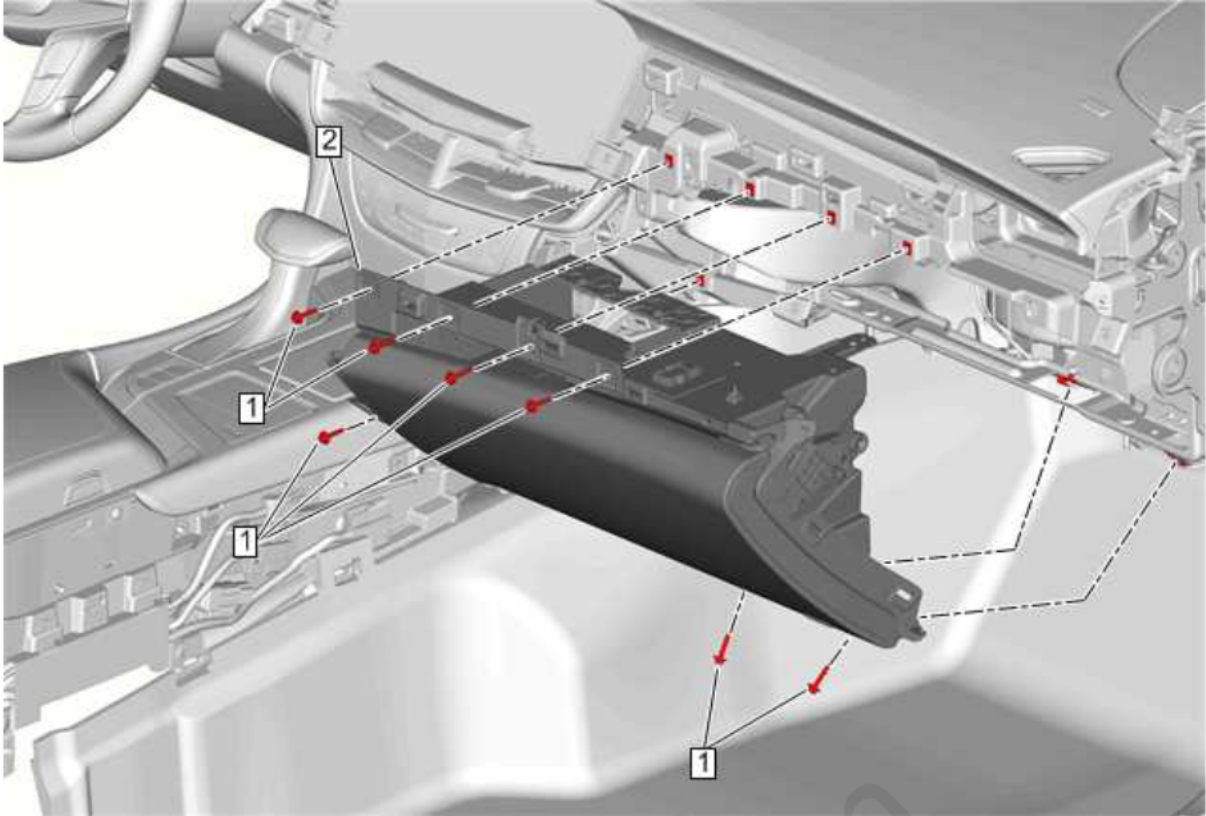


Fig. 47: Instrument Panel Compartment
 Courtesy of GENERAL MOTORS COMPANY

2. Heater and Air Conditioning Mode Control Cam Cover Bolt (1)» Remove [4x]

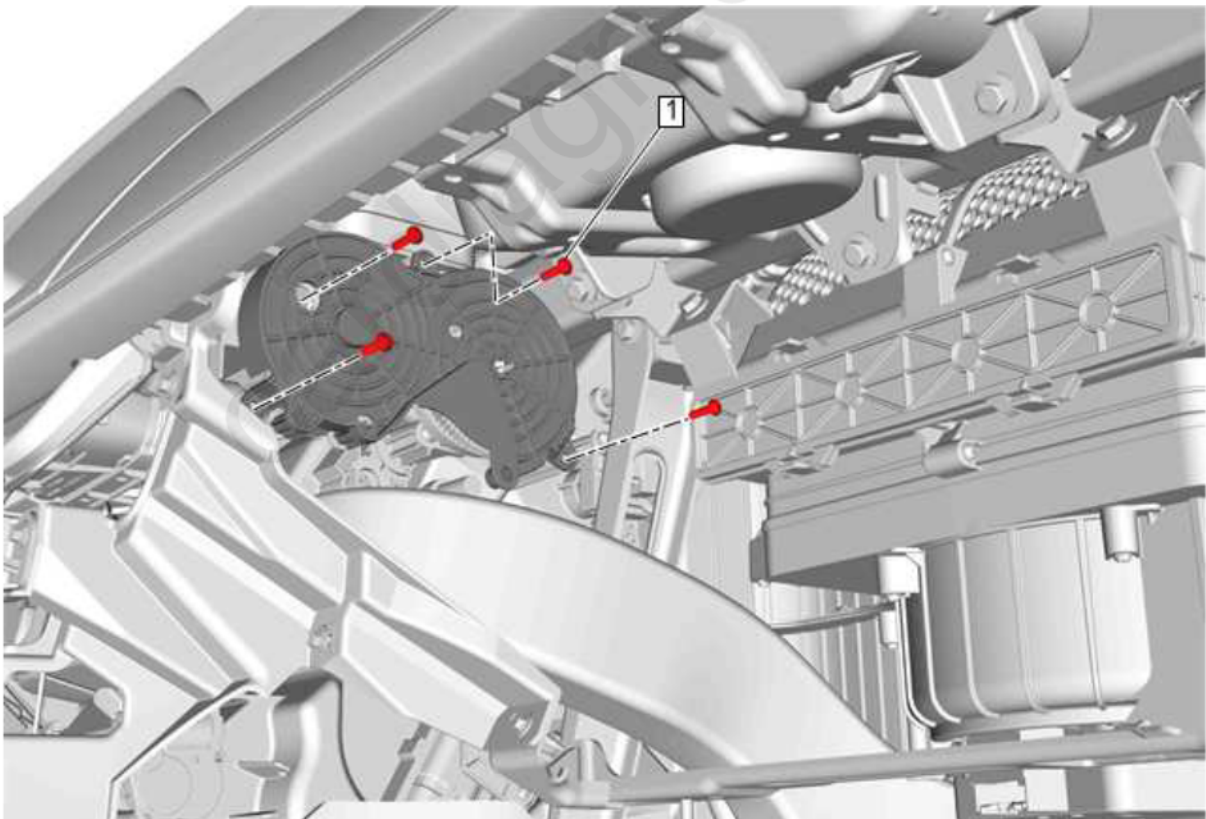


Fig. 48: Heater and Air Conditioning Mode Control Cam Cover And Retaining Bolts
 Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the electrical connector.
4. Heater and Air Conditioning Mode Control Cam Cover (1)» Remove

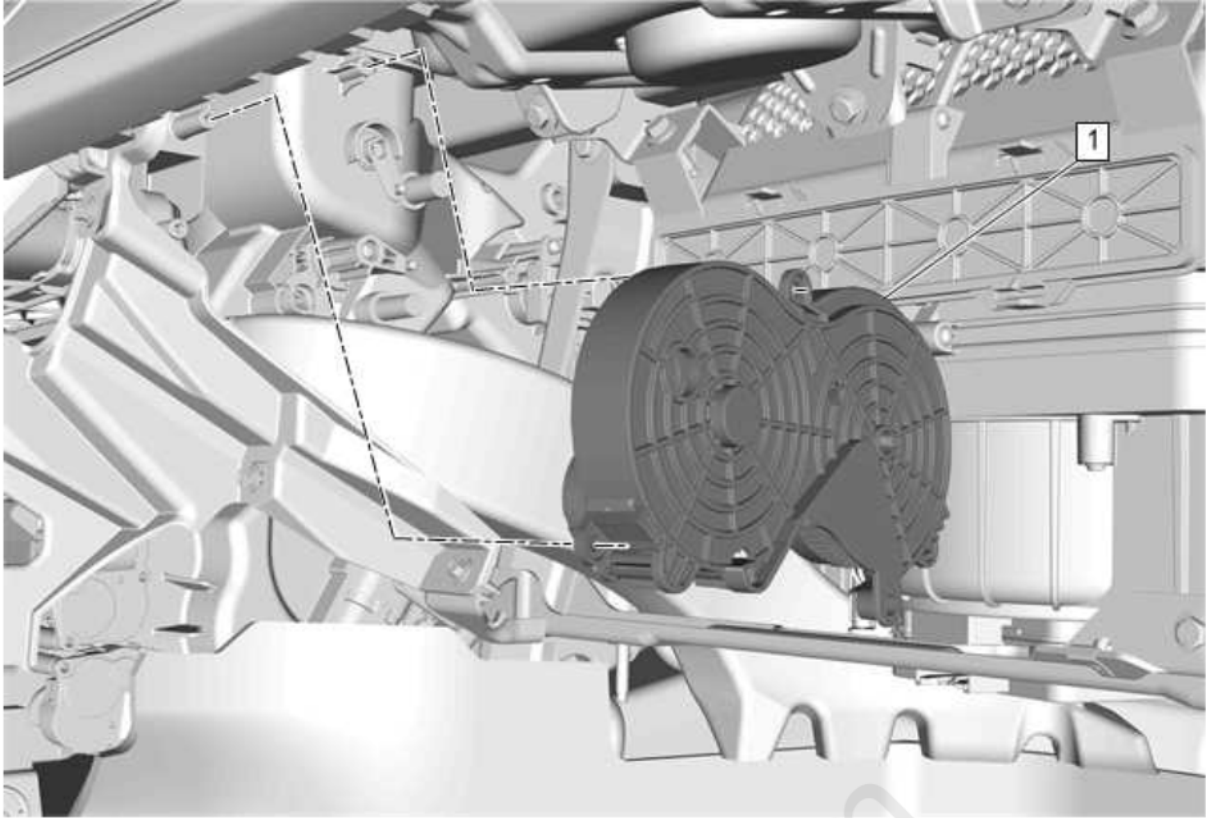


Fig. 49: Heater and Air Conditioning Mode Control Cam Cover
 Courtesy of GENERAL MOTORS COMPANY

5. Transfer components as necessary.

Installation Procedure

1. Align the mode control cams as necessary. Refer to [Mode Control Cam Alignment](#)
2. Connect the electrical connector.
3. Heater and Air Conditioning Mode Control Cam Cover (1) » Install

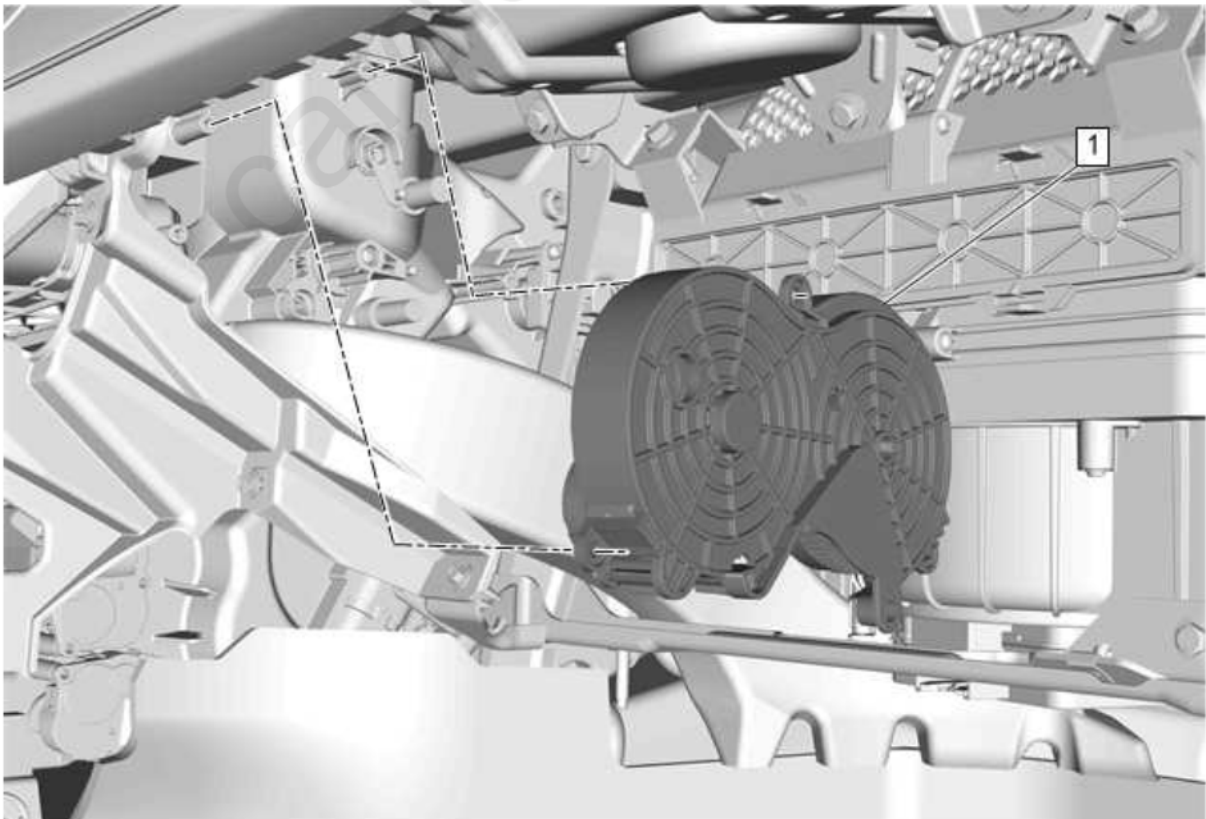


Fig. 50: Heater and Air Conditioning Mode Control Cam Cover
 Courtesy of GENERAL MOTORS COMPANY

4. Heater and Air Conditioning Mode Control Cam Cover Bolt (1)A, A» Install and tighten 2.0 N.m (18 lb in) [4x]

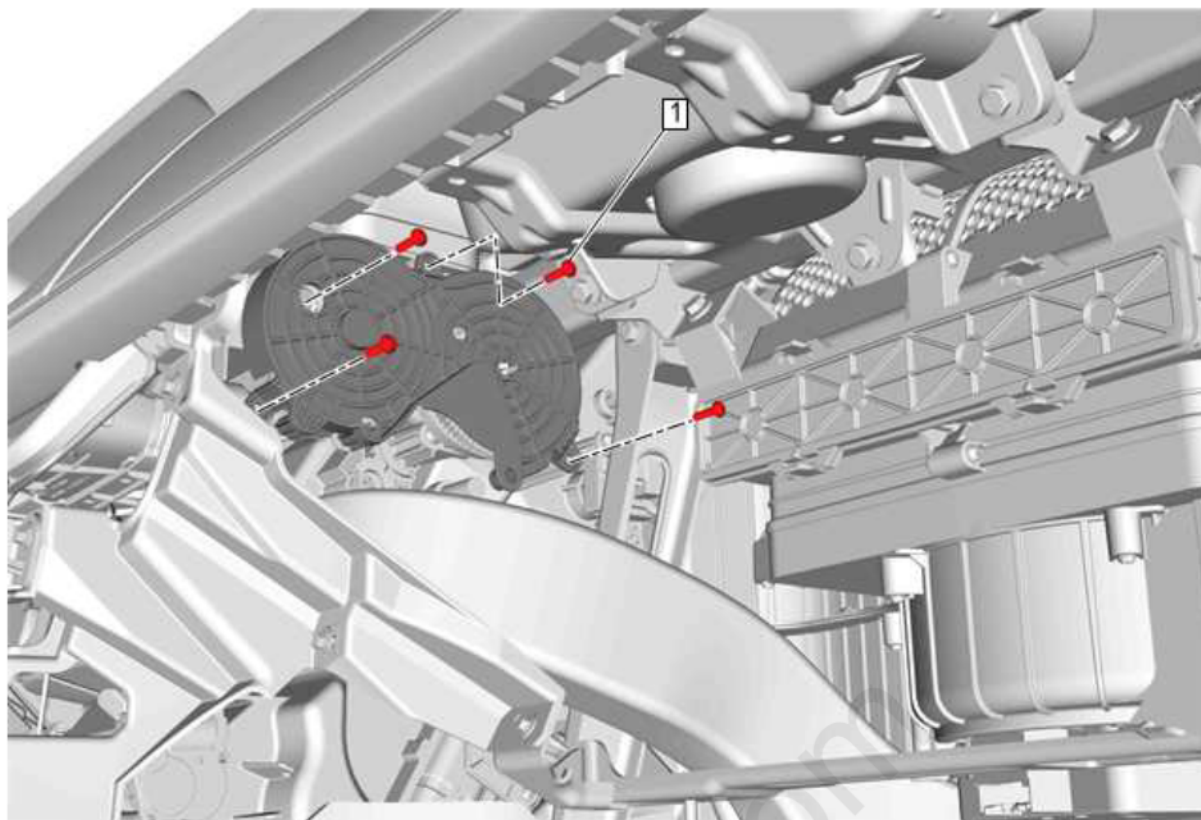


Fig. 51: Heater and Air Conditioning Mode Control Cam Cover And Retaining Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

5. Instrument Panel Compartment (2)A, A» Install - [Instrument Panel Compartment Replacement](#)

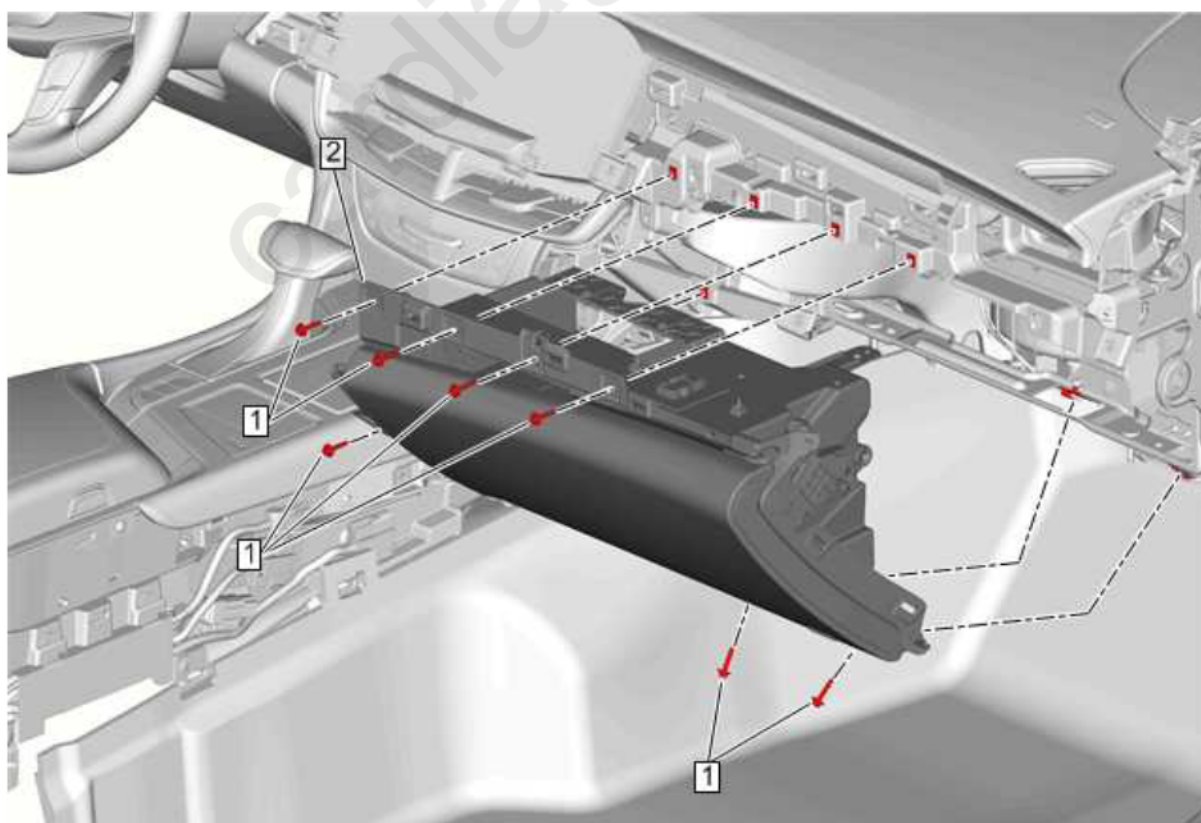


Fig. 52: Instrument Panel Compartment
Courtesy of GENERAL MOTORS COMPANY

6. Perform the actuator calibration procedure. Refer to [Actuator Recalibration](#)
7. Clear the DTCs from the heater and air conditioning remote control module.

MODE CONTROL CAM ALIGNMENT



Fig. 53: Mode Control Cam

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Mode Valve Actuator Gear Procedure Index the mode valve actuator gear window with the heater and air conditioning mode control cam cover window.
2	Mode Valve Cam Procedure Index the mode valve cam window with the heater and air conditioning mode control cam cover window.

FRONT FLOOR CONSOLE REAR AIR VALVE ACTUATOR LEVER LINK REPLACEMENT

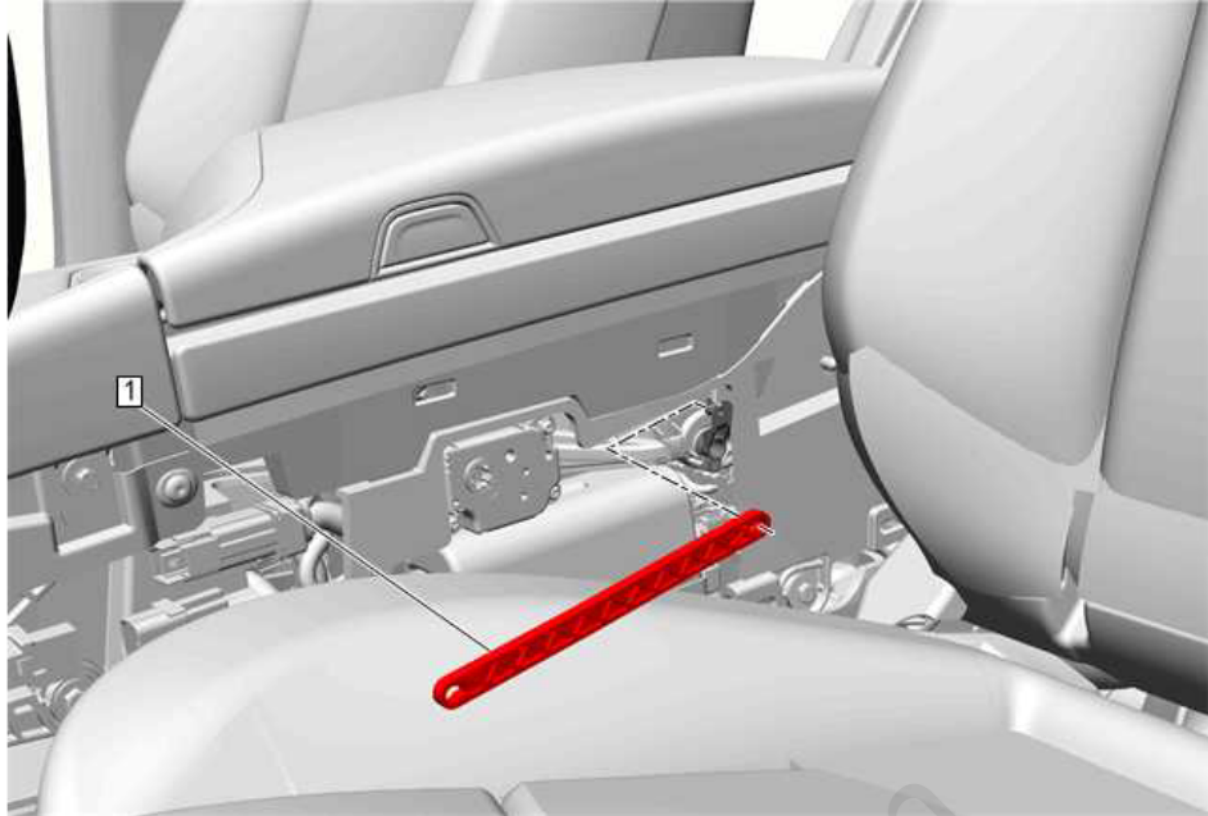


Fig. 54: Front Floor Console Rear Air Valve Actuator Lever Link

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
<u>Front Floor Console Rear Air Valve Actuator Lever Replacement</u>	
1	Front Floor Console Rear Air Valve Actuator Lever Link Procedure Rotate the front floor console rear air valve actuator lever link to disengage from the front floor console rear air valve lever.

FRONT FLOOR CONSOLE REAR AIR VALVE ACTUATOR LEVER REPLACEMENT

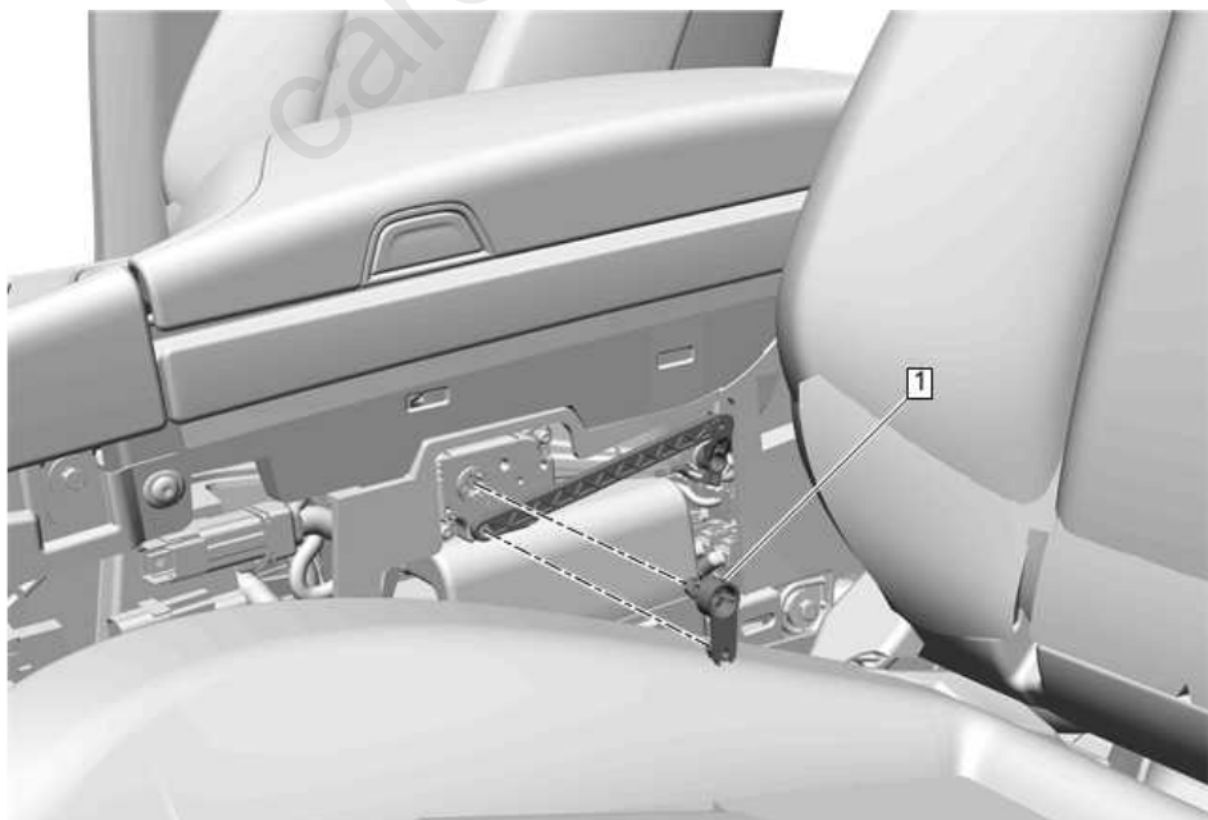


Fig. 55: Front Floor Console Rear Air Valve Actuator Lever
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Front Floor Lower Console Replacement (Left Side) Front Floor Lower Console Replacement (Right Side) - Left Side</u>	
1	Front Floor Console Rear Air Valve Actuator Lever Procedure Rotate the front floor console rear air valve actuator lever to disengage from the front floor console rear air valve actuator lever link.

FRONT FLOOR CONSOLE REAR AIR VALVE ACTUATOR REPLACEMENT (MODE)

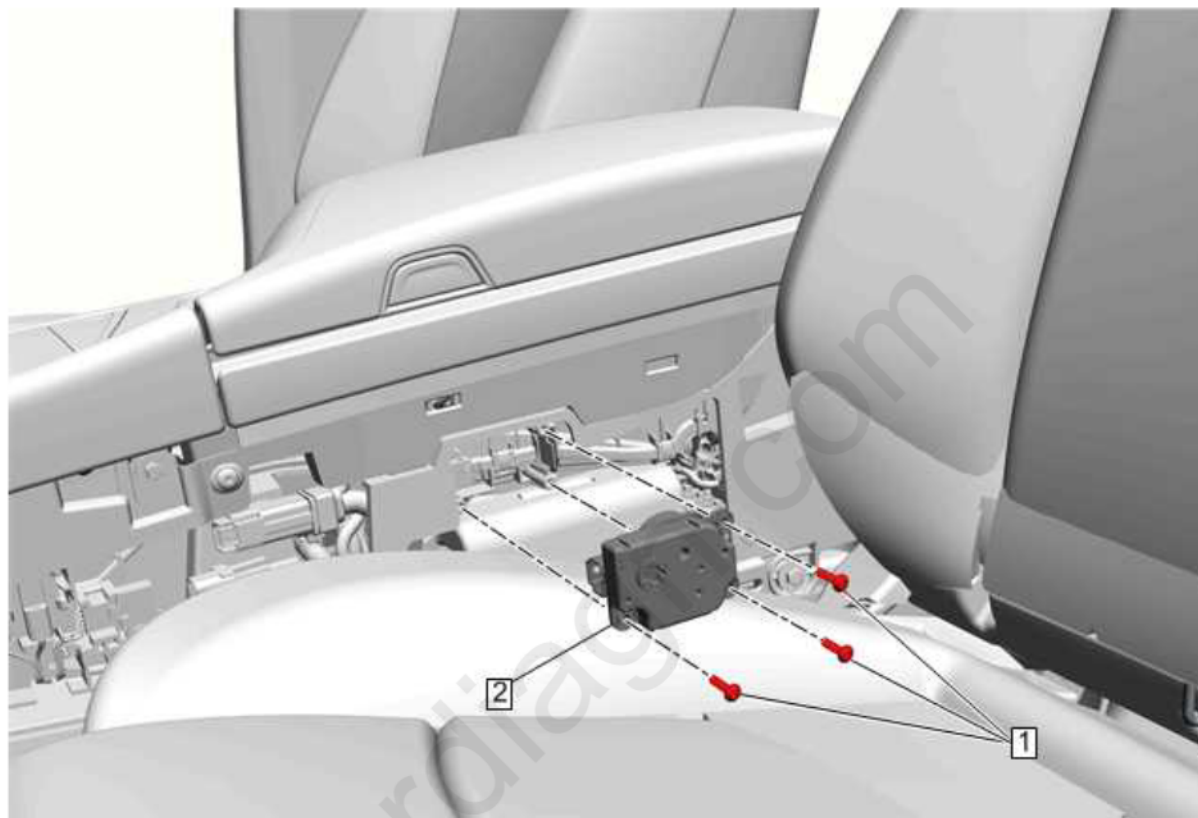


Fig. 56: Front Floor Console Rear Air Valve Actuator (Mode)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Front Floor Console Rear Air Valve Actuator Lever Replacement</u>	
1	Front Floor Console Rear Air Valve Actuator Fastener [3x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.3 N.m (12 lb in)
2	Front Floor Console Rear Air Valve Actuator - Mode Procedure 1. Disconnect the electrical connector. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u> 3. Clear the DTCs from the heater and air conditioning remote control module.

TEMPERATURE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE (CJ2 C24)

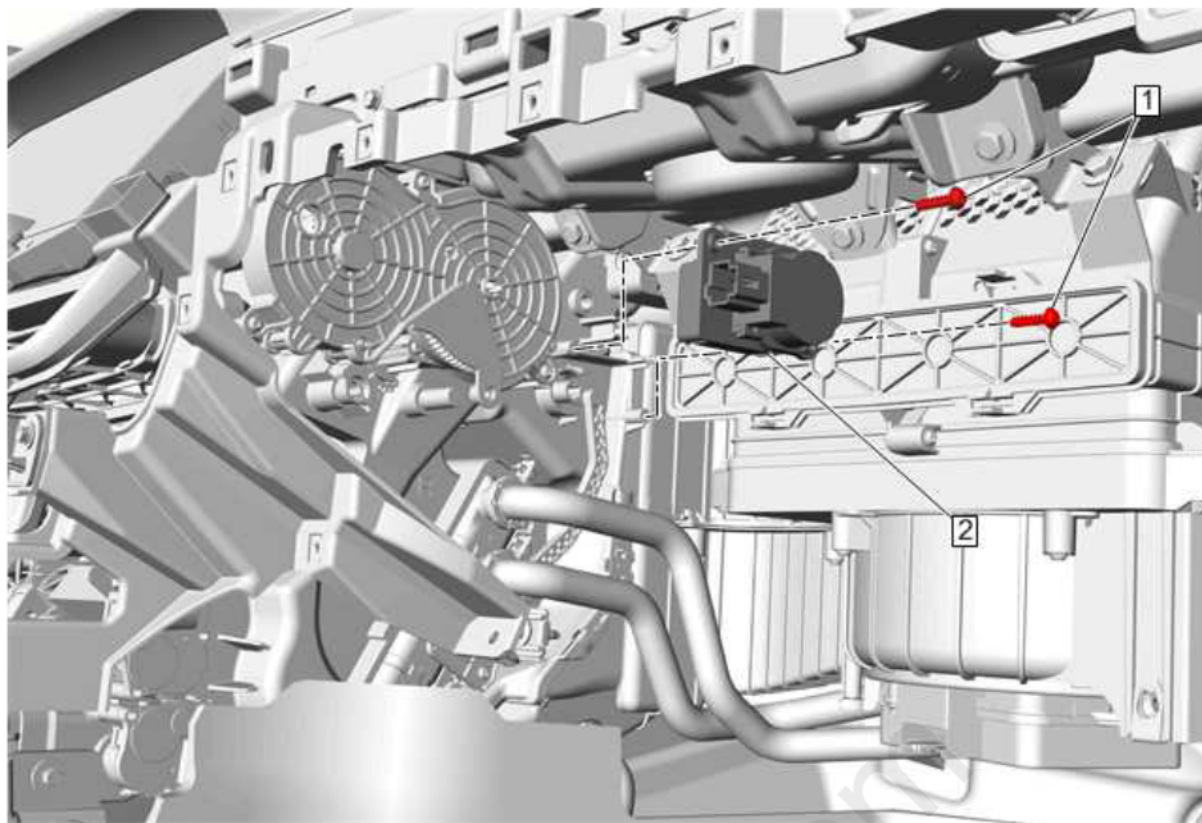


Fig. 57: Temperature Valve Actuator - Right Side (CJ2 C24)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures 1. Instrument Panel Center Support Bracket Replacement 2. Floor Front Air Outlet Duct Replacement - Right Side	
1	Temperature Valve Actuator Fastener [2x] CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Temperature Valve Actuator - Right Side Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module. 3. Perform the actuator calibration procedure. Refer to Actuator Recalibration

TEMPERATURE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE (FLOOR FRONT CONSOLE C24)

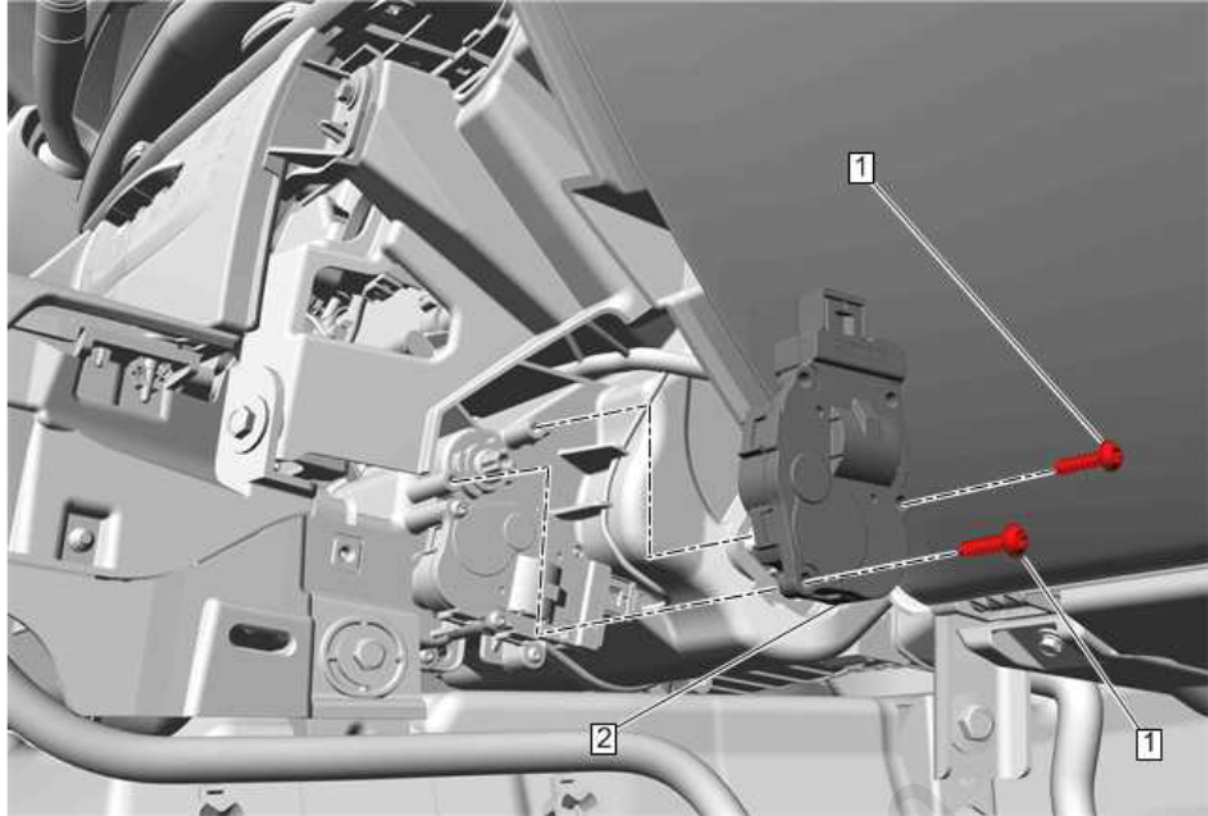


Fig. 58: Temperature Valve Actuator - Right Side (Floor Front Console C24)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures Front Floor Console Extension Panel Replacement - Right Side - Pull the carpet back to gain access to the temperature valve actuator.	
1	Temperature Valve Actuator Fastener [2x] CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Temperature Valve Actuator - Floor Front Console Right Side Procedure - Disconnect the electrical connector. - Clear the DTCs from the heater and air conditioning remote control module. - Perform the actuator calibration procedure. Refer to Actuator Recalibration

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE (CJ2 C24)

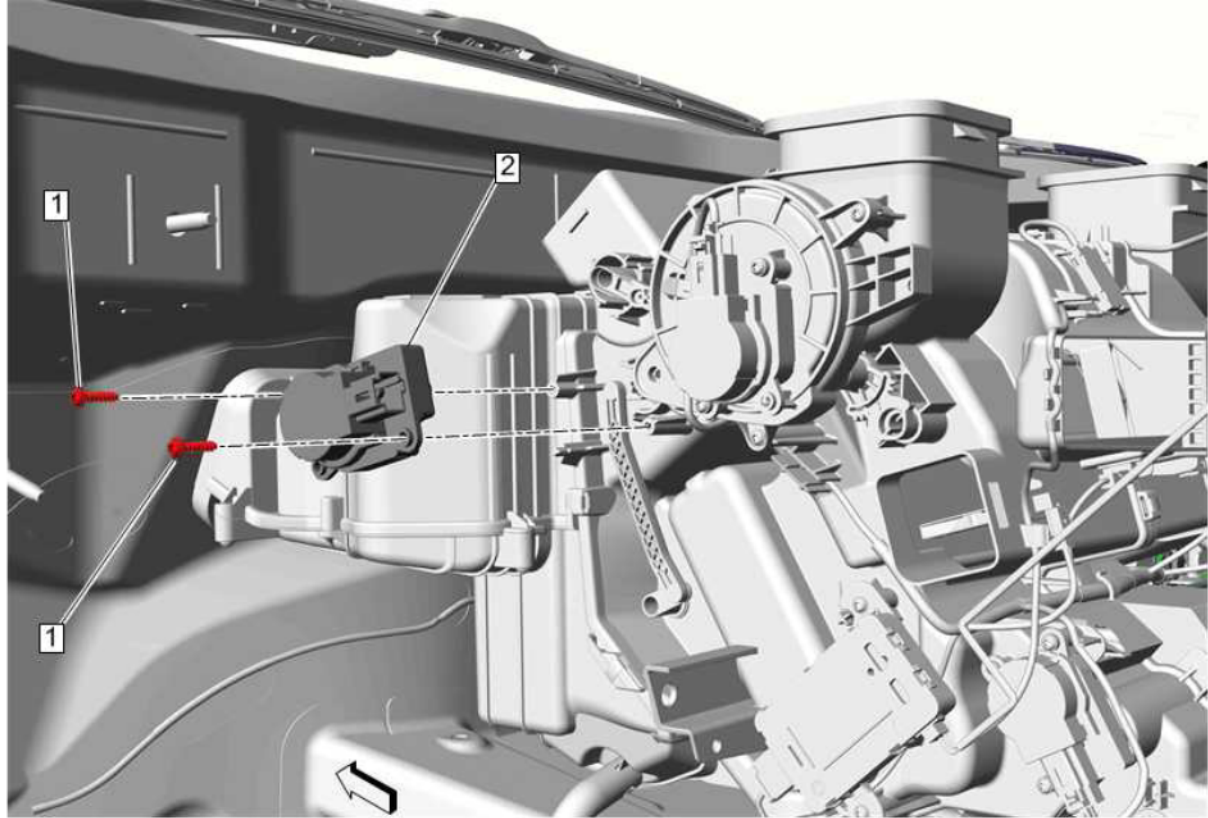


Fig. 59: Temperature Valve Actuator - Left Side (CJ2 C24)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Instrument Panel Tie Bar Replacement	
1	Temperature Valve Actuator Screw [2x] CAUTION: Refer to Fastener Caution . Tighten 1.3 N.m (12 lb in)
2	Temperature Valve Actuator - Left Side Procedure Disconnect the electrical connector.

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE (FLOOR CONSOLE CJ2 C24)

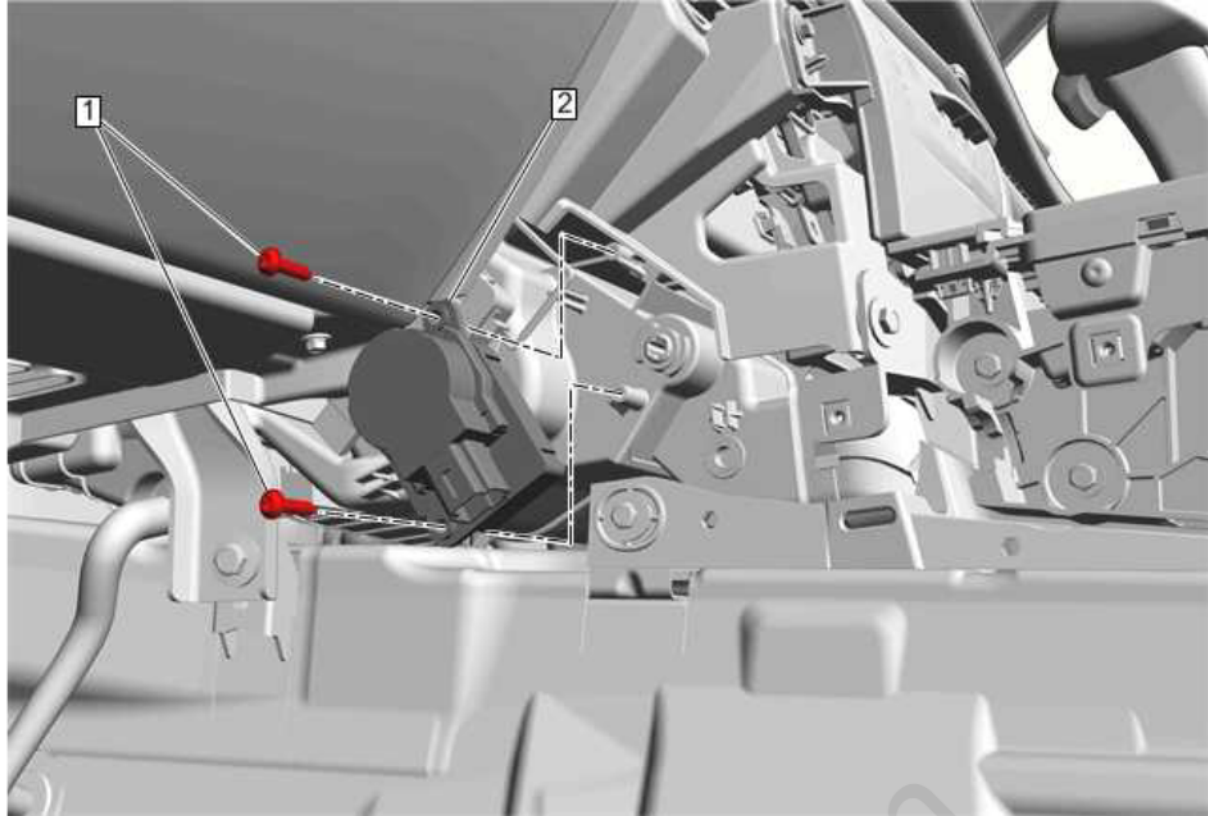


Fig. 60: Temperature Valve Actuator - Left Side (Floor Console CJ2 C24)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures <u>Front Floor Console Extension Panel Replacement - Left Side</u> - Pull the carpet back to gain access to the temperature valve actuator.	
1	Temperature Valve Actuator Fastener [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.3 N.m (12 lb in)
2	Temperature Valve Actuator - Floor Front Console Left Side Procedure - Disconnect the electrical connector. - Clear the DTCs from the heater and air conditioning remote control module. - Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>

AUXILIARY TEMPERATURE VALVE ACTUATOR REPLACEMENT (RIGHT SIDE)

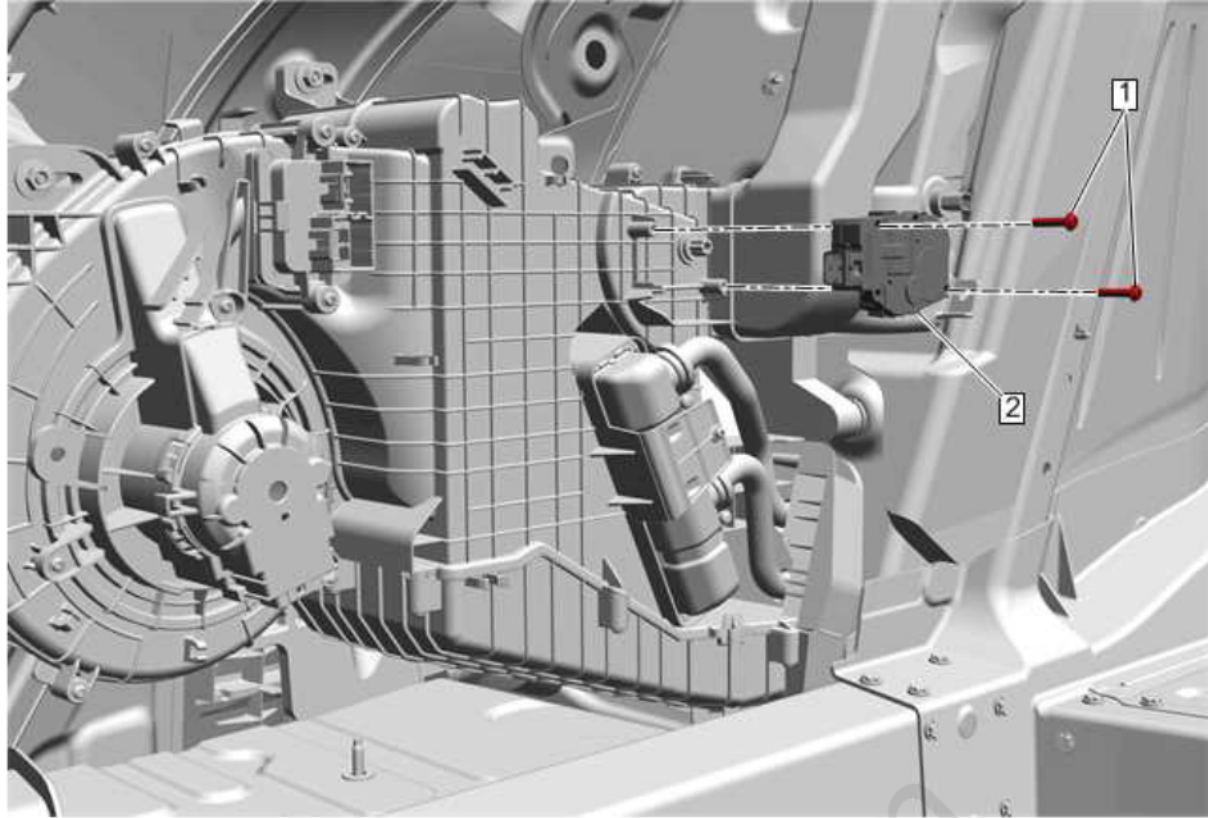


Fig. 61: Auxiliary Temperature Valve Actuator (Right Side)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Rear Compartment Side Trim Replacement - Left Side (Without HP9)</u> <u>Rear Compartment Side Trim Replacement - Left Side (With HP9)</u>	
1	Temperature Valve Actuator Fastener [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.3 N.m (12 lb in)
2	Auxiliary Temperature Valve Actuator Procedure 1. Disconnect the electrical connectors. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>

AUXILIARY TEMPERATURE VALVE ACTUATOR REPLACEMENT (LEFT SIDE)

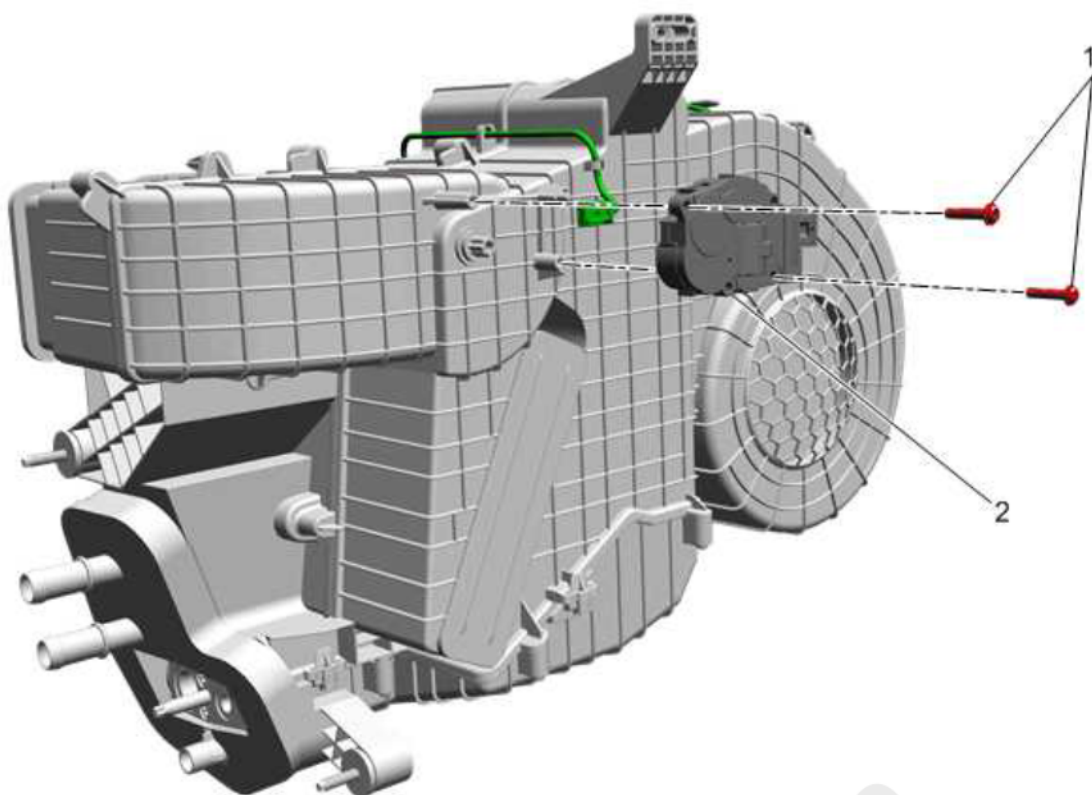


Fig. 62: Auxiliary Temperature Valve Actuator (Left Side)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Auxiliary Air Conditioning (A/C) Evaporator and Blower Module Assembly Removal and Installation</u> NOTE: Prior to removing the temperature valve actuator note the gap between the actuator and the case. If the gap is wider, the temperature door is not properly seated into actuator. Properly seat the temperature door by inserting the temperature door shaft into the actuator to the noted gap.	
1	Temperature Valve Actuator Fastener [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.3 N.m (12 lb in)
2	Auxiliary Temperature Valve Actuator - Left Side Procedure 1. Disconnect the electrical connector. 2. Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>

MODE VALVE ACTUATOR REPLACEMENT - CONSOLE (TURN OFF C24)

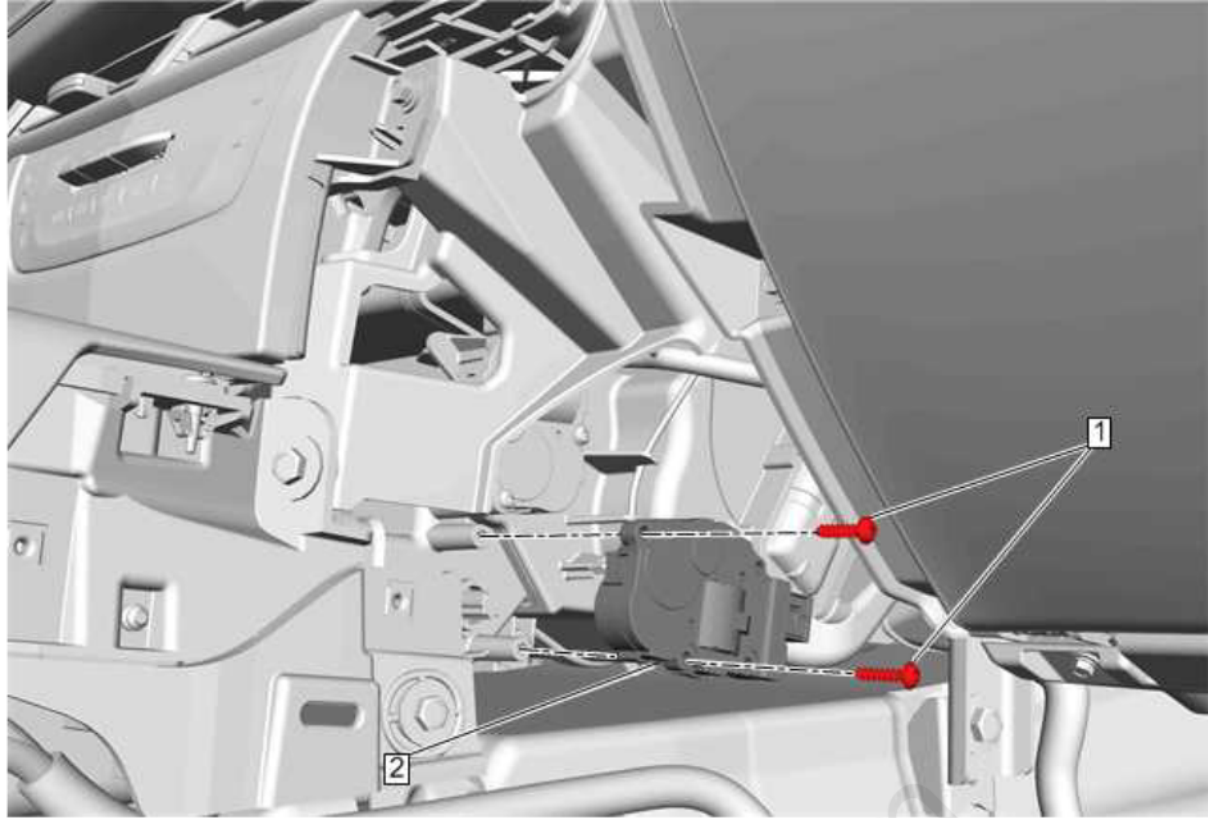


Fig. 63: Mode Valve Actuator - Console (Turn Off C24)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures <u>Front Floor Console Extension Panel Replacement - Right Side</u> - Pull the carpet back to gain access to the front floor console mode valve actuator.	
1	Mode Valve Actuator Screw [2x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.3 N.m (12 lb in)
2	Mode Valve Actuator - Console Procedure - Disconnect the electrical connector. - Clear the DTCs from the heater and air conditioning remote control module. - Perform the actuator calibration procedure. Refer to <u>Actuator Recalibration</u>

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER RIGHT SIDE

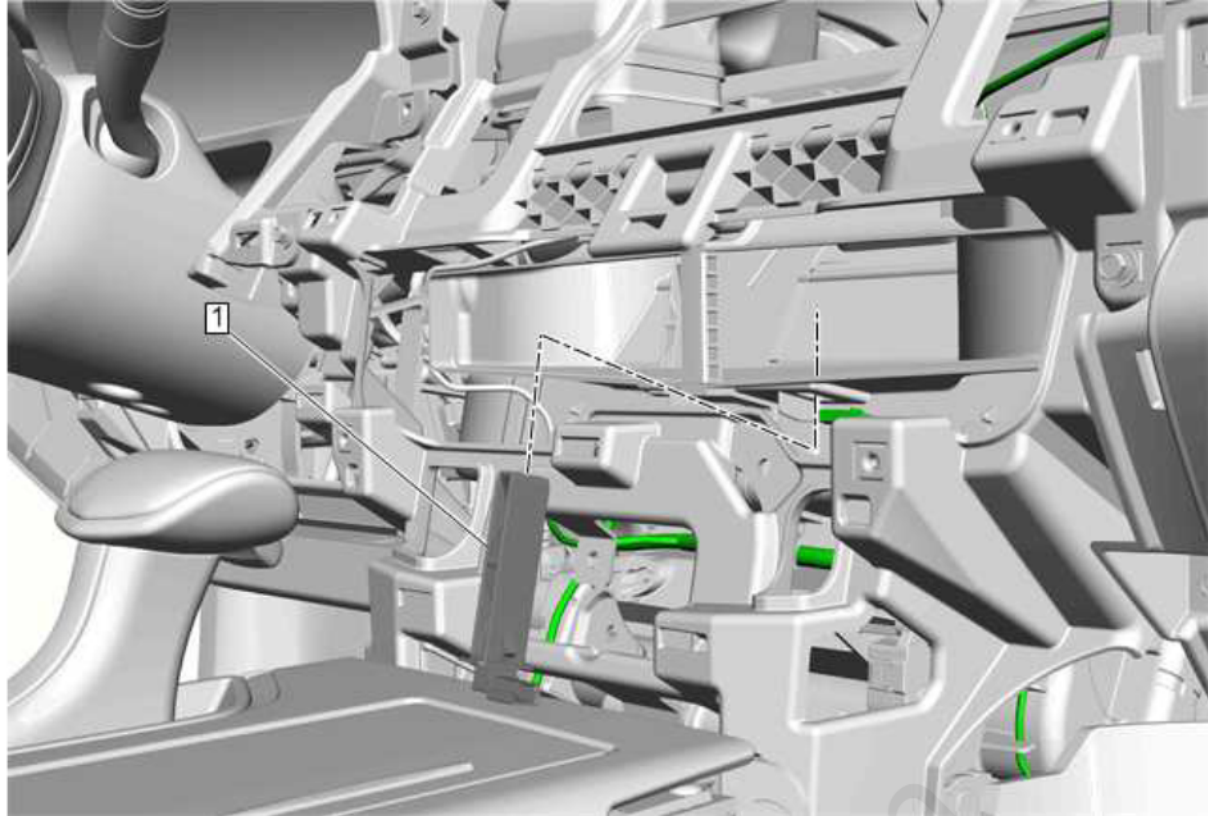


Fig. 64: Duct Air Temperature Sensor - Upper Right Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Heater and Air Conditioning User Interface Control Replacement</u>	
1	Duct Air Temperature Sensor - Upper Right Side Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER LEFT SIDE

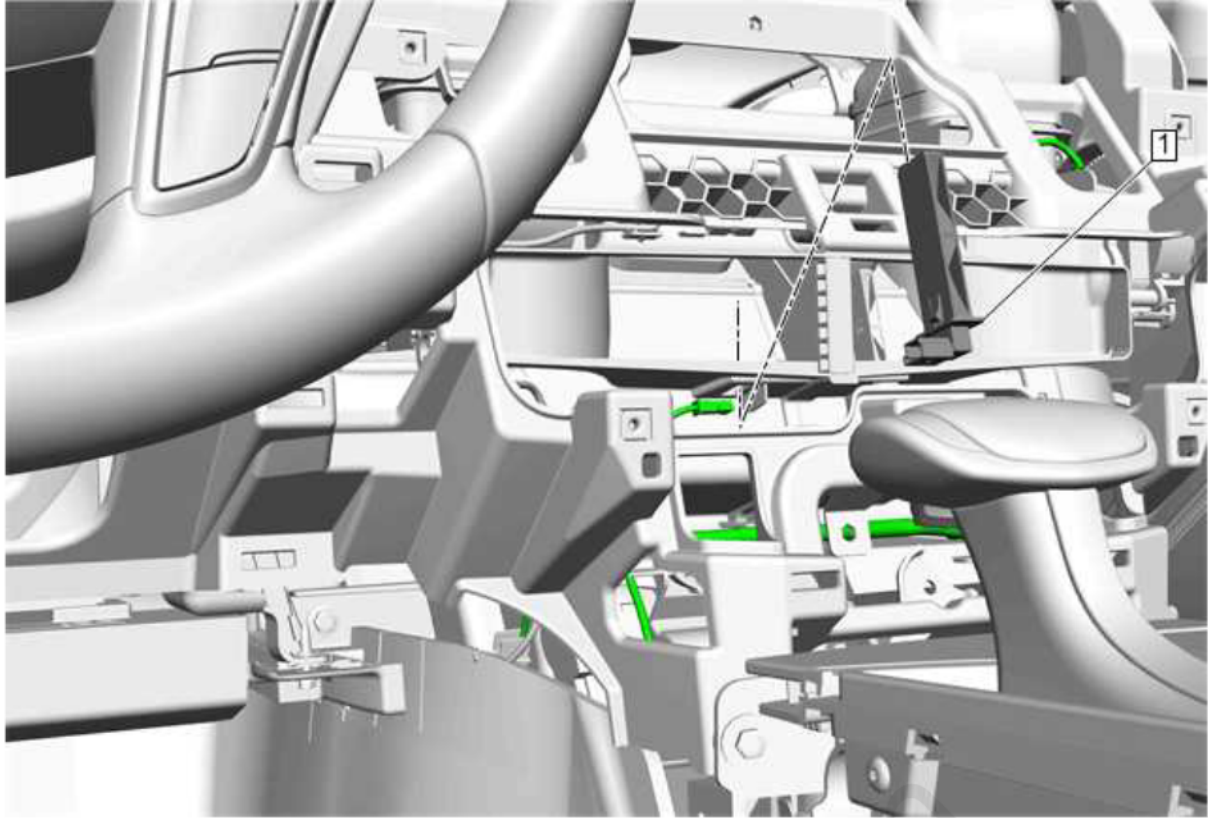


Fig. 65: Duct Air Temperature Sensor - Upper Left Side
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Heater and Air Conditioning User Interface Control Replacement</u>	
1	Duct Air Temperature Sensor - Upper Left Side Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER LEFT SIDE

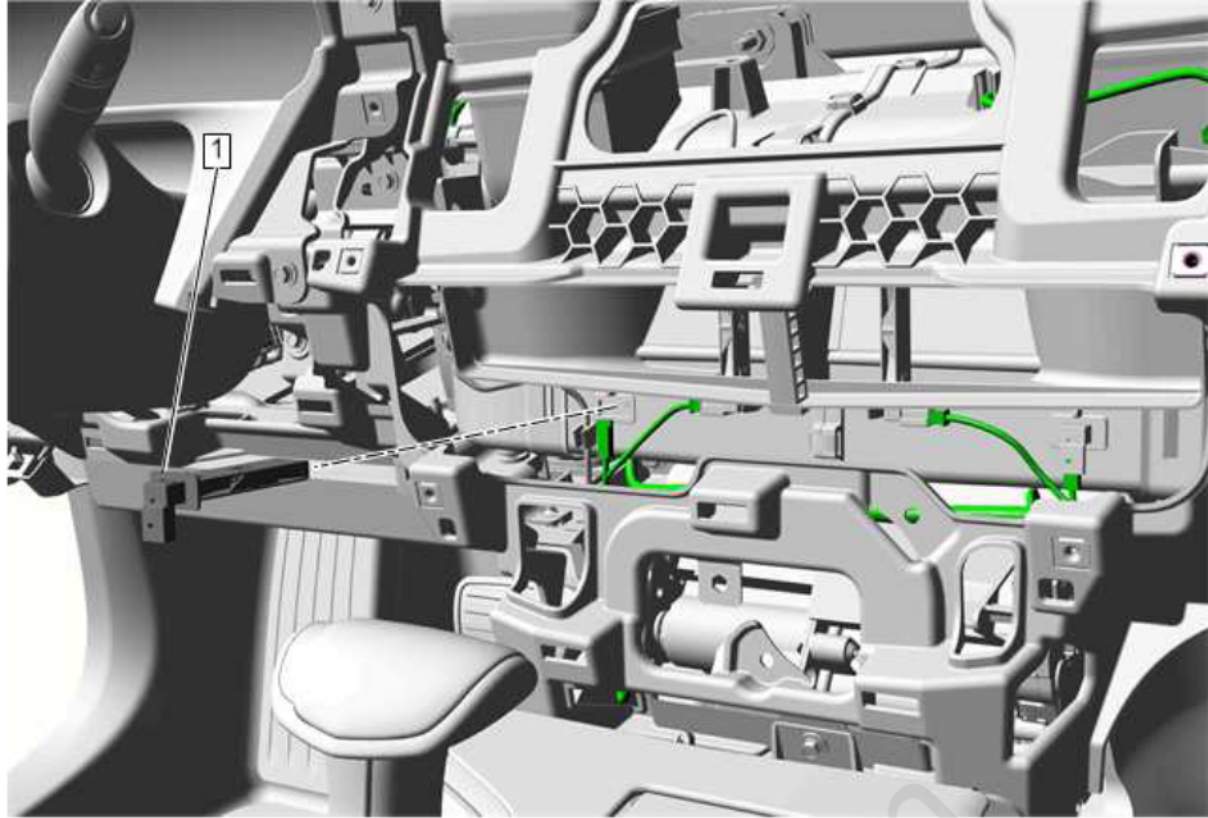


Fig. 66: Duct Air Temperature Sensor - Lower Left Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Heater and Air Conditioning User Interface Control Replacement</u>	
1	Duct Air Temperature Sensor - Lower Left Side Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER RIGHT SIDE

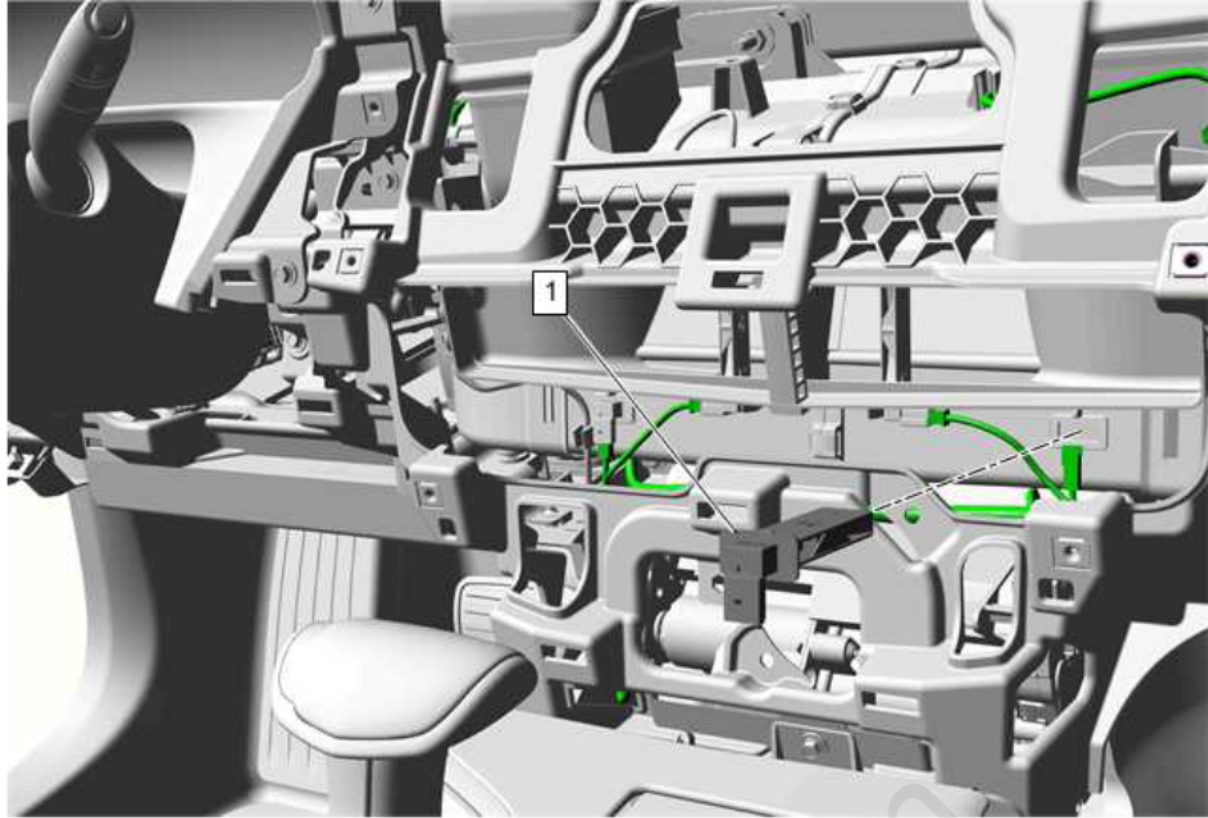


Fig. 67: Duct Air Temperature Sensor - Lower Right Side

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Heater and Air Conditioning User Interface Control Replacement</u>	
1	Duct Air Temperature Sensor - Lower Right Side Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - REAR LEFT SIDE (FLOOR FRONT CONSOLE)

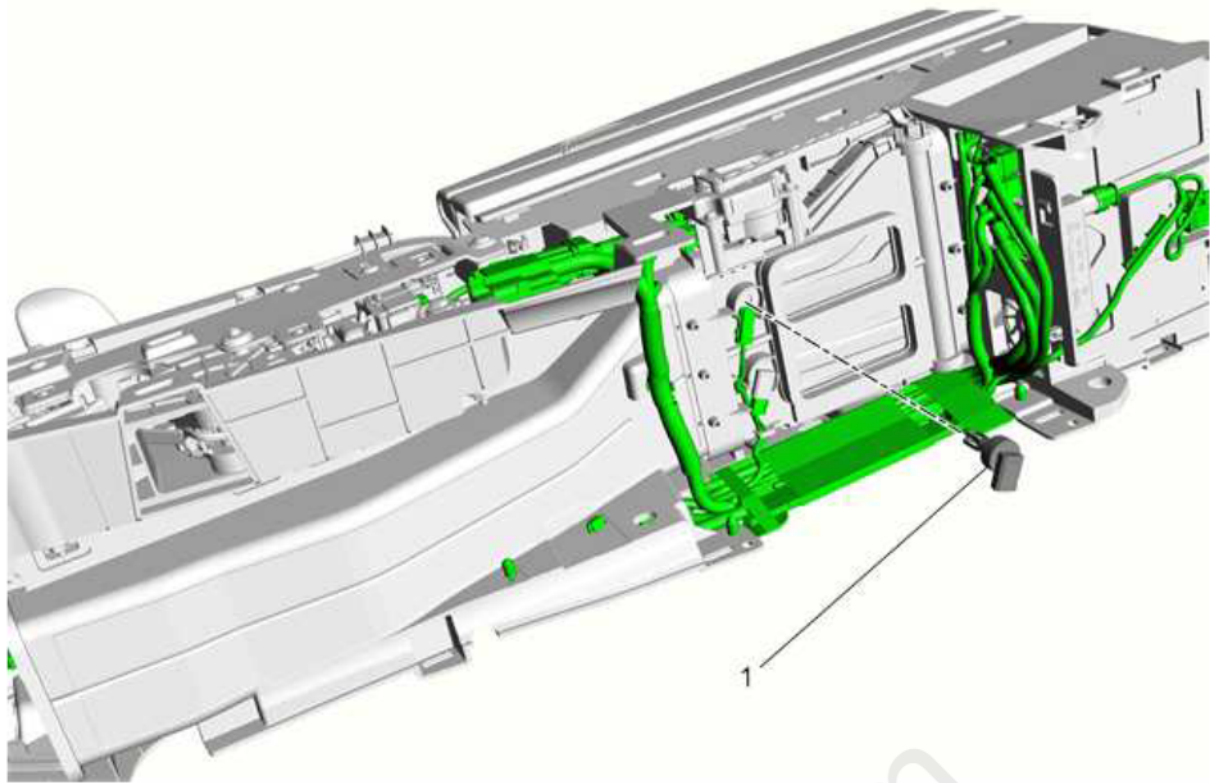


Fig. 68: Duct Air Temperature Sensor - Rear Left Side (Floor Front Console)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Front Floor Console Replacement</u>	
1	Duct Air Temperature Sensor - Left Side Procedure 1. Disconnect the electrical connector. 2. To remove the duct air temperature sensor, pull the duct air temperature sensor out of the floor rear air distributor duct.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - REAR RIGHT SIDE (FLOOR FRONT CONSOLE)

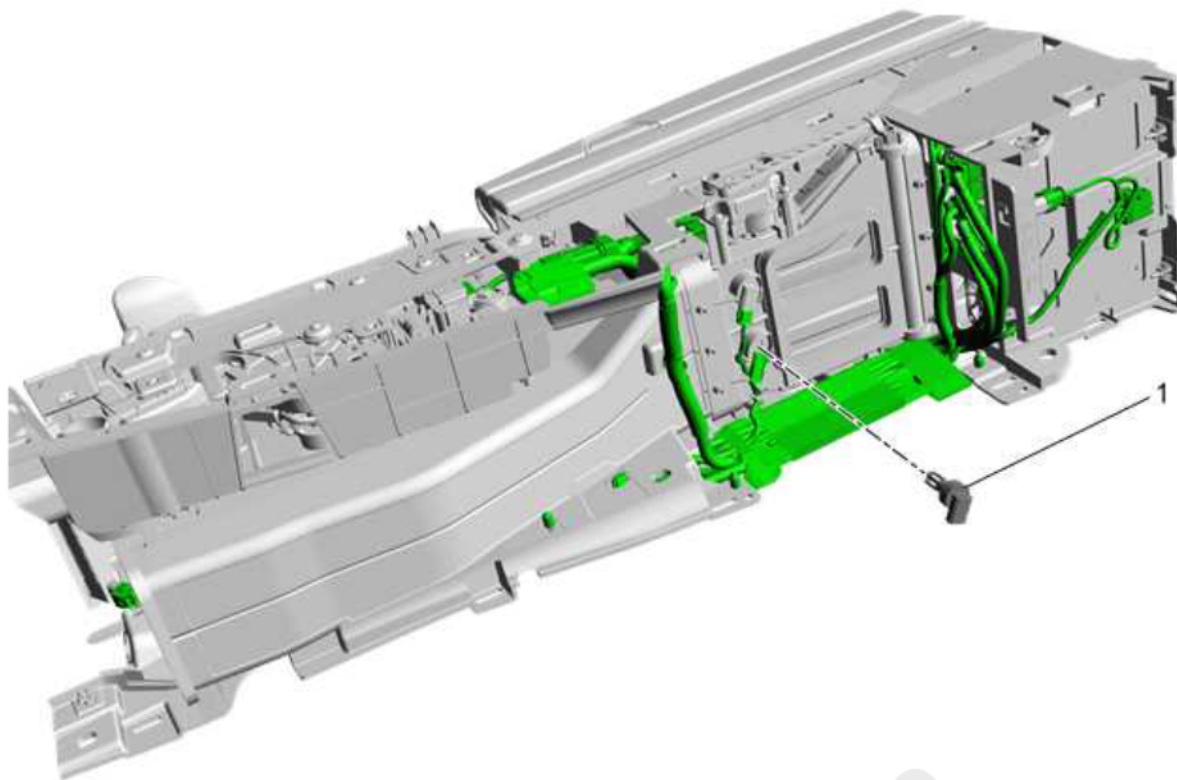


Fig. 69: Duct Air Temperature Sensor - Rear Right Side (Floor Front Console)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Front Floor Console Replacement</u>	
1	Duct Air Temperature Sensor - Right Side Procedure 1. Disconnect the electrical connector. 2. To remove the duct air temperature sensor, pull the duct air temperature sensor out of the floor rear air distributor duct.

AUXILIARY DUCT AIR TEMPERATURE SENSOR REPLACEMENT (LEFT SIDE)

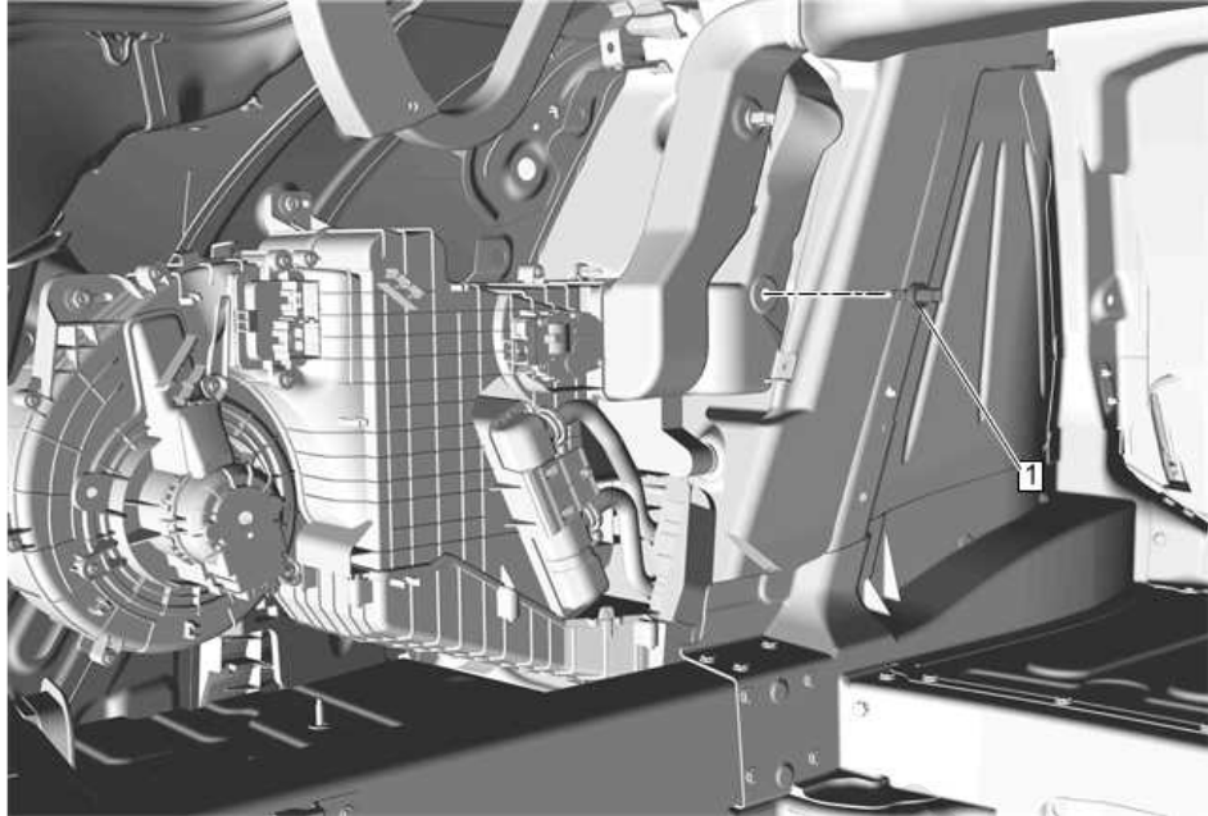


Fig. 70: Auxiliary Duct Air Temperature Sensor (Left Side)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Rear Compartment Side Trim Replacement - Left Side (Without HP9)</u> <u>Rear Compartment Side Trim Replacement - Left Side (With HP9)</u>	
1	Auxiliary Duct Air Temperature Sensor - Left Side Procedure Disconnect the electrical connector.

AUXILIARY DUCT AIR TEMPERATURE SENSOR REPLACEMENT (RIGHT SIDE)

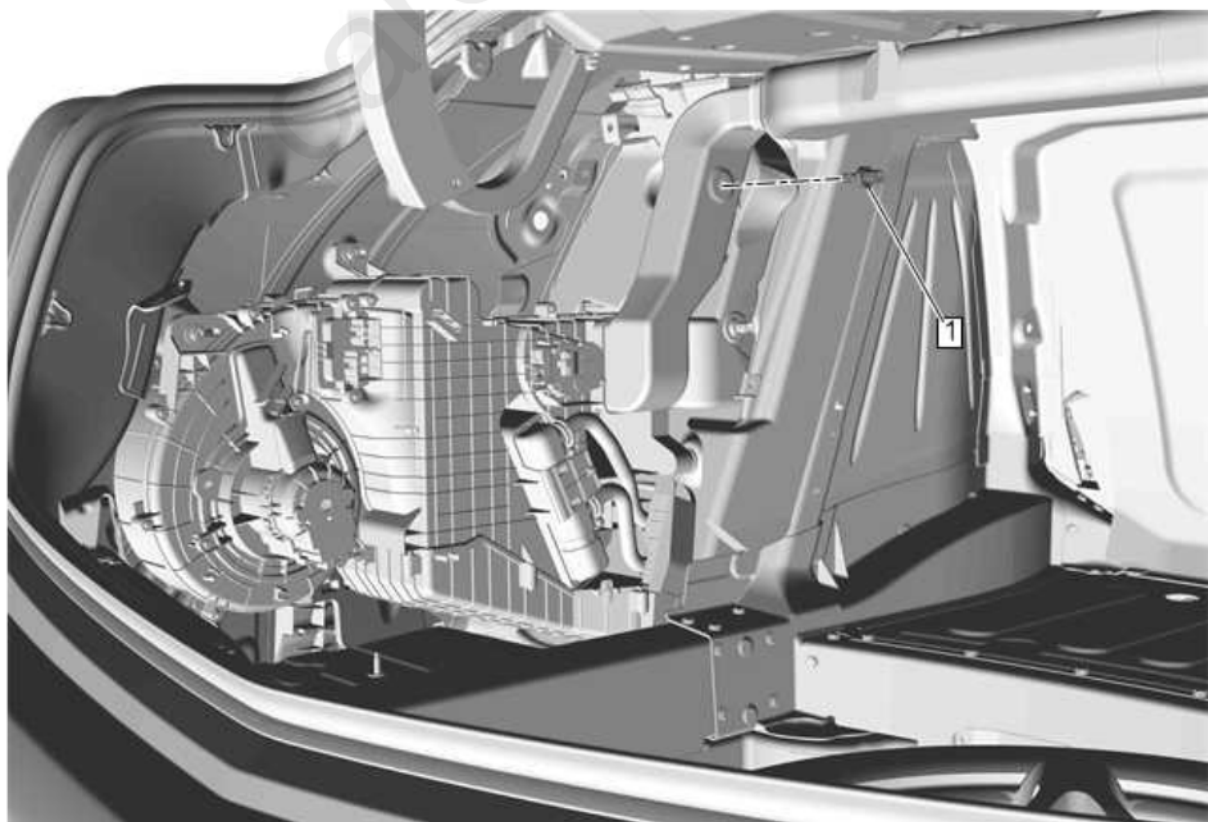


Fig. 71: Auxiliary Duct Air Temperature Sensor (Right Side)
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Rear Compartment Side Trim Replacement - Left Side (Without HP9) Rear Compartment Side Trim Replacement - Left Side (With HP9)	
1	Auxiliary Duct Air Temperature Sensor - Right Side Procedure Disconnect the electrical connector.

AMBIENT AIR QUALITY SENSOR REPLACEMENT

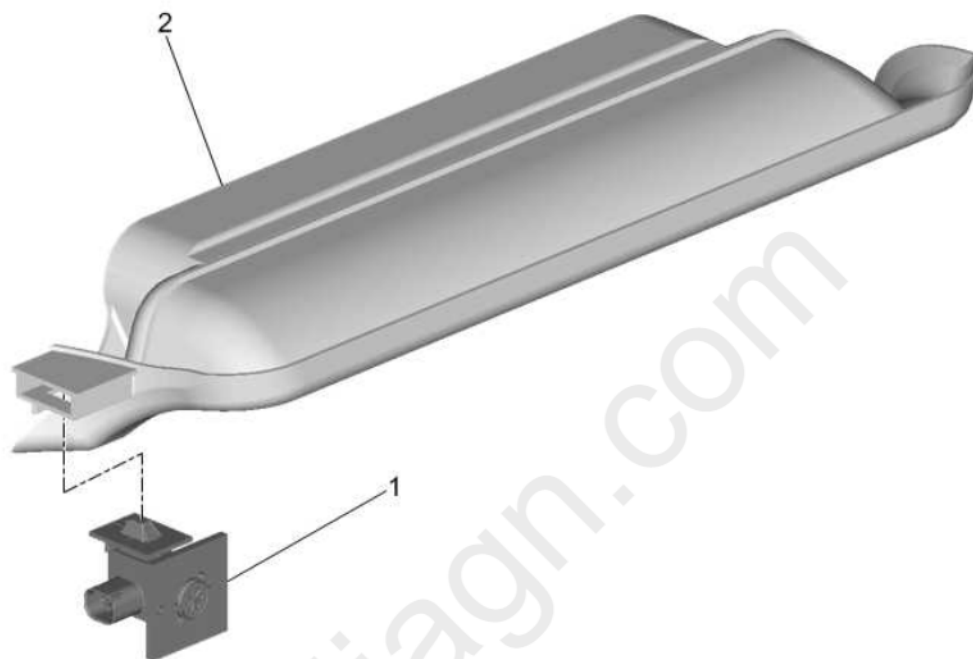


Fig. 72: Ambient Air Quality Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Air Inlet Grille Panel Replacement Air Inlet Deflector Water Deflector Replacement	
1	Ambient Air Quality Sensor Procedure Un-clip the ambient air quality sensor from the air inlet deflector water deflector.
2	Air Inlet Deflector Water Deflector

EVAPORATOR AIR TEMPERATURE SENSOR REPLACEMENT



Fig. 73: Evaporator Air Temperature Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure <u>Floor Front Air Outlet Duct Replacement - Right Side</u>	
1	Air Conditioning Evaporator Air Temperature Sensor Procedure Disconnect the electrical connector.

WINDSHIELD OUTSIDE MOISTURE/AMBIENT LIGHT AND HUMIDITY SENSOR REPLACEMENT



Fig. 74: Windshield Outside Moisture/Ambient Light and Humidity Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Inside Rearview Mirror Replacement	
1	Windshield Outside Moisture/Ambient Light and Humidity Sensor Procedures 1. Unlatch the inside windshield outside moisture and ambient light and humidity sensor, from the inside rear view mirror support bracket. 2. Disconnect the inside windshield outside moisture and ambient light and humidity sensor connector.

SUN LOAD, AMBIENT LIGHT AND CHARGE INDICATOR SENSOR REPLACEMENT

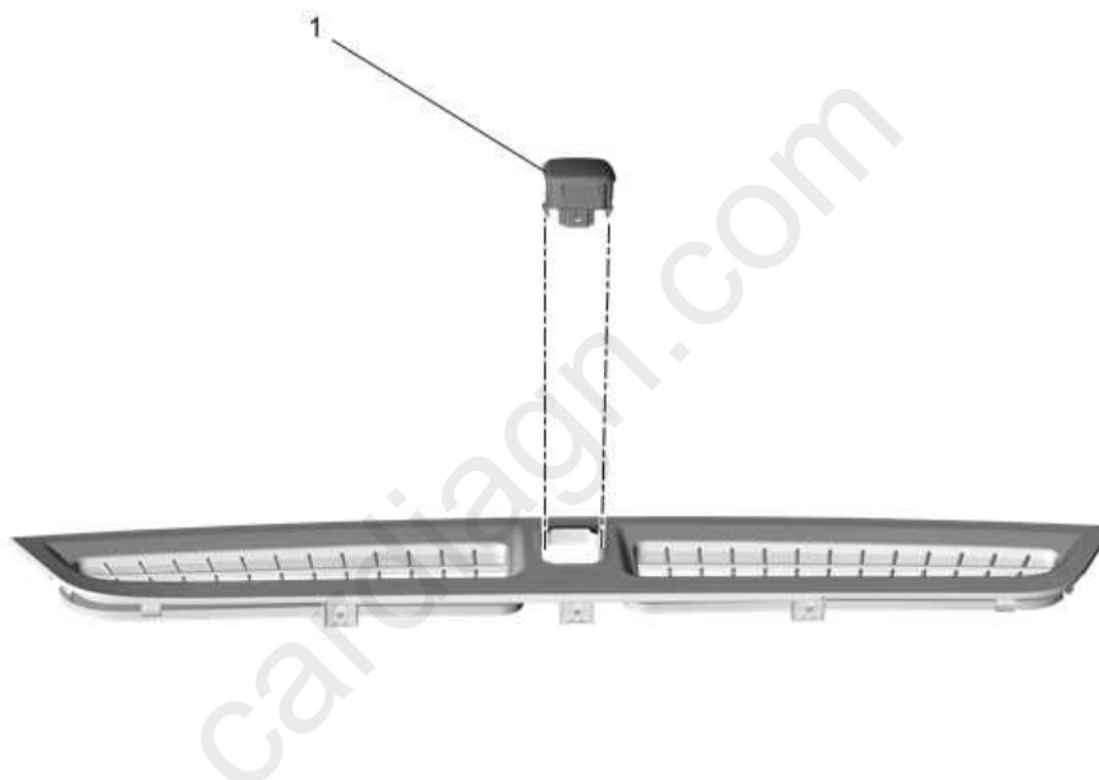


Fig. 75: Sun Load, Ambient Light and Charge Indicator Sensor
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Instrument Panel Extension Replacement	
1	Sun Load, Ambient Light and Charge Indicator Sensor Procedure Depress the sun load temperature and ambient light and charge indicator sensor tabs to remove from the instrument panel extension.

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 Delivery (Front)

- Air Delivery (Rear)
- Heating and A/C Operation
- Recirculation Operation
- Automatic Operation
- Coolant Heater Control Module
- Engine Coolant and A/C System Refrigerant

HVAC Control Components

HVAC Controls

The HVAC controls contains all switches, buttons and dials which are required to control the functions of the HVAC system 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 Controls - Auxiliary (C24 only)

The HVAC controls - auxiliary contains all switches, buttons and dials which are required to control the functions of the rear HVAC system 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

Actuators (Front)

Doors in the HVAC case assembly are used to control air flow. The HVAC control module operates the doors through the use of actuators, with one actuator being used for each door. The system has the following air control doors and associated actuators: left and right mode, left and right temperature, rear console air flow control, rear console temperature and recirculation.

Each actuator used in the system is a 5-wire stepper motor. The HVAC control module supplies a 12 V reference voltage to the stepper motor and energizes the 4 stepper motor coils with individual control circuits. The control circuits are operated to move the door to the required position. The null point of the stepper motor will be calibrated, if the stepper motor is new. When the stepper motor is calibrated, the HVAC control module can drive the applicable coil to reach exactly the desired position of the flap.

Actuators - Rear (C24 only)

Four additional actuators are added to the system to control the airflow and temperature for the rear seat passengers: right rear console temperature, right rear upper temperature, left rear upper temperature and a rear airflow shutoff. The actuators are stepper motors controlled by the HVAC control module via a LIN-Bus. The auxiliary HVAC controls supply a 12 V reference voltage to the actuators and ground is provided by the wiring harness. The HVAC control module sends a request message to the actuator, the actuator then operates the internal stepper motors to move the door to the required position.

Air Speed and Blower Motor (Front)

The blower speed control is part of the HVAC control. The selected value is sent to the HVAC control module via LIN-Bus.

The blower motor speed control from the HVAC control module, battery positive and ground circuits enable the blower motor to operate. 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.

Air Speed and Blower Motor - Rear (C24 only)

An auxiliary blower motor is used to regulate the air speed from the rear passenger ducts. The rear blower speed control is part of the HVAC control - auxiliary. The selected value is sent to the HVAC control module via LIN-Bus.

The blower motor speed control from the HVAC control module, battery positive and ground circuits enable the blower motor to operate. 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.

Duct Temperature Sensors

The air temperature sensors are 2-wire negative temperature coefficient thermistors. The sensors operate within a temperature range of -40 to $+85^{\circ}\text{C}$ (-40 to $+185^{\circ}\text{F}$). 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 actuator position.

Evaporator Temperature Sensor

The evaporator temperature sensor is a 2-wire negative temperature coefficient thermistor. The sensor operates within a temperature range of -40 to $+85^{\circ}\text{C}$ (-40 to $+185^{\circ}\text{F}$). 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 evaporator freezing.

A/C Refrigerant High 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 Refrigerant Low Pressure Sensor (with HP9)

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 Hybrid/EV Powertrain Control Module 2 monitors the low side refrigerant pressure through the A/C pressure sensor.

A/C Compressor (without HP9)

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 cooling load.

A/C Compressor (with HP9)

The AC compressor function is to provide refrigerant flow in the AC refrigerant loop to help cool down the cabin, help dehumidify the air in a defrost mode and help maintain the battery temperature. Rather than a more-typical pulley, the A/C compressor uses a 3-phase alternating current, high voltage electric motor to operate. It has an on-board inverter that takes high voltage direct current from the vehicle's high voltage battery and inverts it to alternating current for the motor. The AC compressor shall be activated when any of the three following events occur:

- The customer pushes the AC button or
- The HVAC control, in ECO climate or Comfort Climate Settings, requests the electric AC compressor on to help in cooling the cabin or removing moisture in conditions where the windows may fog or
- The hybrid/EV powertrain control module 2 requests the AC compressor on to help maintain the battery temperature

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.

HVAC Coolant Pump (without HP9)

The heater coolant pump is controlled by a relay. When operating conditions exist that requires coolant flow when the engine is not operating, the ECM turns ON the heater coolant pump by applying ground to the relay control circuit which energizes the heater coolant pump relay.

HVAC Coolant Pump (with HP9)

The HVAC control module will control the cabin coolant heater pump based on a valid flow rate. If the HVAC Heating system requests a coolant flow rate, the HVAC coolant pump will be commanded on and to the desired speed.

Air Ionizer (KEM)

The ionizer is a method of electronically cleaning the air to improve the air quality in the vehicle cabin. The air ionizer electrodes produce positive and negative ions to reduce certain pollutants and odors. The ionizer uses a battery voltage circuit, ground circuit and a serial data signal from the HVAC control module to operate. When the air ionizer is enabled, the HVAC control module will send a serial data message for the ionizer to operate when the blower is on.

Refer to the owners manual for information regarding enabling or disabling the air ionizer.

Air Delivery (Front)

The HVAC control module controls the distribution of air by the use of the actuators. Mode and temperature may be individually selected for the driver and front passenger.

The HVAC controls delivers the selected settings to the HVAC control module via LIN-Bus. The HVAC control module controls air door actuators to the calculated position to achieve the desired settings. Air flow is then distributed through various ducts leading to the outlets in the dash.

When defrost is selected, the blower motor will be activated, regardless of the coolant temperature. The HVAC control module will move the recirculation actuator to outside air, to aid in reducing window fogging. The HVAC control module enables a high volume of air delivered to the front defrost vents.

A/C is available in all modes.

Air Delivery - Rear (CJ2)

Rear air delivery does not include an auxiliary blower or rear controls. The air temperature and mode from the rear ducts will match the selections chosen for the driver. When defrost is selected, airflow is blocked from the rear ducts.

Air Delivery - Rear (C24)

The desired rear air distribution mode and can be selected with the HVAC controls or the HVAC controls - auxiliary. The selected settings are delivered to the HVAC control module via LIN-Bus. The actuators are stepper motors controlled by the HVAC control module via a LIN-Bus. The HVAC control module sends a request message to the actuator, the actuator then operates the internal stepper motors to move the door to the required position.

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 according to adjusted interior temperature on the basis of characteristic lines. Therefore the HVAC control module grounds the A/C compressor with the PWM signal.

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 induce 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 HVAC controls. The selected recirculation switch position is sent to the HVAC control module via LIN-Bus. The HVAC control module controls the air intake through the air inlet actuator and recirculation actuator. In the recirculation mode the air inlet flap closes and the recirculation flap opens in order to circulate the air within the vehicle. In fresh air mode the air inlet flap opens and the recirculation flap is closed again in order to route outside air into the vehicle. Recirculation is only available if the defrost mode is not active. When the defrost mode is active, the recirculation actuator opens the recirculation flap and the air inlet actuator opens the air inlet flap and outside air is circulated to the windshield to reduce fogging.

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 switches must be in any other position than 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
 - Ambient light/sunload sensor
 - Duct air temperature sensors
 - Evaporator temperature sensor
 - Windshield temperature and inside moisture sensor
- Controls the following:
 - Regulate the blower motor speed
 - Regulate the rear blower motor speed (only C24)
 - Position the air control door actuators
 - Request A/C operation
 - Control the A/C compressor solenoid

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.

Coolant Heater Control Module (HP9)

The coolant heater control module is a high voltage electric heater. High voltage is supplied from the hybrid/EV battery pack. A fused battery input, ground and LIN serial data from the HVAC control module are used to control the operation of the coolant heater control module.

The coolant heater control module is an essential element of the hybrid heating system. The hybrid/EV powertrain control module 2 controls the passenger compartment heater coolant control valve and the HVAC commands the coolant heater control module activation via serial data. Heated coolant either from the engine or the coolant heater control module will meet HVAC temperature demands. The

coolant heater control module will be commanded "off" if the coolant temperature exceeds the desired temperature.

Coolant heat generated by the engine is also an element of the heating system. Once the engine coolant is warm enough to supply the required heat, the passenger compartment heater coolant control valve will move to the "link" position, which allows sharing of coolant between the engine, the coolant heater control module and passenger compartment heater core. The coolant heater control module power level will be reduced and/or cycled on/off as the engine turns on/off during charge-sustaining mode, maintaining cabin comfort. When the engine is utilized for charge sustaining mode the thermostat will control 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.

Heater coolant enters the heater core through the inlet heater hose, in a pressurized state. The heater core is located inside the HVAC module. The ambient air drawn through the HVAC module, absorbs the heat of the coolant flowing through the heater core. Heated air is distributed to the passenger compartment, through the HVAC module, for passenger comfort. Opening or closing the air temperature 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 system as controlled by the coolant passenger compartment heater coolant control valve.

Engine Coolant and A/C System Refrigerant

For information on engine coolant, coolant flow, A/C refrigerant and the A/C refrigerant cycle, refer to [**Heating and Air Conditioning System Description and Operation**](#) and/or [**Heating and Air Conditioning System Description and Operation \(With HP9\)**](#).
