

2018 HVAC

HVAC - Automatic - Traverse

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

NOTE:

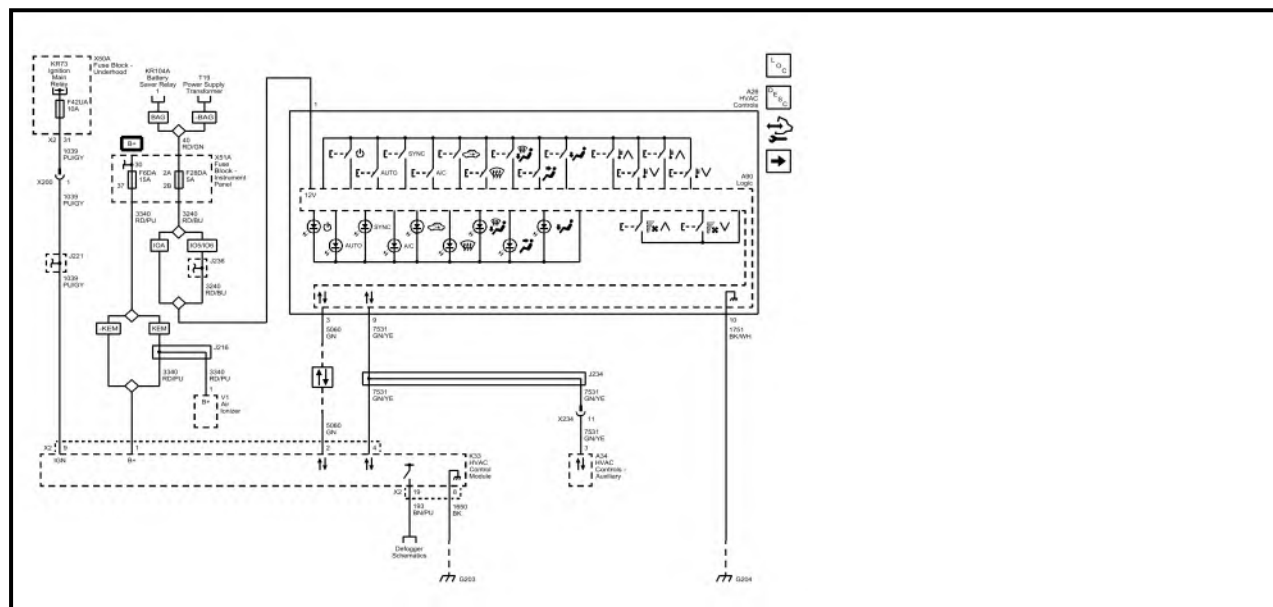
All fasteners listed in this table can be reused after removal.

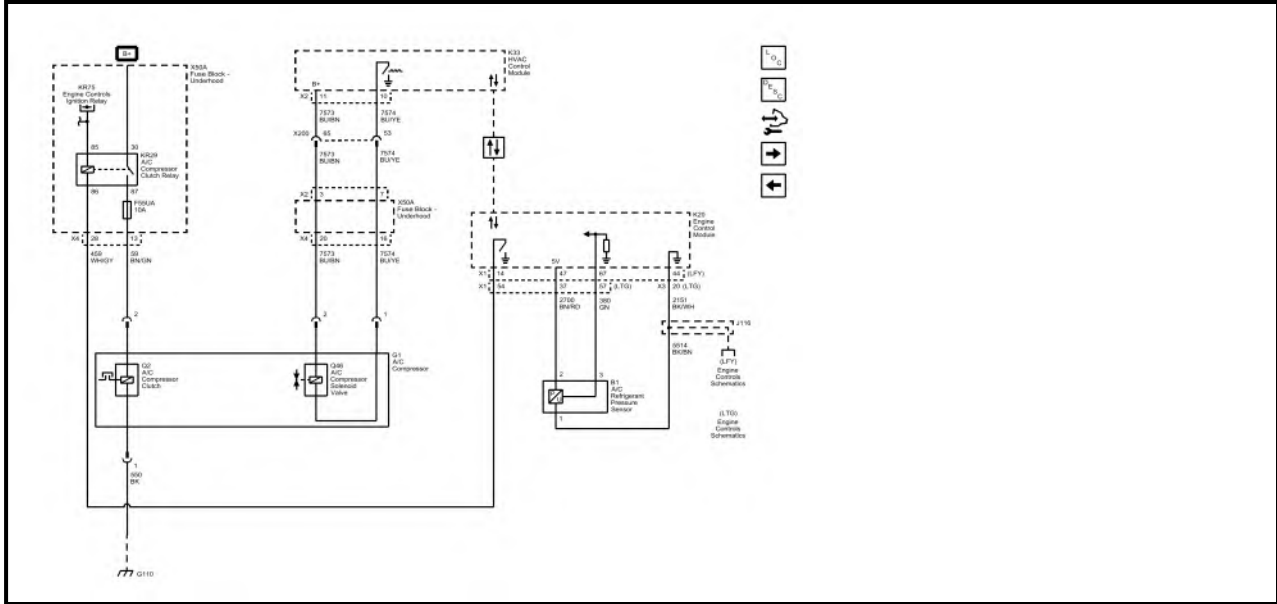
Application	Specification
	Metric (English)
Air Inlet Valve Actuator Screw	1.3 N.m (12 lb in)
Auxiliary Air Conditioning Evaporator and Blower Module Bolt (C69)	2.5 N.m (22 lb in)
Auxiliary Air Conditioning Evaporator and Blower Module Nut (C69)	9 N.m (80 lb in)
Auxiliary Heater and Air Conditioning Control Bolt (C69)	1.0 N.m (9 lb in)
Ground Nut	9 N.m (80 lb in)
Heater and Air Conditioning Mode Control Cam Cover Bolt (CJ2)	2.5 N.m (22 lb in)
Heater and Air Conditioning User Interface Control Bolt (CJ2)	2.5 N.m (22 lb in)
Mode Valve Actuator Bolt (CJ2)	1.3 N.m (12 lb in)
Mode Valve Actuator Bolt (C69)	1.5 N.m (13 lb in)
Temperature Valve Actuator Bolt (CJ2)	1.3 N.m (12 lb in)
Temperature Valve Actuator Bolt (C69)	1.5 N.m (13 lb in)

SCHEMATIC WIRING DIAGRAMS

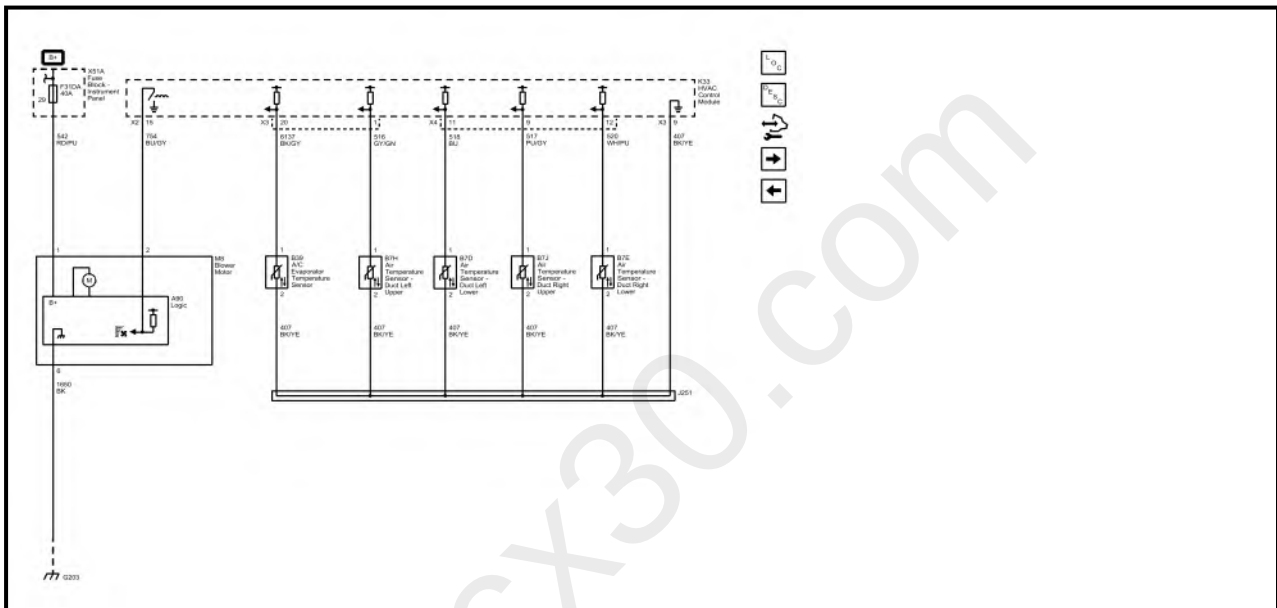
HVAC WIRING SCHEMATICS

Power, Ground, Serial Data and HVAC Controls

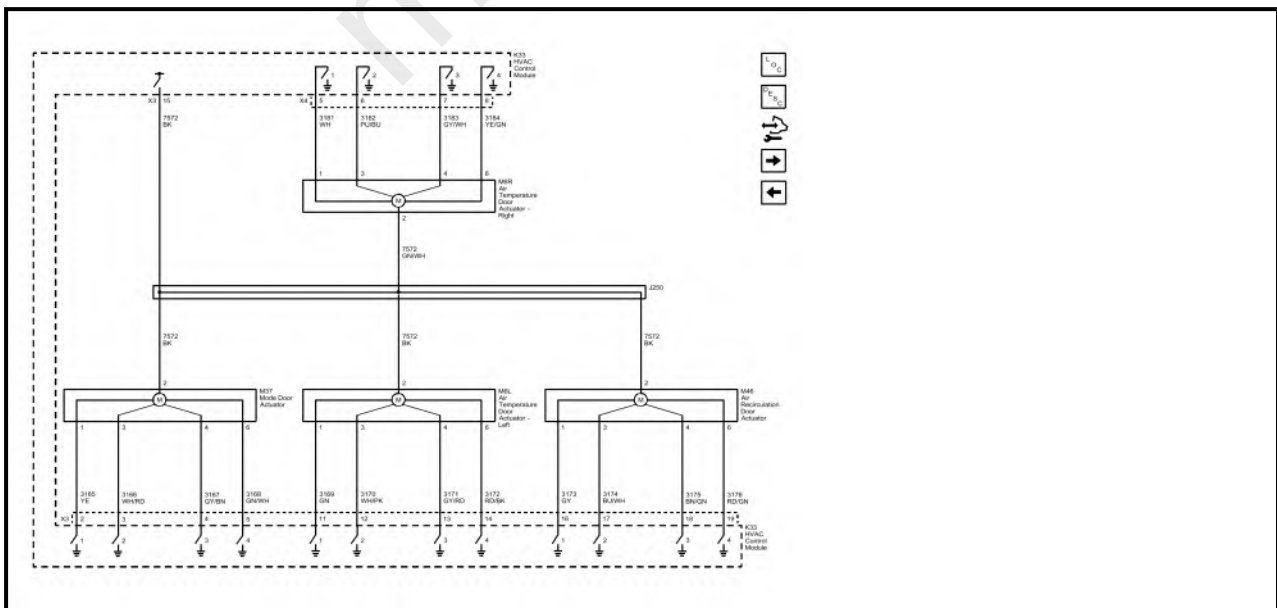




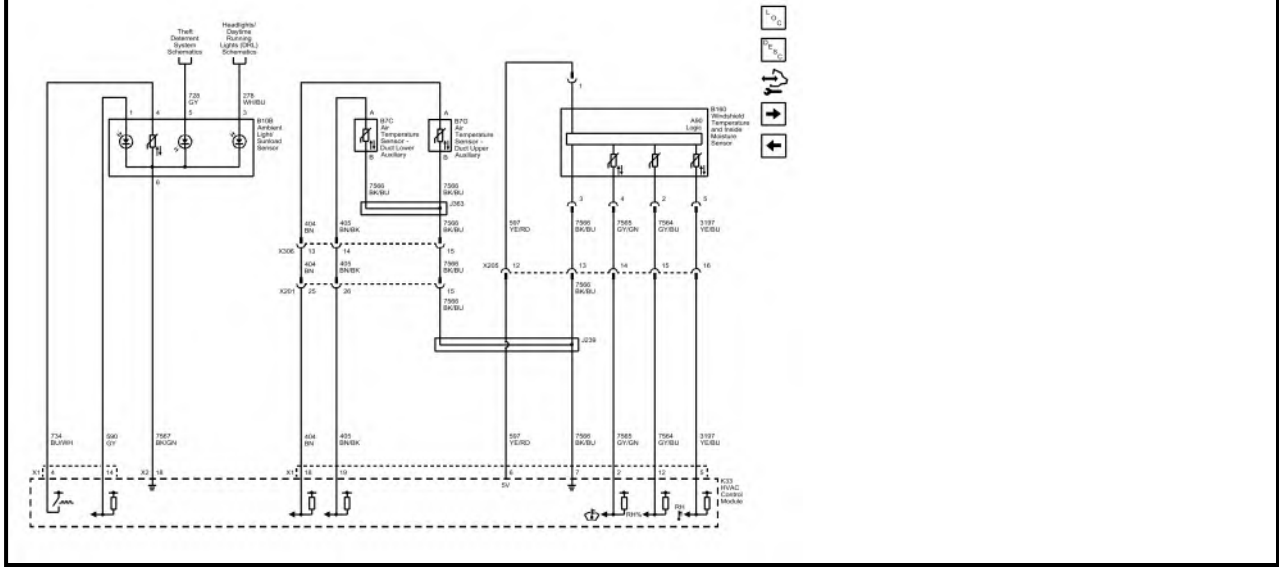
Blower Motor, Duct and Evaporator Temperature Sensors



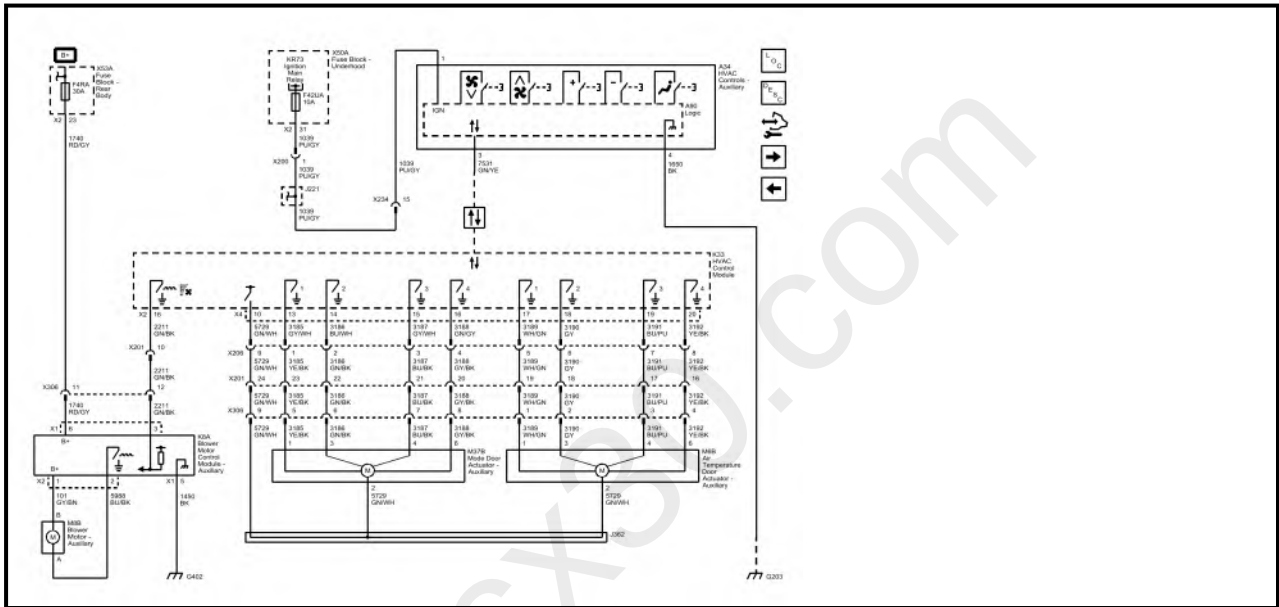
Mode and Temperature Control Actuators



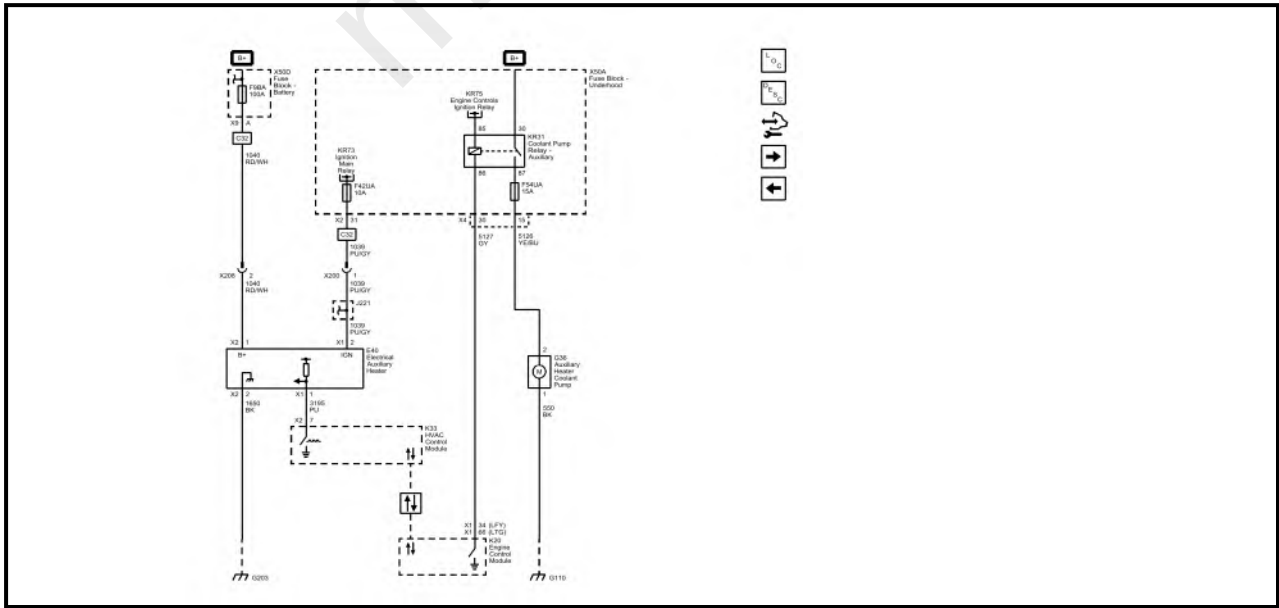
Sunload Sensor, Windshield Temperature Sensor, and Auxiliary Duct Air Temperature Sensors



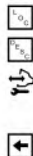
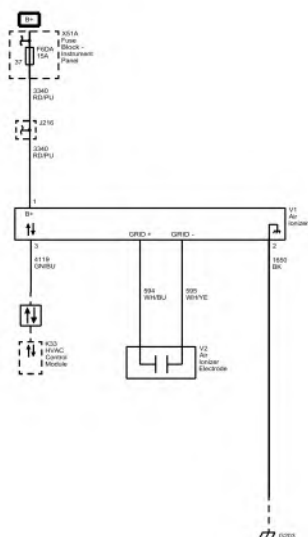
Rear HVAC



Auxiliary Heater Coolant Pump, and Electrical Auxiliary Heater (C32)



Air Ionizer (KEM)



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 (LFY) Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement (LTG)
B10B Ambient Light/Sunload Sensor	Sun Load Temperature and Ambient Light and Security Indicator Sensor Replacement
B160 Windshield Temperature and Inside Moisture Sensor	Inside Air Moisture and Windshield Temperature Sensor Replacement
B39 A/C Evaporator Temperature Sensor	Evaporator Air Temperature Sensor Replacement
B7C Air Temperature Sensor - Duct Lower Auxiliary	Auxiliary Heater and Air Conditioning Wiring Harness Replacement (C69)
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
B7G Air Temperature Sensor - Duct Upper Auxiliary	Auxiliary Heater and Air Conditioning Wiring Harness Replacement (C69)
B7H Air Temperature Sensor - Duct Left Upper	Duct Air Temperature Sensor Replacement - Upper Left Side
B7J Air Temperature Sensor Duct - Right Upper	Duct Air Temperature Sensor Replacement - Upper Right Side
E40 Electrical Auxiliary Heater	Air Heater Replacement (C32)
G1 A/C Compressor	Air Conditioning Compressor Replacement (LFY) Air Conditioning Compressor Replacement (LTG)
G36 Auxiliary Heater Coolant Pump	Heater Coolant Pump Replacement (LFY)

Component	Repair Instruction
K33 HVAC Control Module	Heater and Air Conditioning Remote Control Replacement
K8A Blower Motor Control Module - Auxiliary	Blower Motor Control Module Replacement (C69)
M37 Mode Door Actuator	Mode Valve Actuator Replacement (Auxiliary C69) Mode Valve Actuator Replacement (CJ2)
M37B Mode Door Actuator - Auxiliary	Mode Valve Actuator Replacement (Auxiliary C69) Mode Valve Actuator Replacement (CJ2)
M46 Air Recirculation Door Actuator	Air Inlet Valve Actuator Replacement
M6B Air Temperature Door Actuator - Auxiliary	Temperature Valve Actuator Replacement (Auxiliary C69)
M6L Air Temperature Door Actuator - Left	Temperature Valve Actuator Replacement - Left Side (CJ2)
M6R Air Temperature Door Actuator - Right	Temperature Valve Actuator Replacement - Right Side (CJ2)
M8 Blower Motor	Blower Motor Replacement
M8B Blower Motor - Auxiliary	Auxiliary Blower Motor Replacement (C69)
Q2 A/C Compressor Clutch	Air Conditioning Clutch Assembly Replacement
Q46 A/C Compressor Solenoid Valve	Air Conditioning Compressor Replacement (LFY) Air Conditioning Compressor Replacement (LTG)
V1 Air Ionizer	⌘

DTC B0163 OR B0183

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 Wiring 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

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.
 - **Go to next step: 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.
 - Go to next step: 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.
 - **Go to next step: 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.
 - **Go to next step: 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, B3583, OR B3933

Diagnostic Instructions

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

DTC Descriptors

DTC 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 B3583

Rear Lower Duct Air Temperature Sensor Circuit

DTC B3933

Air Conditioning Evaporator Temperature Sensor Circuit

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

Diagnostic Fault Information

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

Circuit/System Description

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

- Air temperature sensor - left upper
- Air temperature sensor - left lower
- Air temperature sensor - right upper
- Air temperature sensor - right lower
- Air temperature sensor - rear upper (with C69)
- Air temperature sensor - rear lower (with C69)
- A/C evaporator temperature sensor

This sensor operates using signal and low reference circuits. As the air temperature surrounding the sensor increases, the sensor resistance decreases. The sensor is capable of reading temperatures ranging from -40 to +80°C (-40 to +176°F), with a signal voltage between 0 - 5 V. If the HVAC control module detects a malfunctioning sensor the software uses a default air temperature value. The default action ensures that the HVAC system can adjust the inside air temperature near the desired temperature until the condition is corrected.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

The system operates using a default value.

Conditions for Clearing the DTC

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

Reference Information

Schematic Reference

HVAC Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Automatic HVAC Description and Operation

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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

1. Ignition ON.
2. Verify DTC B3933 is not set.

- **If DTC B3933 is set.**

Refer to Circuit/System Testing - B3933.

- **Go to next step: If DTC B3933 is not set.**

3. Refer to Circuit/System Testing - DTC B0173, B0178, B0509, B0514, B0519, or B3583.

Circuit/System Testing

B3933

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate temperature sensor. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal listed below and ground:
 - Front duct and A/C evaporator temperature sensors - terminal 2
 - Auxiliary duct temperature sensors (with C69) - terminal B
 - **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.
 - **Go to next step: If less than 10 Ω**
3. Test for 4.8 - 5.2 V between the signal circuit terminal listed below and ground.
 - Front duct and A/C evaporator temperature sensors - terminal 1
 - Auxiliary duct temperature sensors (with C69) - terminal A
 - **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.
 - Go to next step: 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.
 - **Go to next step: If between 4.8 - 5.2 V**
4. Test or replace the temperature sensor.
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**

Replace the K33 HVAC Control Module.

 - **Go to next step: If the DTC does not set**
7. All OK

B0173, B0178, B0509, B0514, B0519, or B3583

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate temperature sensor. It may take up to 10 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal listed below and ground:
 - Front duct and A/C evaporator temperature sensors - terminal 2
 - Auxiliary duct temperature sensors (with C69) - terminal B
 - **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.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Verify the appropriate scan tool Temperature Sensor parameter is less than -37 $^{\circ}\text{C}$ (-35 $^{\circ}\text{F}$)
 - **If greater than -37 $^{\circ}\text{C}$ (-35 $^{\circ}\text{F}$)**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminal listed below and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **Go to next step: If -37 $^{\circ}\text{C}$ (-35 $^{\circ}\text{F}$) or less**
5. Install a 3 A fused jumper wire between the appropriate signal circuit terminal and the low reference circuit terminal listed below:
 - Front duct and A/C evaporator temperature sensors - signal circuit terminal 1 and low reference terminal 2
 - Auxiliary duct temperature sensors (with C69) - signal circuit terminal A and low reference terminal B
6. Verify the scan tool temperature sensor parameter is greater than 77 $^{\circ}\text{C}$ (170 $^{\circ}\text{F}$).
 - **If less than 77 $^{\circ}\text{C}$ (170 $^{\circ}\text{F}$)**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: 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.
 - **Go to next step: If 77 $^{\circ}\text{C}$ (170 $^{\circ}\text{F}$) or greater**
7. Test or replace the 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 B018A, B048C, B048F, OR B1395

Diagnostic Instructions

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

DTC Descriptors

DTC B018A

Windshield Temperature Sensor Circuit

DTC B048C

Humidity Sensor Humidity Circuit

DTC B048F

Humidity Sensor Temperature Circuit

DTC B1395

Control Module Voltage Reference Output Circuit

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

Diagnostic Fault Information

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

Circuit/System Description

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

This sensor assembly provides information about:

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

B018A 02, B048C 02, or B048F 02

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

B018A 05, B048C 05, B048F 05 or B1395 07

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

B1395 03

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

B1395 07

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

Reference Information

Schematic Reference

HVAC Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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Electrical Information Reference

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- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

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

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

2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.

- **If 10 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.
 - **Go to next step: If less than 10 Ω**
- 3. Ignition ON.
- 4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 1 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: 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 K33 HVAC Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
- 5. Verify the scan tool parameters listed below are less than -37 $^{\circ}$ C (-35 $^{\circ}$ F).
 - Windshield Temperature
 - Passenger Compartment Humidity Sensor Temperature
 - **If -37 $^{\circ}$ C (-35 $^{\circ}$ F) or greater**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module.
 2. Test for infinite resistance between the signal circuit terminals listed below and ground:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **Go to next step: If less than -37 $^{\circ}$ C (-35 $^{\circ}$ F)**
- 6. Test for 4.8 - 5.2 V between the signal circuit terminals listed below and ground.
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 - **If 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.
 - Go to next step: 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 for 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
7. Install a 3 A fused jumper wire between the low reference circuit terminal 3 and each signal circuit terminal listed below:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 8. Verify the appropriate scan tool parameter listed below is greater than 114°C (238°F).
 - Windshield Temperature
 - Passenger Compartment Humidity Sensor Temperature
 - **If 114°C (238°F) or less**
 1. Ignition OFF, remove the jumper wire and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminals listed below and ground:
 - Windshield temperature sensor signal terminal 4
 - Passenger compartment humidity sensor temperature signal terminal 5
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: If less than 1 V
 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.
 - **Go to next step: If greater than 114°C (238°F)**
 9. Remove the jumper wire.
 10. Verify the scan tool Passenger Compartment Humidity parameter is greater than 95%.
 - **If 95% or less**
 1. Ignition OFF, disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
 2. Test for infinite resistance between the signal circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K33 HVAC Control Module.
 - **Go to next step: If greater than 95%**
 11. Test for 4.8 - 5.2 V between the signal circuit terminal 2 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.
 - Go to next step: 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 for 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K33 HVAC Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K33 HVAC Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
 - 12. Install a 3 A fused jumper wire between the passenger compartment humidity signal circuit terminal 2 and the low reference circuit terminal 3.
 - 13. Verify the scan tool Passenger Compartment Humidity Sensor parameter is less than 5%.

- **If 5% or greater**

1. Ignition OFF, remove the jumper wire and disconnect the harness connectors at the K33 HVAC Control Module, ignition ON.
2. Test for less than 1 V between the signal circuit terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: If less than 1 V
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.
 - **Go to next step: If less than 5%**
14. Test or replace the B160 Windshield Temperature and Inside Moisture Sensor.

Repair Instructions

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

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

DTC B0193

Diagnostic Instructions

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

DTC Descriptors

DTC B0193 01

Front Blower Motor Speed Circuit Short to Battery

DTC B0193 06

Front Blower Motor Speed Circuit Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B0193 06	B0193 06	-	-
Control	B0193 06	B0193 06	B0193 01	1
Ground	-	B0193 01	-	-

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 Wiring 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 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.
 - **Go to next step: 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.

- **Go to next step: 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

- **Go to next step: 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

- **Go to next step: If infinite resistance**

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

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

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.

- **Go to next step: 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.

- **Go to next step: 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

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 01

Rear Blower Motor Speed Circuit Short to Battery

DTC B0208 06

Rear Blower Motor Speed Circuit Low Voltage/Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+	B0208 06, 1	B0208 06, 1	-	-
Control	B0208 06, 1	B0208 06, 1	B0208 01, 1	-
Blower Motor Supply Voltage	1	1	1	-
Blower Motor Return	2	1	1	-
Ground	-	1	-	-
1. Rear blower motor inoperative. 2. Rear blower motor operates on high speed at all times				

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 5 circuits: a B+ input, ground, a control signal from the HVAC module, a B+ output and a low side pulse width modulation (PWM) control to the auxiliary blower motor. 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 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 control circuit to the auxiliary blower motor control module is always high.

B0208 06

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

Action Taken When the DTC Sets

The auxiliary 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.

Reference Information

Schematic Reference

HVAC Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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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 2 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. 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.
 - **Go to next step: 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 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - Go to next step: 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 B+ 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.
- **Go to next step: If the test lamp illuminates**
5. Remove the test lamp.
6. Ignition ON. Test for less than 1 V between the control circuit terminal 3 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
 - **Go to next step: If less than 1 V**
7. Ignition OFF. It may take up to 2 min for all vehicle systems to power down.
8. Test for infinite resistance between the control circuit terminal 3 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
 - **Go to next step: If infinite resistance**
9. Ignition OFF, connect the X1 harness connector at the K8A Blower Motor Control Module - Auxiliary. Ignition ON.
10. While backprobing terminal 31 X1 at the K8A Blower Motor Control Module - Auxiliary, test for greater than 1 V between control circuit and ground.
 - **If less than 1 V**

Replace the K8A Blower Motor Control Module - Auxiliary.
 - **Go to next step: If 1 V or greater**
11. Verify the voltage decreases and increases while using the controls to change the rear 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.
 - **Go to next step: If the voltage decreases and increases as the blower speed selection is changed**
12. Ignition OFF, disconnect the harness connector at the M8B Blower Motor - Auxiliary, ignition ON and blower ON.
13. Verify a test lamp illuminates between the B+ 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.

• **Go to next step: If the test lamp illuminates**

14. Ignition OFF, connect the harness connector at the M8B Blower Motor - Auxiliary. Ignition ON.

15. While backprobing terminal 2 X2 at the K8A Blower Motor Control Module - Auxiliary, test for greater than 1 V between control circuit and ground.

• **If less than 1 V**

1. Ignition OFF, disconnect the X2 harness connector at the K8A Blower Motor Control Module - Auxiliary and the harness connector at the M8B Blower Motor - 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.
- Go to next step: 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 M8B Blower Motor - Auxiliary.

• **Go to next step: If 1 V or greater**

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

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

Replace the K8A Blower Motor Control Module - Auxiliary.

• **Go to next step: If the voltage decreases and increases as the blower speed selection is changed**

17. 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, B022A, B0233, B023A, B0408, B0418, B0428, OR B3531

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 01

Recirculate Position Command 1 Circuit

DTC B0233 01

Air Flow Control Circuit - Mode

DTC B023A 02

HVAC Actuators Supply Voltage

DTC B0408 01

Front Temperature Control Circuit

DTC B0418 01

Right Temperature Control Circuit

DTC B0428 01

Rear Temperature Control Circuit

DTC B3531 01

Rear Air Flow 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
Stepper Motors 12 V Reference	B023A 02, B0223 06, B0233 06, B0408 06, B0418 06, B0428 06, B3531 06 *	B0223 06, B0233 06, B0408 06, B0418 06, B0428 06, B3531 06 *	-	-
Recirculation Actuator Control 1	B0223 06	B0223 06	B0223 01	1
Recirculation Actuator Control 2	B0223 06	B0223 06	B0223 01	1
Recirculation Actuator Control 3	B0223 06	B0223 06	B0223 01	1
Recirculation Actuator Control 4	B0223 06	B0223 06	B0223 01	1
Air Temperature Actuator Control 1	B0408 06	B0408 06	B0408 01	1
Air Temperature Actuator Control 2	B0408 06	B0408 06	B0408 01	1
Air Temperature Actuator Control 3	B0408 06	B0408 06	B0408 01	1
Air Temperature Actuator Control 4	B0408 06	B0408 06	B0408 01	1
Passenger Air Temperature Actuator Control 1	B0418 06	B0418 06	B0418 01	1
Passenger Air Temperature Actuator Control 2	B0418 06	B0418 06	B0418 01	1
Passenger Air Temperature Actuator Control 3	B0418 06	B0418 06	B0418 01	1
Passenger Air Temperature Actuator Control 4	B0418 06	B0418 06	B0418 01	1
Mode Actuator Control 1	B0233 06	B0233 06	B0233 01	1
Mode Actuator Control 2	B0233 06	B0233 06	B0233 01	1
Mode Actuator Control 3	B0233 06	B0233 06	B0233 01	1
Mode Actuator Control 4	B0233 06	B0233 06	B0233 01	1
Rear Temperature Actuator Control 1 (C69)	B0428 06	B0428 06	B0428 01	1
Rear Temperature Actuator Control 2 (C69)	B0428 06	B0428 06	B0428 01	1
Rear Temperature Actuator Control 3 (C69)	B0428 06	B0428 06	B0428 01	1
Rear Temperature Actuator Control 4 (C69)	B0428 06	B0428 06	B0428 01	1
Rear Air Flow Actuator Control 1 (C69)	B3531 06	B3531 06	B3531 01	1

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Rear Air Flow Actuator Control 2 (C69)	B3531 06	B3531 06	B3531 01	1
Rear Air Flow Actuator Control 3 (C69)	B3531 06	B3531 06	B3531 01	1
Rear Air Flow Actuator Control 4 (C69)	B3531 06	B3531 06	B3531 01	1
* DTCs for auxiliary actuators only set when equipped with CJ4 1. HVAC Malfunction				

Circuit/System Description

Stepper motors are used for temperature regulation, air distribution control and recirculation door control.

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 coils with a pulsed ground signal. The stepper motors move the appropriate doors into the calculated positions, in order to reach the desired positions.

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, B0408 01, B0418 01, B0428 01 or B3531 01

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

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

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

B0223 04, B0223 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 the voltage is low when the motor starts moving. Faults are not detected when motor is already running or 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, B0233, B0408, B0418, B0428 or B3531

- The affected output 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 Wiring 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. 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, B0408, B0418, B0428 or B3531.
 - **Go to next step: 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.
 - M37 Mode Door Actuator
 - M46 Air Recirculation Door Actuator
 - M6L Air Temperature Door Actuator - Left
 - M6R Air Temperature Door Actuator - Right
 - M37B Mode Door Actuator - Auxiliary (C69)
 - M6B Air Temperature Door Actuator - Auxiliary (C69)
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 terminals listed below and ground:

- K33 HVAC Control Module terminal 15 X3
- K33 HVAC Control Module terminal 10 X4 (C69)
- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **Go to next step: If infinite resistance**

4. Ignition ON.

5. Test for less than 1 V between the K33 HVAC Control Module 12 V reference circuit terminals listed below and ground:

- K33 HVAC Control Module terminal 15 X3
- K33 HVAC Control Module terminal 10 X4 (C69)
- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: 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.

- **Go to next step: 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.

- M37 Mode Door Actuator
- M46 Air Recirculation Door Actuator
- M6L Air Temperature Door Actuator - Left
- M6R Air Temperature Door Actuator - Right
- M37B Mode Door Actuator - Auxiliary (C69)
- M6B Air Temperature Door Actuator - Auxiliary (C69)
- **If the DTC sets**

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

- **Go to next step: If the DTC does not set**

10. All OK.

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

1. Ignition OFF, disconnect the harness connector at the appropriate door actuator, It may take up to 2 min for all vehicle systems to power down. Ignition ON.

NOTE: **If more than one actuator is affected, test the B+ circuit at each actuator.**

2. Verify a test lamp illuminates between the 12 V reference circuit terminal 2 and ground.

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

1. Ignition OFF, disconnect the harness connector at the K33 HVAC control module.

2. Test for infinite resistance between the 12 V reference circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- Go to next step: If infinite resistance

3. Test for less than 2 Ω in the 12 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 K33 HVAC control module.
- **Go to next step: If the test lamp illuminates**
3. Command the appropriate actuator with a scan tool.
4. Verify a test lamp is flashing on and off when connected between the 12 V reference circuit terminal 2 and each control circuit terminal listed below:
 - Control Circuit - terminal 1
 - Control Circuit - terminal 3
 - Control Circuit - terminal 4
 - Control Circuit - terminal 6
 - **If the test lamp is always OFF**
 1. Ignition OFF, 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.
 - Go to next step: 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 is always ON**
 1. Ignition OFF, 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.
 - **Go to next step: If the test lamp is flashing On and Off**
 - 5. Test or replace the 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

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

Schematic Reference

HVAC Wiring Schematics

Connector End View Reference

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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.
 - **Go to next step: If DTC B040A is not set**
3. All OK.

Repair Instructions

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

DTC B1020

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

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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.
 - **Go to next step: 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

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

DTC B269C

Heater Coolant Pump Control Circuit Low Voltage

DTC B269D

Heater Coolant Pump Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Coil B+	1	1	-	-
Relay Switch Ignition	B269C	B269C	-	-
Relay Coil Control	B269C, 2	B269A	B269D	-
Relay Switch Control	1	1	2	-
Component Ground	-	1	-	-

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

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Scan Tool Reference

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

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the KR31 Coolant Pump Relay-Auxiliary. It may take up to 2 min for all vehicle systems to power down.
2. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.

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

Replace the X50A Fuse Block- Underhood.

- **Go to next step: If the test lamp illuminates**

3. Ignition ON.

4. Verify a test lamp illuminates between the ignition circuit terminal 85 and ground.

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

Refer to [Power Mode Mismatch](#) .

- **Go to next step: If the test lamp illuminates**

5. Connect a test lamp between the ignition circuit terminal 85 and the control circuit terminal 86.

6. Verify the test lamp turns ON and OFF when commanding the G36 Auxiliary Heater 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 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.
- Go to next step: 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 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.

- **Go to next step: If the test lamp turns ON and OFF**

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

- **If the test lamp illuminates**

Repair the short to voltage on the circuit.

- **Go to next step: If the test lamp does not illuminate**

8. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the G36 Auxiliary Heater Coolant Pump. It may take up to 2 min for all vehicle systems to power down.

9. 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.

- **Go to next step: If less than 10 Ω**

10. Connect the harness connector at the G36 Auxiliary Heater Coolant Pump.

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

12. Verify the G36 Auxiliary Heater Coolant Pump is activated.

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

1. Ignition OFF, remove the jumper wire. Disconnect the harness connector at the G36 Auxiliary Heater Coolant Pump.
2. Test for infinite resistance between the control circuit 2 and ground.
 - If less than Infinite resistance, repair the short to ground on the circuit.
 - Go to next step: 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 , test or replace the G36 Auxiliary Heater Coolant Pump.
 - **Go to next step: If the G36 Auxiliary Heater Coolant Pump activates**
13. Test or replace the KR31 Coolant Pump Relay-Auxiliary.

Component Testing

Relay Test

1. Ignition OFF, disconnect the KR31 Coolant Pump Relay-Auxiliary.
2. Test for 60 - 180 Ω between terminals 85 and 86.
 - **If less than 60 Ω or greater than 180 Ω**

Replace the KR31 Coolant Pump Relay-Auxiliary.

 - **Go to next step: 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 KR31 Coolant Pump Relay-Auxiliary.

 - **Go to next step: If infinite resistance**
4. Install a 10 A fused jumper wire between relay terminal 86 and 12 V. Install a jumper wire between relay terminal 85 and ground.
5. Test for less than 2 Ω between terminals 30 and 87.
 - **If 2 Ω or greater**

Replace the KR31 Coolant Pump Relay-Auxiliary.

 - **Go to next step: 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 B393B

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

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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 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.
 - Go to next step: 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.
 - Go to next step: 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.
 - Go to next step: If less than 2 Ω , replace the K33 HVAC Control Module.
 - **Go to next step: 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.
 - **Go to next step: 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.

- Go to next step: 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

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.

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Ignition ON
2. Verify the scan tool engine control module A/C High Side Pressure Sensor parameter is between 6.8 kPa (1 psi) and 2950 kPa (428 psi).
 - **If not between 6.8 kPa (1 psi) and 2950 kPa (428 psi)**
Refer to Circuit/System Testing
 - **Go to next step: 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.
- **Go to next step: 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.
 - Go to next step: 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.
 - **Go to next step: If between 4.8 - 5.2 V**
5. Verify the scan tool A/C High Side Pressure Sensor parameter is less than .25 V.
 - **If .25 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit terminal 3 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: 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.
 - Go to next step: 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.
 - **Go to next step: If greater than 4.8 V**
8. Test or replace the B1 A/C Refrigerant Pressure Sensor.

Repair Instructions

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

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

DTC P0645, P0646, OR P0647

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.

The A/C compressor is inoperative.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present.

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Ignition OFF, disconnect the KR29 A/C Compressor Clutch Relay, ignition ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 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.
 - Go to next step: 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 2 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.
- **Go to next step: If the test lamp illuminates**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 85 and ground.

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

Refer to [Power Mode Mismatch](#) .

- **Go to next step: If the test lamp illuminates**

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

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

1. Ignition OFF, remove the test lamp and disconnect the harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - Go to next step: 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 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.

- **Go to next step: If the test lamp turns ON and OFF**

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

- **If the test lamp illuminates**

Repair the short to voltage on the circuit.

- **Go to next step: If the test lamp does not illuminate**

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

- **Go to next step: If less than 10 Ω**

10. Connect the harness connector at the Q2 A/C Compressor Clutch.
11. Ignition ON, connect a 10 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.
12. Verify the Q2 A/C Compressor Clutch is engaged.

- **If the Q2 A/C Compressor Clutch does not engage**

1. Ignition OFF, disconnect the harness connector at the Q2 A/C Compressor Clutch.
2. Test for less than 2 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.

- **Go to next step: If the Q2 A/C Compressor Clutch is engaged**

13. Test or replace the KR29 A/C Compressor Clutch Relay.

Component Testing

1. Ignition OFF, disconnect the KR29 A/C Compressor Clutch Relay.
2. Test for 60 - 180 Ω between terminals 85 and 86.

- **If not between 60 - 180 Ω**

Replace the KR29 A/C Compressor Clutch Relay.

- **Go to next step: 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.

- **Go to next step: If infinite resistance**

4. Install a 15 A fused jumper wire between terminal 86 and 12 V. Install a jumper wire between terminal 85 and ground.

5. Test for less than 2 Ω between terminals 30 and 87.

- **If 2 Ω or greater**

Replace the KR29 A/C Compressor Clutch Relay.

- **Go to next step: 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 engine control module replacement, programming and setup

SYMPTOMS - HVAC SYSTEMS - AUTOMATIC

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

1. Perform the [Diagnostic System Check - Vehicle](#) before using the HVAC System Malfunction procedure in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to [Automatic HVAC Description and Operation](#).

Visual/Physical Inspection

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

- Inspect for aftermarket devices which may affect the operation of the HVAC System. Refer to [Checking Aftermarket Accessories](#).
- Inspect the easily accessible or visible system components for obvious damage or conditions which may cause the symptom.

- Verify the A/C compressor turns freely and is not seized.
- Verify that the customer is using the correct key to enable personalization and is not inadvertently activating auxiliary HVAC controls.
- The A/C compressor will not operate in cold outside air temperatures.
- The following conditions may cause window fogging:
 - Wet carpet or mats
 - High humidity
 - Interior water leak
 - Blocked A/C evaporator drain tube
 - Maximum passenger capacity
 - Blocked body pressure relief valves
- Inspect the air distribution system for causes of reduced air flow:
 - Obstructed or dirty passenger compartment air filter, if equipped
 - Blocked or damaged air inlet or outlet vents

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to [Testing for Intermittent Conditions and Poor Connections](#) .

Symptom List

Refer to [HVAC System Malfunction](#) in order to diagnose the symptom.

HVAC SYSTEM MALFUNCTION

Diagnostic Instructions

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

Diagnostic Aids

Check the following mechanical fault sources:

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

Reference Information

Schematic Reference

[HVAC Wiring 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](#)

[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.
 - **Go to next step: 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.
 - **Go to next step: If all parameters change**
4. Verify the front blower motor operates properly with the blower motor switch in each speed position.
 - **If the front blower motor does not operate in each speed position**
Refer to [DTC B0193](#).
 - **Go to next step: If the front 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](#).
 - **Go to next step: If the rear blower motor operates properly in each speed position**
6. Verify every HVAC door moves correctly when pressing the appropriate switch.
 - **If any HVAC door does not move correctly**
Refer to [DTC B0223, B022A, B0233, B023A, B0408, B0418, B0428, or B3531](#).
 - **Go to next step: If all HVAC doors move correctly**
7. Install the appropriate ACR Air Conditioning Recharge Service Center. Ignition ON.
8. Verify the high side pressure reading on the Air Conditioning Service Center is within 10% of the scan tool A/C High Side Pressure Sensor parameter.
 - **If the reading is not within 10%**
Refer to [DTC P0532 or P0533](#).
 - **Go to next step: If the reading is within 10%**
9. Verify the A/C High Side Pressure Sensor parameter is between 269-2929 kPa (39-425 PSI).
 - **If the reading is not between 269-2929 kPa (39-425 PSI)**
Refer to [Air Conditioning \(A/C\) System Performance Test](#).
 - **Go to next step: If the reading is between 269-2929 kPa (39-425 PSI)**
10. Verify the scan tool parameters listed below are within 10% of ambient temperature.
 - Lower Left Duct Air Temperature Sensor

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

Refer to [DTC B0173, B0178, B0509, B0514, B0519, B3583, or B3933](#).

- **Go to next step: If within 10% of ambient temperature**

11. Verify the 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](#).

- **Go to next step: If the Sunload parameter changes**

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

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

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

- **Go to next step: If less than a 3Â°C (5Â°F) difference**

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

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

Refer to [DTC B018A, B048C, B048F, or B1395](#).

- **Go to next step: If within 10% of actual conditions**

14. Engine ON, A/C system ON

15. 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](#).

- **Go to next step: If the air is cool**

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](#).

- **Go to next step: 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

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 124Â°C (255Â°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 3Â°C (38Â°F).
- ECM does not detect excessive torque load.
- ECM does not detect insufficient idle quality.
- The ambient temperature sensor senses above 1Â°C (34Â°F).
- Blower motor is ON.

Reference Information

Schematic Reference

[HVAC Wiring 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: Refer to [HVAC System Malfunction](#) before performing this procedure.

1. Ignition ON, press and release the A/C Switch.
2. Verify the HVAC control module scan tool A/C Switch parameter changes between Active and Inactive.
 - **If the parameter does not change**
Replace the A26 HVAC Controls.
 - **Go to next step: 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.
 - **Go to next step: 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](#)
 - **Go to next step: 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](#)
 - **Go to next step: If the parameter does change**
9. All OK.

Repair Instructions

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

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

AFTERBLOW ENABLING

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.

Use the following procedure to enable the afterblow feature:

1. Connect the Scan Tool.
2. Ignition ON/ Vehicle in Service Mode
3. Select Module Diagnostics.
4. Select HVAC Control Module.
5. Select Configuration/Reset Functions.
6. Select HVAC Afterblow Configuration.

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

- The vehicle must be turned OFF.
- The outside air temperature must be at least 11Â°C (52Â°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)

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.

1. Open the harness by removing any tape:

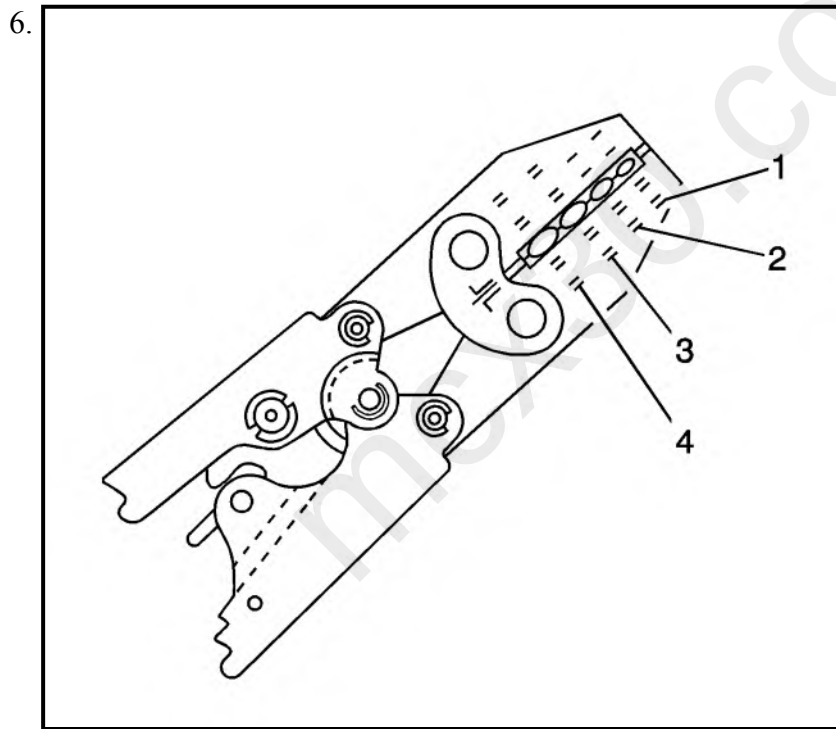
- Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
- Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
- Do not use the crimp and DuraSeal splice sleeve to form a splice with more 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.

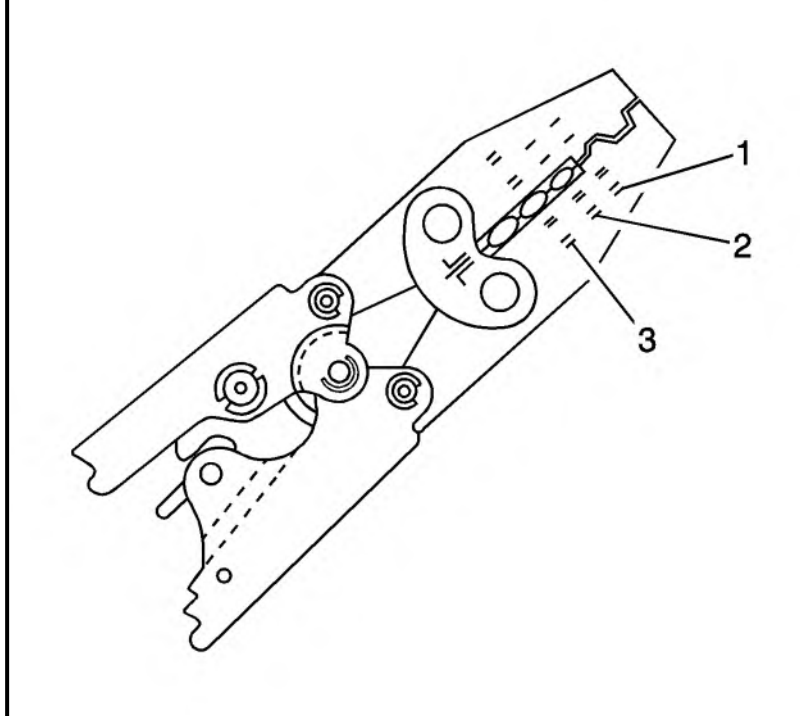
3. Strip the insulation:

- 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.



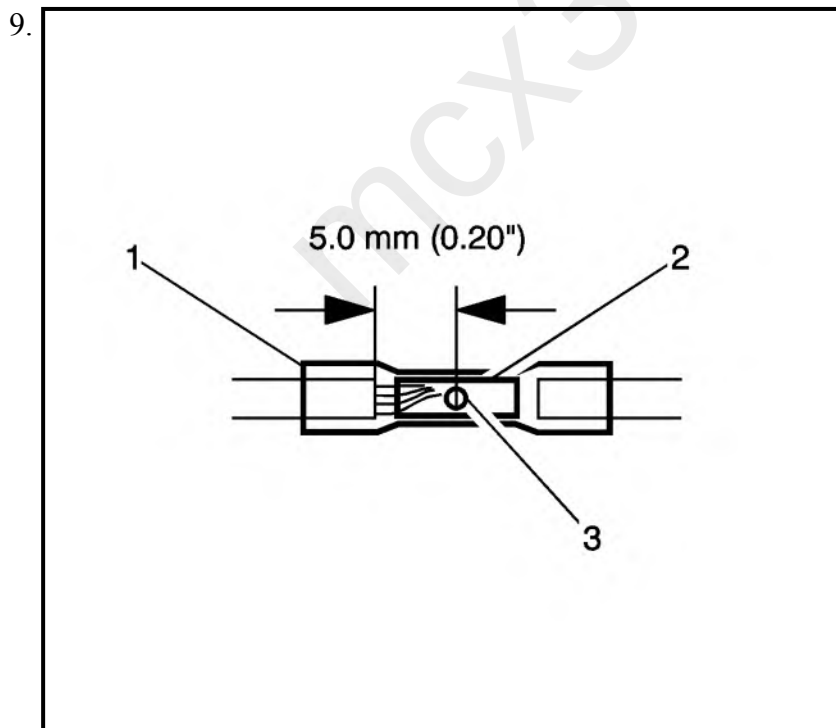
The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest 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.



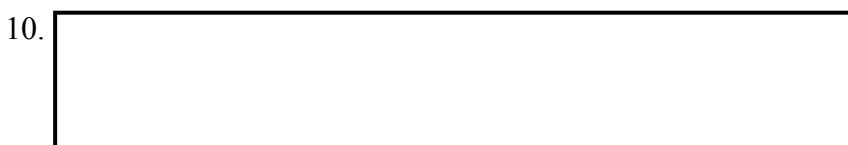


The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests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

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).



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.



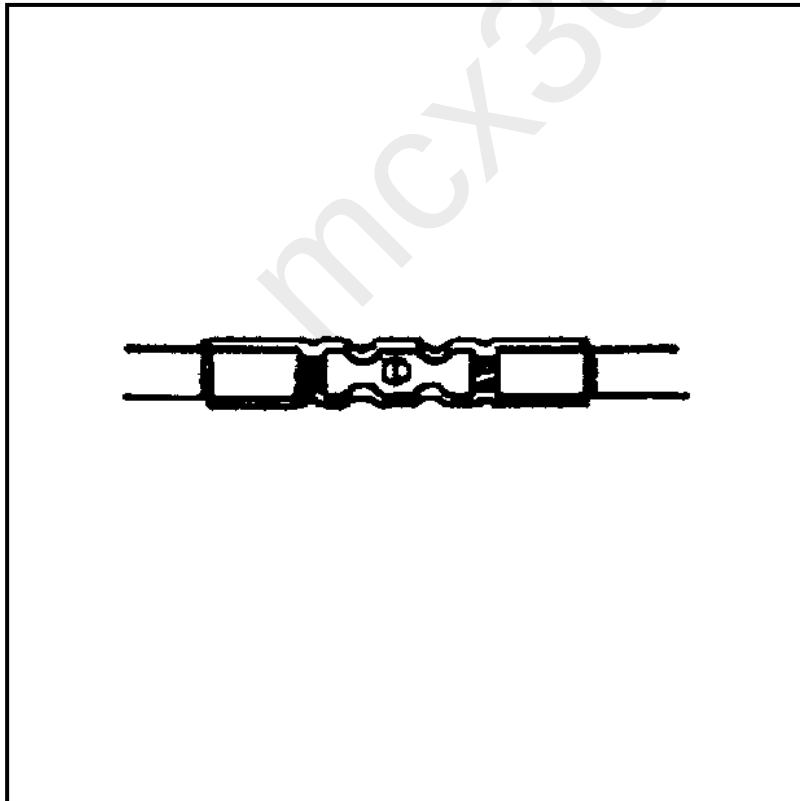


Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to **Folded-Over Wire Repair** for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

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.

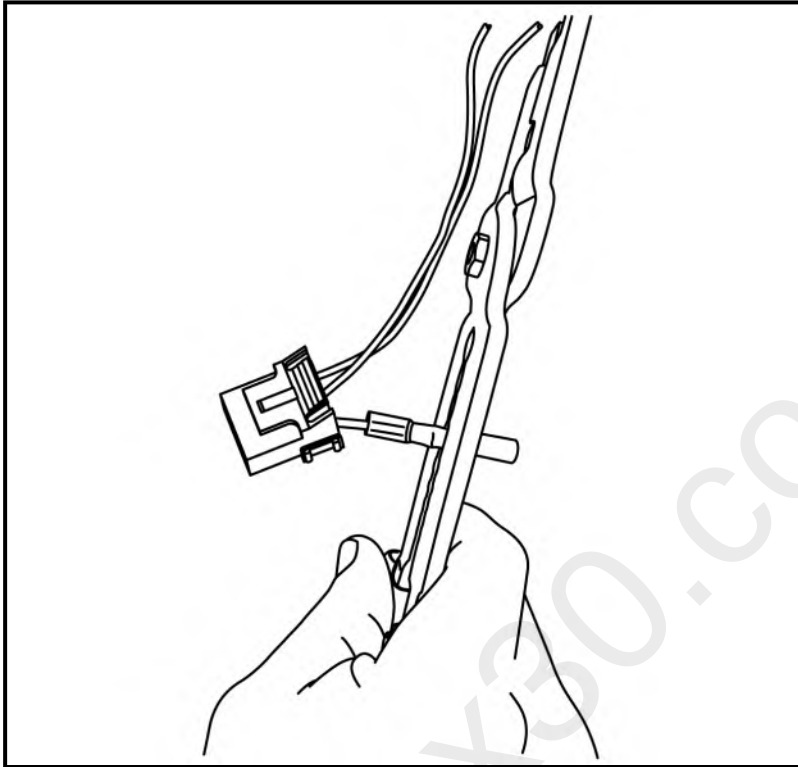


Using the heat torch, apply heat to the crimped area of the barrel.

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.

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.

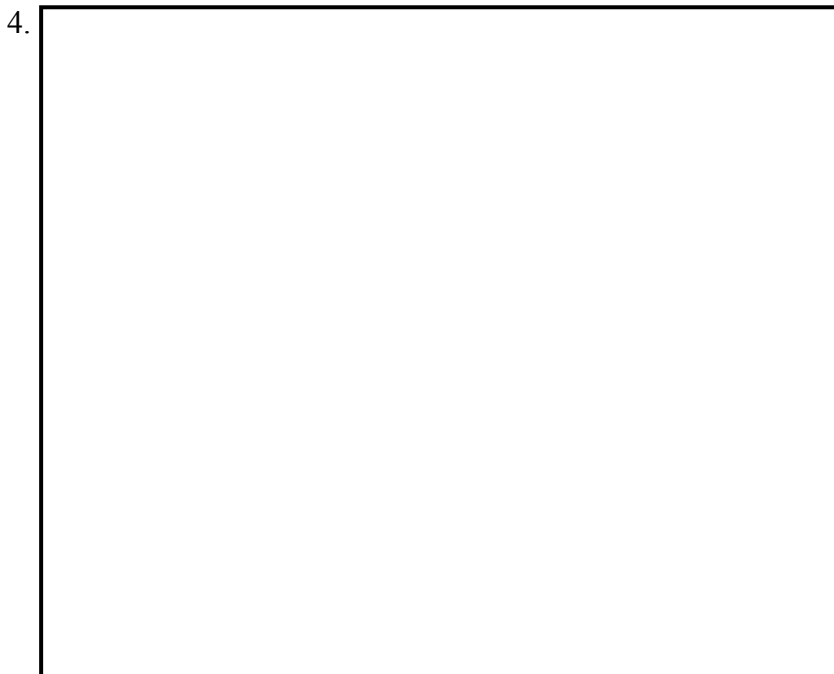
1. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop. Refer to [Folded-Over Wire Repair](#) for splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes) and for splicing wires of different gauges.

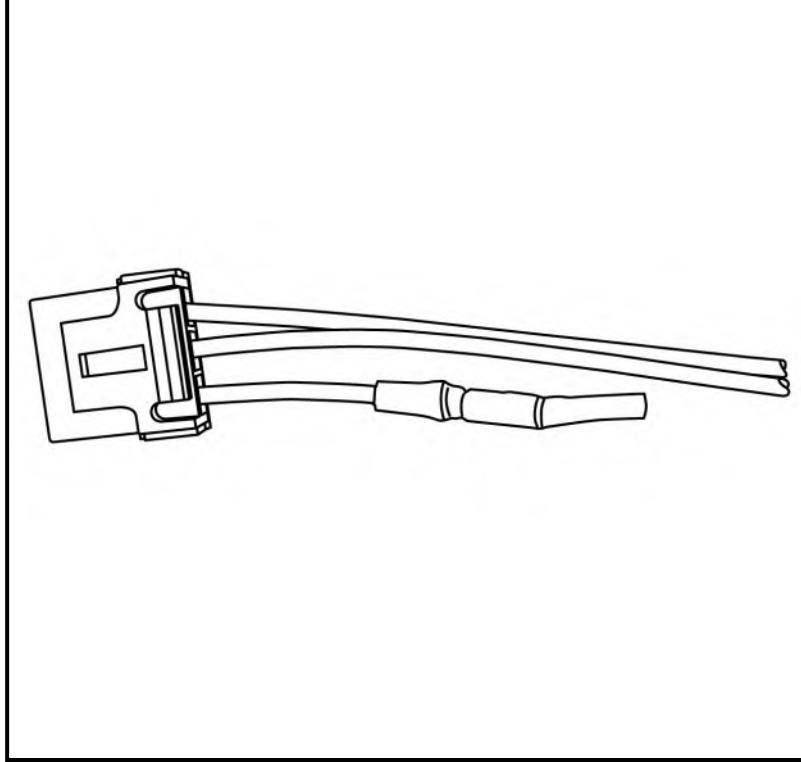


2. Tightly close the handles of the crimp tool until the crimper handles open when released.

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.

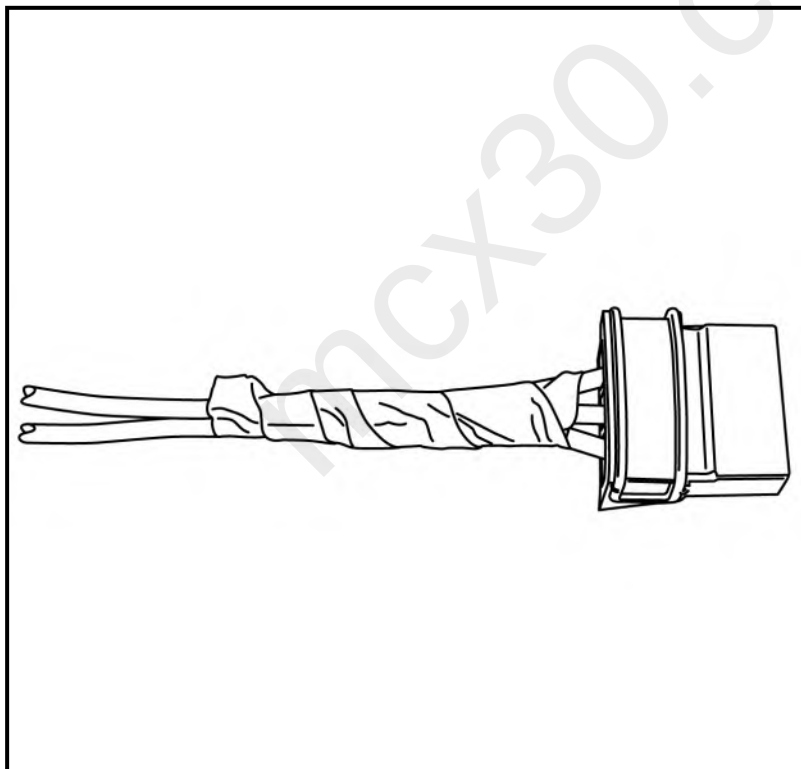




Start in the middle and gradually move the heat barrel to the open ends of the tubing:

- 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.

5.



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

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 Wiring 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 Wiring 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.

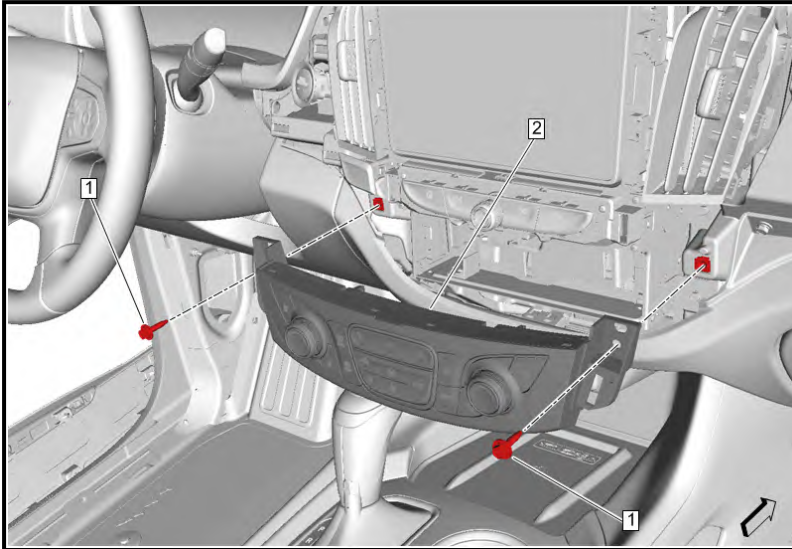
Incorrect Control Module

- 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.

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.**

- 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.

HEATER AND AIR CONDITIONING USER INTERFACE CONTROL REPLACEMENT

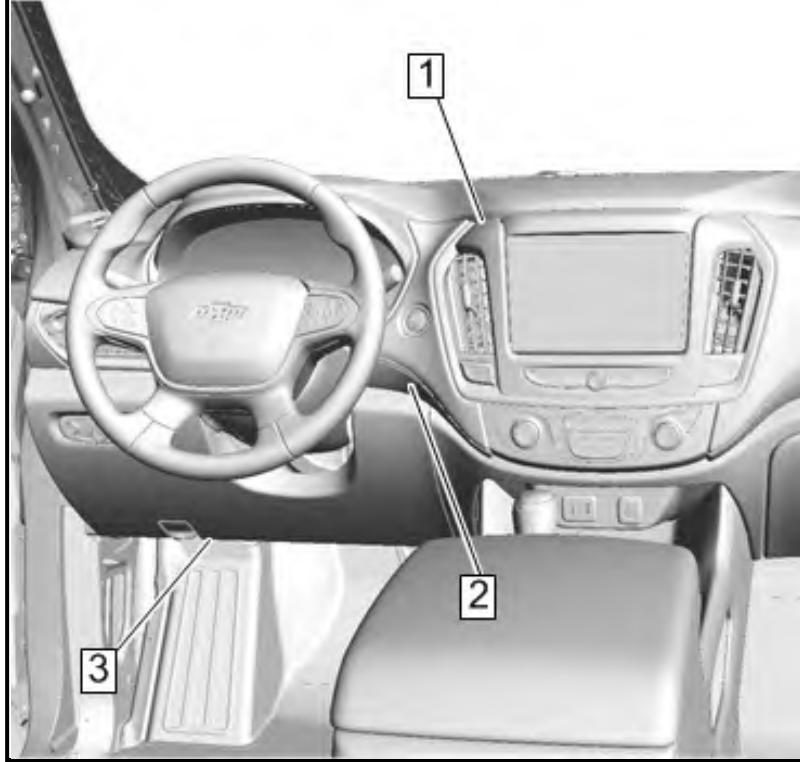


Callout	Component Name
Preliminary Procedures 1. Instrument Panel Trim Pad Replacement - Left Side 2. Instrument Panel Trim Pad Replacement - Right Side 3. Instrument Panel Radio Front Trim Plate Replacement (RPO IOA), Instrument Panel Radio Front Trim Plate Replacement (RPO IO5, IO6)	
1	Heater and Air Conditioning User Interface Control Bolt [2x] CAUTION: Refer to Fastener Caution . Tighten 2.5 N.m (22 lb in)
2	Heater and Air Conditioning User Interface Control Procedure Disconnect the electrical connector.

HEATER AND AIR CONDITIONING REMOTE CONTROL REPLACEMENT

Removal Procedure

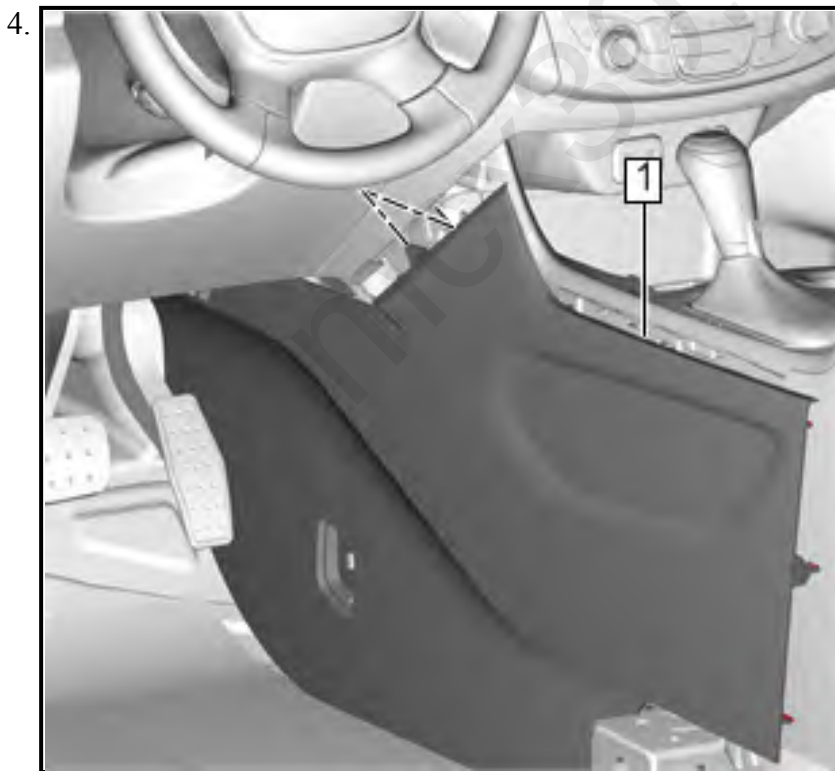
1.



Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

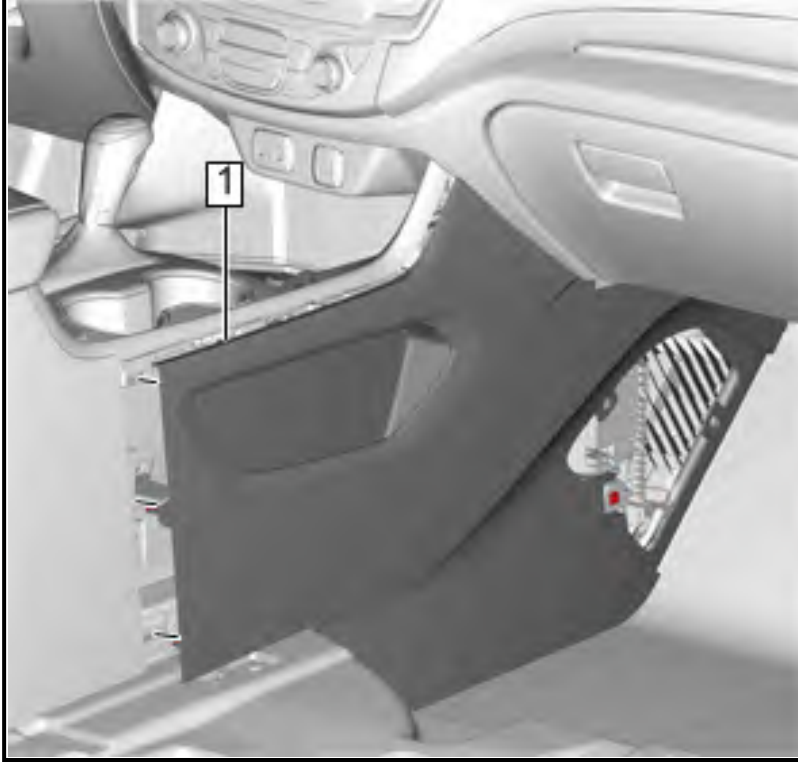
2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

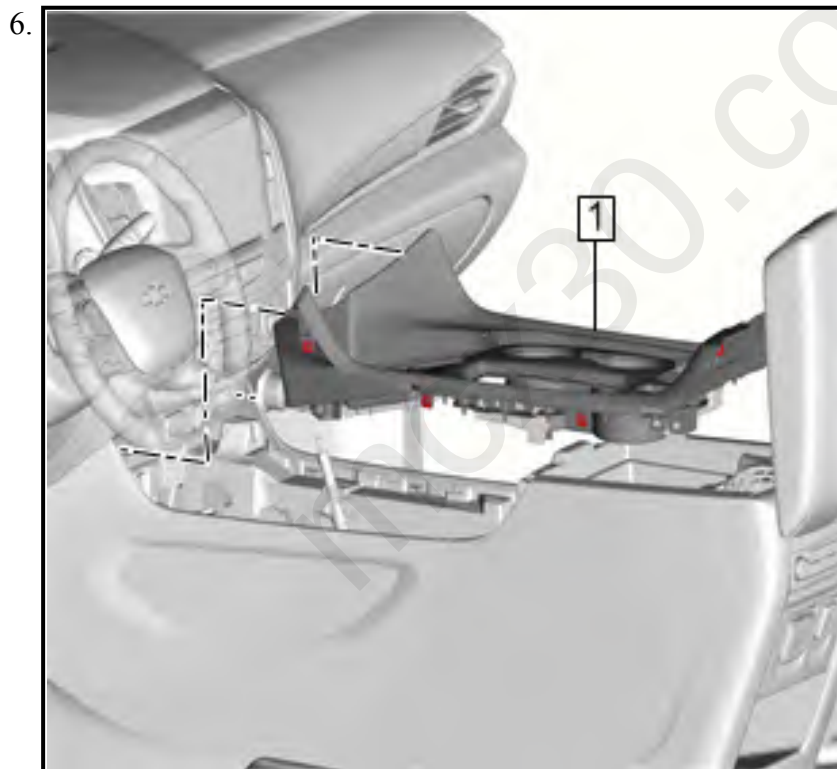


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)



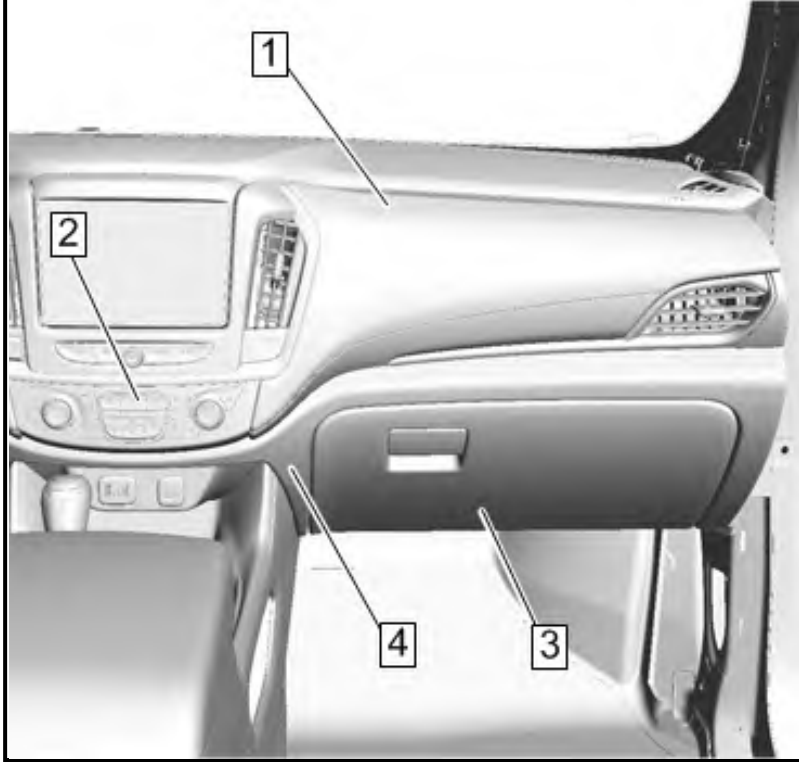


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)





Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

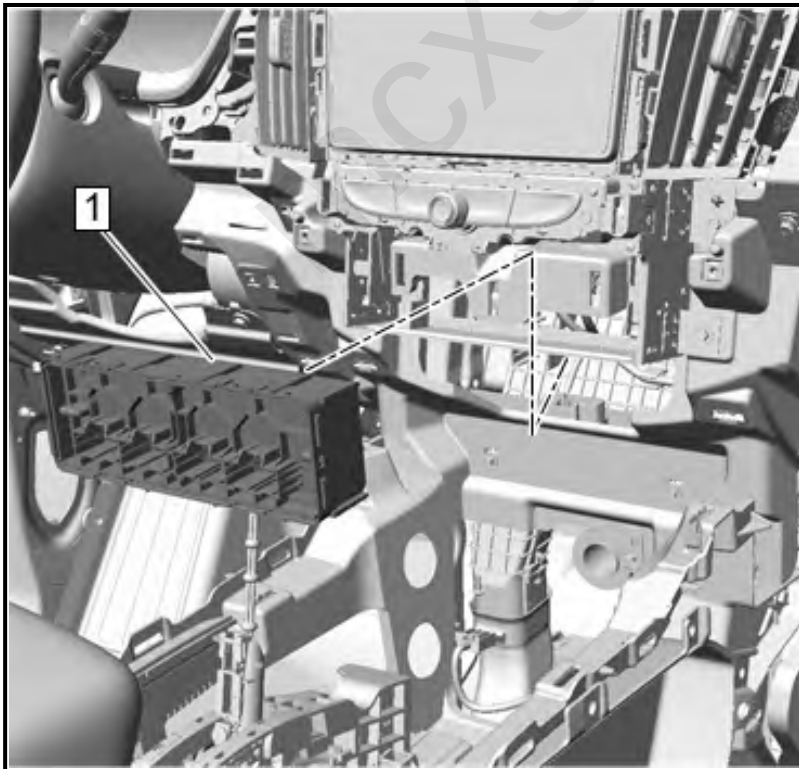
8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect the electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)

12.

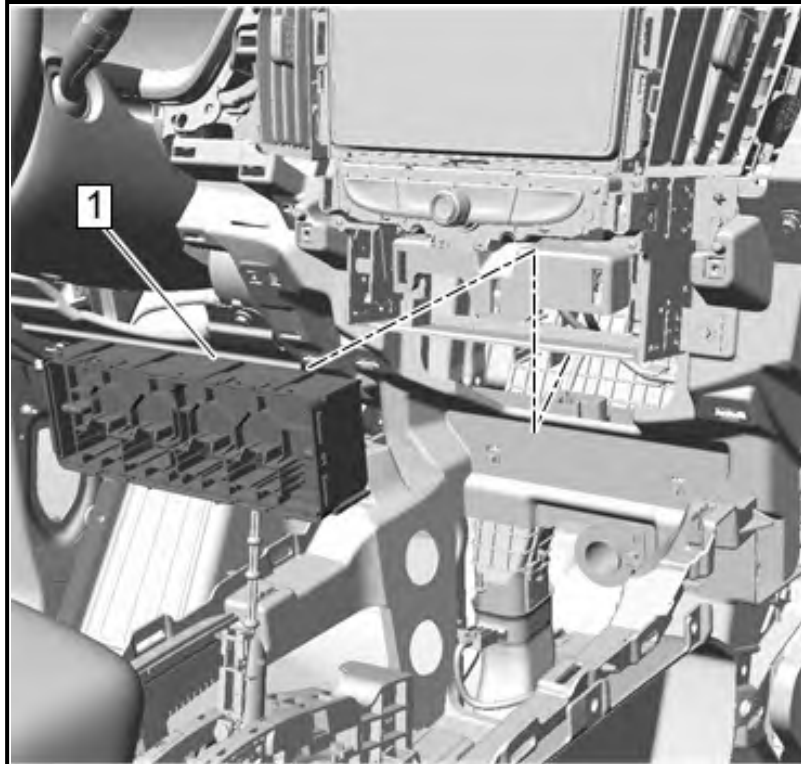


Heater and Air Conditioning Remote Control (1) - Remove

13. Disconnect the electrical connectors.

Installation Procedure

1.

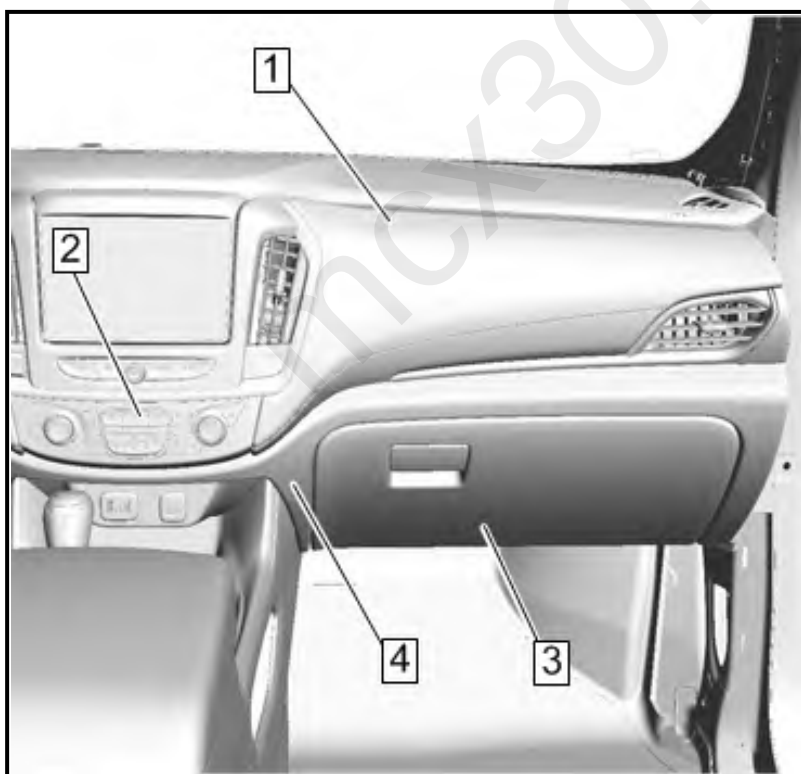


NOTE: When reconnecting the module, the BROWN J2 connector must be connected last. Once all the parts are all in place, check and clear all DTCs in the heater and air conditioning remote control.

Heater and Air Conditioning Remote Control (1) - Install

2. Connect the electrical connectors.

3.



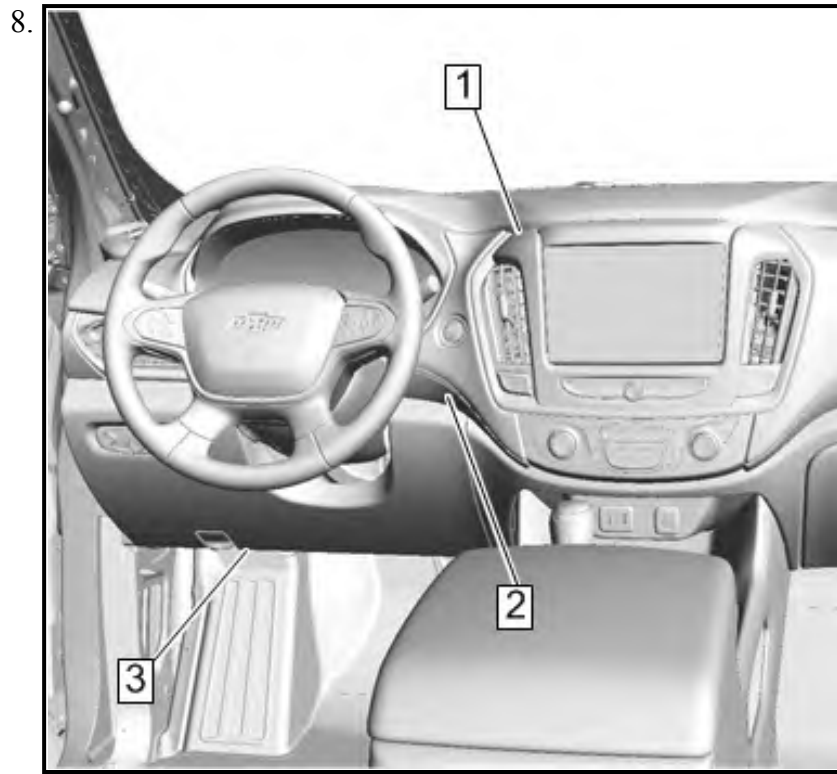
Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

4. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

5. Connect the electrical connectors.

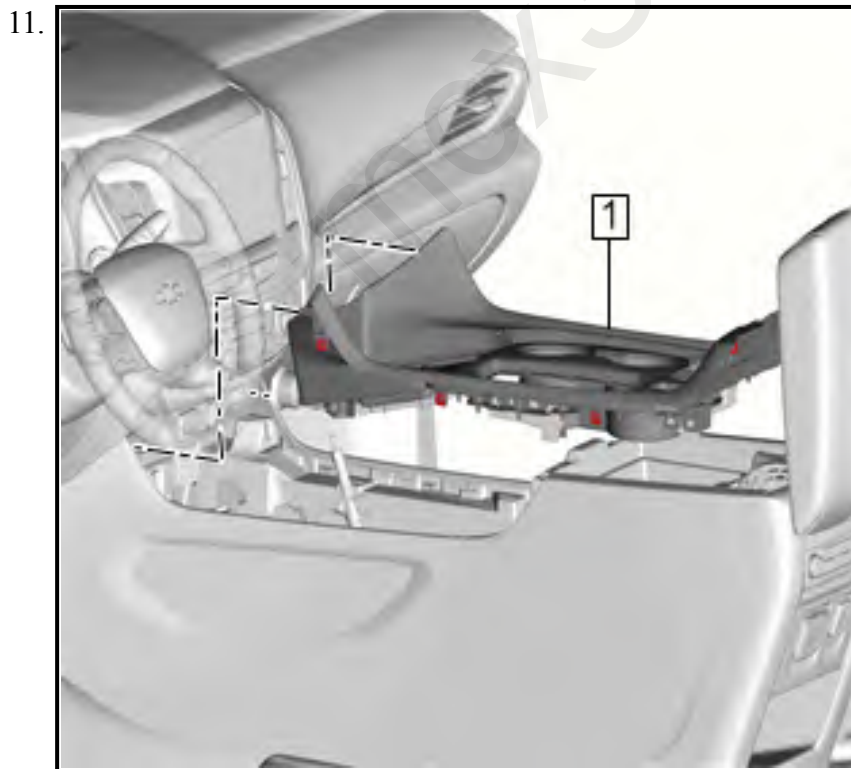
6. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

7. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)



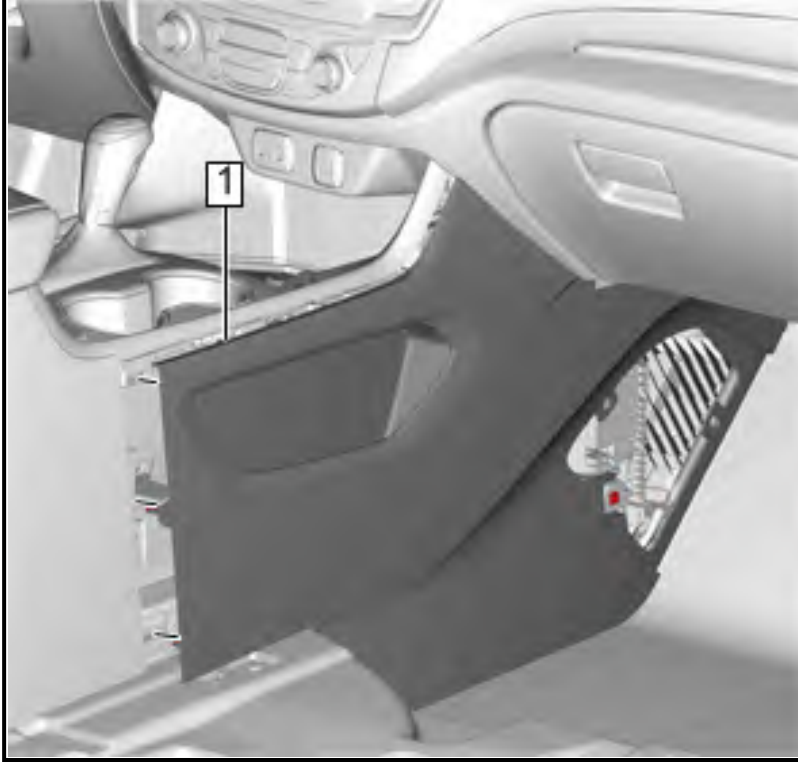
Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

9. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)
10. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

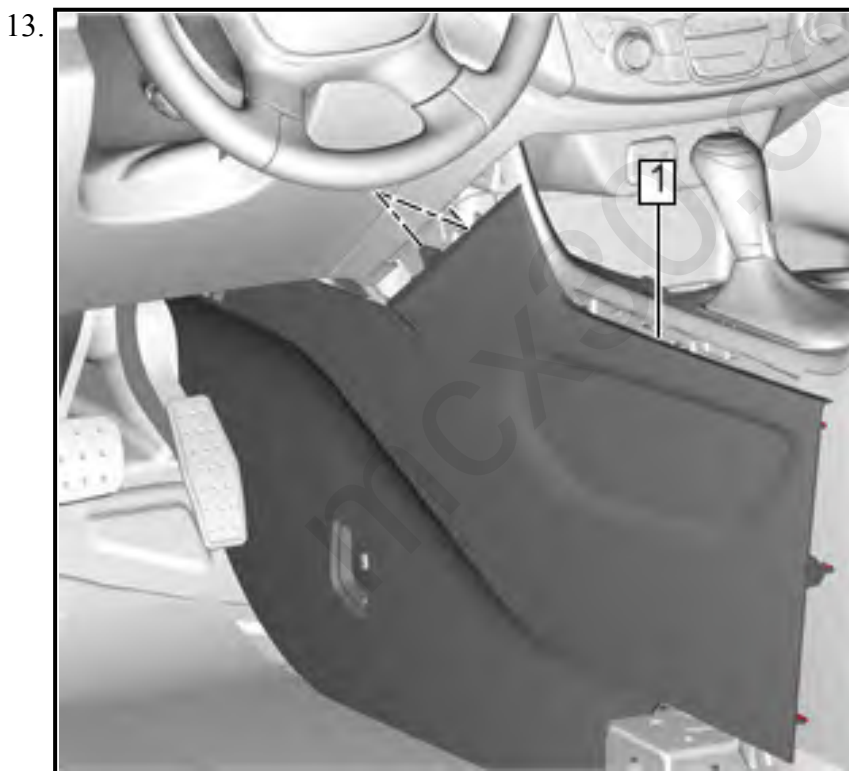


Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)





Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)



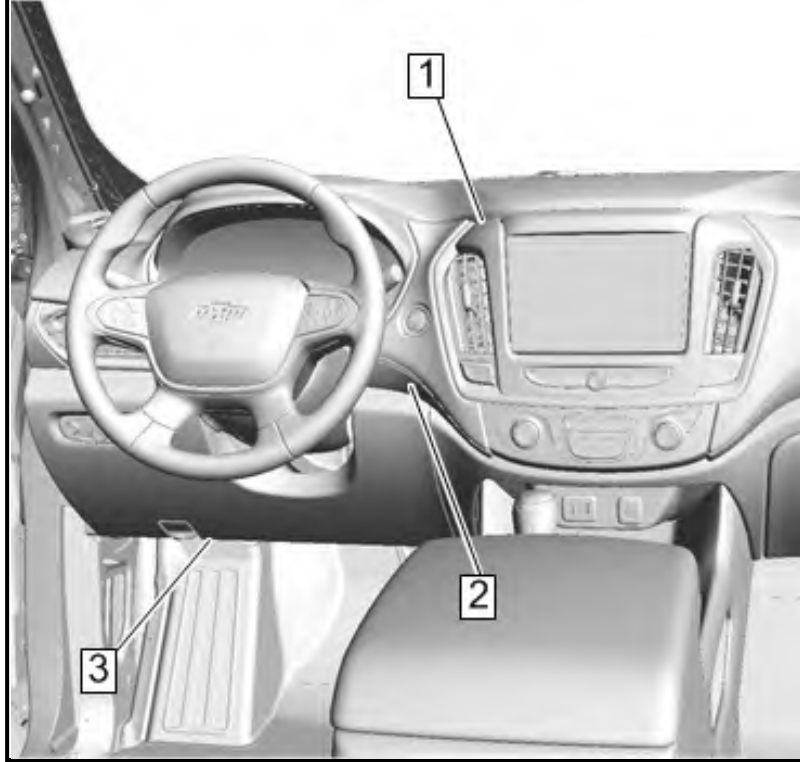
Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

14. Perform the necessary programming and setup procedure: [Control Module References](#)
15. Clear the DTCs from the heater and air conditioning remote control module.
16. Perform the actuator calibration procedure. [Actuator Recalibration](#)

AIR CONDITIONING WIRING HARNESS REPLACEMENT (CJ2)

Removal Procedure

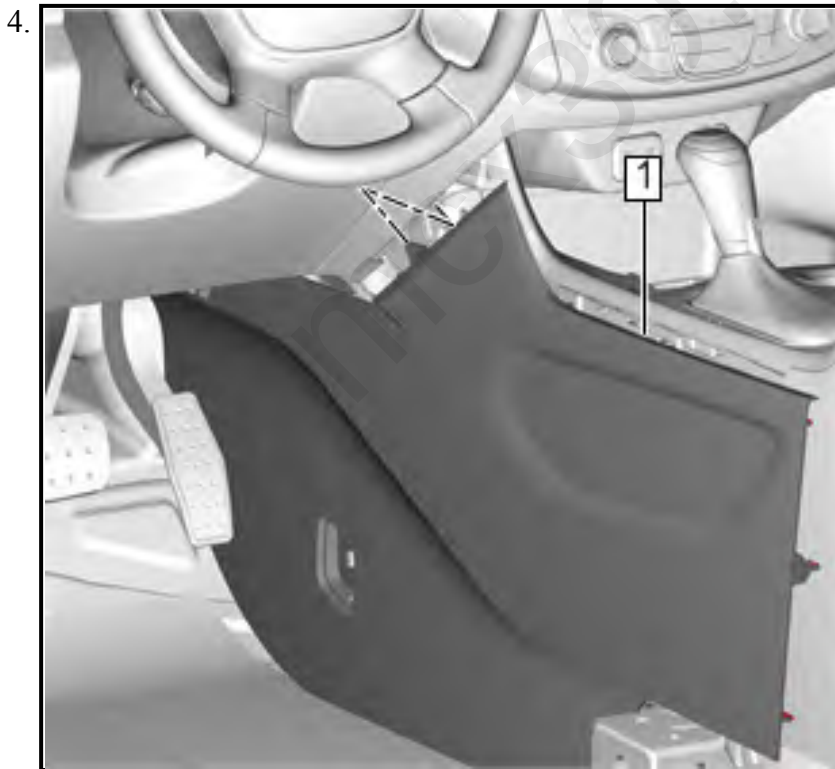
1.



Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

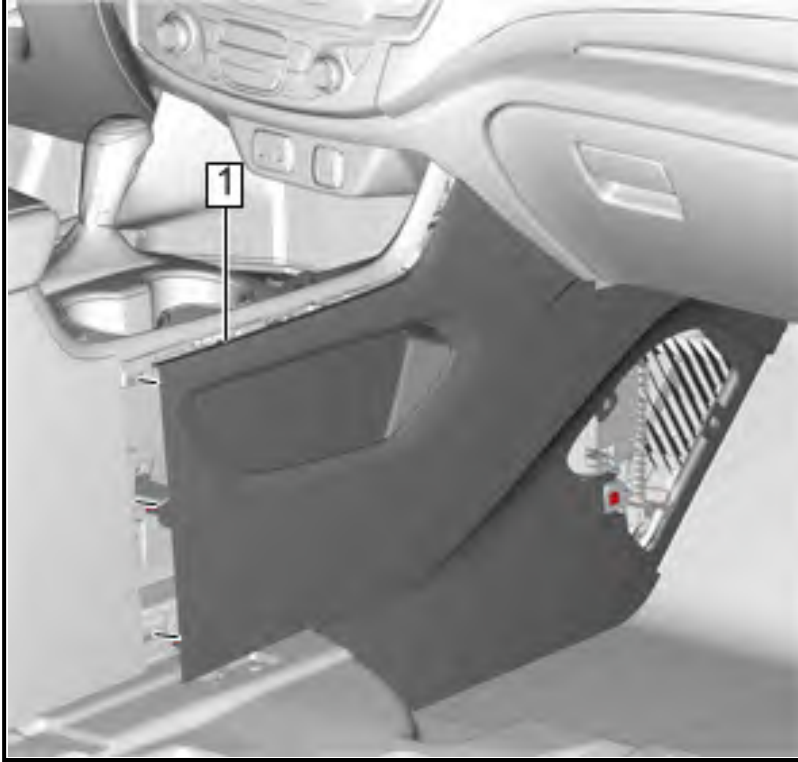
2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

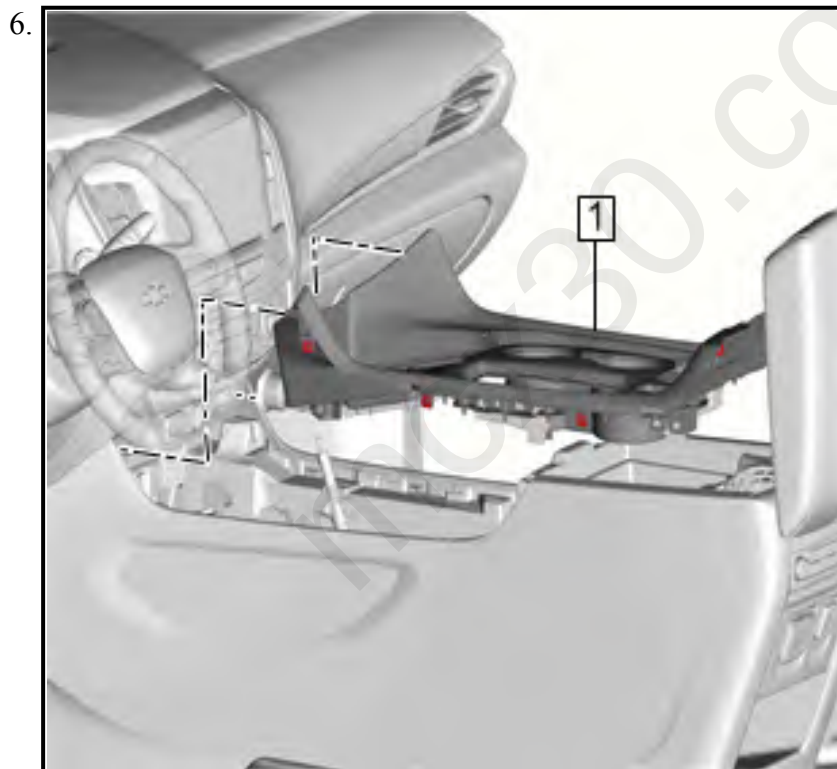


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)



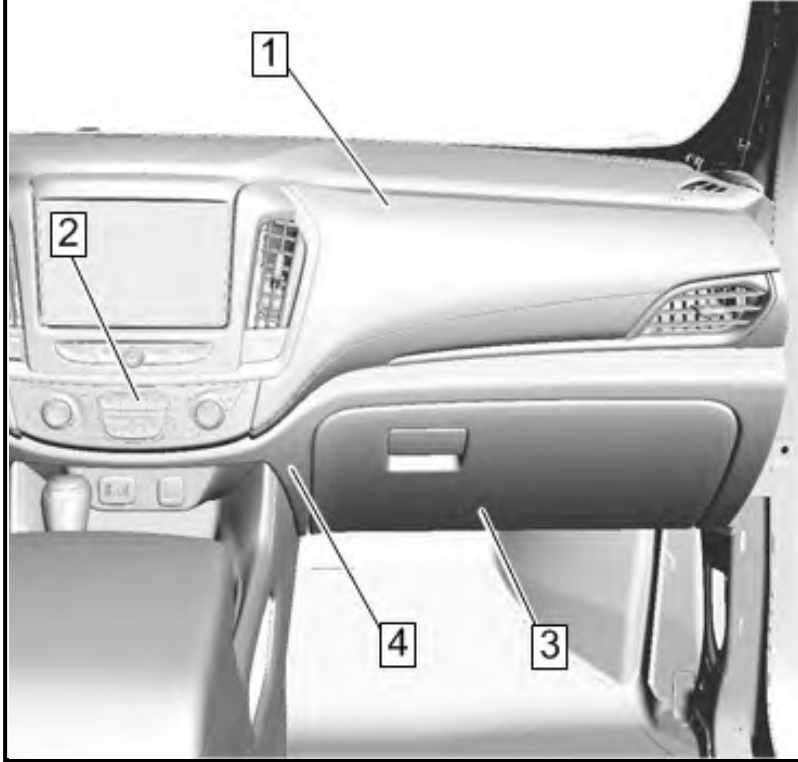


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)





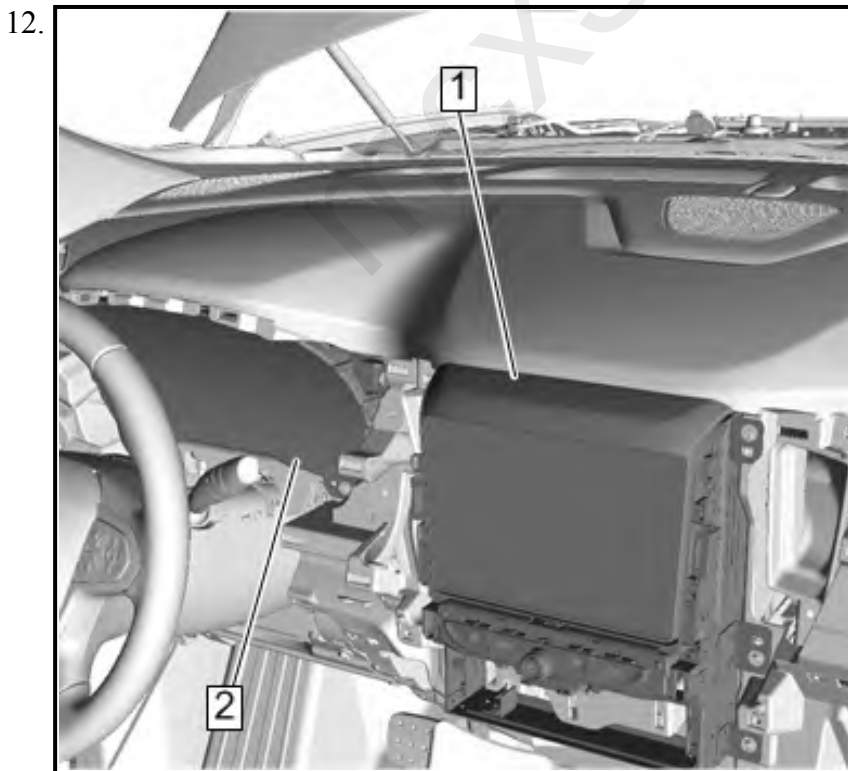
Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect all electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)

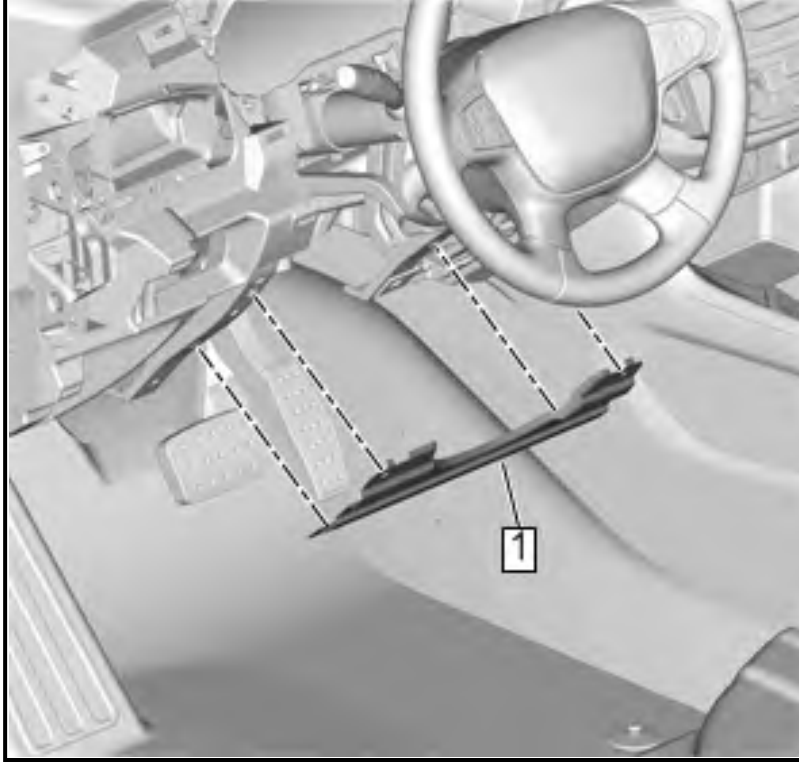


Radio Control (1) - Remove - [Radio Control Assembly Replacement \(With IO5, IO6\)](#)

13. Instrument Cluster (2) - Remove - [Instrument Cluster Replacement](#)

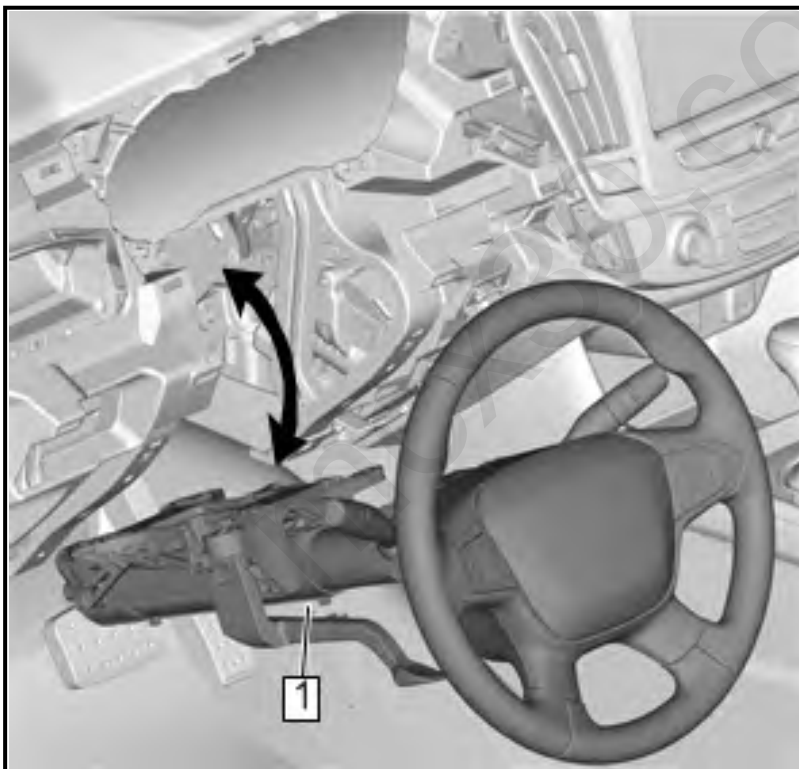
14. Disconnect the electrical connectors.

15.



Instrument Panel Knee Bolster Bracket (1) - Remove - [Instrument Panel Knee Bolster Bracket Replacement](#)

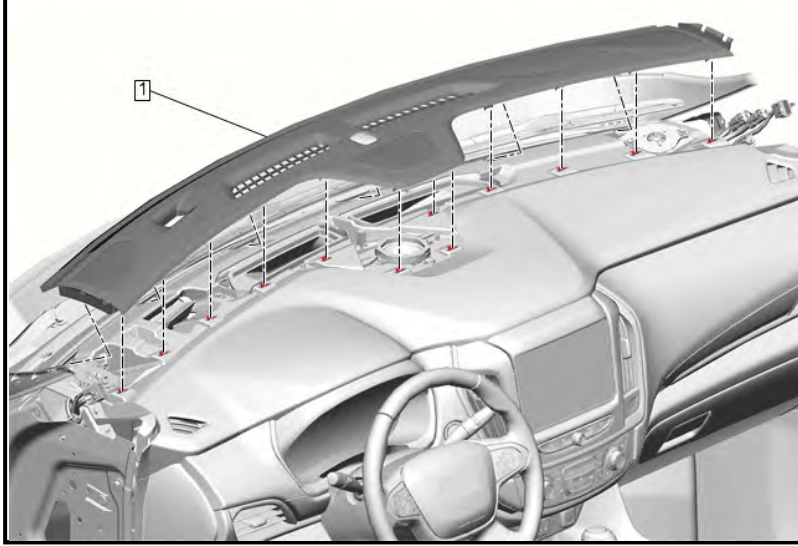
16.



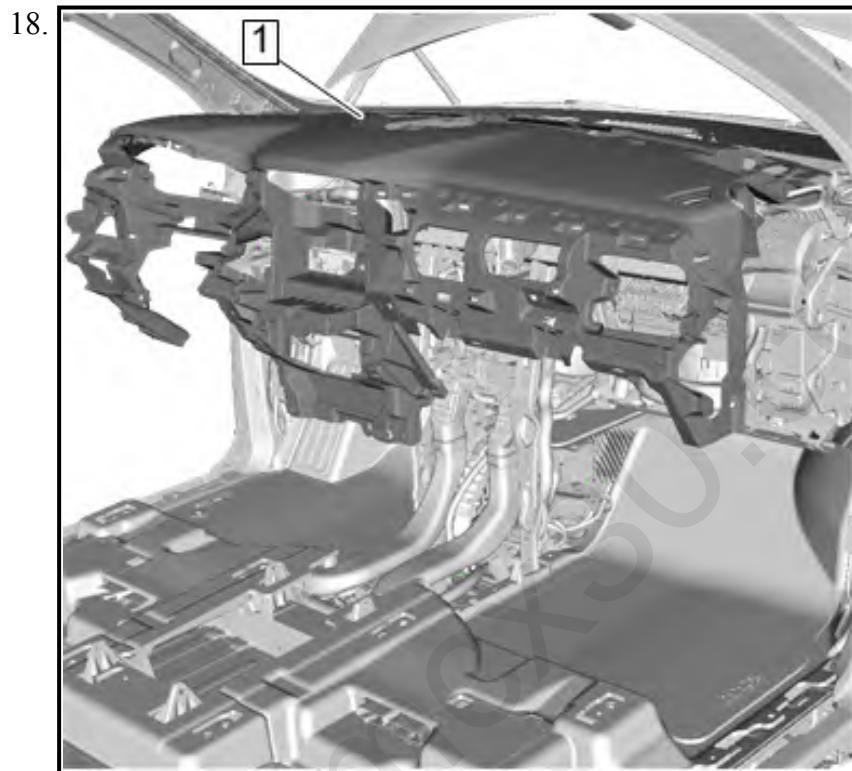
Steering Column (1) - Remove - [Steering Column Replacement \(N37\)](#) [Steering Column Replacement \(N38\)](#)

17.

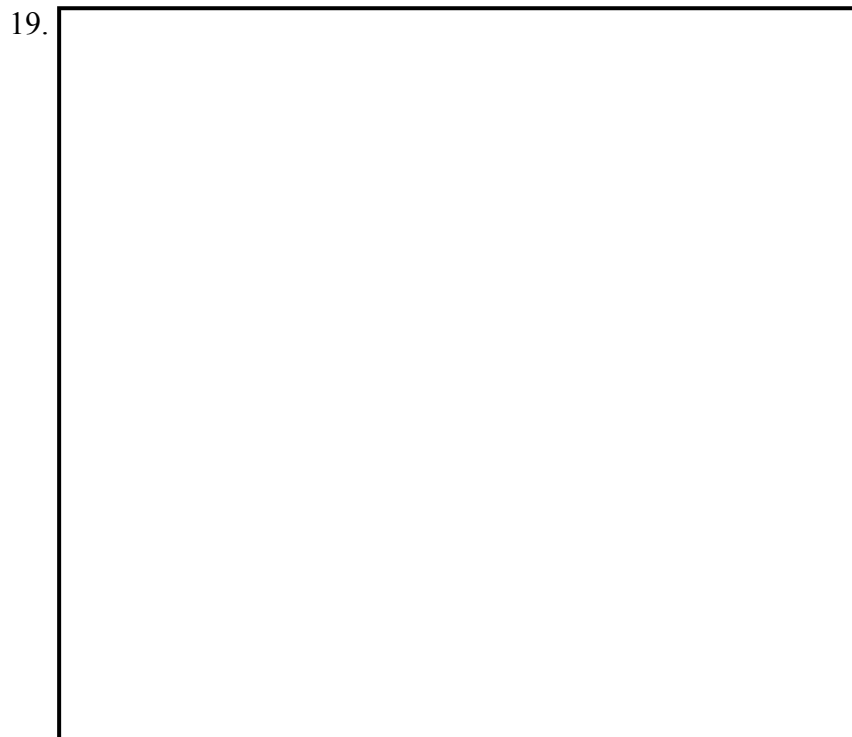


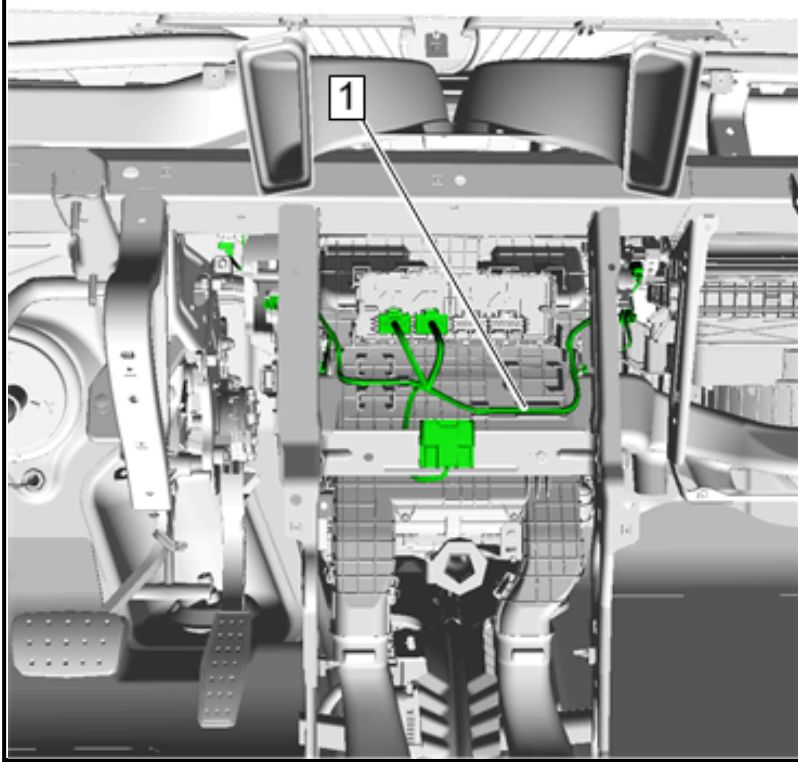


Instrument Panel Extension (1) - Remove - [Instrument Panel Extension Replacement](#)



Instrument Panel (1) - Remove - [Instrument Panel Assembly Replacement](#)





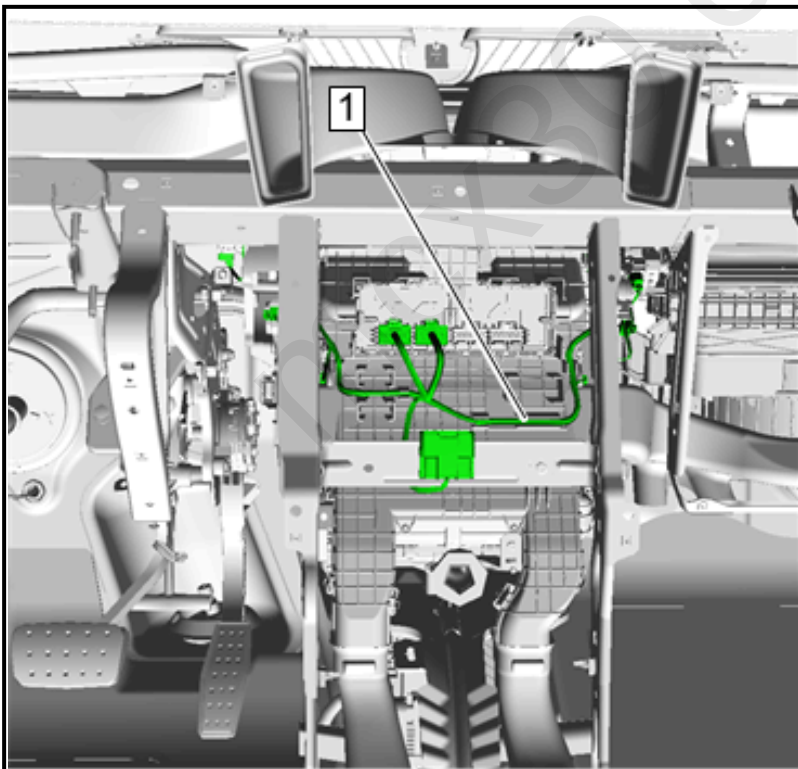
Note the location and routing of the wiring harness to ensure proper reinstallation.

20. Disconnect all electrical connectors.

21. Air Conditioning Wiring Harness (1) - Remove

Installation Procedure

1.

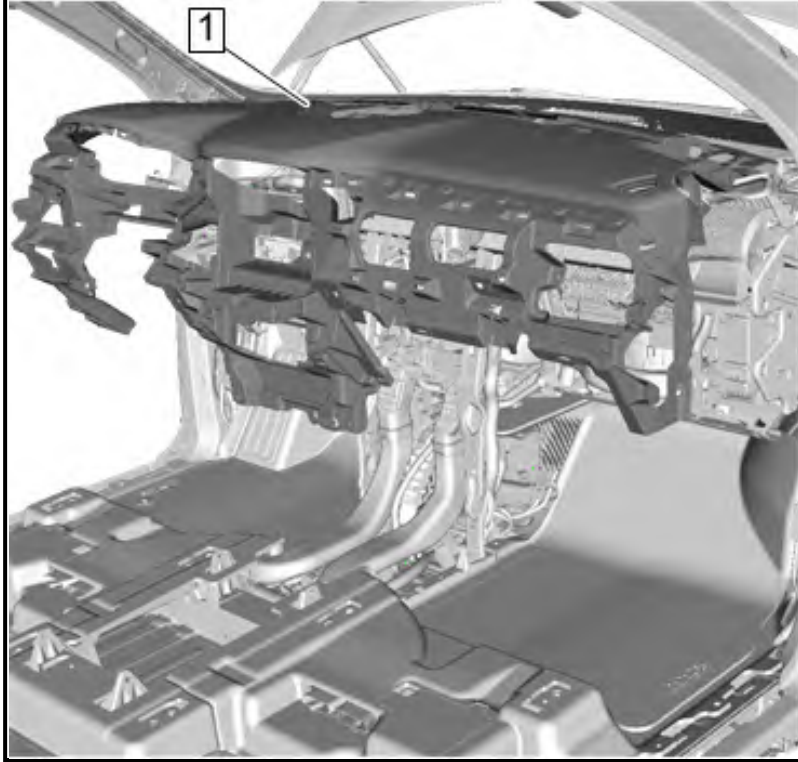


Air Conditioning Wiring Harness (1) - Install

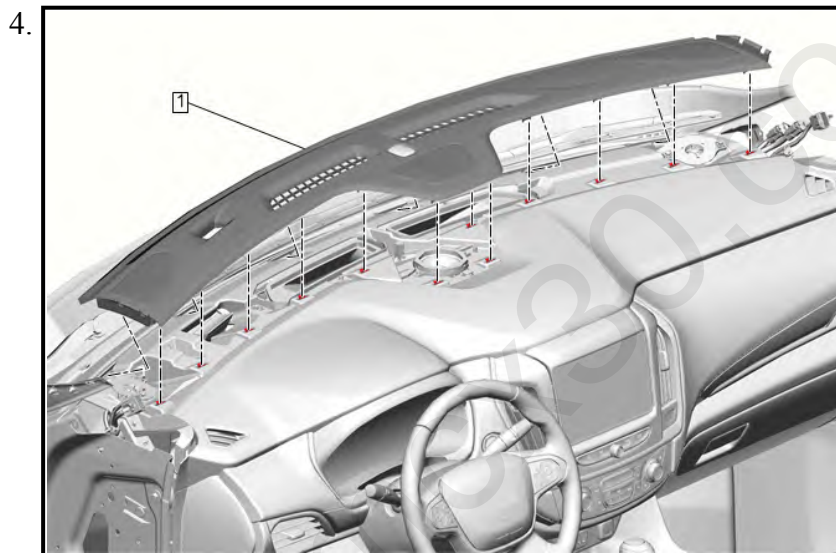
2. Connect all electrical connectors.

3.

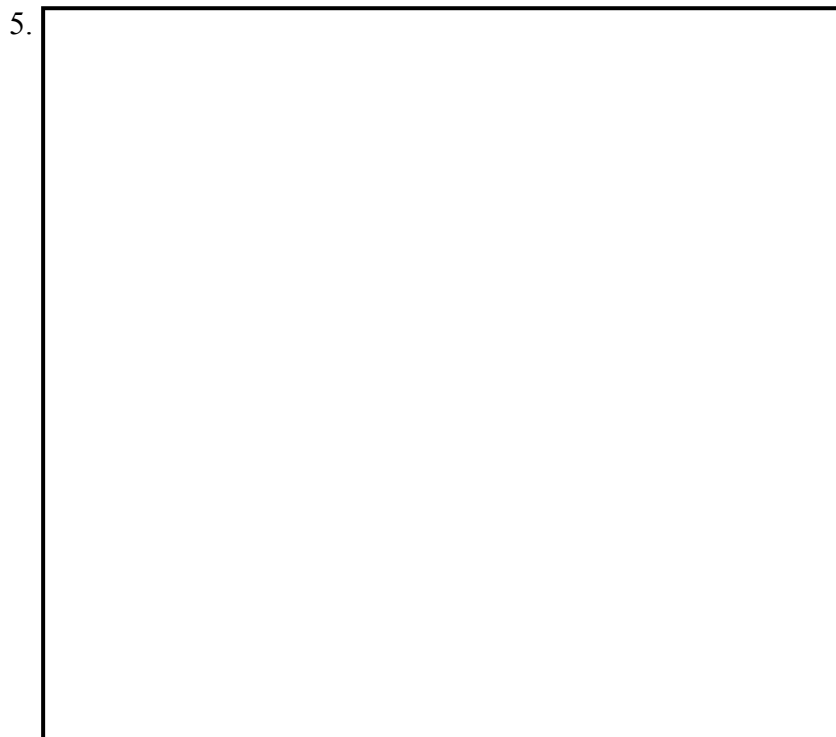


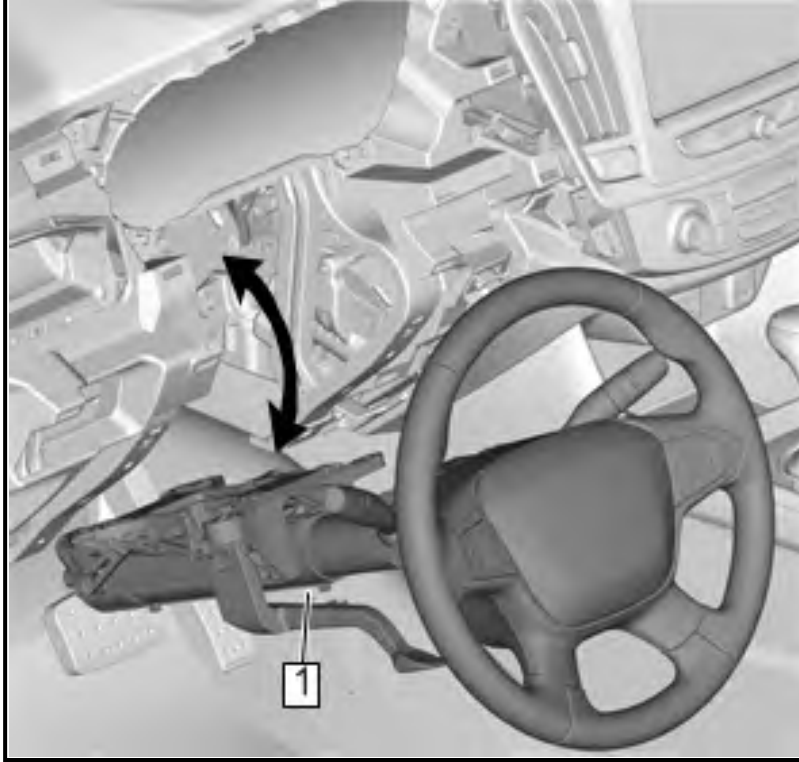


Instrument Panel (1) - Install - [Instrument Panel Assembly Replacement](#)

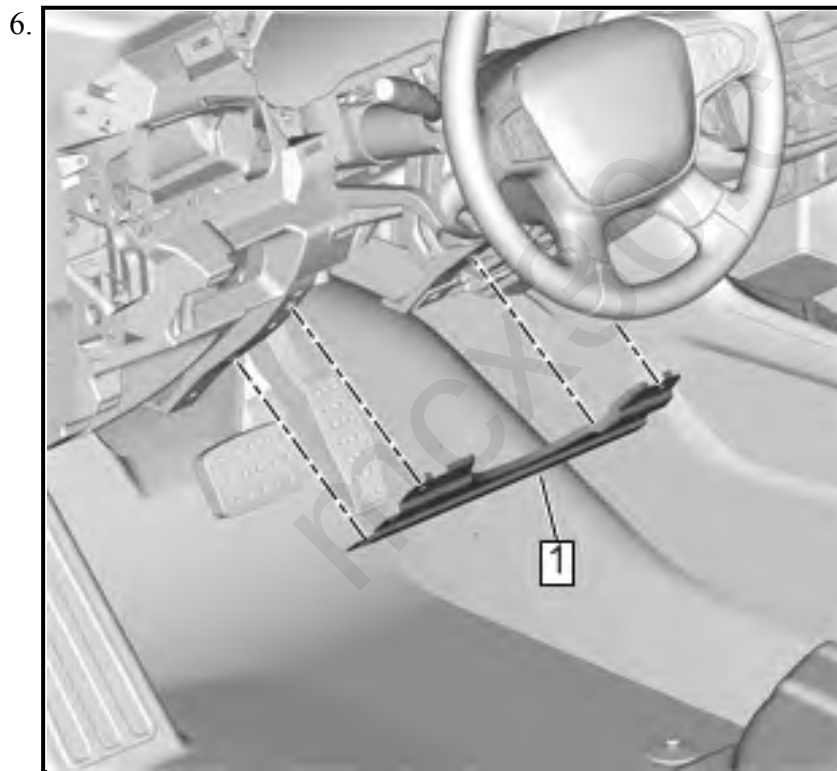


Instrument Panel Extension (1) - Install - [Instrument Panel Extension Replacement](#)



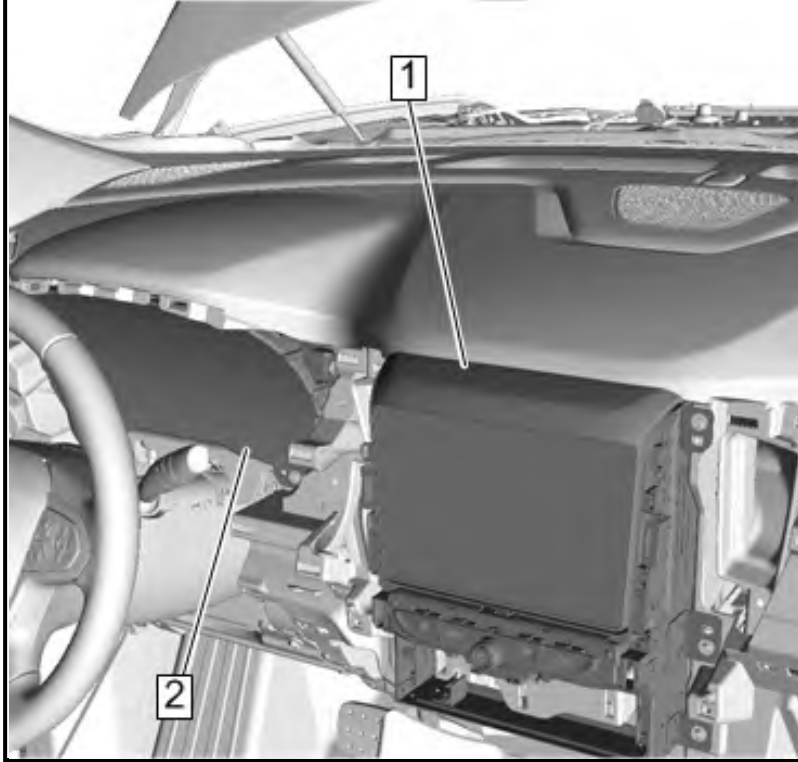


Steering Column (1) - Install - [Steering Column Replacement \(N37\)](#), [Steering Column Replacement \(N38\)](#)



Instrument Panel Knee Bolster Bracket (1) - Install - [Instrument Panel Knee Bolster Bracket Replacement](#)



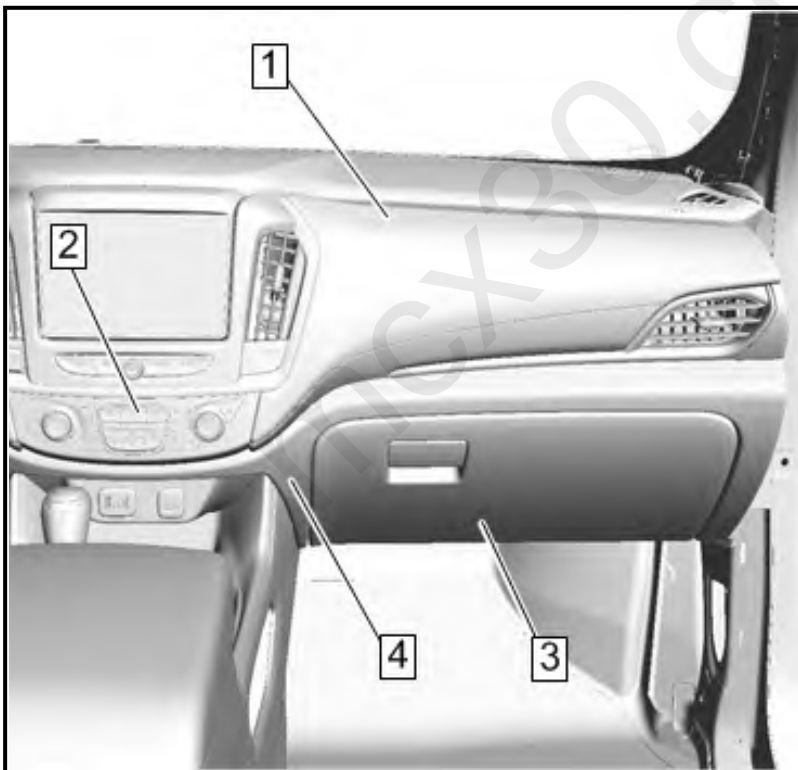


Connect the electrical connectors.

8. Instrument Cluster (2) - Install - [Instrument Cluster Replacement](#)

9. Radio Control (1) - Install - [Radio Control Assembly Replacement \(With IO5, IO6\)](#)

10.



Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

11. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

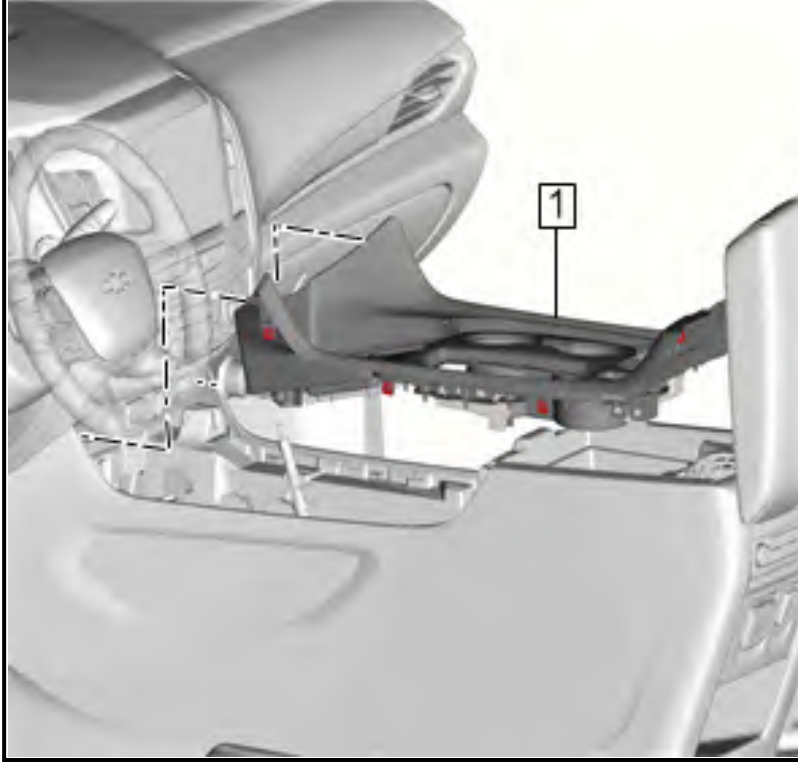
12. Connect the electrical connectors.

13. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

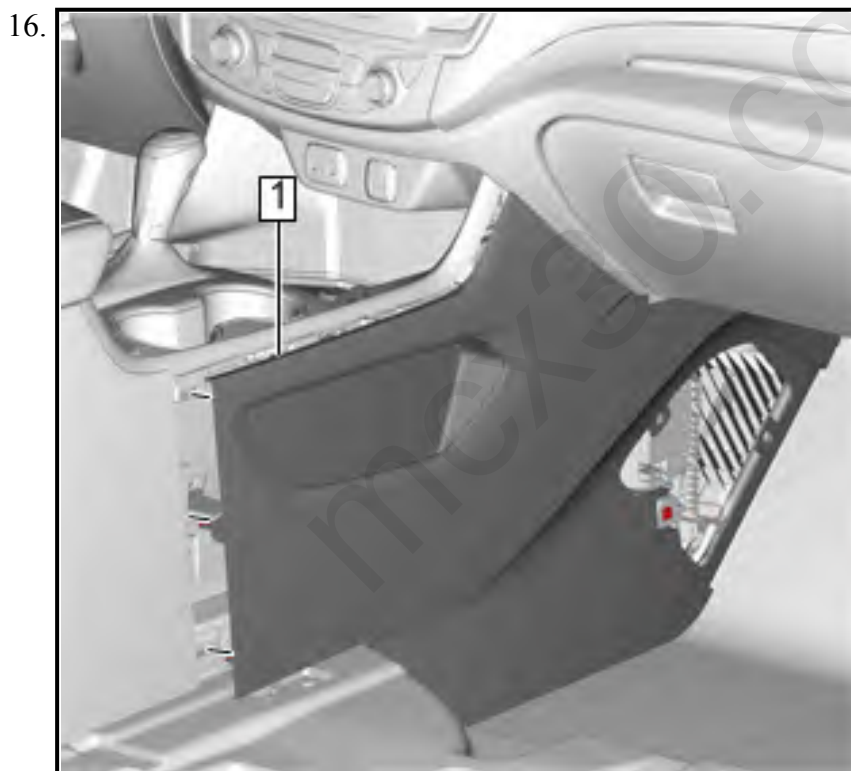
14. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)

15.



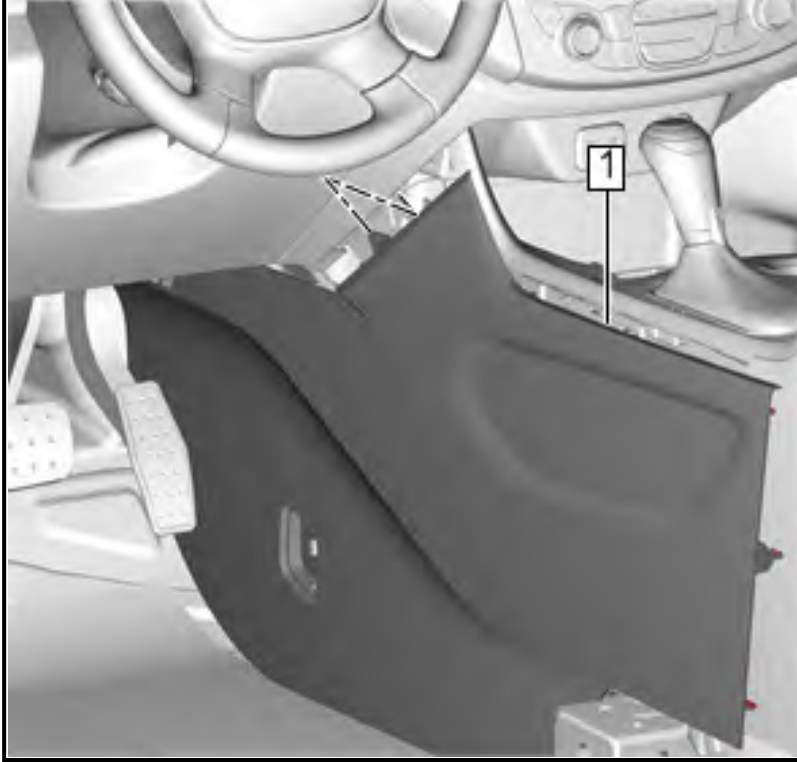


Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)



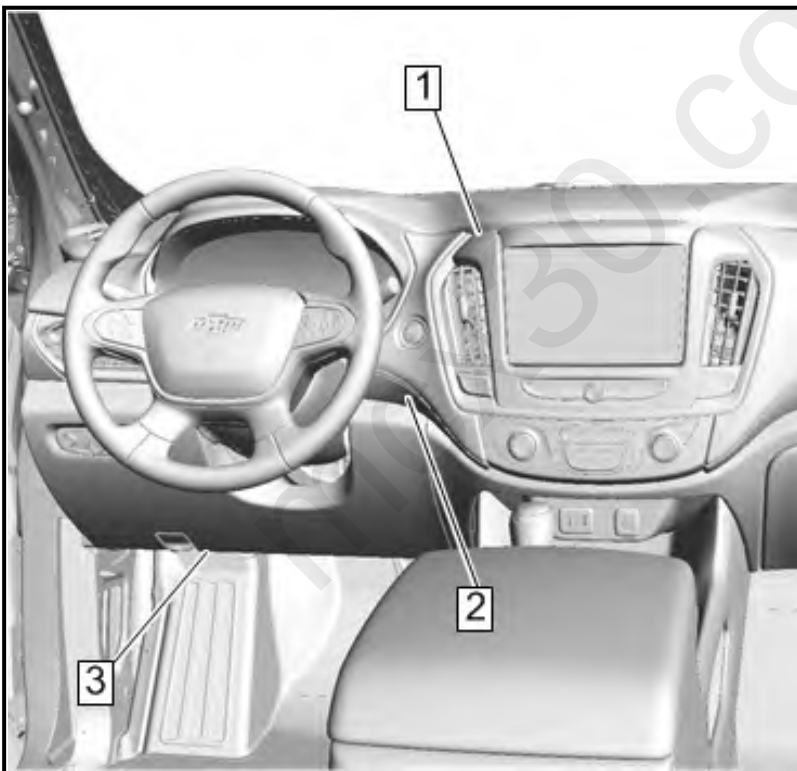
Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)





Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

18.



Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

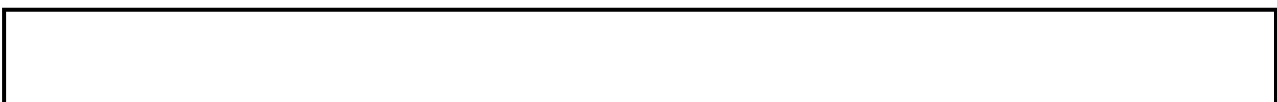
19. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

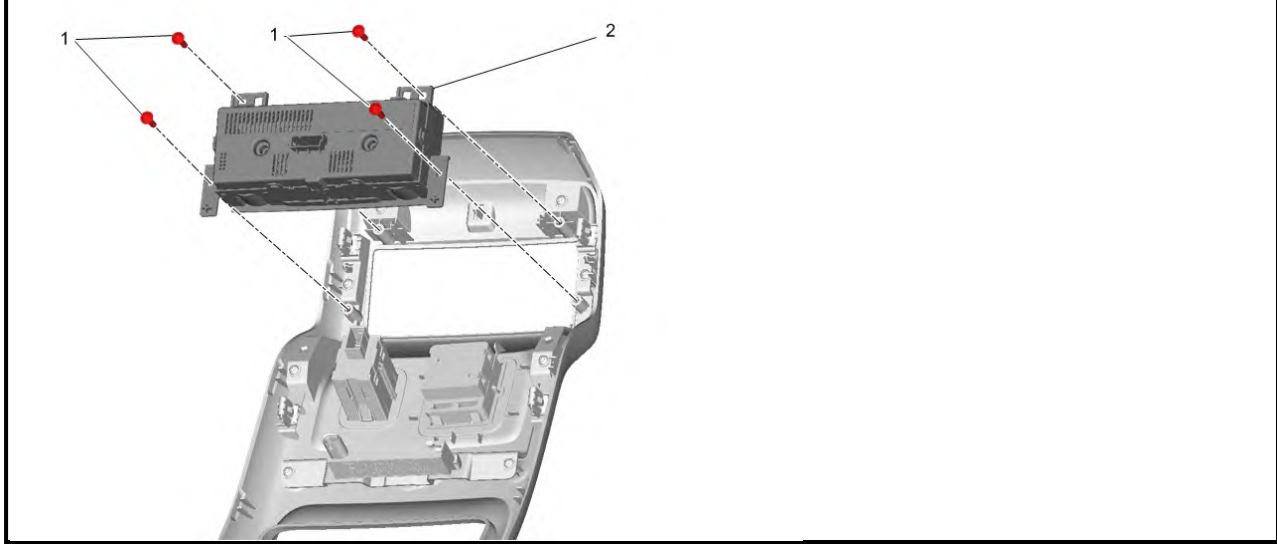
20. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

21. Clear the DTCs from the heater and air conditioning remote control module.

22. Perform the actuator calibration procedure. [Actuator Recalibration](#)

AUXILIARY HEATER AND AIR CONDITIONING CONTROL REPLACEMENT

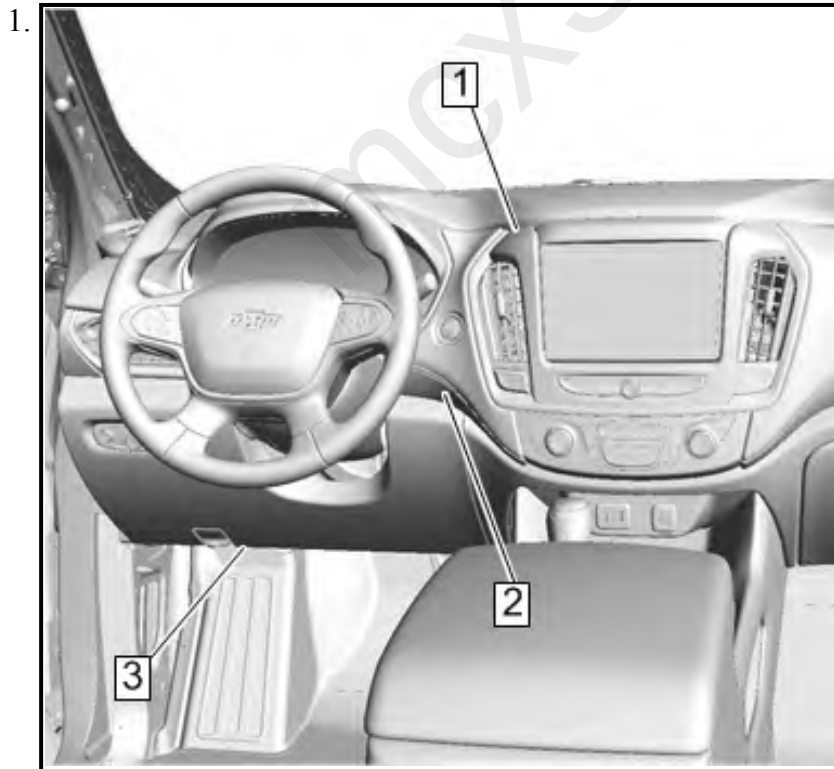




Callout	Component Name
Preliminary Procedure	
<u>Front Floor Console Rear Trim Panel Replacement</u>	
1	Auxiliary Heater and Air Conditioning Control Bolt [4x] CAUTION: Refer to <u>Fastener Caution</u> . Tighten 1.0 N.m (9 lb in)
2	Auxiliary Heater and Air Conditioning Control

AIR INLET VALVE ACTUATOR REPLACEMENT

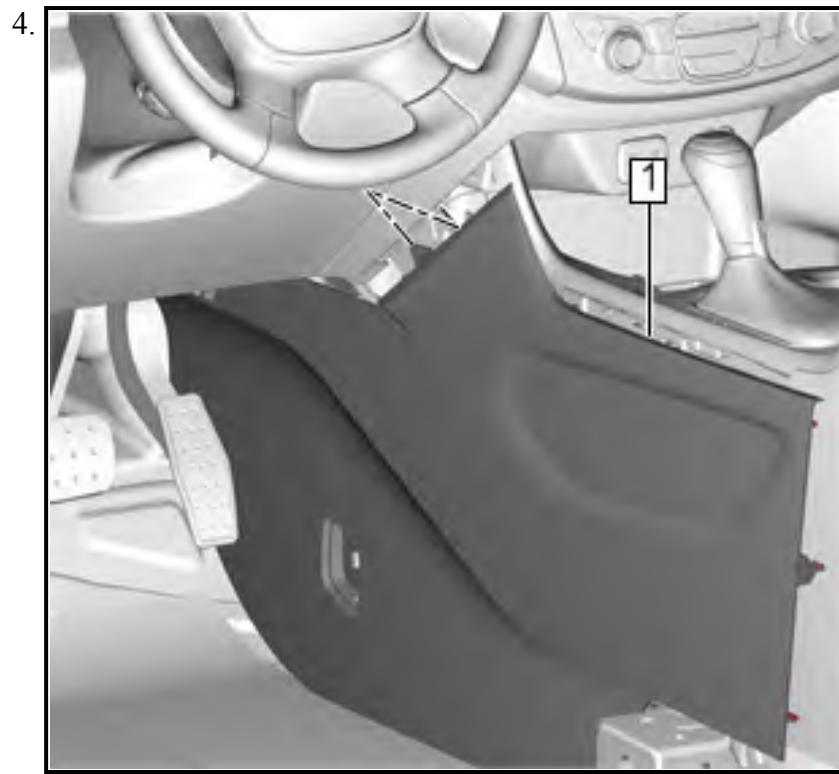
Removal Procedure



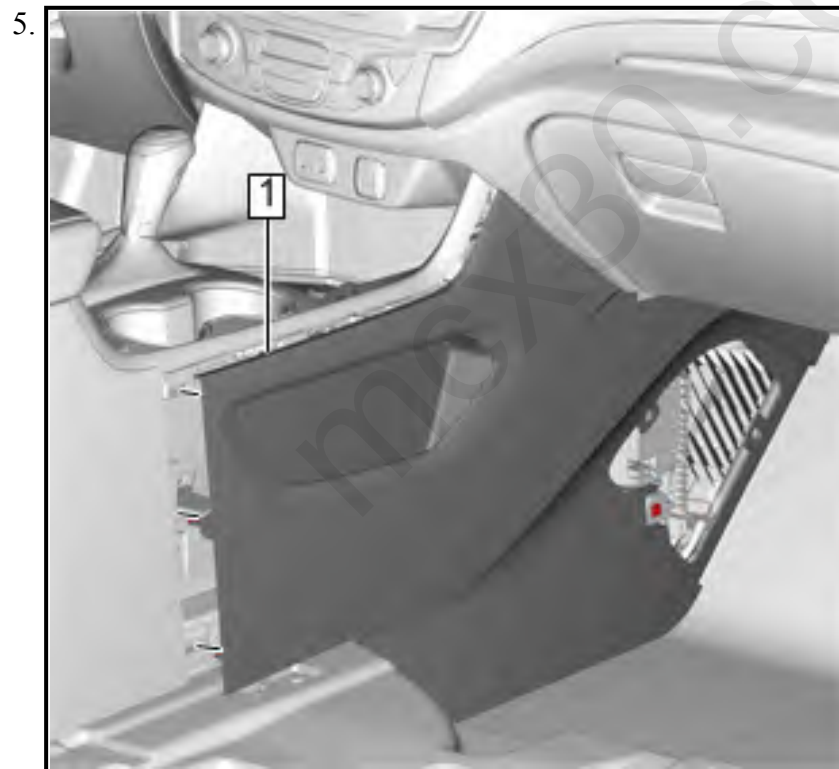
Instrument Panel Radio Front Trim Plate (1) - Remove - **Instrument Panel Radio Front Trim Plate Replacement (RPO IOA)** **Instrument Panel Radio Front Trim Plate Replacement (RPO IO5, IO6)**

2. Instrument Panel Trim Pad - Left Side (2) - Remove - **Instrument Panel Trim Pad Replacement - Left Side**

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

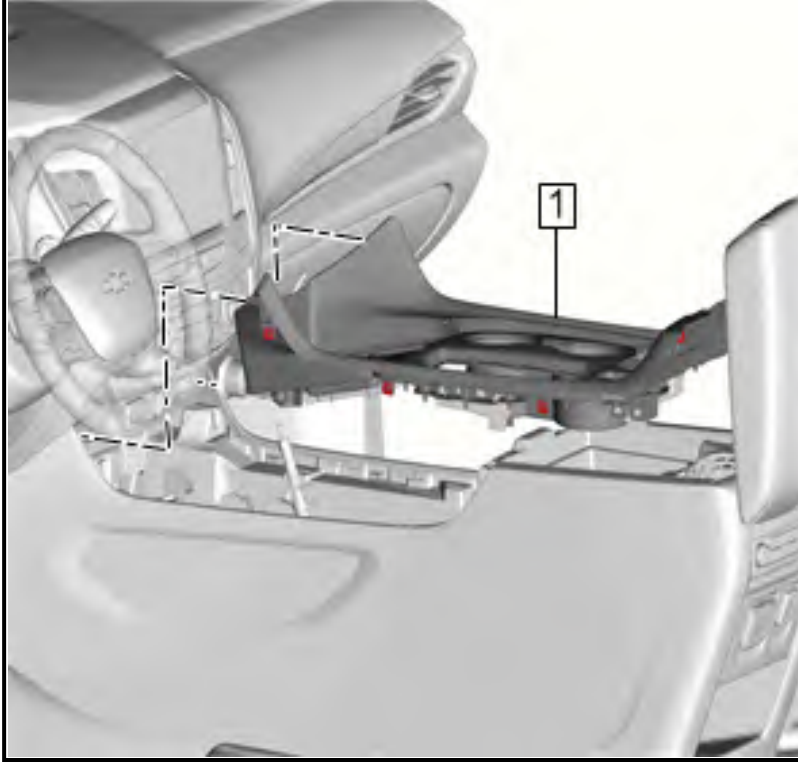


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)

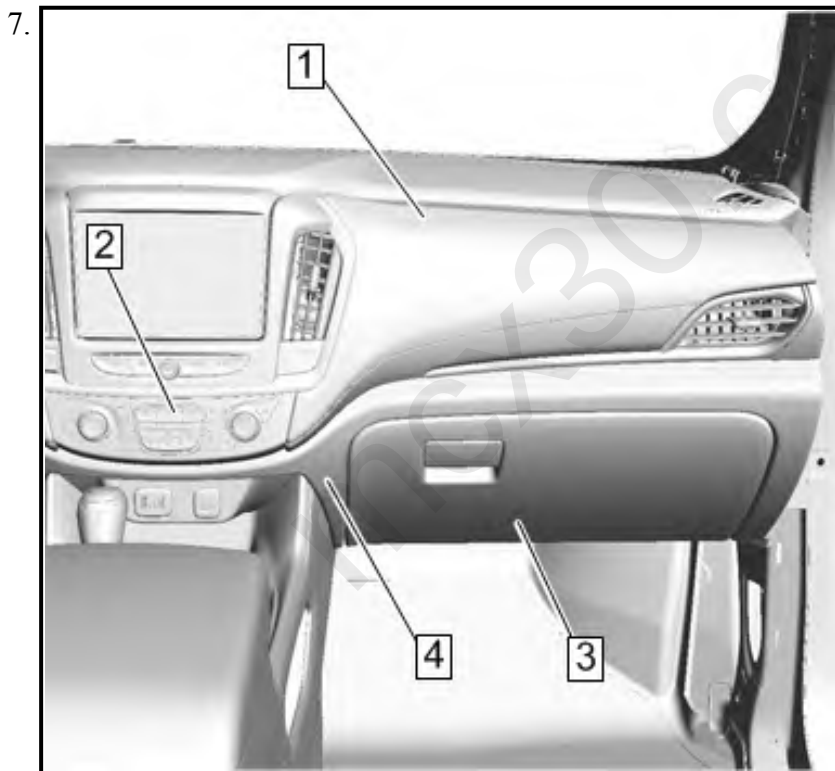


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)





Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)



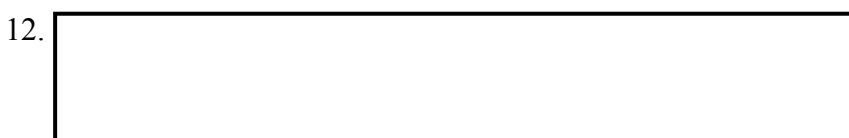
Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

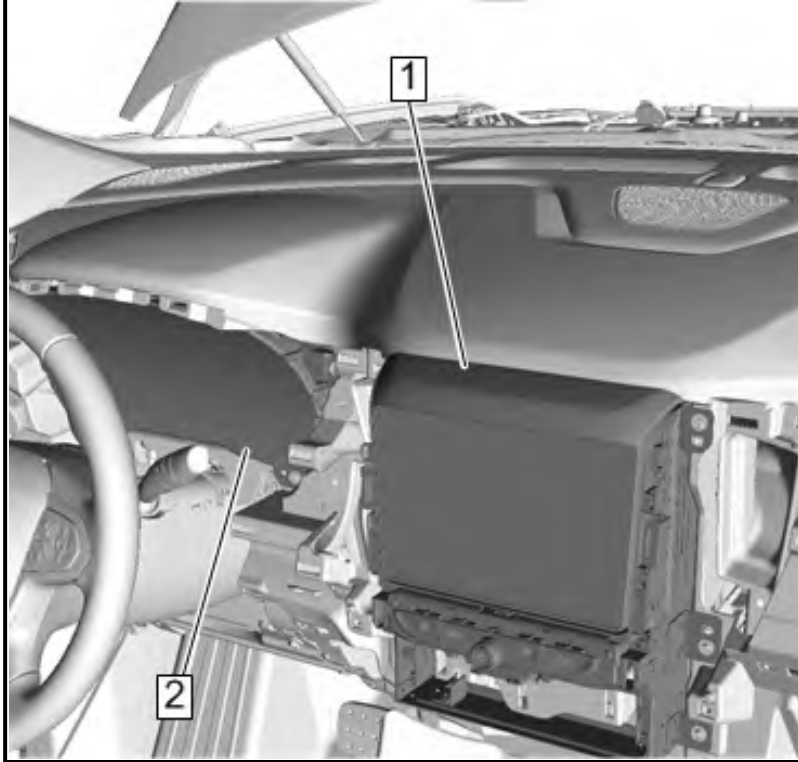
8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect all electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)



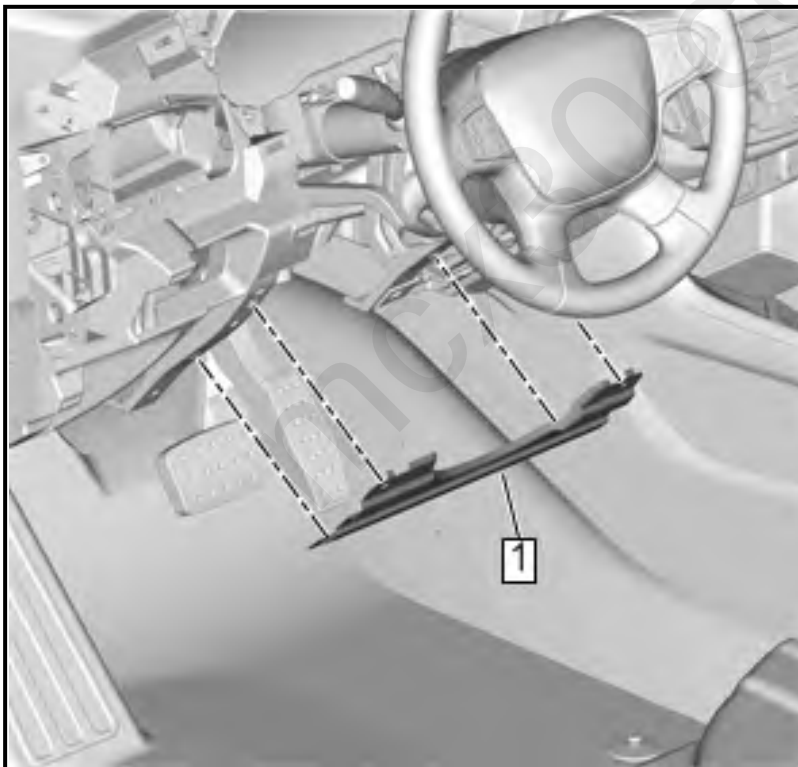


Radio Control (1) - Remove - [Radio Control Assembly Replacement \(With IO5, IO6\)](#).

13. Instrument Cluster (2) - Remove - [Instrument Cluster Replacement](#)

14. Disconnect the electrical connectors.

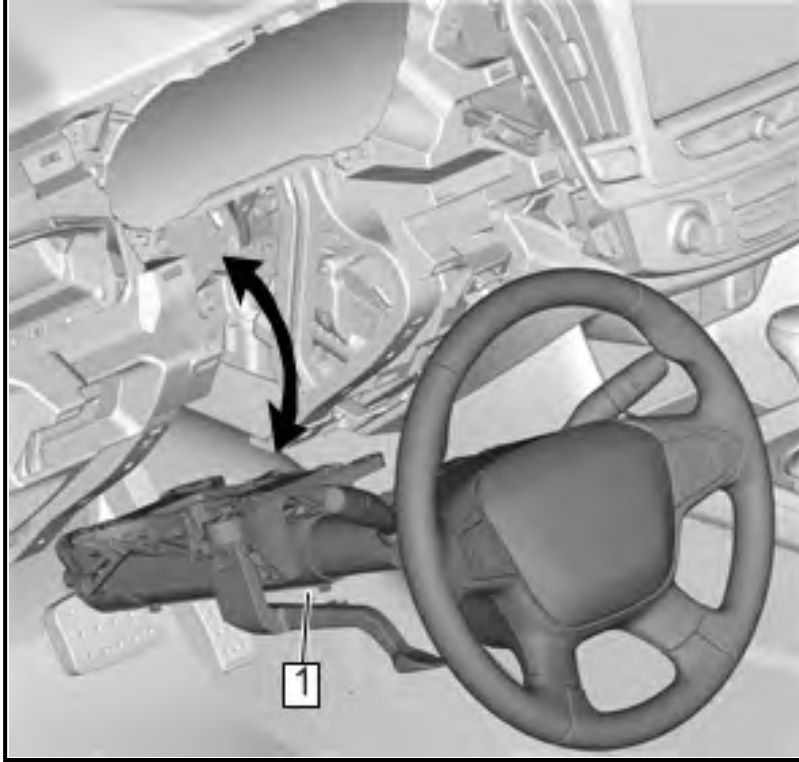
15.



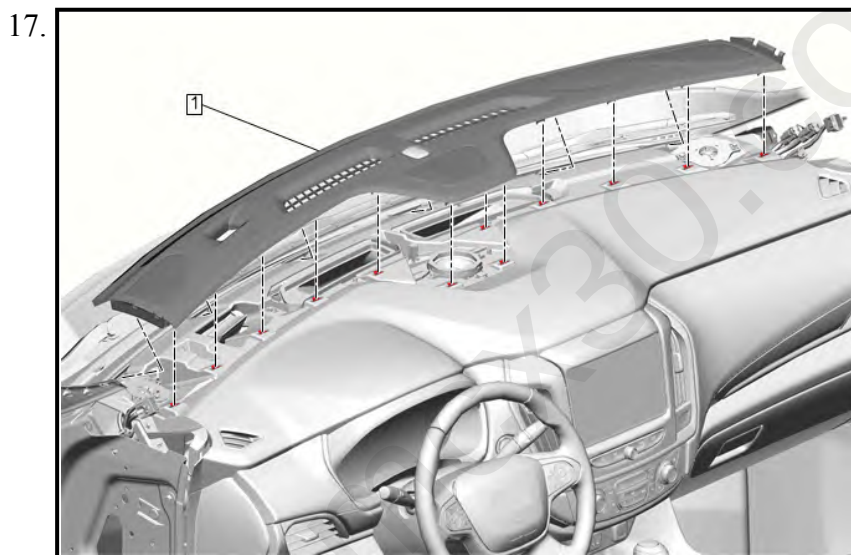
Instrument Panel Knee Bolster Bracket (1) - Remove - [Instrument Panel Knee Bolster Bracket Replacement](#)

16.



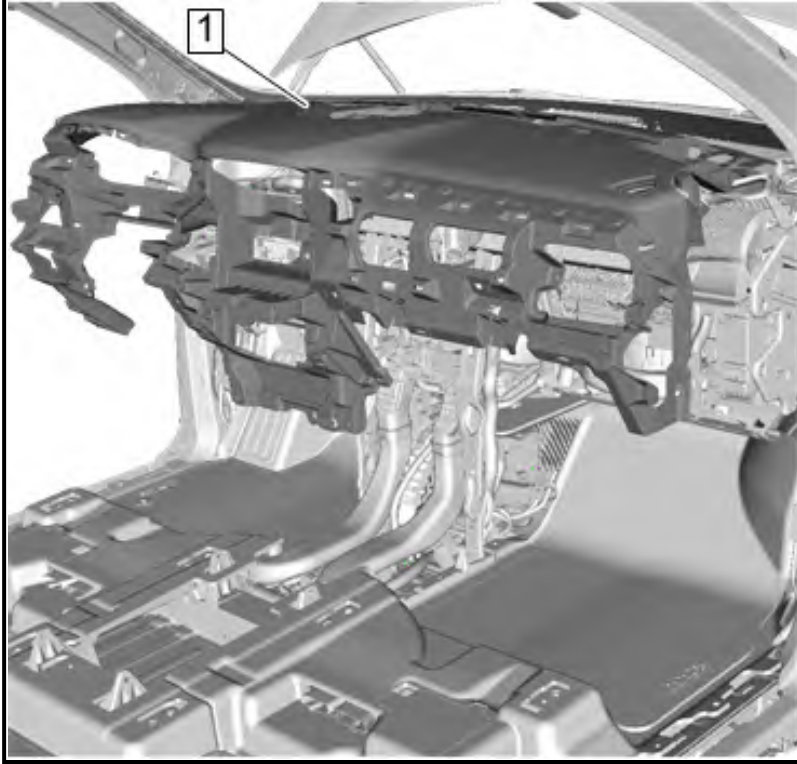


Steering Column (1) - Remove - [Steering Column Replacement \(N37\)](#), [Steering Column Replacement \(N38\)](#)



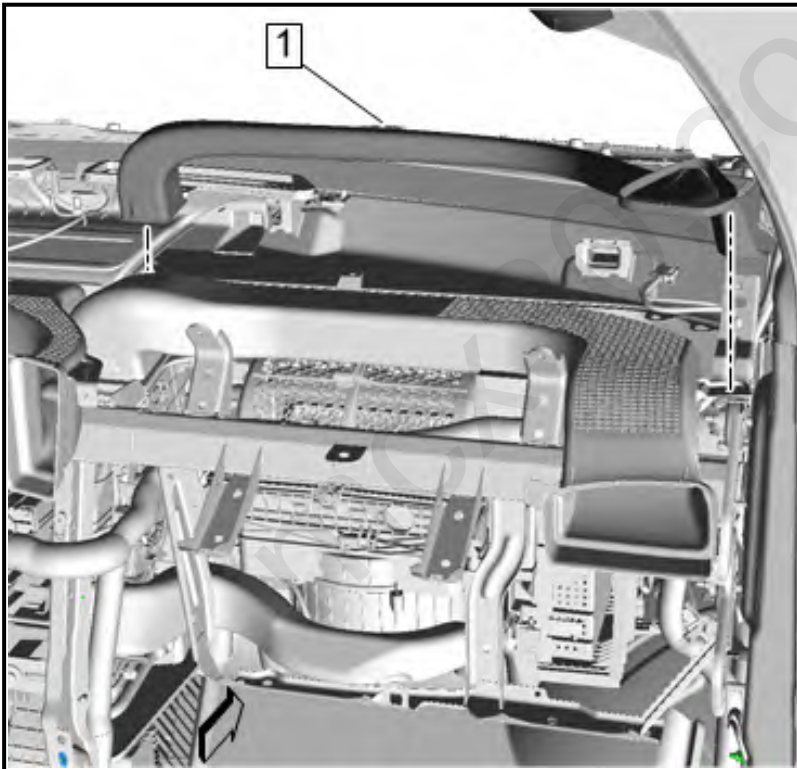
Instrument Panel Extension (1) - Remove - [Instrument Panel Extension Replacement](#)





Instrument Panel (1) - Remove - [Instrument Panel Assembly Replacement](#)

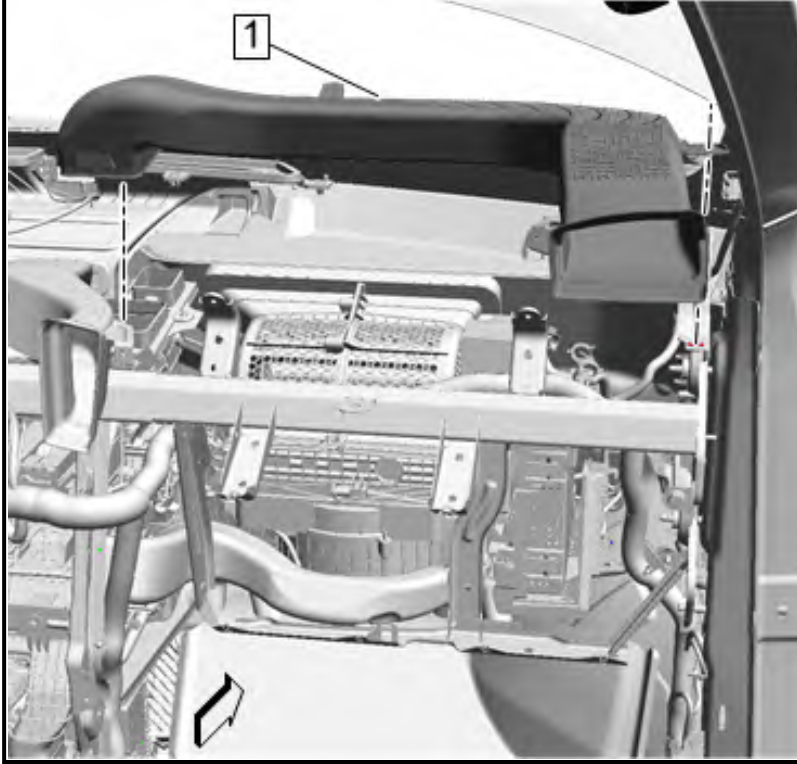
19.



Side Window Defogger Outlet Duct - Right Side (1) - Remove - [Side Window Defogger Outlet Duct Replacement - Right Side](#)

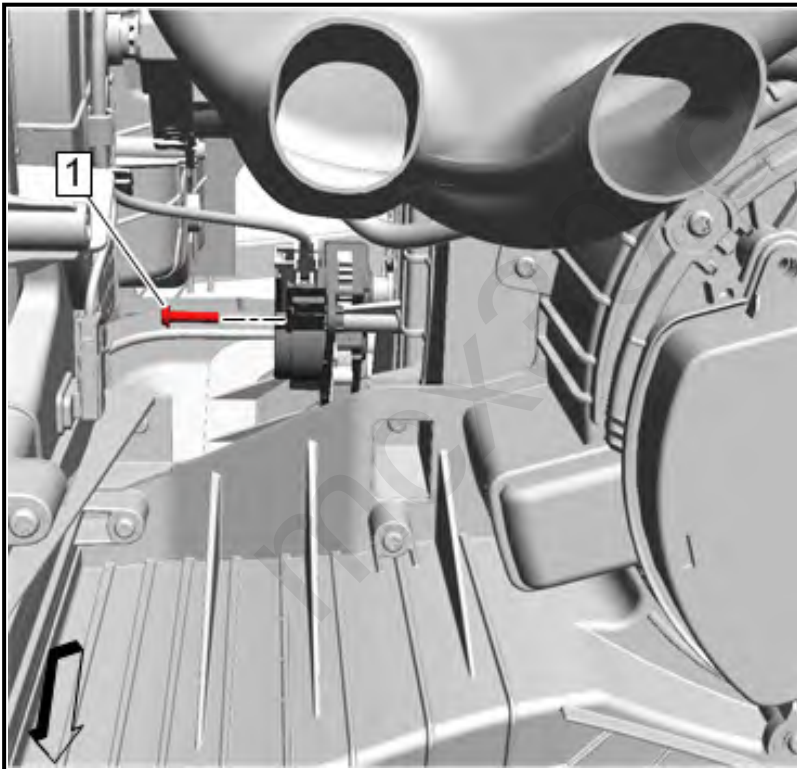
20.





Instrument Panel Outer Air Outlet Duct - Right Side (1) - Remove

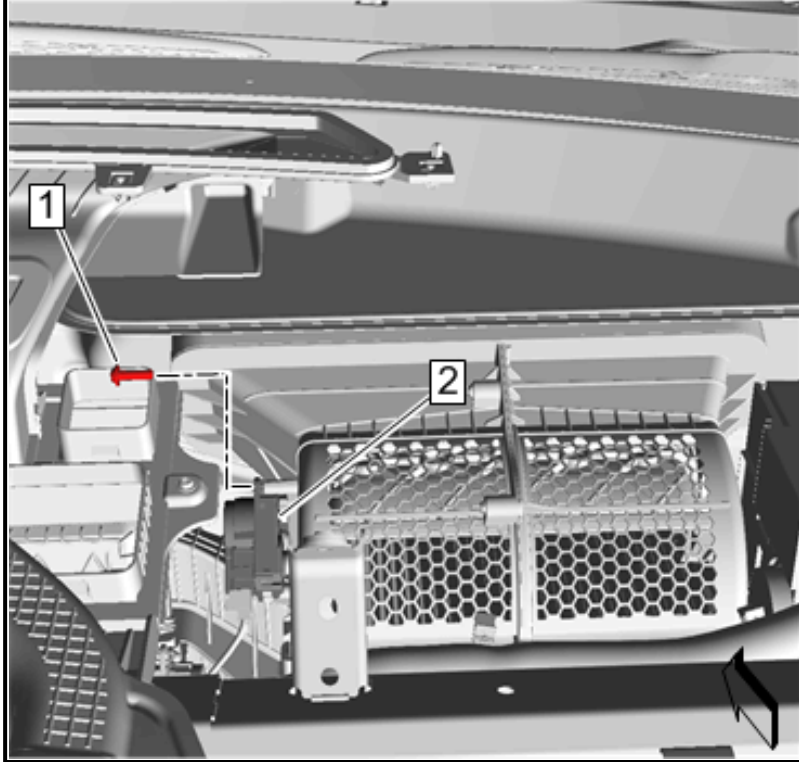
21.



Air Inlet Valve Actuator Screw (1) - Remove

22.





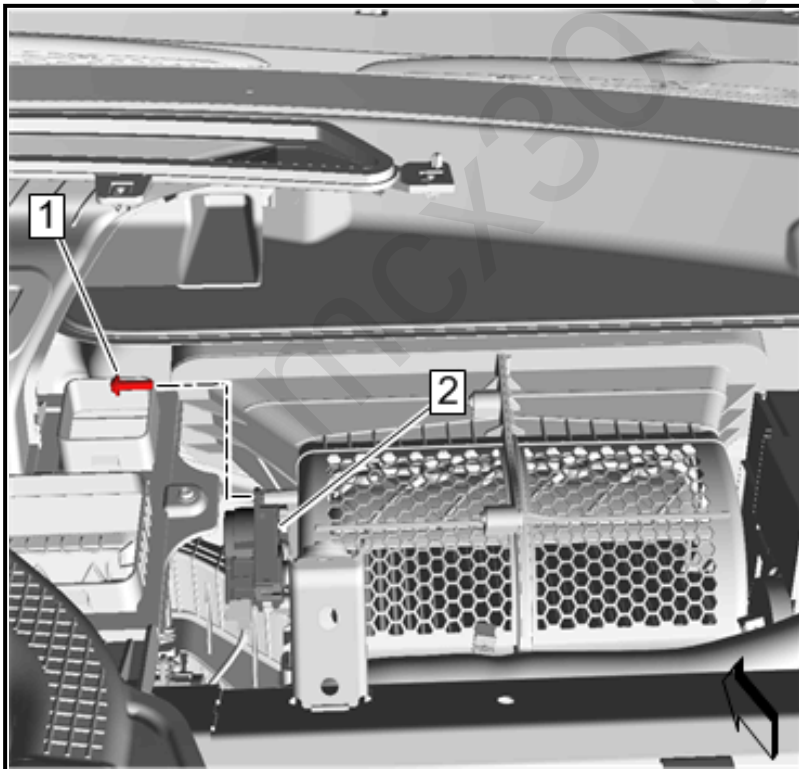
Air Inlet Valve Actuator Screw (1) - Remove

23. Air Inlet Valve Actuator (2) - Remove

24. Disconnect the electrical connector.

Installation Procedure

1.



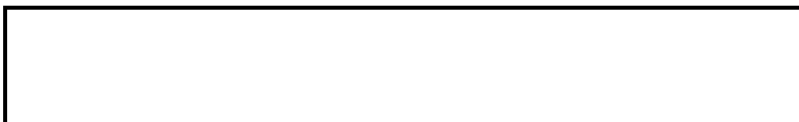
Connect the electrical connector.

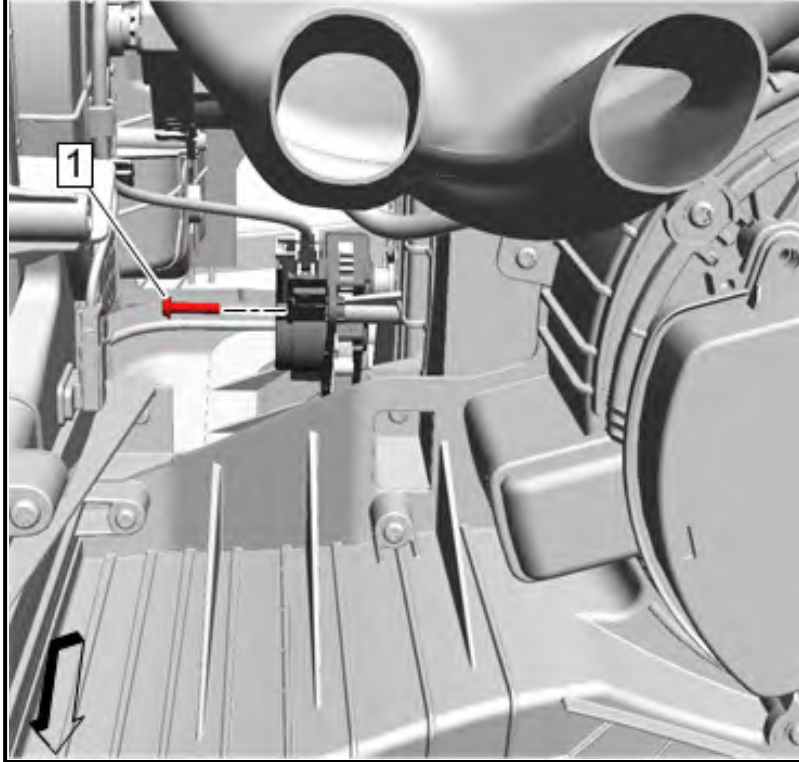
2. Air Inlet Valve Actuator (2) - Install

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

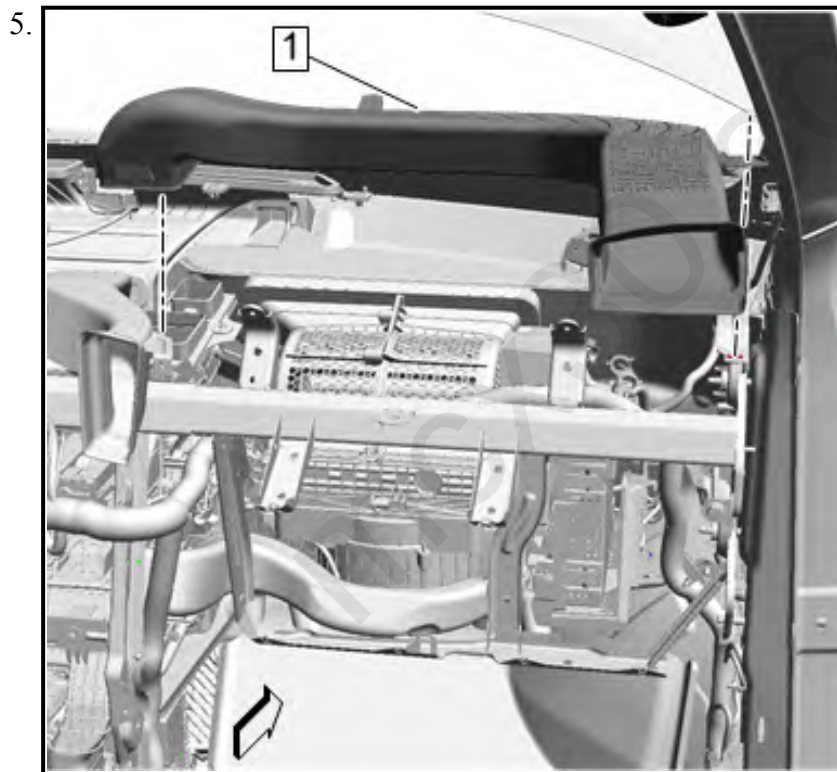
3. Air Inlet Valve Actuator Screw (1) - Install and tighten 1.3 N.m (12 lb in)

4.



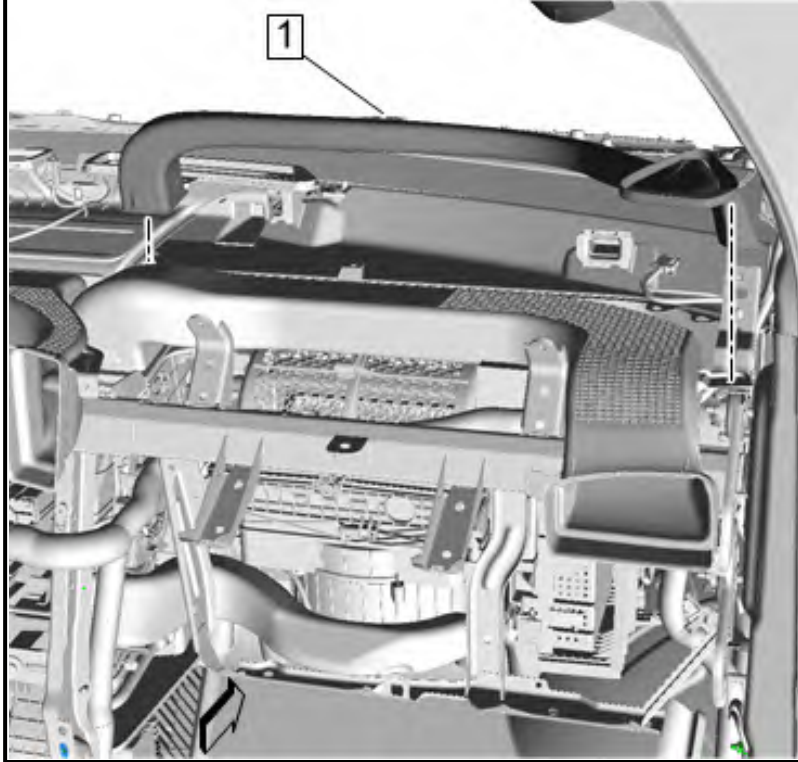


Air Inlet Valve Actuator Screw (1) - Install and tighten 1.3 N.m (12 lb in)

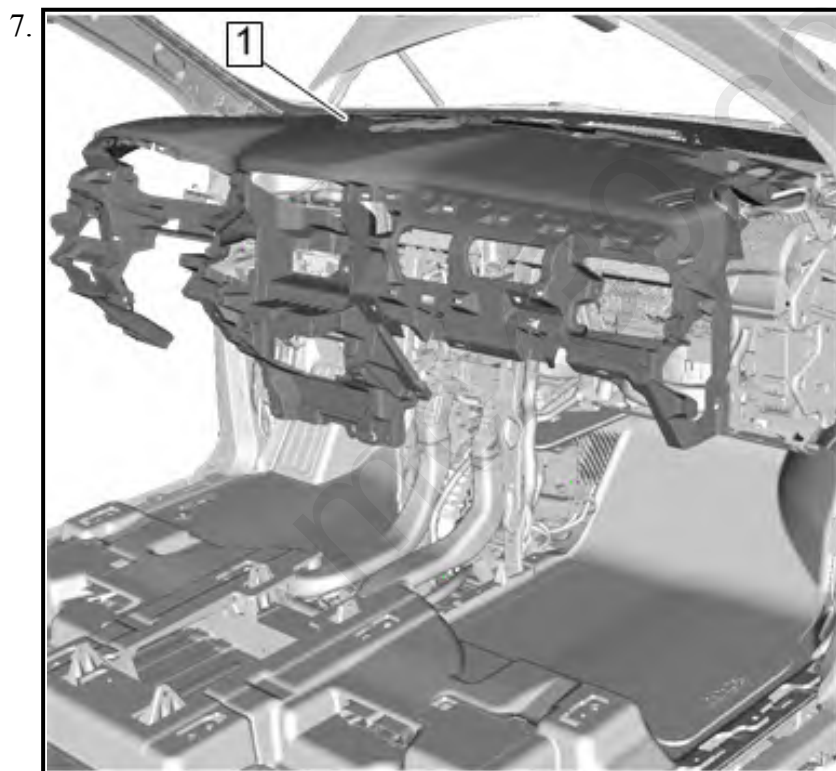


Instrument Panel Outer Air Outlet Duct - Right Side (1) - Install

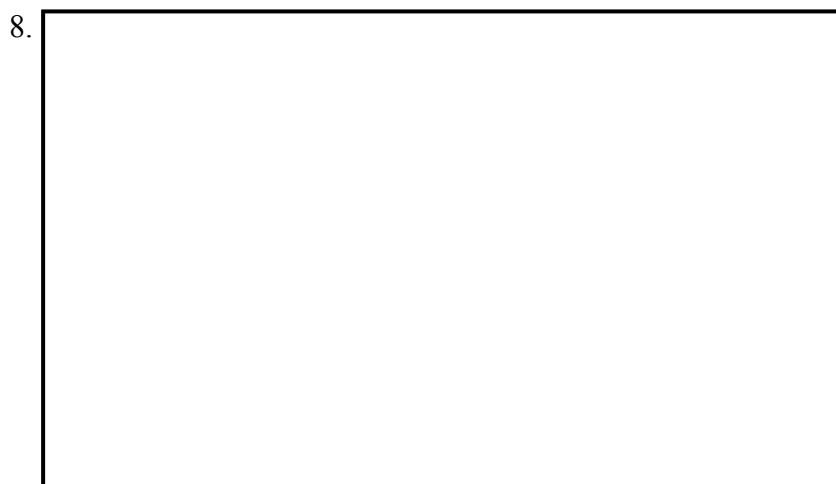


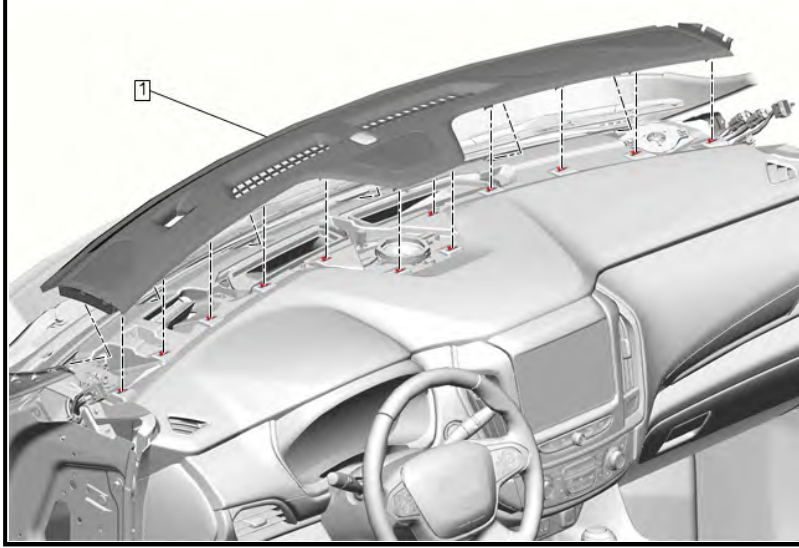


Side Window Defogger Outlet Duct - Right Side (1) - Install - [Side Window Defogger Outlet Duct Replacement - Right Side](#)



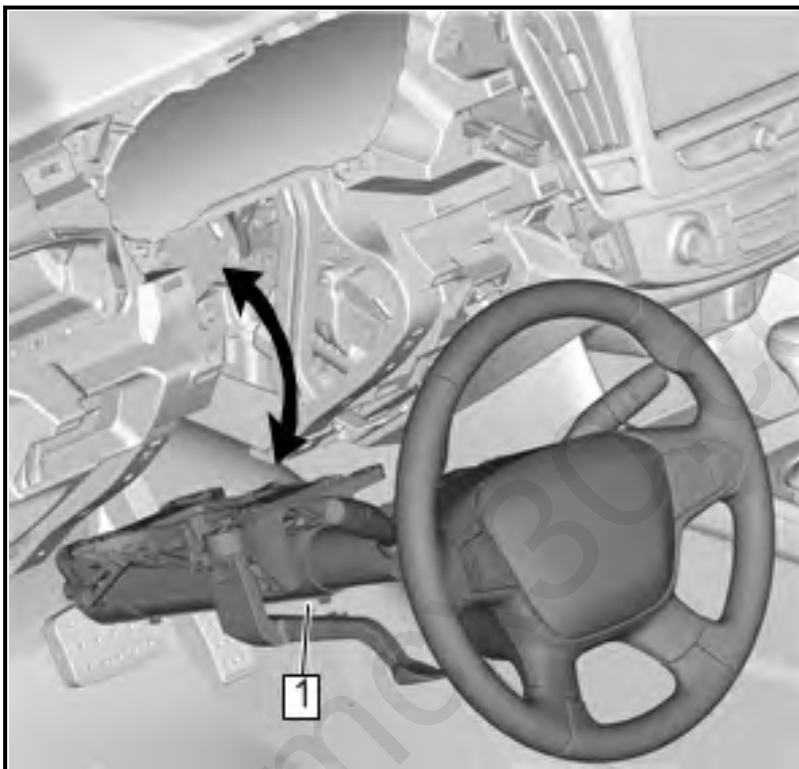
Instrument Panel (1) - Install - [Instrument Panel Assembly Replacement](#)





Instrument Panel Extension (1) - Install - [Instrument Panel Extension Replacement](#)

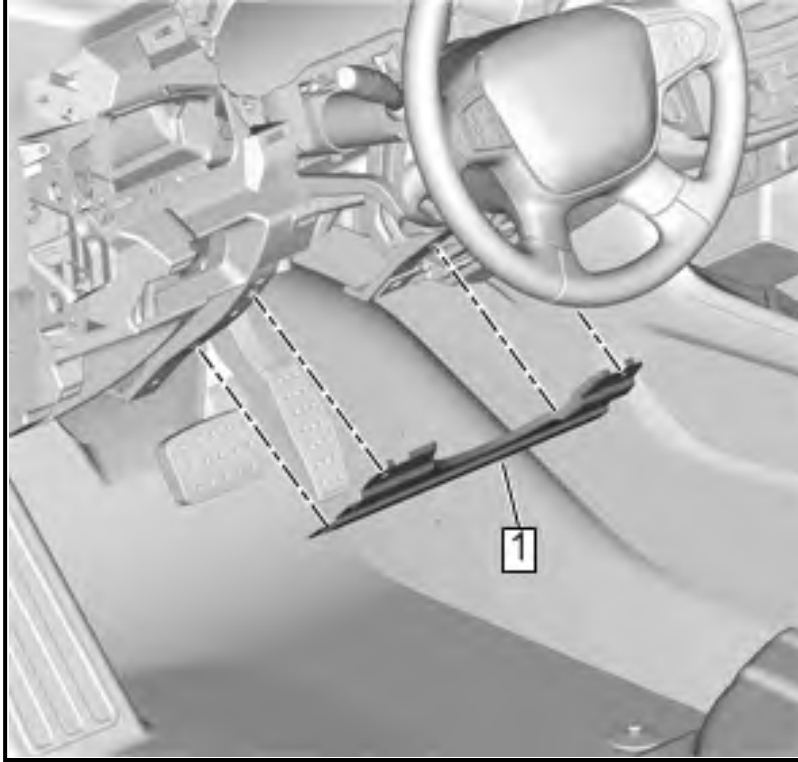
9.



Steering Column (1) - Install - [Steering Column Replacement \(N37\)](#). [Steering Column Replacement \(N38\)](#).

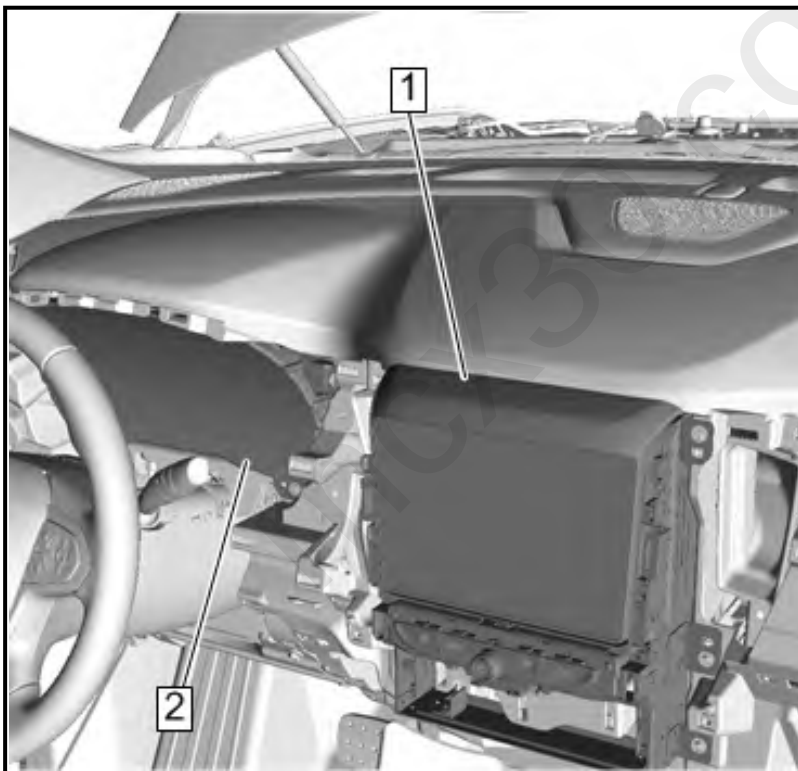
10.





Instrument Panel Knee Bolster Bracket (1) - Install - [Instrument Panel Knee Bolster Bracket Replacement](#)

11.



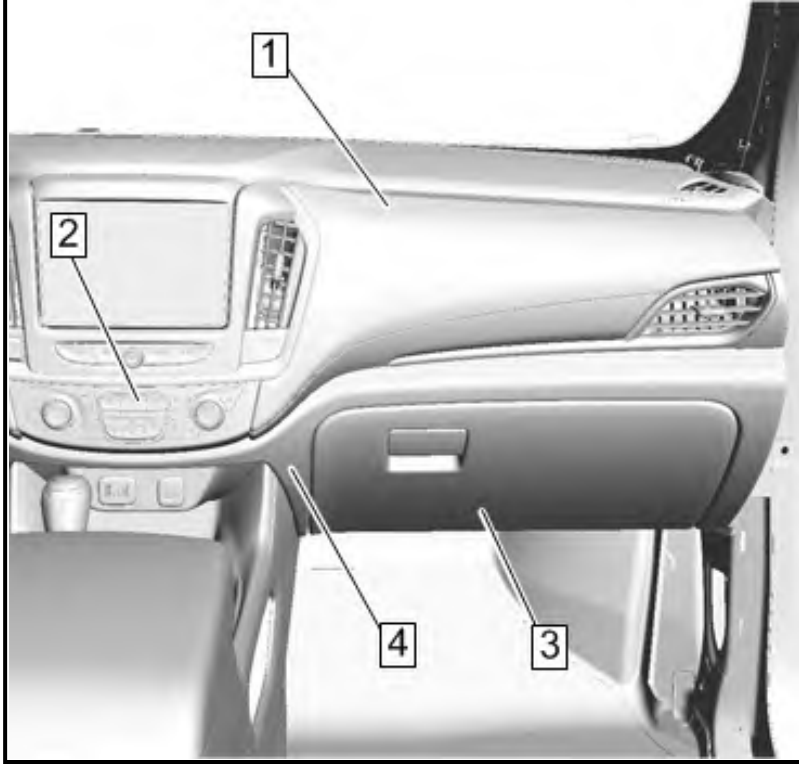
Connect the electrical connectors.

12. Instrument Cluster (2) - Install - [Instrument Cluster Replacement](#)

13. Radio Control (1) - Install - [Radio Control Assembly Replacement \(With IO5, IO6\)](#)

14.





Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

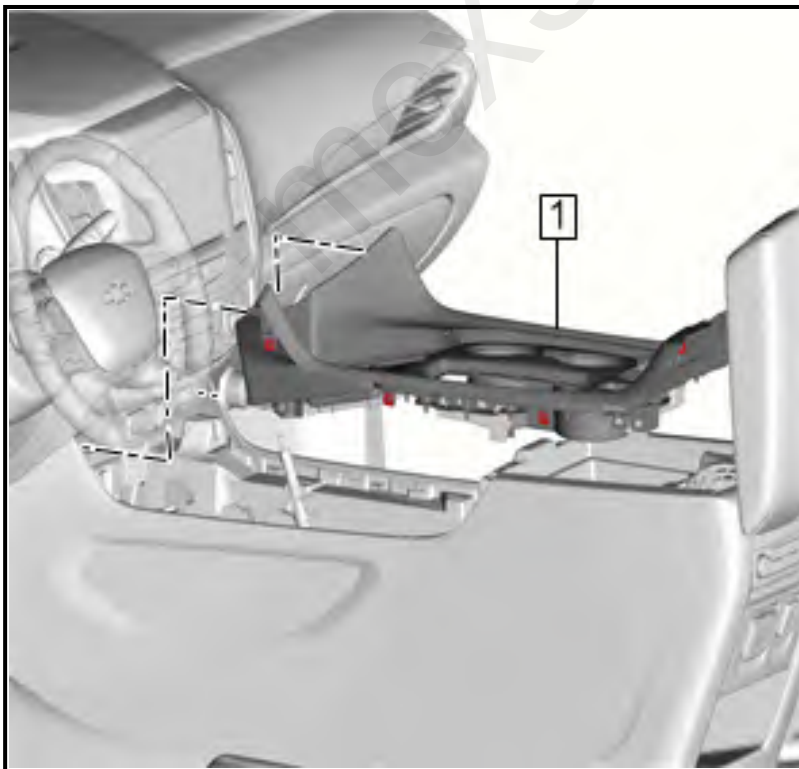
15. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

16. Connect the electrical connectors.

17. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

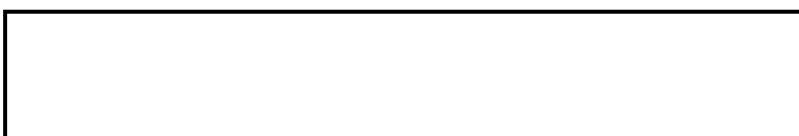
18. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)

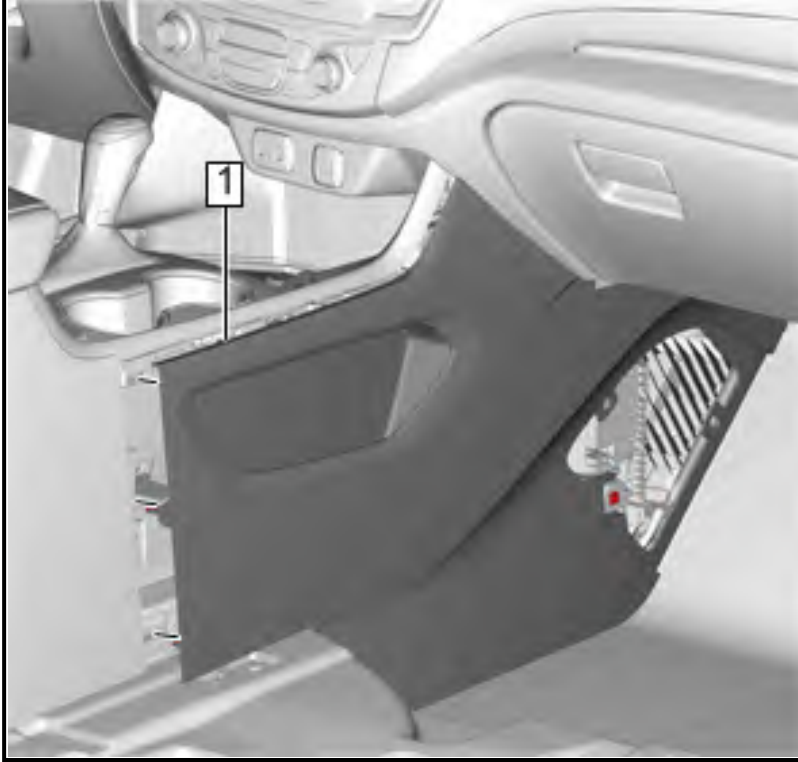
19.



Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)

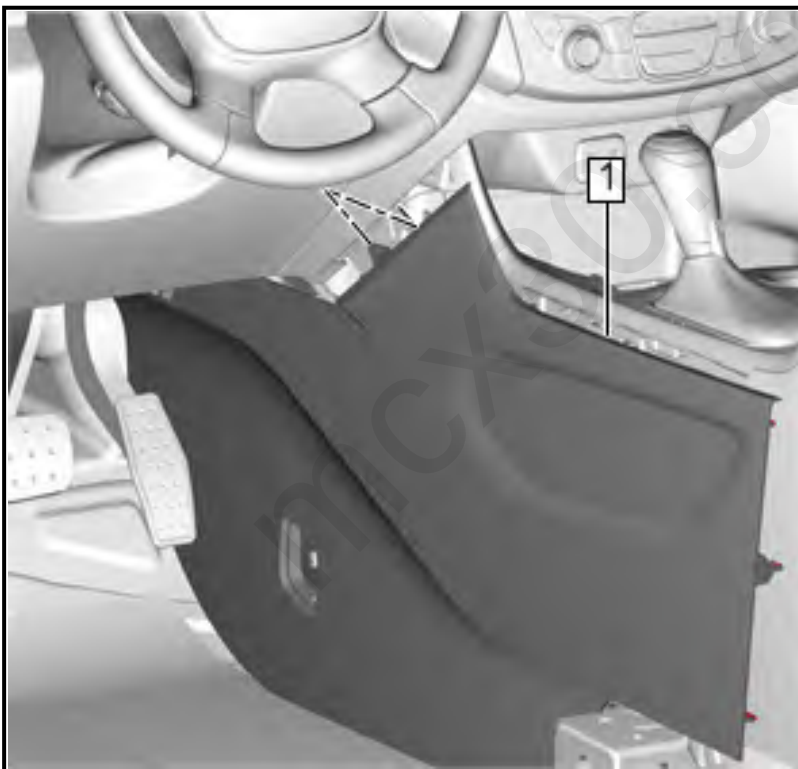
20.





Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)

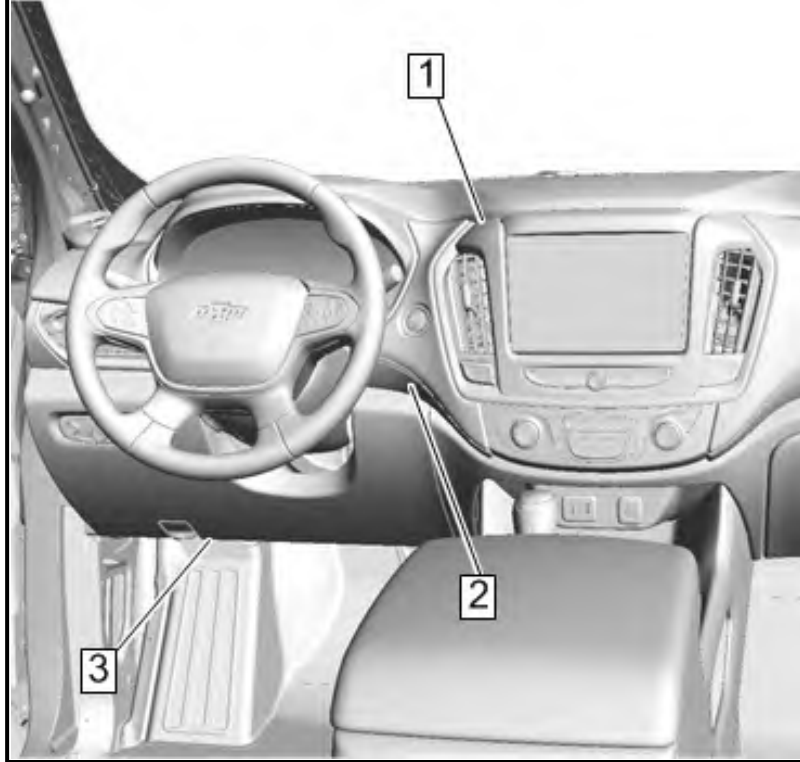
21.



Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

22.





Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

23. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#), [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)
24. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)
25. Clear the DTCs from the heater and air conditioning remote control module.
26. Perform the actuator calibration procedure. [Actuator Recalibration](#)

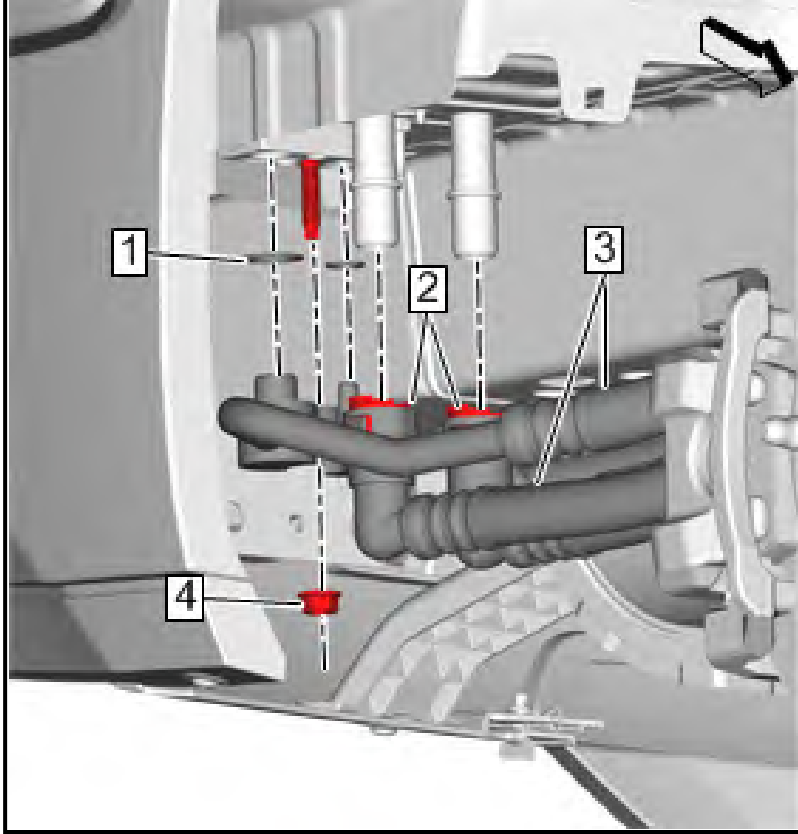
MODE VALVE ACTUATOR REPLACEMENT (AUXILIARY C69)

Removal Procedure

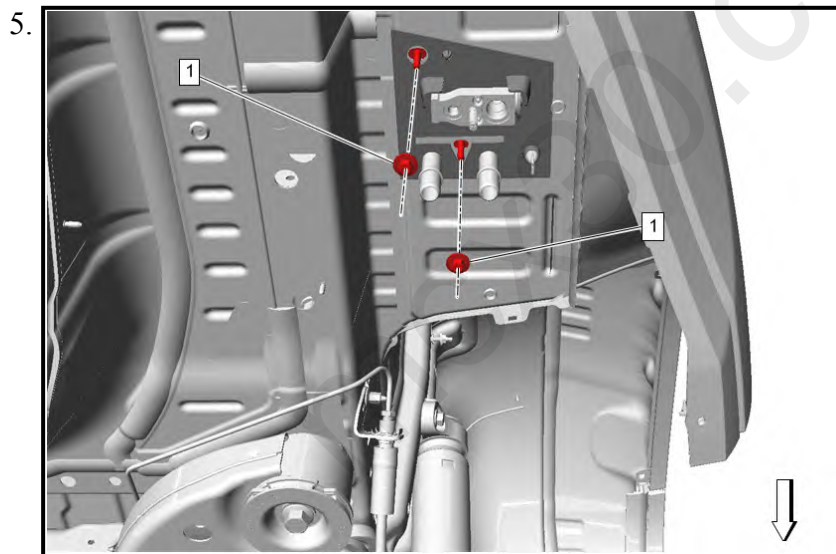
1. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)
2. Recover the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#), [Refrigerant Recovery and Recharging \(R-1234yf\)](#)
3. Drain the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#), [Cooling System Draining and Filling \(Static Fill\)](#)

4.





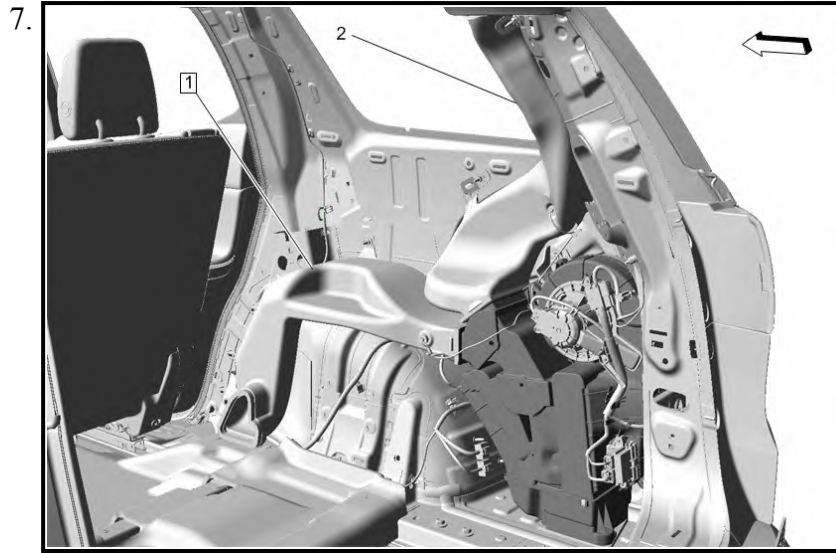
Auxiliary Air Conditioning Evaporator Intermediate Tube (3) @ Auxiliary Air Conditioning Evaporator and Blower Module - Remove - Auxiliary Air Conditioning Evaporator Intermediate Tube Replacement



Auxiliary Air Conditioning Evaporator and Blower Module Nut (1) - Remove [2x]



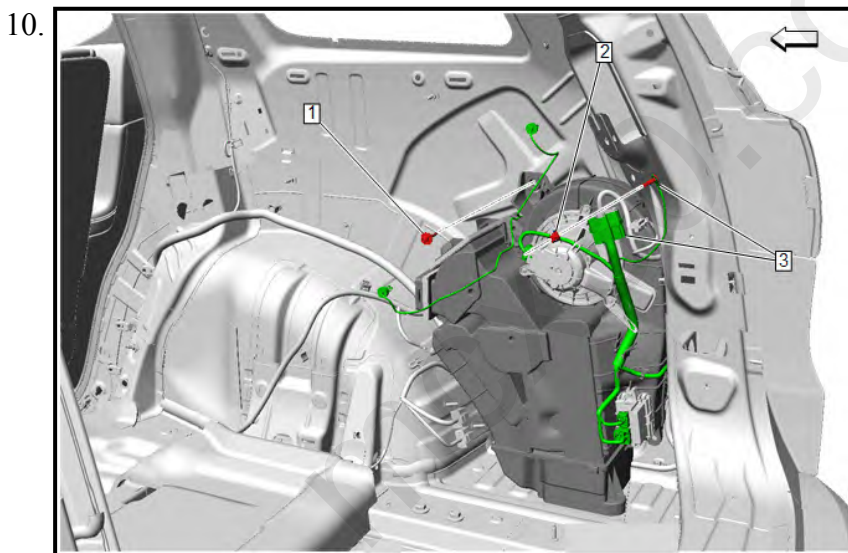
Quarter Lower Rear Trim Panel (1) - Remove - [Quarter Lower Rear Trim Panel Replacement \(Right Side\)](#) [Quarter Lower Rear Trim Panel Replacement \(Left Side\)](#)



Remove the duct temperature sensors from the ducts.

8. Auxiliary Heater Air Outlet Duct (1) - Remove - [Auxiliary Heater Air Outlet Duct Replacement](#)

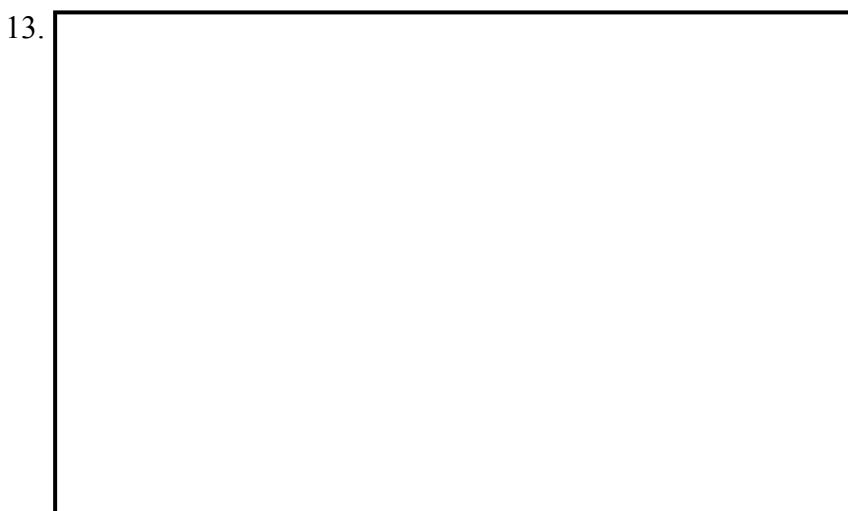
9. Auxiliary Air Conditioning Air Lower Duct (2) - Remove - [Auxiliary Air Conditioning Air Lower Duct Replacement](#)

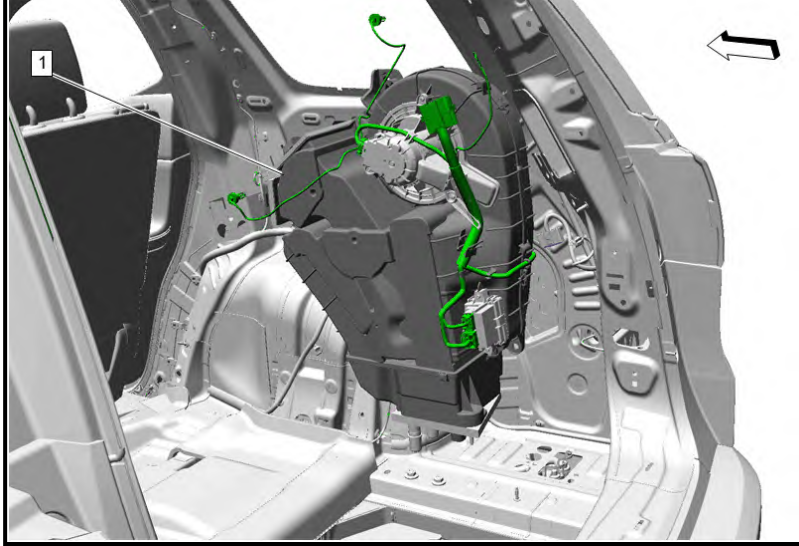


Auxiliary Air Conditioning Evaporator and Blower Module Bolt (1) - Remove

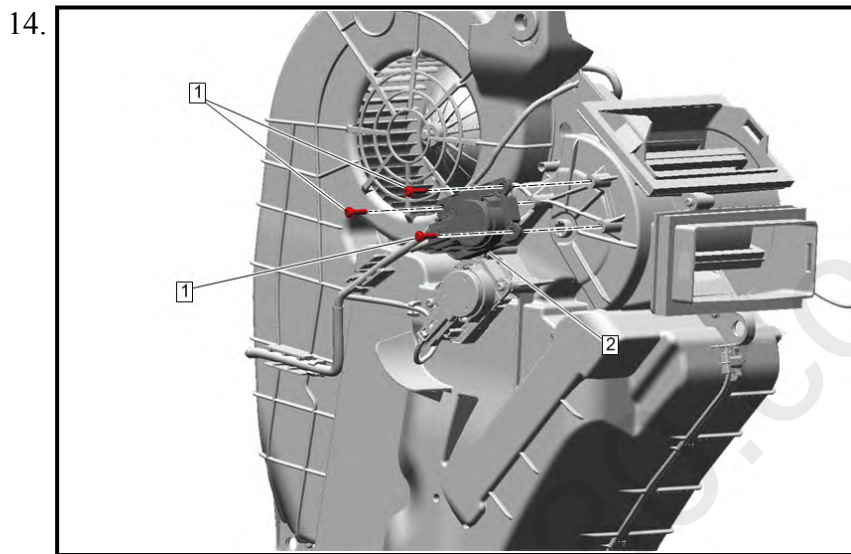
11. Ground Nut (2) - Remove

12. Disconnect the auxiliary heater and air conditioning wiring harness connector and ground terminal (3).





Auxiliary Air Conditioning Evaporator and Blower Module (1) - Remove

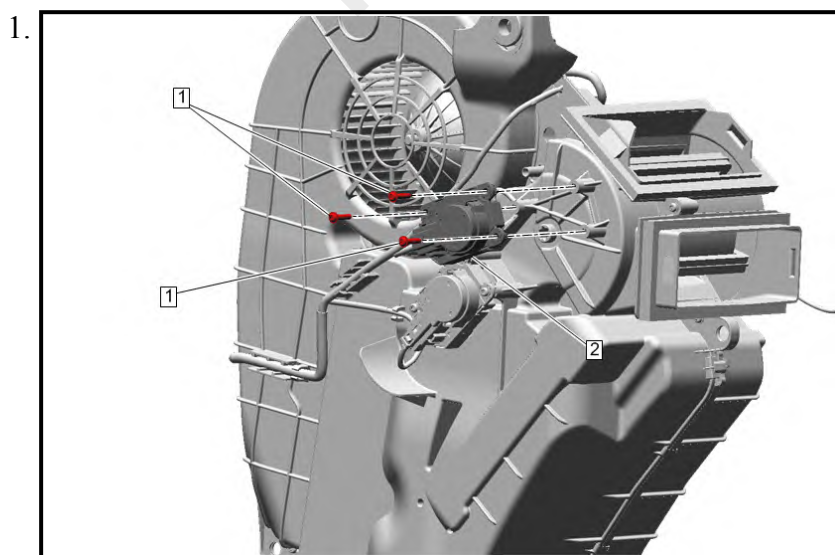


Disconnect the electrical connector.

15. Mode Valve Actuator Bolt (1) - Remove [3x]

16. Mode Valve Actuator (2) - Remove

Installation Procedure

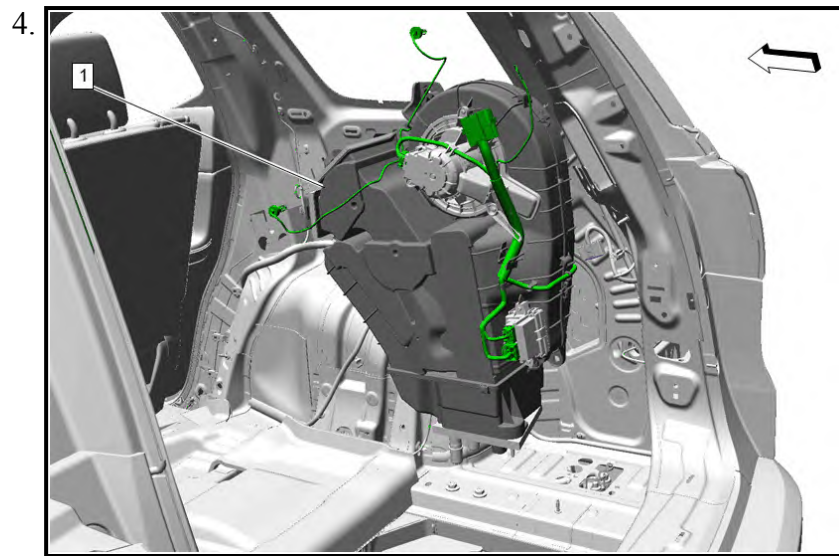


CAUTION: Refer to [Fastener Caution](#) .

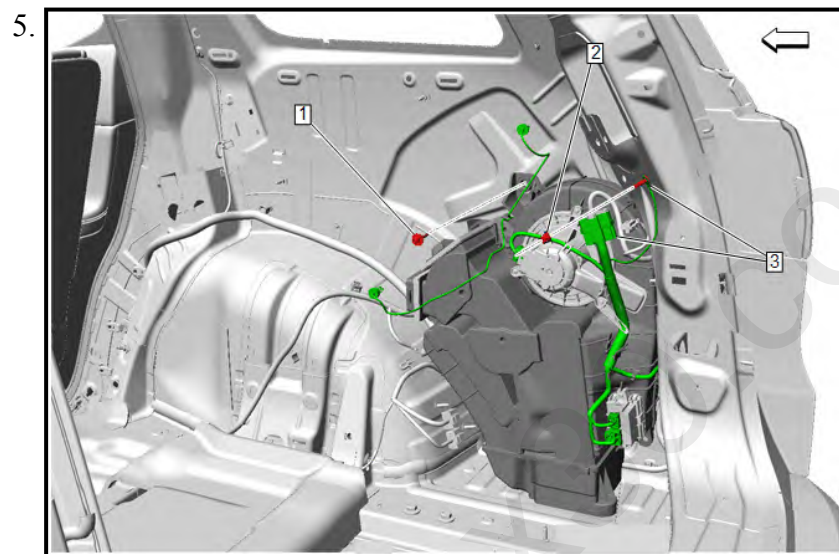
Mode Valve Actuator (2) - Install

2. Mode Valve Actuator Bolt (1) - Install and tighten [3x] 1.5 N.m (13 lb in)

3. Connect the electrical connector.



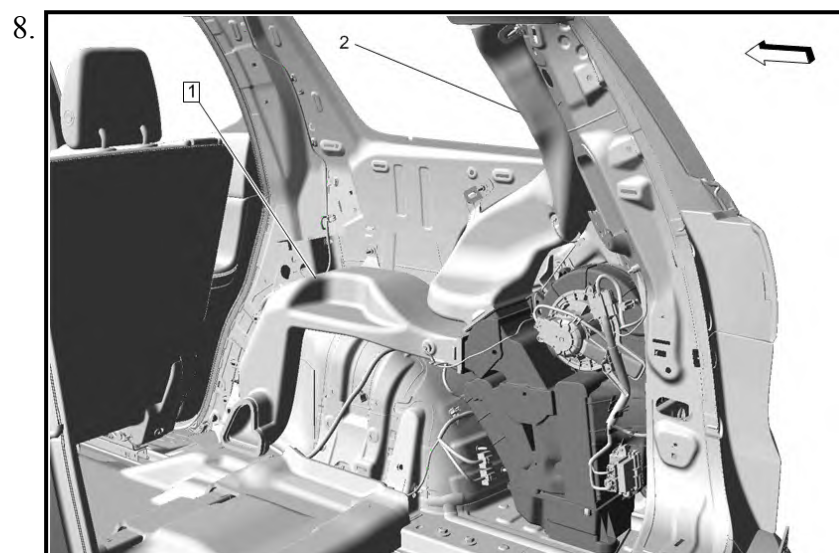
Auxiliary Air Conditioning Evaporator and Blower Module (1) - Install



Auxiliary Air Conditioning Evaporator and Blower Module Bolt (1) - Install and tighten 2.5 N.m (22 lb in)

6. Connect the auxiliary heater and air conditioning wiring harness connector and ground terminal (3).

7. Ground Nut (2) - Install and tighten 9 N.m (80 lb in)

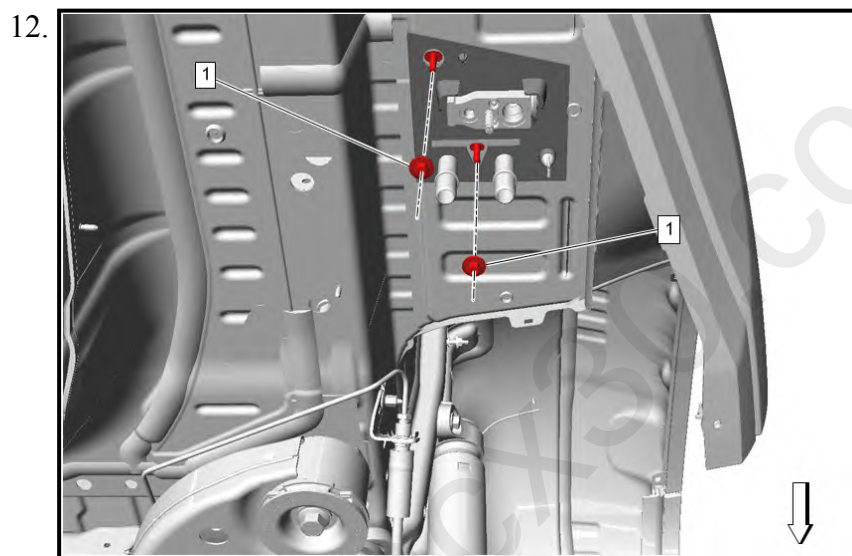


Auxiliary Air Conditioning Air Lower Duct (2) - Install - [Auxiliary Air Conditioning Air Lower Duct Replacement](#)

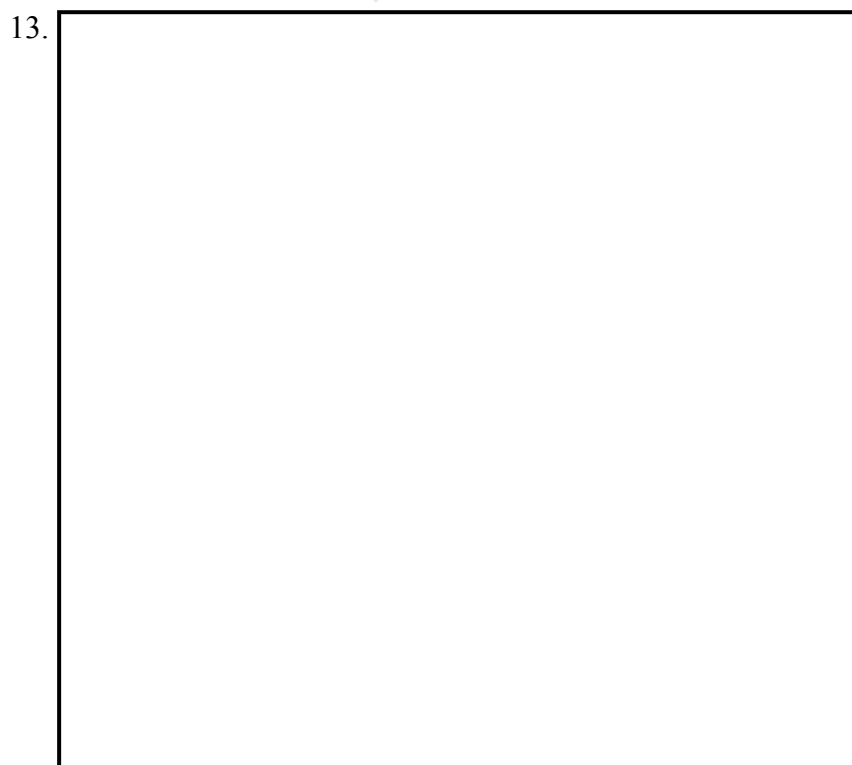
9. Auxiliary Heater Air Outlet Duct (1) - Install - [Auxiliary Heater Air Outlet Duct Replacement](#)
10. Install the duct temperature sensors into the ducts.

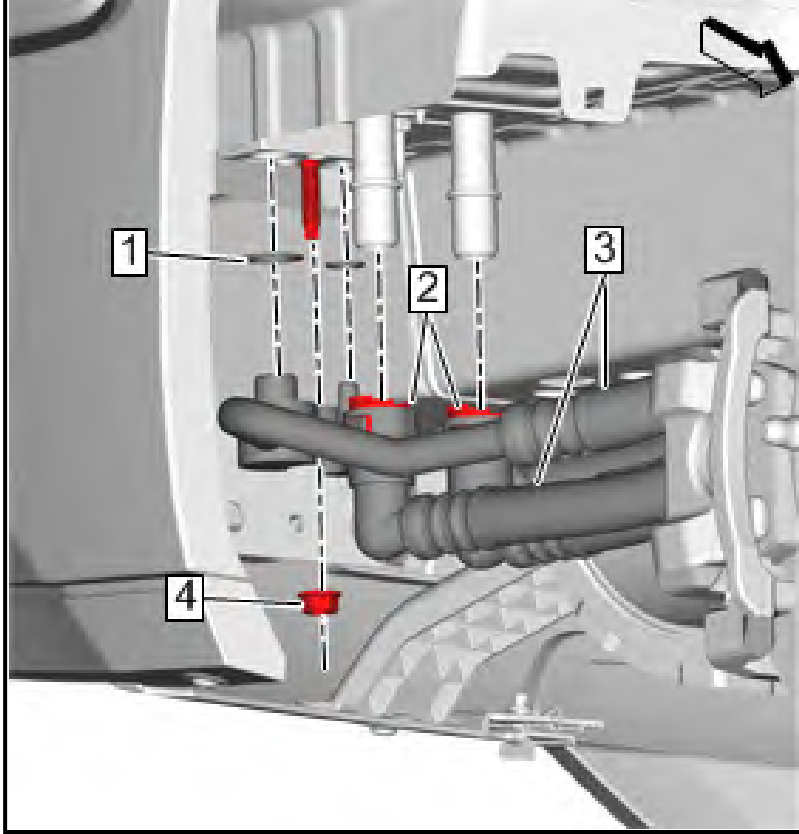


Quarter Lower Rear Trim Panel (1) - Install - [Quarter Lower Rear Trim Panel Replacement \(Right Side\)](#) [Quarter Lower Rear Trim Panel Replacement \(Left Side\)](#)



Auxiliary Air Conditioning Evaporator and Blower Module Nut (1) - Install and tighten [2x] 9 N.m (80 lb in)



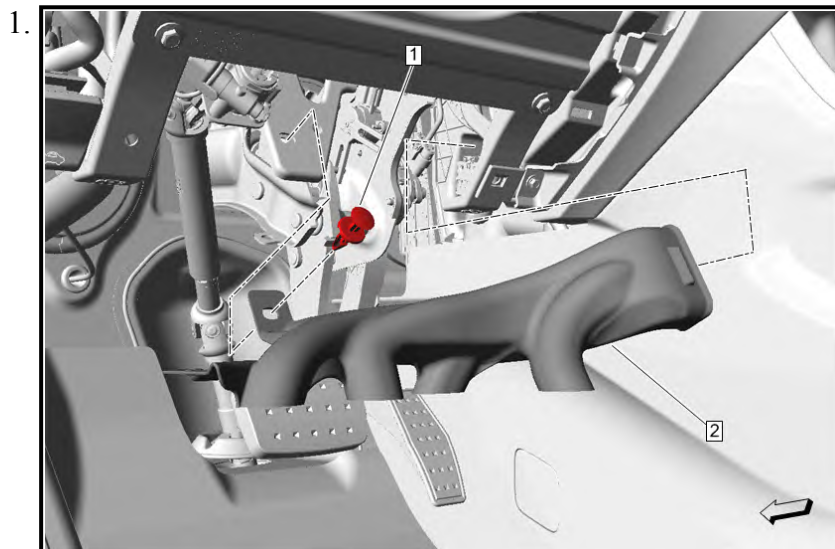


Auxiliary Air Conditioning Evaporator Intermediate Tube (3) @ Auxiliary Air Conditioning Evaporator and Blower Module - Install - [Auxiliary Air Conditioning Evaporator Intermediate Tube Replacement](#)

14. Connect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)
15. Fill the cooling system to the proper level. [Cooling System Draining and Filling \(GE 47716\)](#)
[Cooling System Draining and Filling \(Static Fill\)](#)
16. Evacuate and charge the refrigerant system. [Refrigerant Recovery and Recharging \(R-134a\)](#)
[Refrigerant Recovery and Recharging \(R-1234yf\)](#)
17. Clear the DTCs from the heater and air conditioning remote control module.
18. Perform the actuator calibration procedure. [Actuator Recalibration](#)
19. Inspect for coolant leaks.
20. Inspect for refrigerant leaks.

MODE VALVE ACTUATOR REPLACEMENT (CJ2)

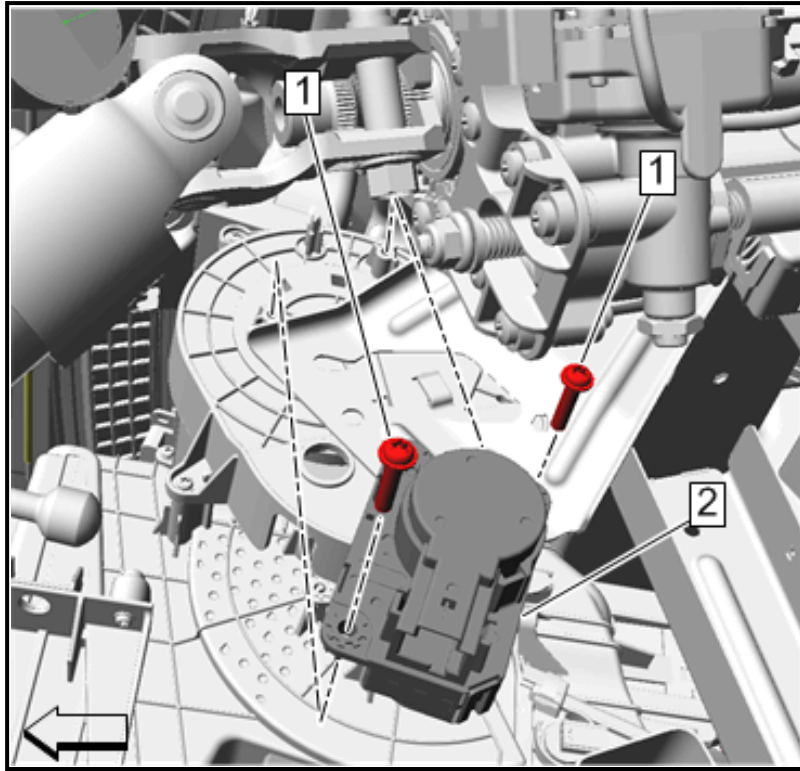
Removal Procedure



Floor Front Air Outlet Duct - Left Side (2) - Remove - [Floor Front Air Outlet Duct Replacement - Left Side](#)

2. Brake and Accelerator Pedal Assembly - Remove - [Brake and Accelerator Pedal Assembly Replacement](#)

3.

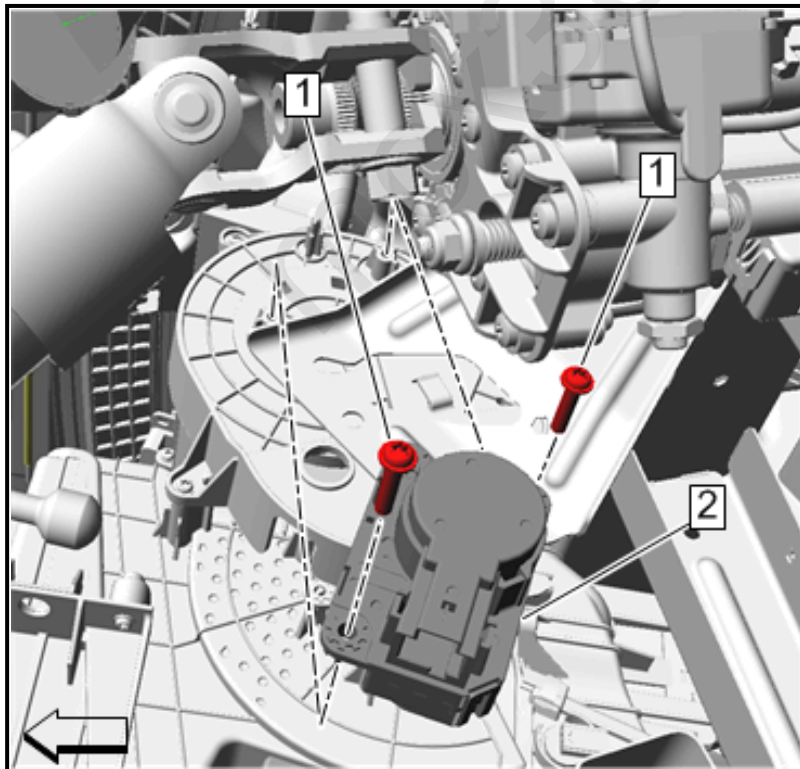


Mode Valve Actuator Bolt (1) - Remove [2x]

4. Mode Valve Actuator (2) - Remove
5. Disconnect the electrical connector.

Installation Procedure

1.



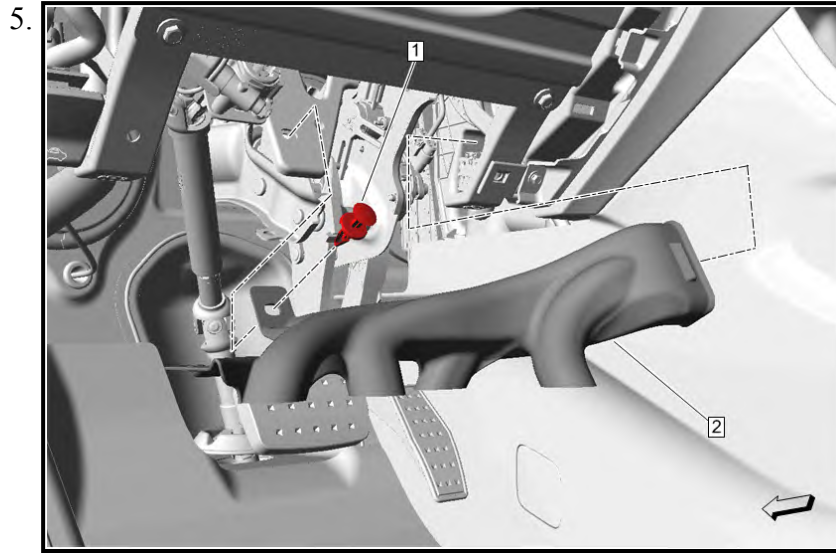
Connect the electrical connector.

2. Mode Valve Actuator (2) - Install

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

3. Mode Valve Actuator Bolt (1) - Install and tighten [2x] 1.3 N.m (12 lb in)

4. Brake and Accelerator Pedal Assembly - Install - [Brake and Accelerator Pedal Assembly Replacement](#)

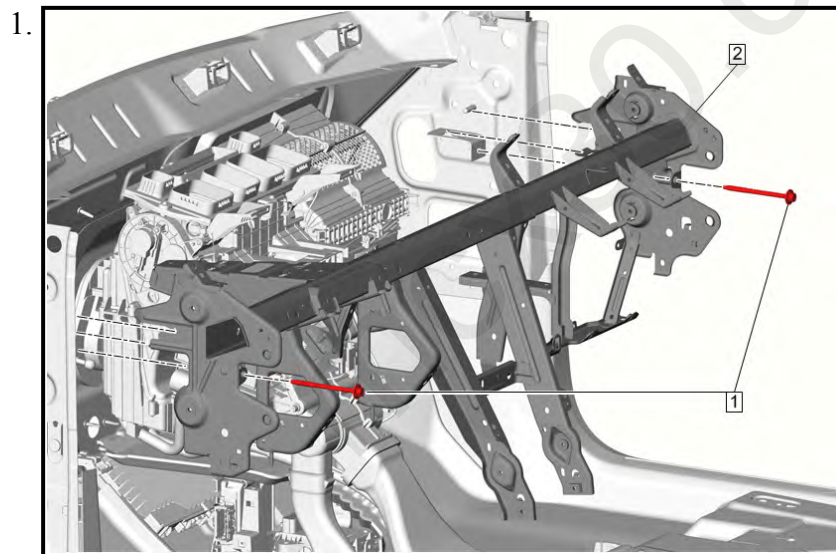


Floor Front Air Outlet Duct - Left Side (2) - Install - [Floor Front Air Outlet Duct Replacement - Left Side](#)

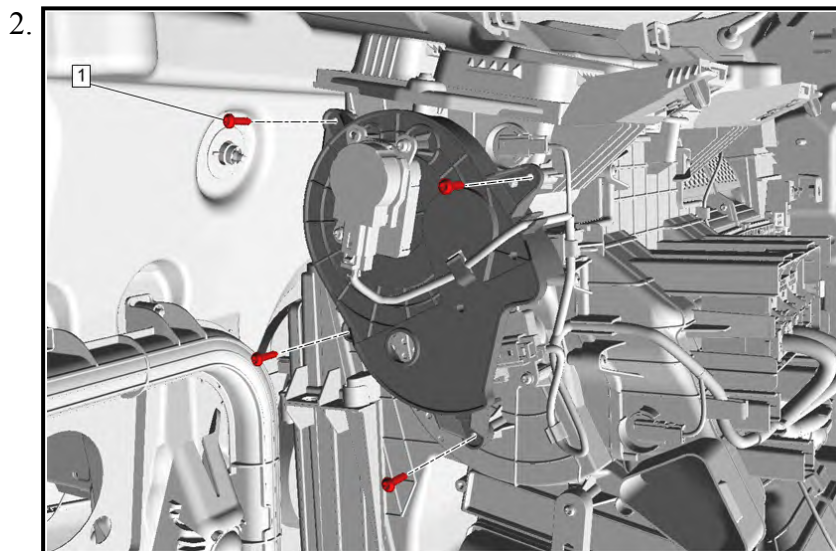
6. Clear the DTCs from the heater and air conditioning remote control module.
7. Perform the actuator calibration procedure. [Actuator Recalibration](#)

MODE CONTROL CAM REPLACEMENT (AND LEVERS)

Removal Procedure

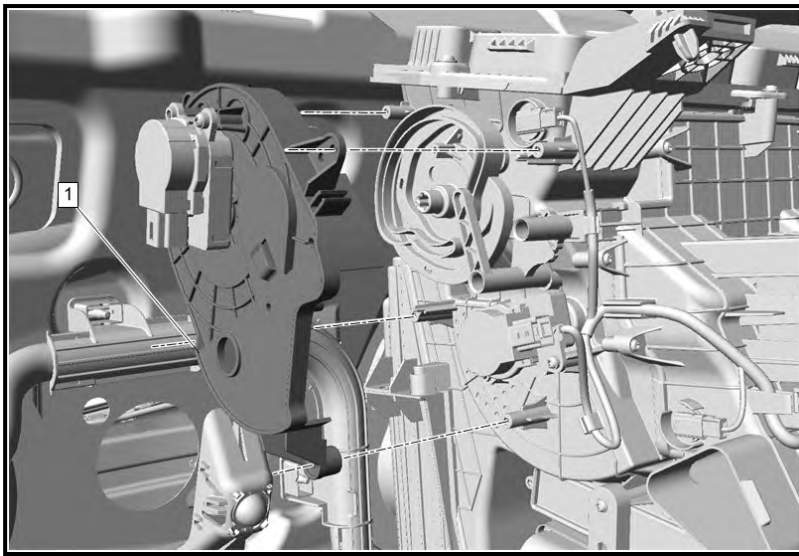


Instrument Panel Tie Bar (2) - Remove - [Instrument Panel Tie Bar Replacement](#)



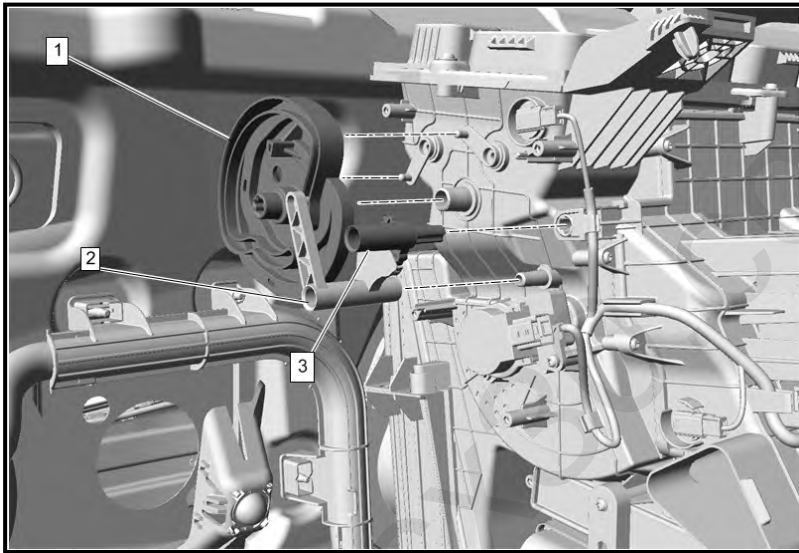
Heater and Air Conditioning Mode Control Cam Cover Bolt (1) - Remove [4x]

3.



Heater and Air Conditioning Mode Control Cam Cover (1) @ Heater and Air Conditioning Evaporator and Blower Module - Remove

4.



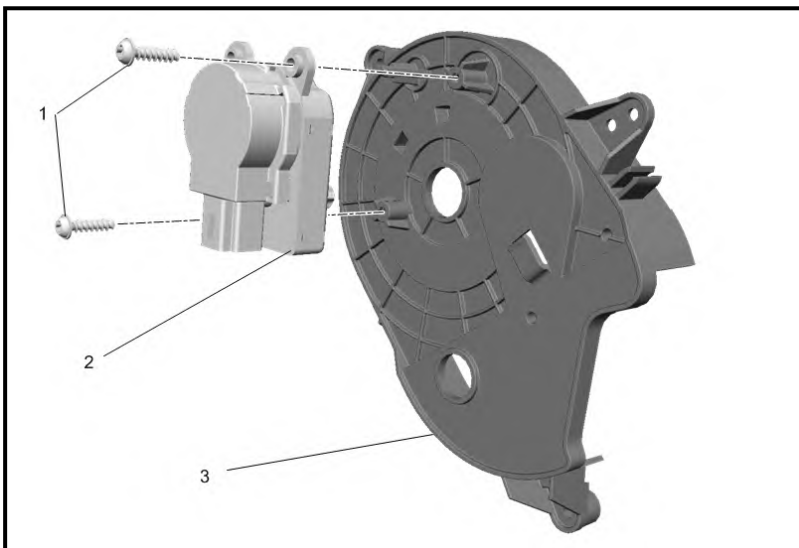
Mode Control Cam (1) - Remove

5. Mode Control Cam Actuator Sub-Lever - Vent (2) - Remove

6. Mode Control Cam Actuator Sub-Lever - Vent Gear (3) - Remove

7. Inspect the components and replace as necessary.

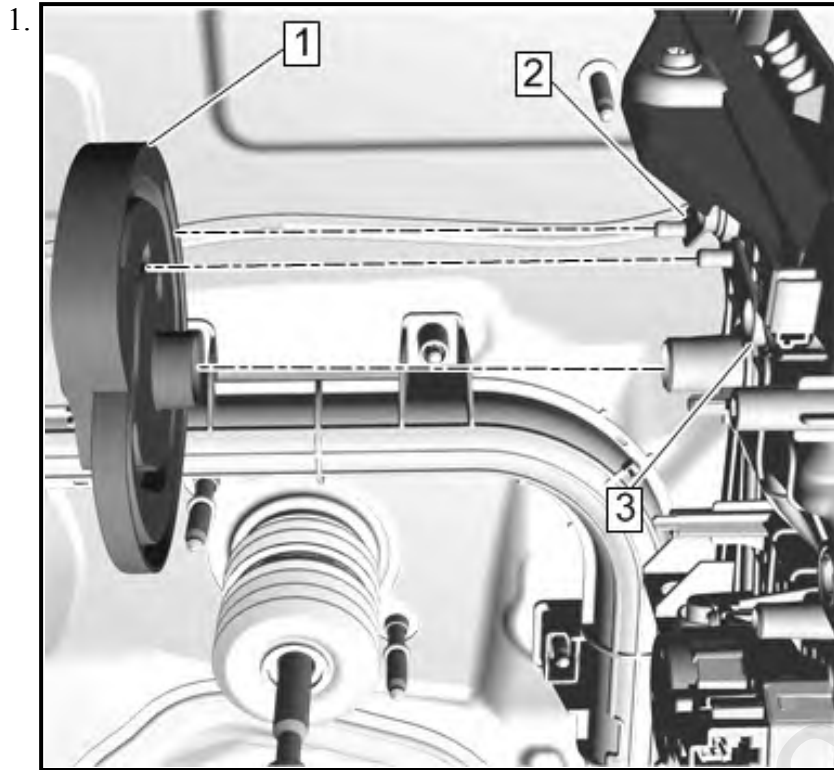
8.



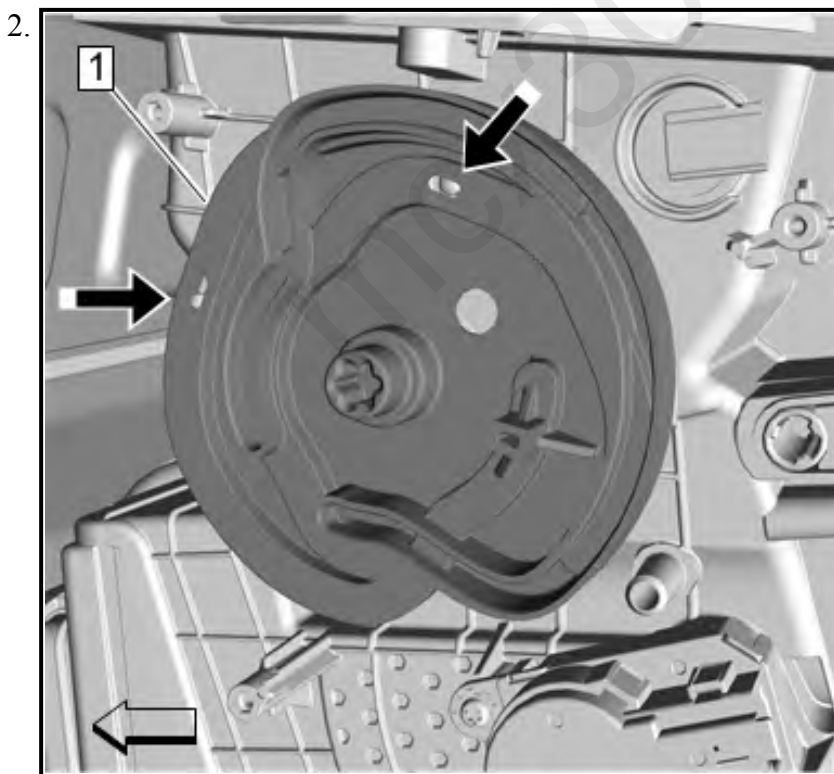
Mode Valve Actuator Bolt (1) - Remove [2x]

9. Mode Valve Actuator (2) @ Heater and Air Conditioning Mode Control Cam Cover (3) - Remove
10. Inspect the components and replace as necessary.

Installation Procedure

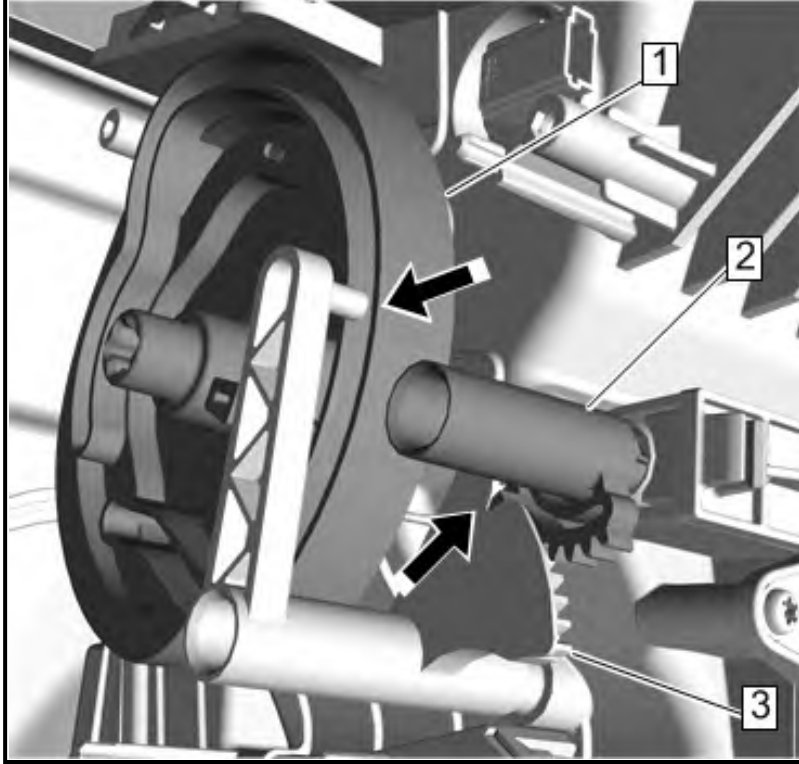


Install the mode control cam (1) onto the heater and air conditioning evaporator and blower module, and install the defroster valve lever (2) pin to the outside mode control cam guide channel, and the vent valve lever (3) pin to the inside mode control cam guide channel.



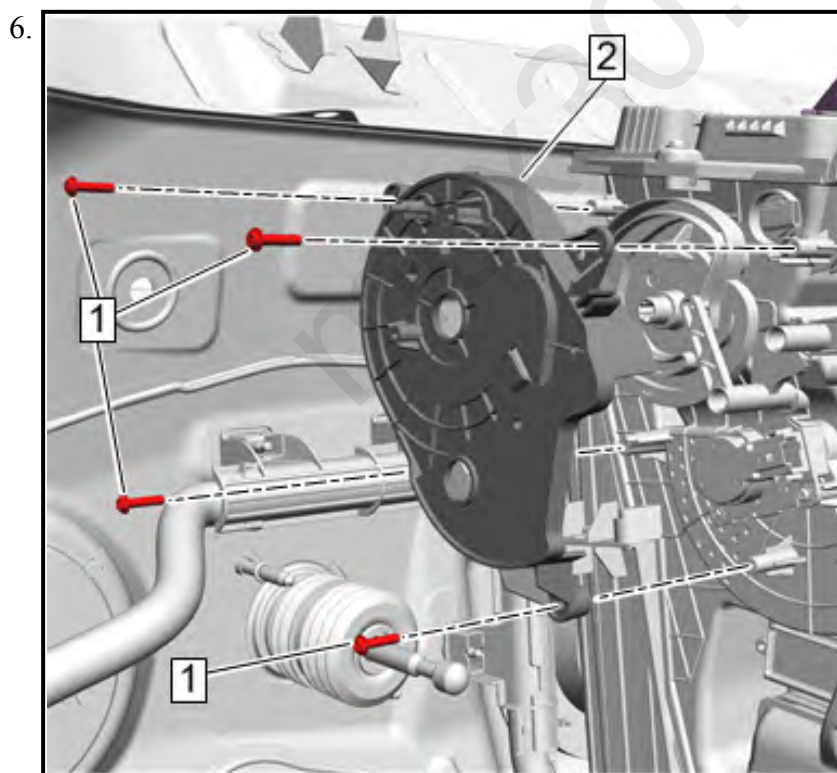
Rotate the mode control cam (1) to the right and to the left. The defroster valve lever and vent valve lever pins should align with the inspection windows indicated by the arrows.





Mode Control Cam Actuator Sub-Lever - Vent Gear (2) - Install

4. Install the mode control cam actuator sub-lever - vent (3) and align the index tooth of the mode control cam actuator sub-lever - vent gear (2) to the index tooth of the mode control cam actuator sub-lever - vent (3) indicated by the arrow.
5. Install the mode control cam actuator sub-lever - vent (3) pin onto the mode control cam (1) guide channel indicated by the arrow.

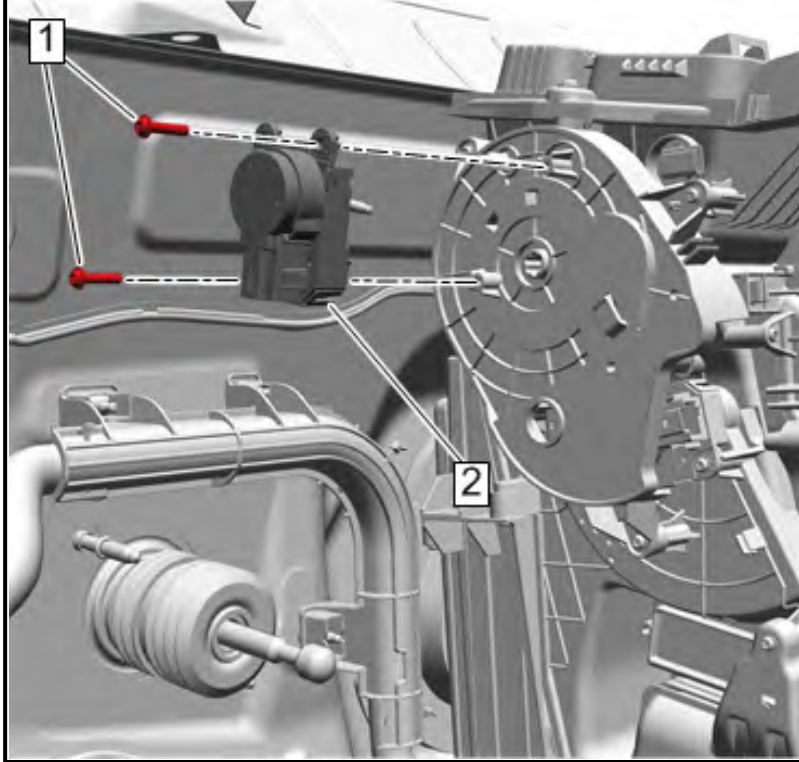


Heater and Air Conditioning Mode Control Cam Cover (2) @ Heater and Air Conditioning Evaporator and Blower Module - Install

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

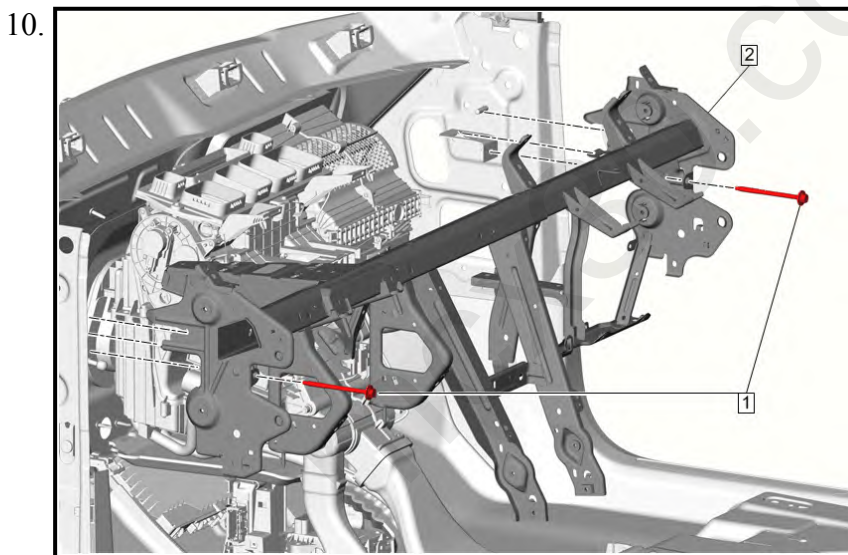
7. Heater and Air Conditioning Mode Control Cam Cover Bolt (1) - Install and tighten [4x] 2.5 N.m (22 lb in)





Mode Valve Actuator (2) @ Heater and Air Conditioning Mode Control Cam Cover - Install

9. Mode Valve Actuator Bolt (1) - Install and tighten [2x] [Mode Valve Actuator Replacement \(Auxiliary C69\)](#) [Mode Valve Actuator Replacement \(CJ2\)](#)



Instrument Panel Tie Bar (2) - Install - [Instrument Panel Tie Bar Replacement](#)

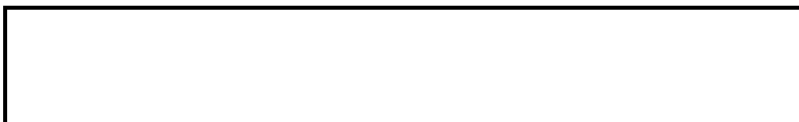
11. Perform the actuator calibration procedure. [Actuator Recalibration](#)
12. Clear the DTCs.

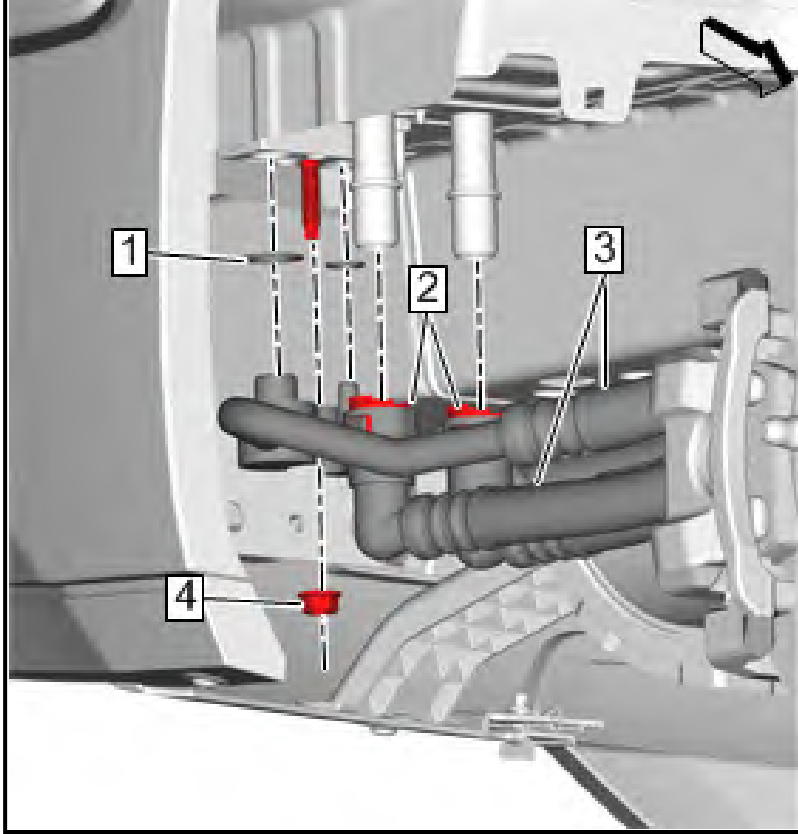
TEMPERATURE VALVE ACTUATOR REPLACEMENT (AUXILIARY C69)

Removal Procedure

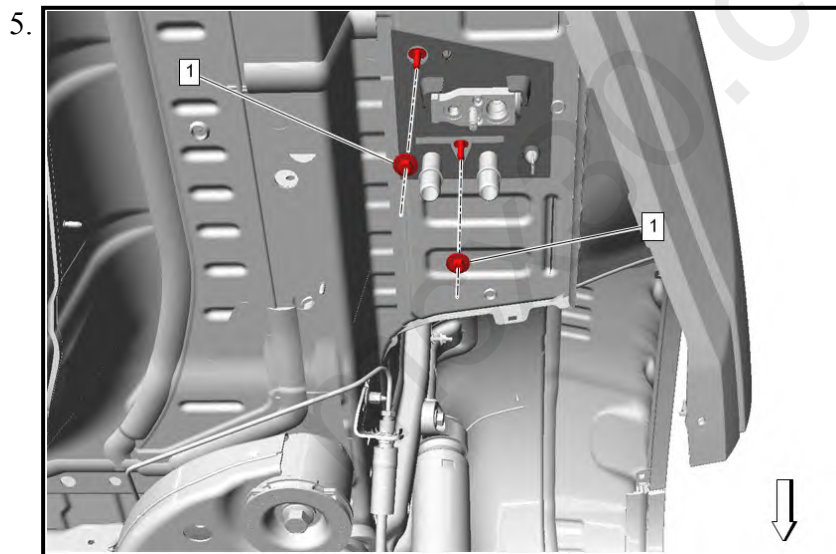
1. Disconnect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)
2. Recover the refrigerant. [Refrigerant Recovery and Recharging \(R-134a\)](#) [Refrigerant Recovery and Recharging \(R-1234yf\)](#)
3. Drain the cooling system. [Cooling System Draining and Filling \(GE 47716\)](#) [Cooling System Draining and Filling \(Static Fill\)](#)

4.



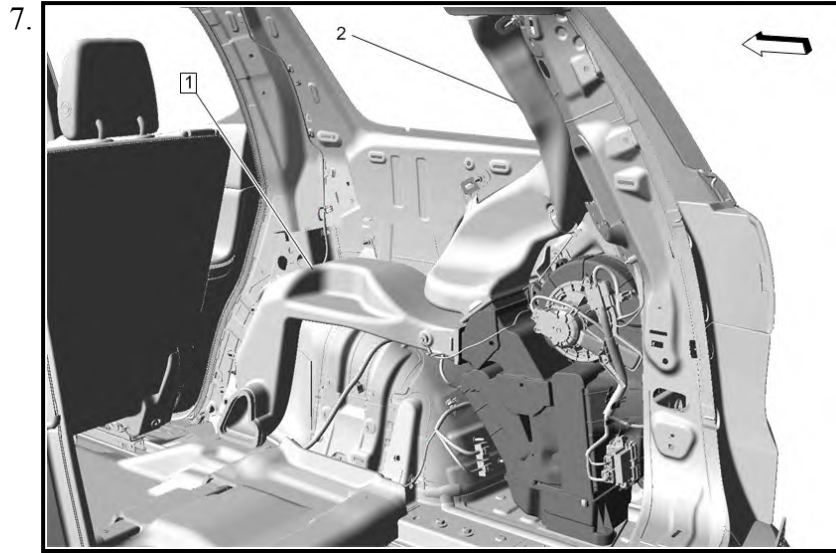


Auxiliary Air Conditioning Evaporator Intermediate Tube (3) @ Auxiliary Air Conditioning Evaporator and Blower Module - Remove - Auxiliary Air Conditioning Evaporator Intermediate Tube Replacement



Auxiliary Air Conditioning Evaporator and Blower Module Nut (1) - Remove [2x]

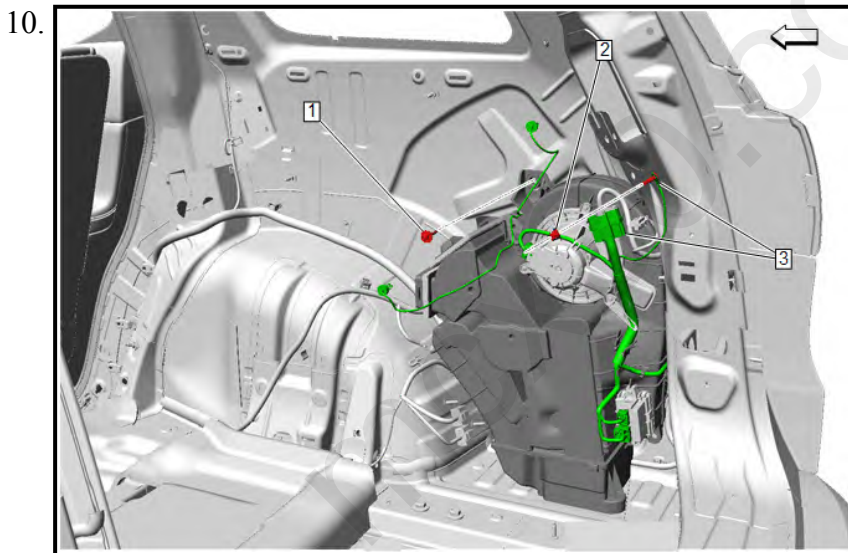




Remove the duct temperature sensors from the ducts.

8. Auxiliary Heater Air Outlet Duct (1) - Remove - [Auxiliary Heater Air Outlet Duct Replacement](#)

9. Auxiliary Air Conditioning Air Lower Duct (2) - Remove - [Auxiliary Air Conditioning Air Lower Duct Replacement](#)

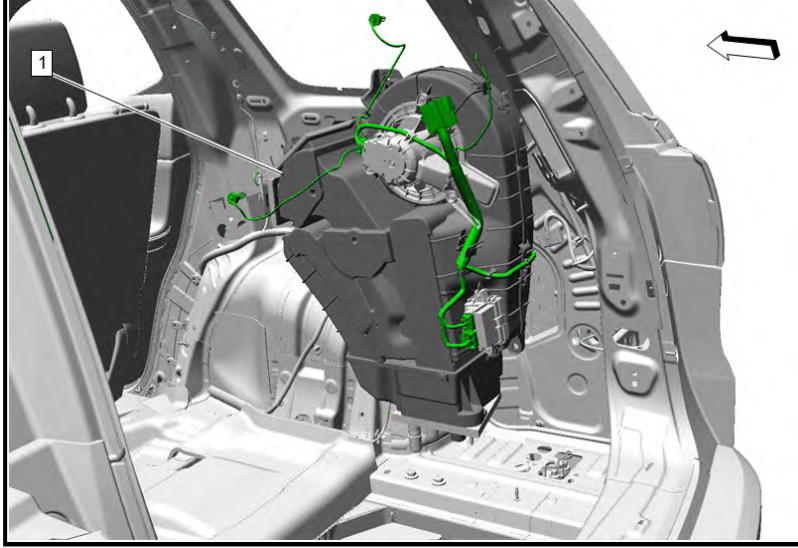


Auxiliary Air Conditioning Evaporator and Blower Module Bolt (1) - Remove

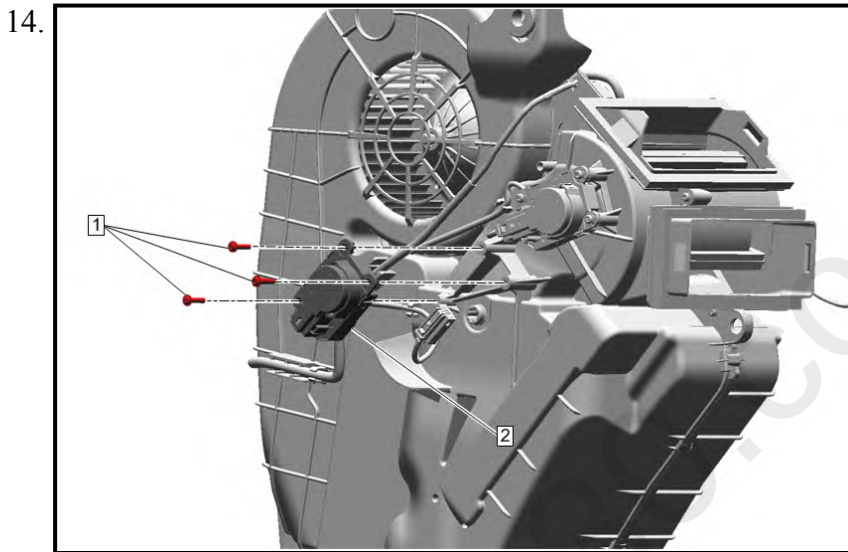
11. Ground Nut (2) - Remove

12. Disconnect the auxiliary heater and air conditioning wiring harness connector and ground terminal (3).





Auxiliary Air Conditioning Evaporator and Blower Module (1) - Remove

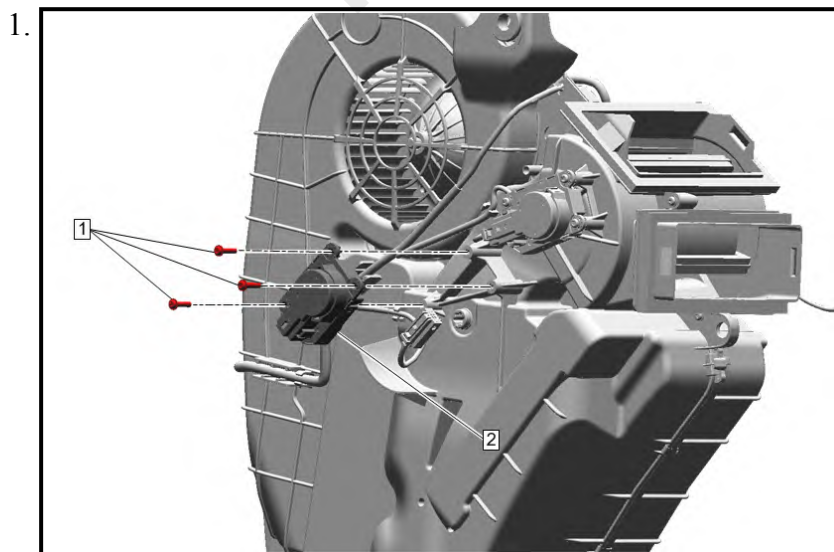


Disconnect the electrical connector.

15. Temperature Valve Actuator Bolt (1) - Remove [3x]

16. Temperature Valve Actuator (2) - Remove

Installation Procedure

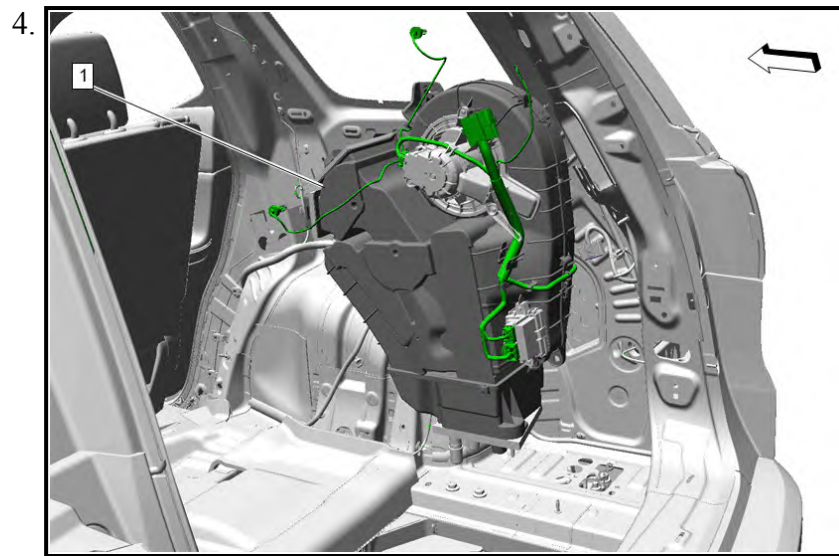


CAUTION: Refer to [Fastener Caution](#) .

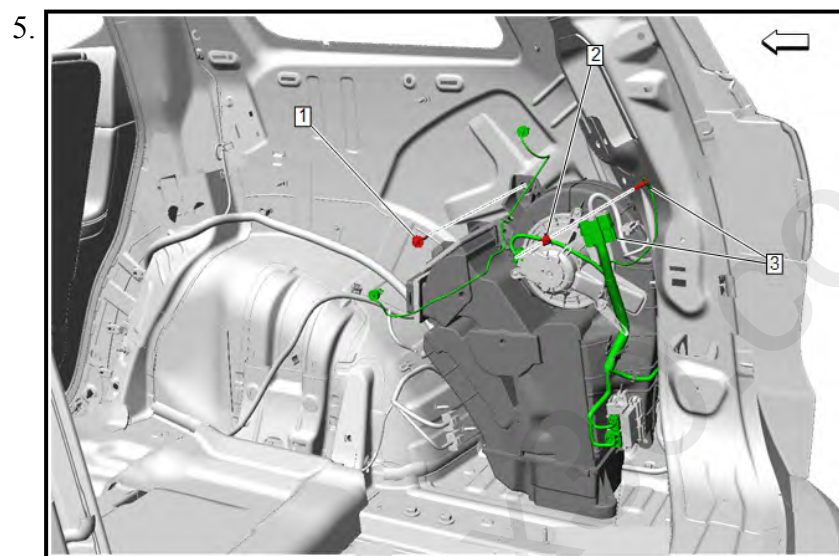
Temperature Valve Actuator (2) - Install

2. Temperature Valve Actuator Bolt (1) - Install and tighten [3x] 1.5 N.m (13 lb in)

3. Connect the electrical connector.



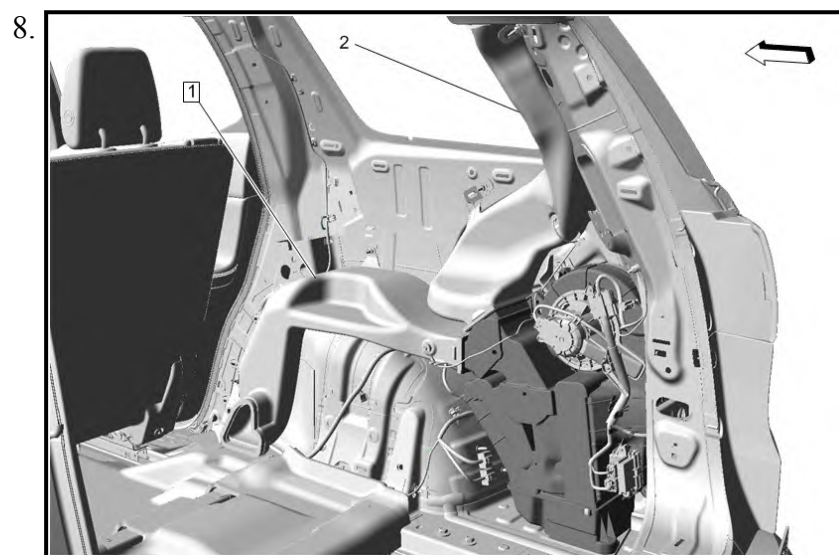
Auxiliary Air Conditioning Evaporator and Blower Module (1) - Install



Auxiliary Air Conditioning Evaporator and Blower Module Bolt (1) - Install and tighten 2.5 N.m (22 lb in)

6. Connect the auxiliary heater and air conditioning wiring harness connector and ground terminal (3).

7. Ground Nut (2) - Install and tighten 9 N.m (80 lb in)

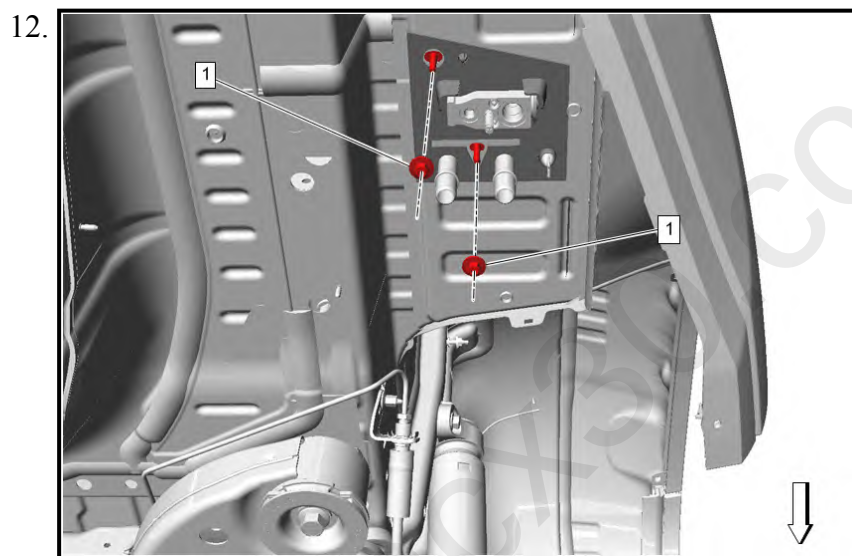


Auxiliary Air Conditioning Air Lower Duct (2) - Install - [Auxiliary Air Conditioning Air Lower Duct Replacement](#)

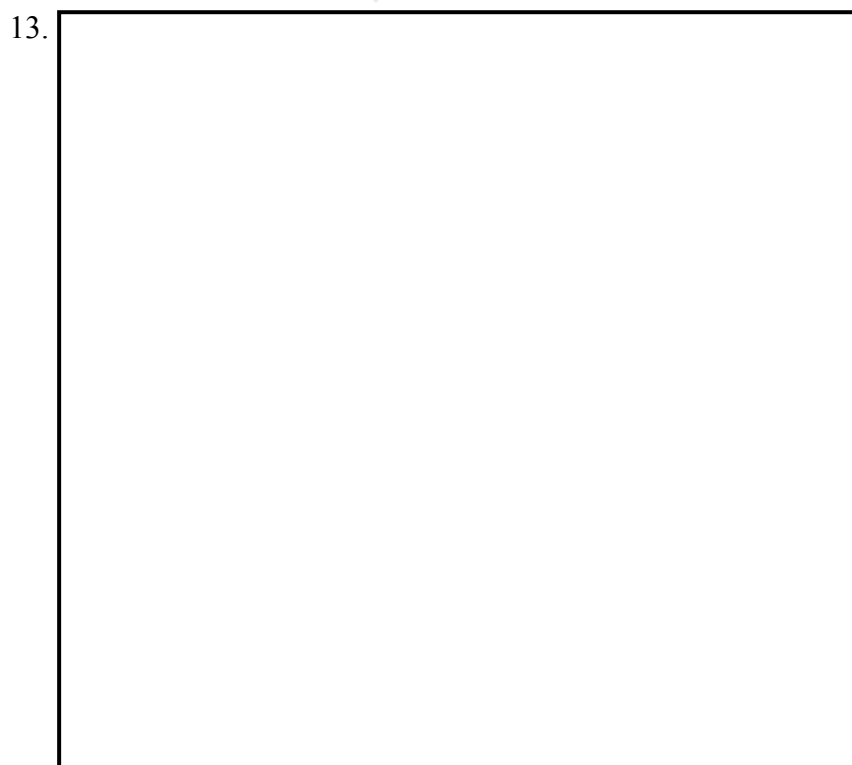
9. Auxiliary Heater Air Outlet Duct (1) - Install - [Auxiliary Heater Air Outlet Duct Replacement](#)
10. Install the duct temperature sensors into the ducts.

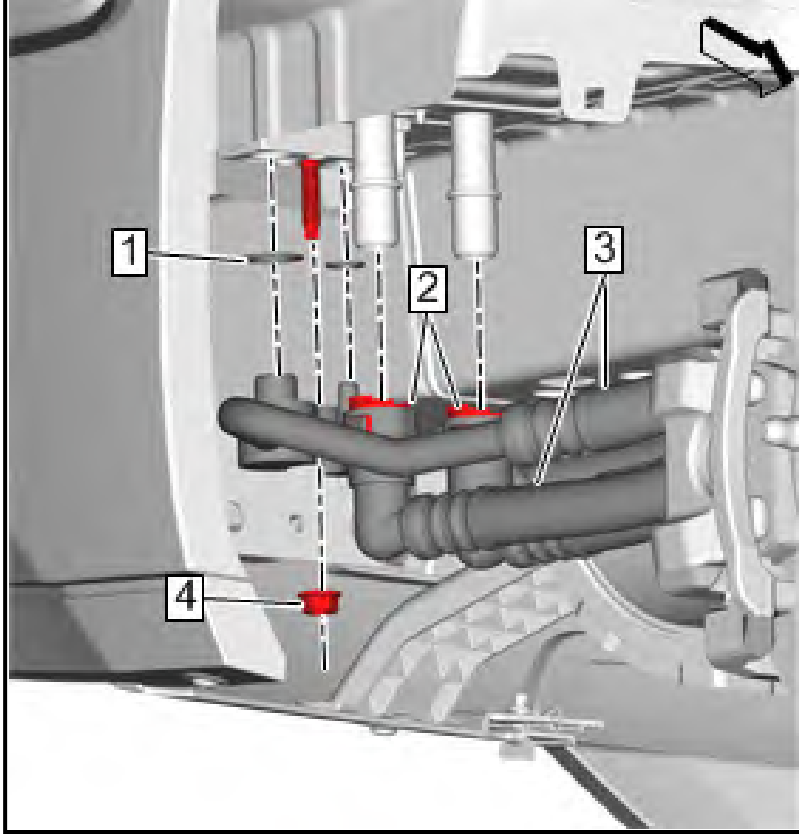


Quarter Lower Rear Trim Panel (1) - Install - [Quarter Lower Rear Trim Panel Replacement \(Right Side\)](#) [Quarter Lower Rear Trim Panel Replacement \(Left Side\)](#)



Auxiliary Air Conditioning Evaporator and Blower Module Nut (1) - Install and tighten [2x] 9 N.m (80 lb in)





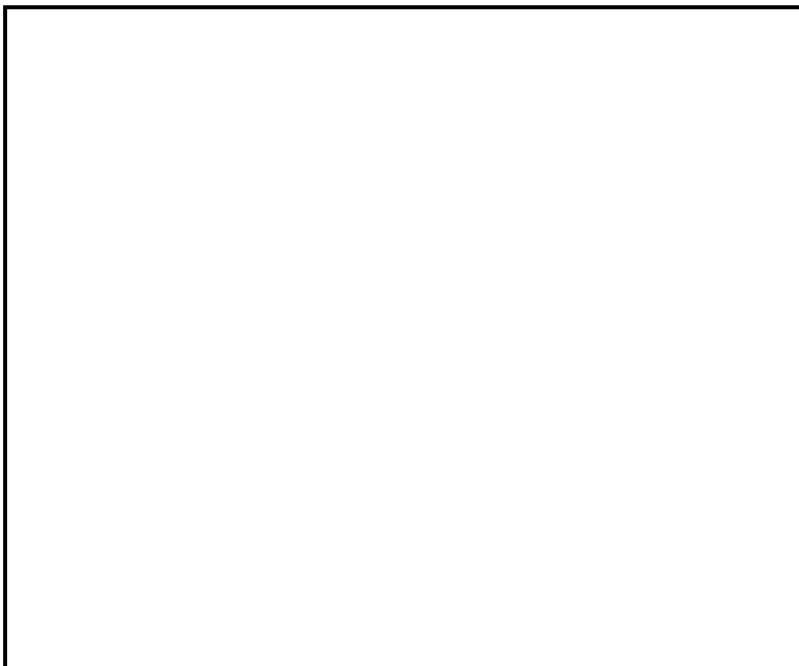
Auxiliary Air Conditioning Evaporator Intermediate Tube (3) @ Auxiliary Air Conditioning Evaporator and Blower Module - Install - [Auxiliary Air Conditioning Evaporator Intermediate Tube Replacement](#)

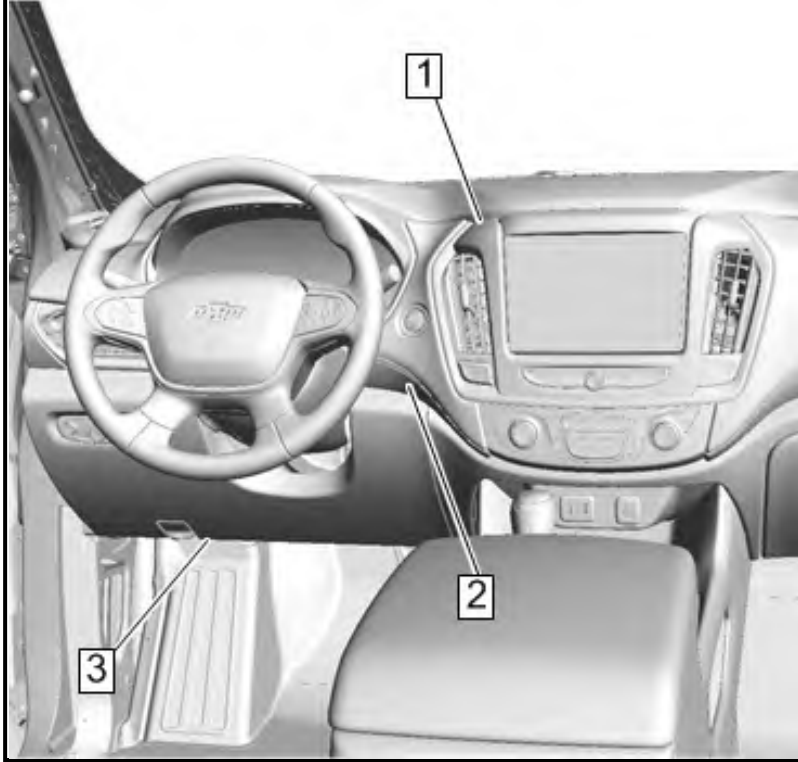
14. Connect the battery negative cable. [Battery Negative Cable Disconnection and Connection \(KL9\)](#)
15. Fill the cooling system to the proper level. [Cooling System Draining and Filling \(GE 47716\)](#)
[Cooling System Draining and Filling \(Static Fill\)](#)
16. Evacuate and charge the refrigerant system. [Refrigerant Recovery and Recharging \(R-134a\)](#)
[Refrigerant Recovery and Recharging \(R-1234yf\)](#)
17. Clear the DTCs from the heater and air conditioning remote control module.
18. Perform the actuator calibration procedure. [Actuator Recalibration](#)
19. Inspect for coolant leaks.
20. Inspect for refrigerant leaks.

TEMPERATURE VALVE ACTUATOR REPLACEMENT - RIGHT SIDE (CJ2)

Removal Procedure

1.

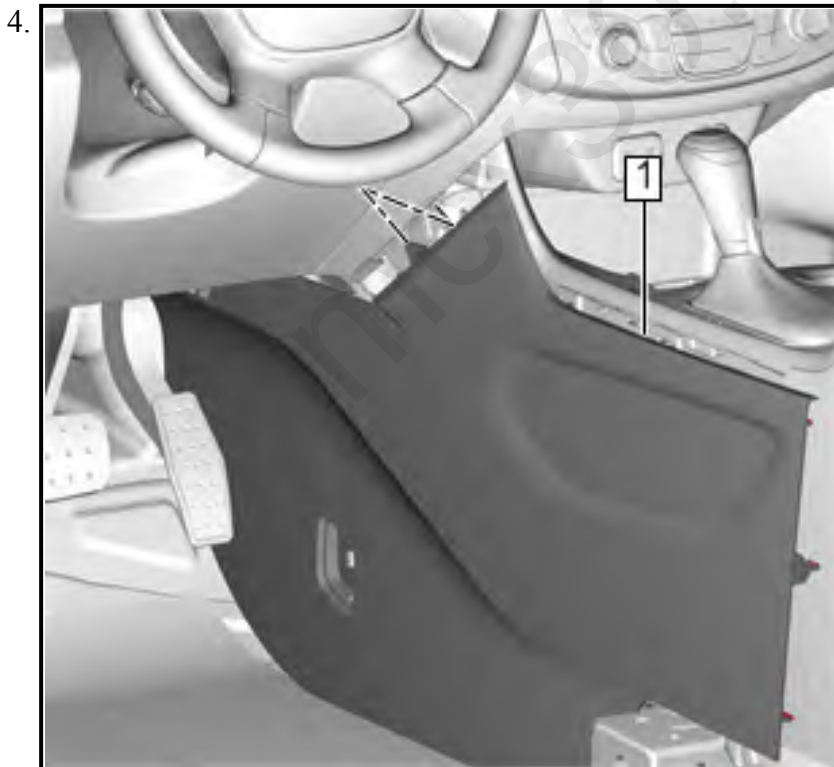




Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

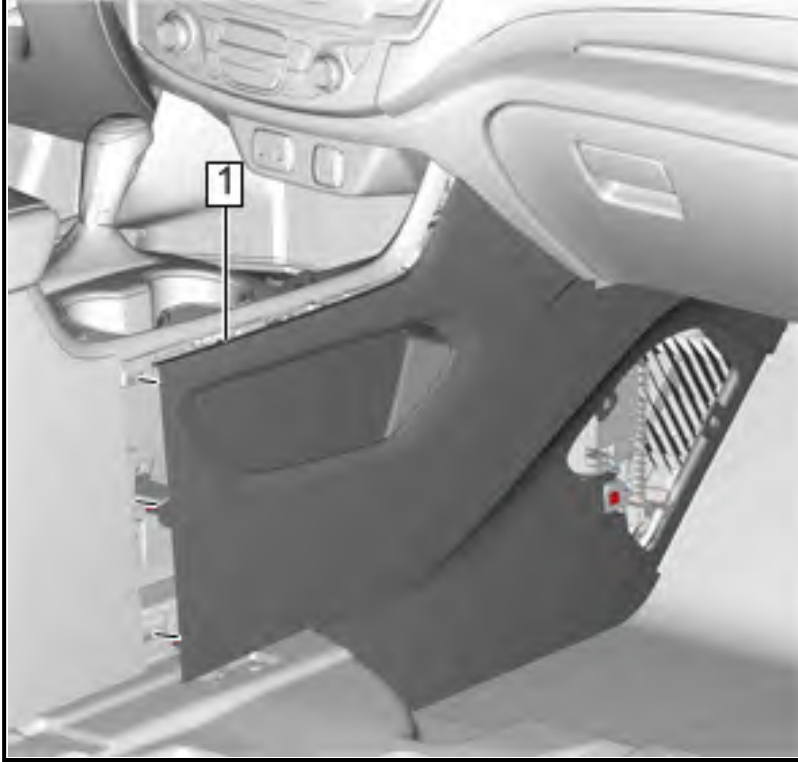
2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

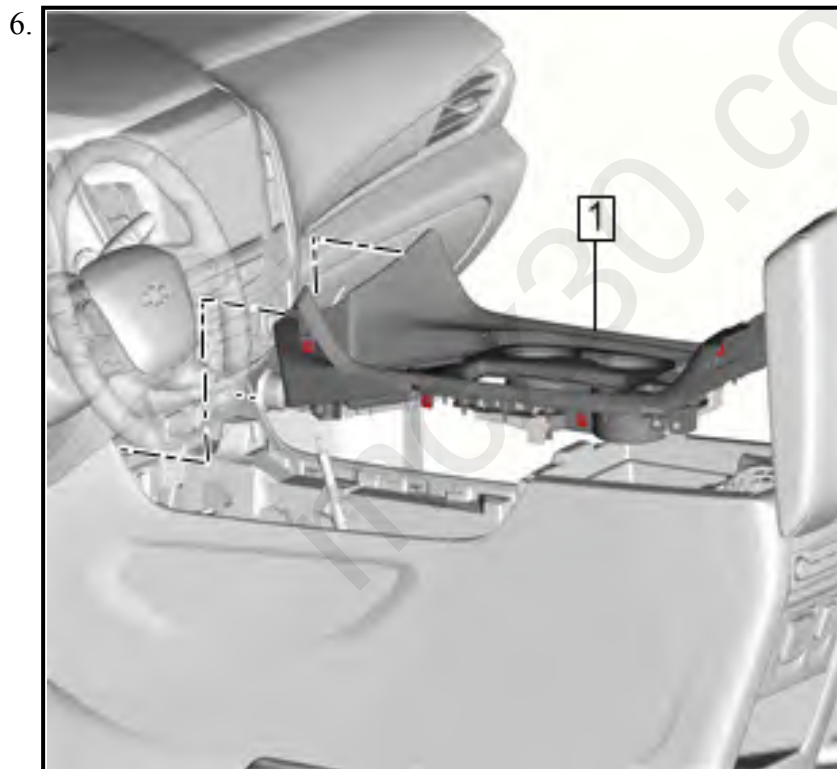


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)



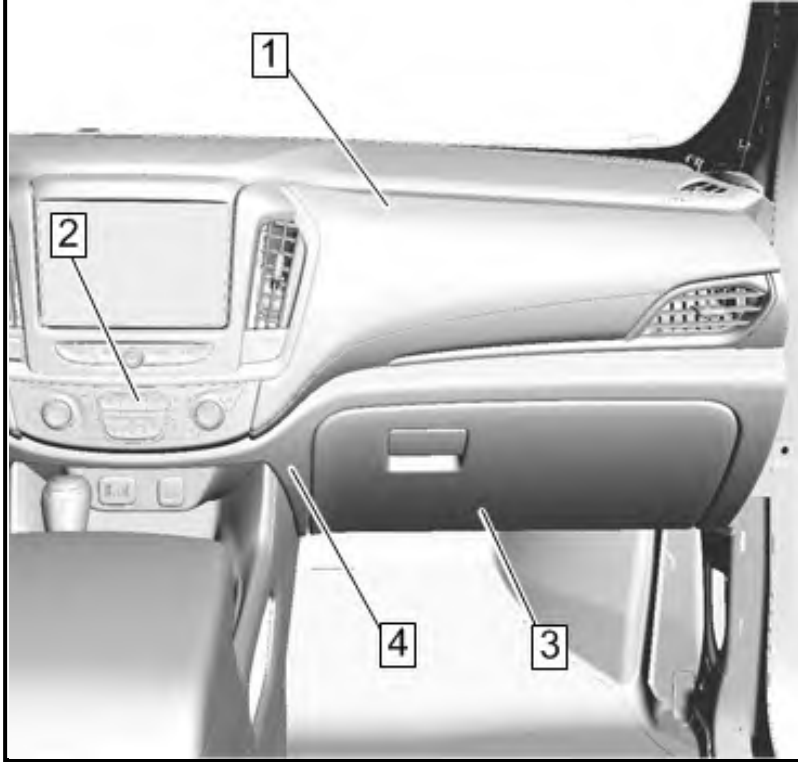


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)





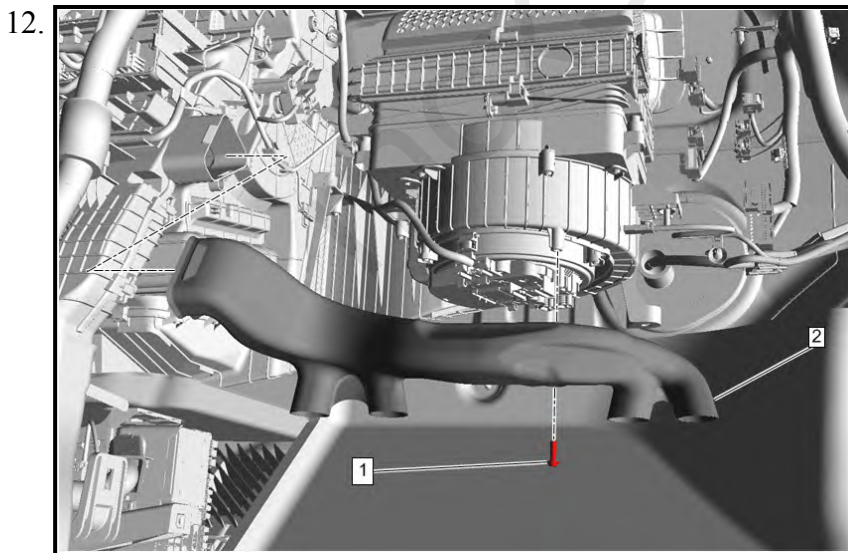
Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect the electrical connectors.

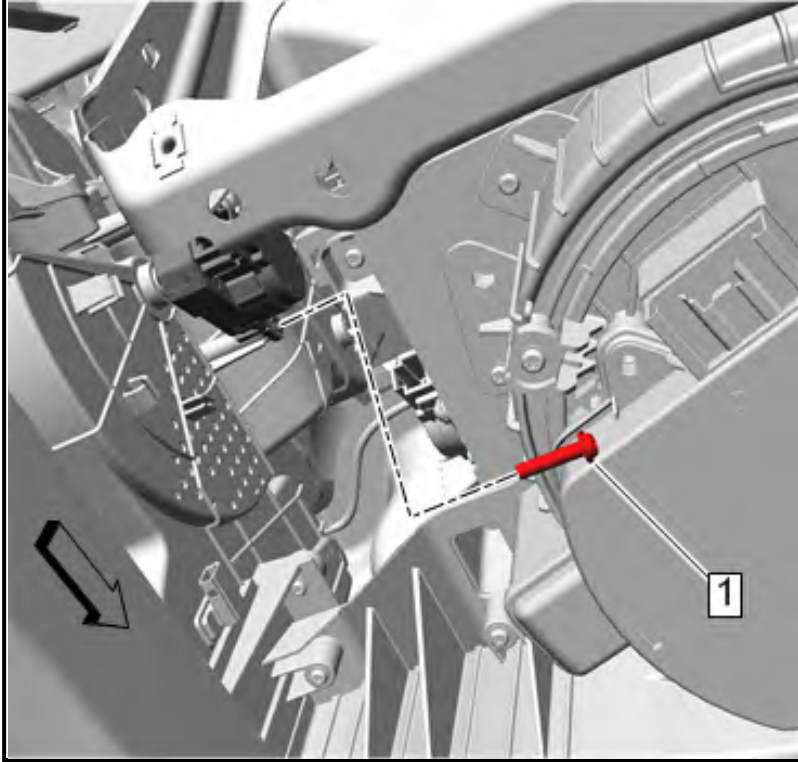
10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)



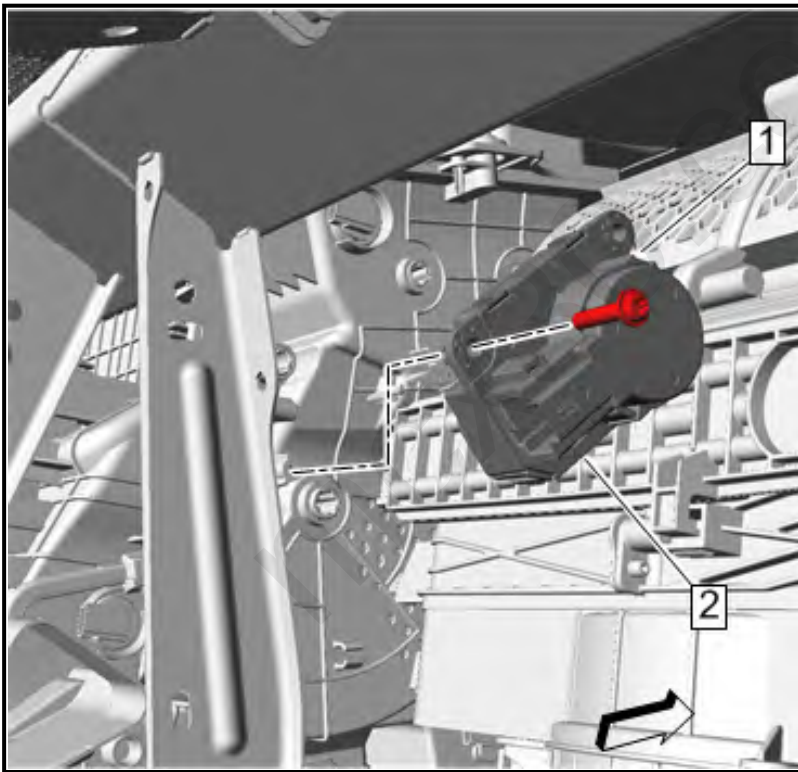
Loosen the right side floor front air outlet duct (2) and position aside to access the temperature valve actuator bolt. [Floor Front Air Outlet Duct Replacement - Right Side](#)





Temperature Valve Actuator Bolt (1) - Remove

14.



Temperature Valve Actuator Bolt (1) - Remove

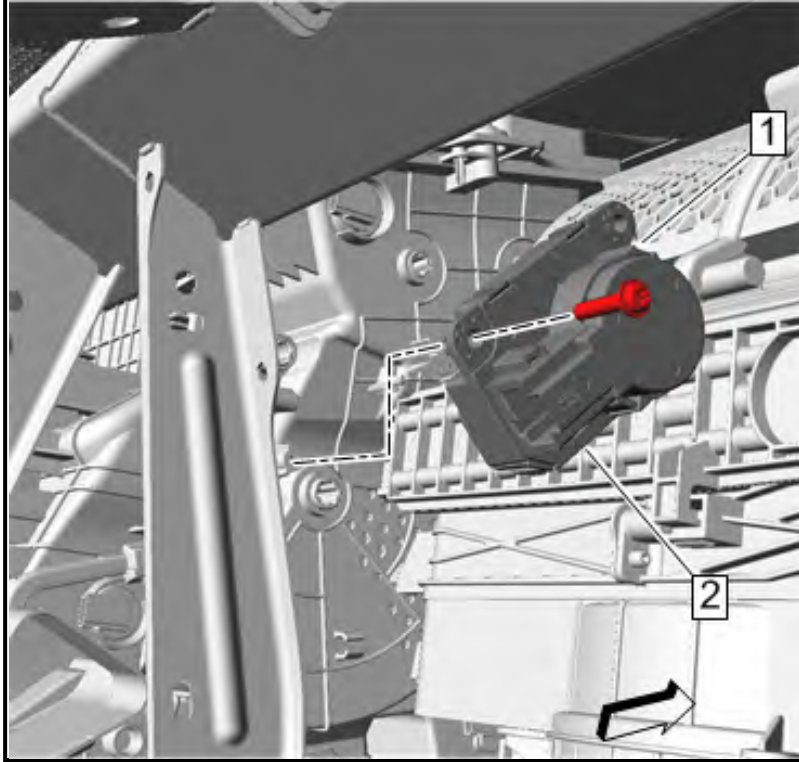
15. Temperature Valve Actuator - Right Side (2) - Remove

16. Disconnect the electrical connectors.

Installation Procedure

1.



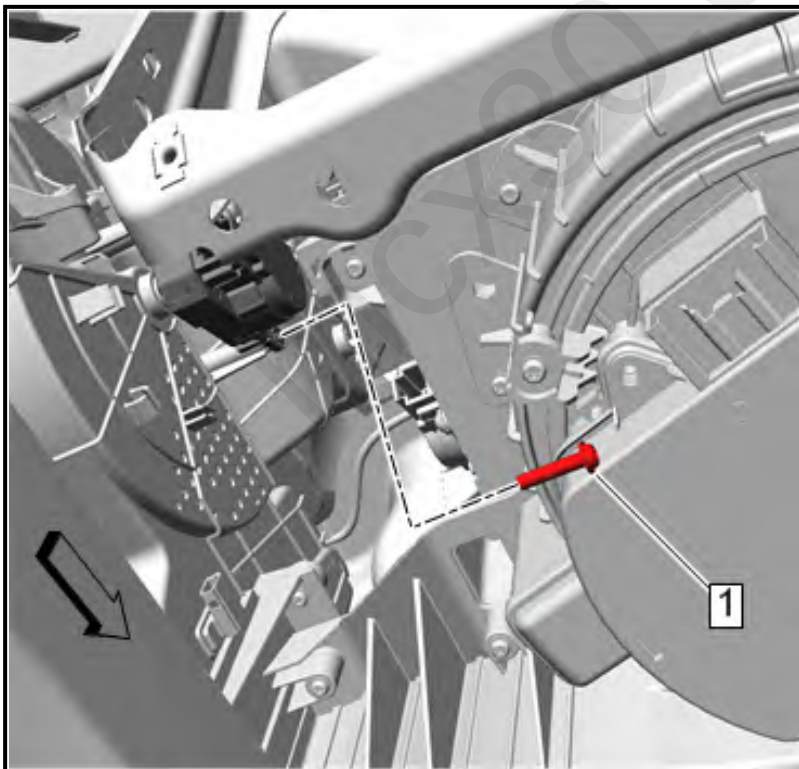


Temperature Valve Actuator - Right Side (2) - Install

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

2. Temperature Valve Actuator Bolt (1) - Install and tighten 1.3 N.m (12 lb in)
3. Connect the electrical connectors.

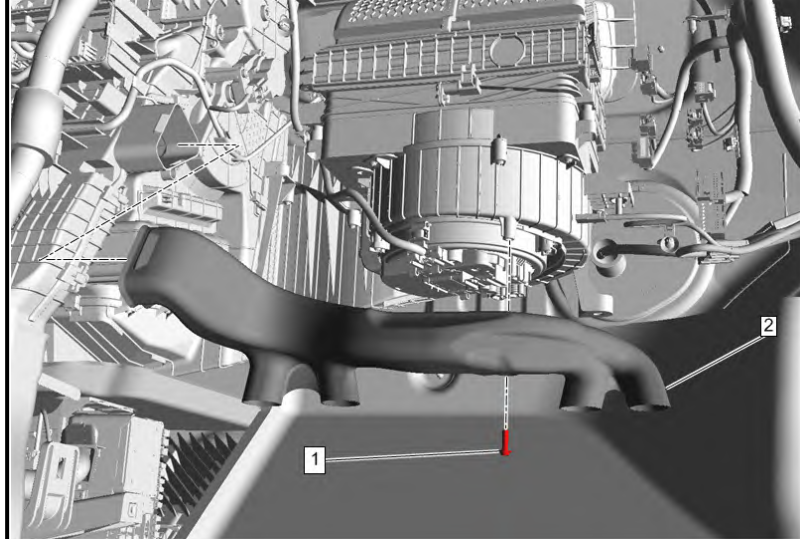
4.



Temperature Valve Actuator Bolt (1) - Install and tighten 1.3 N.m (12 lb in)

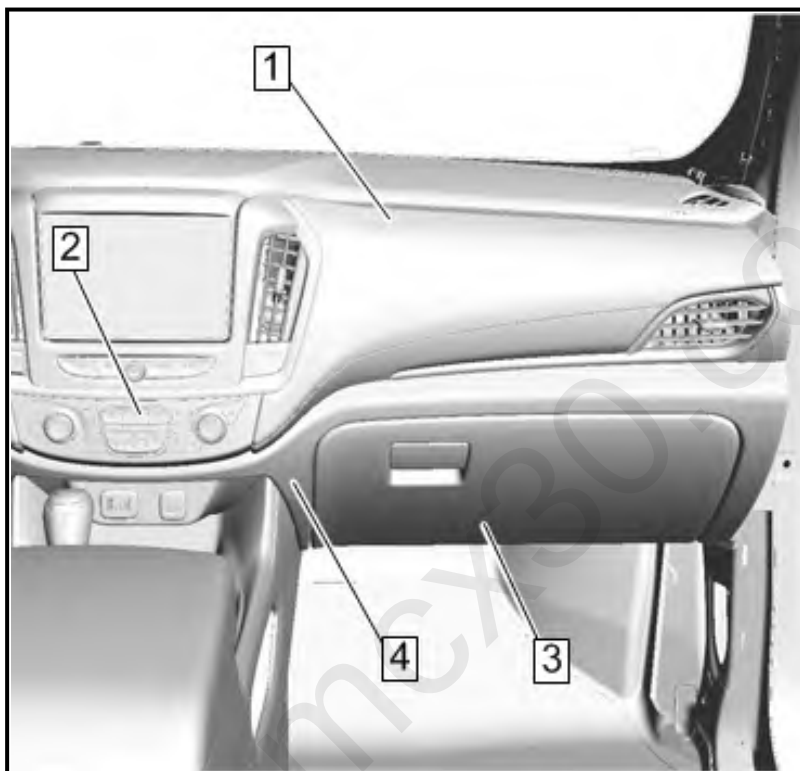
5.





Floor Front Air Outlet Duct - Right Side (2) - Install - [Floor Front Air Outlet Duct Replacement - Right Side](#)

6.



Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

7. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

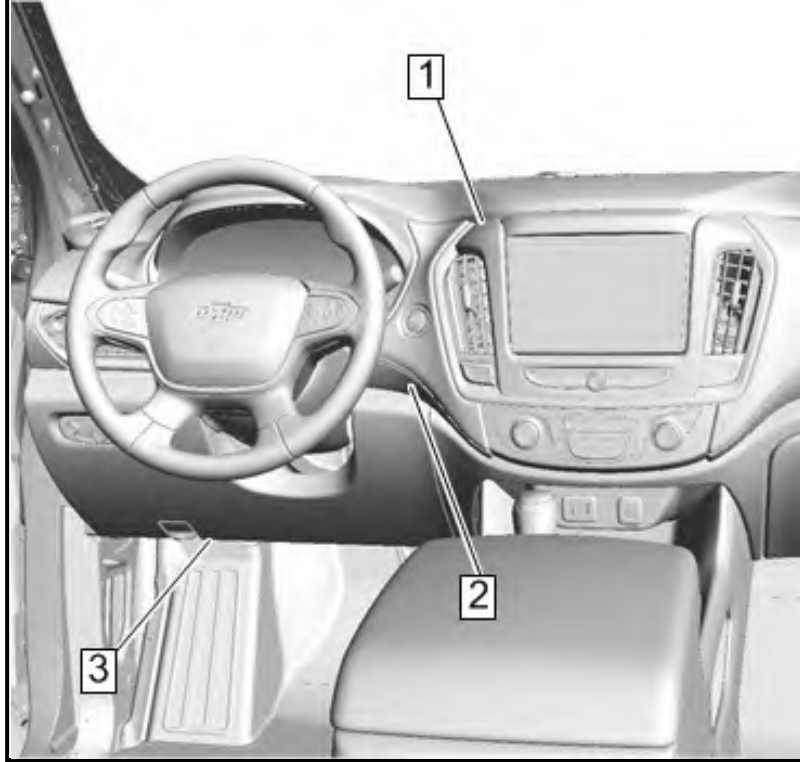
8. Connect the electrical connectors.

9. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

10. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)

11.

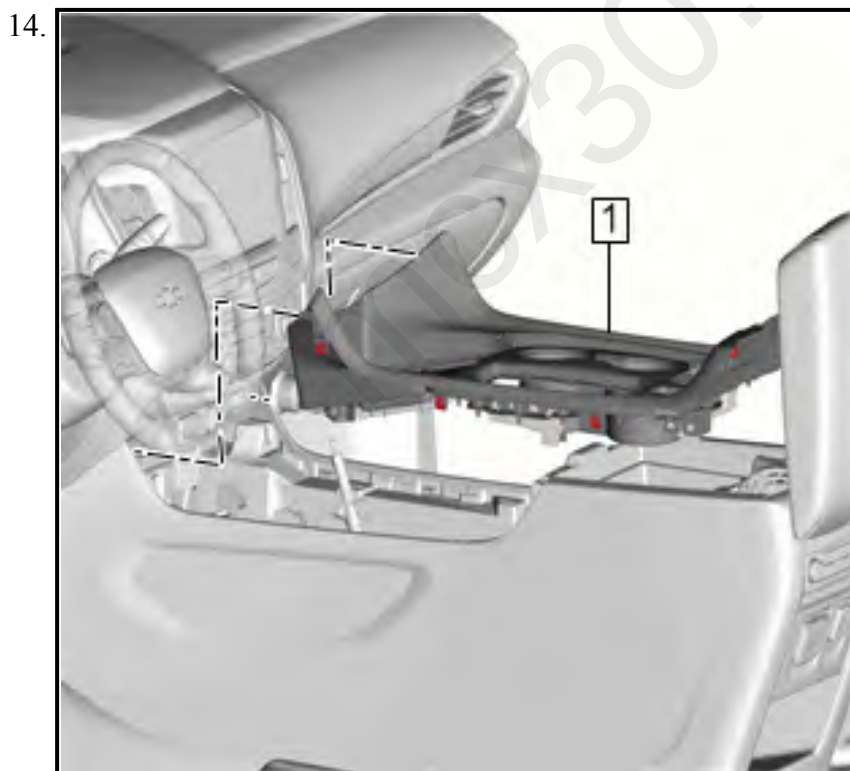




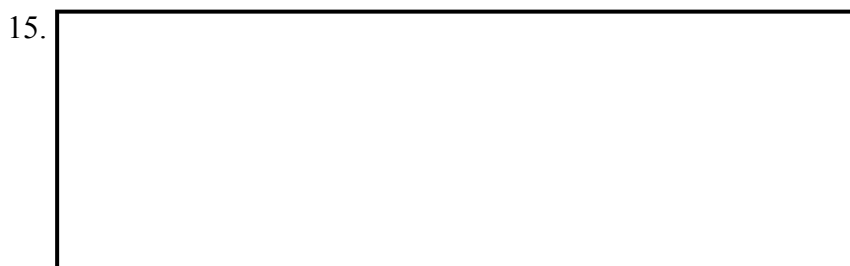
Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

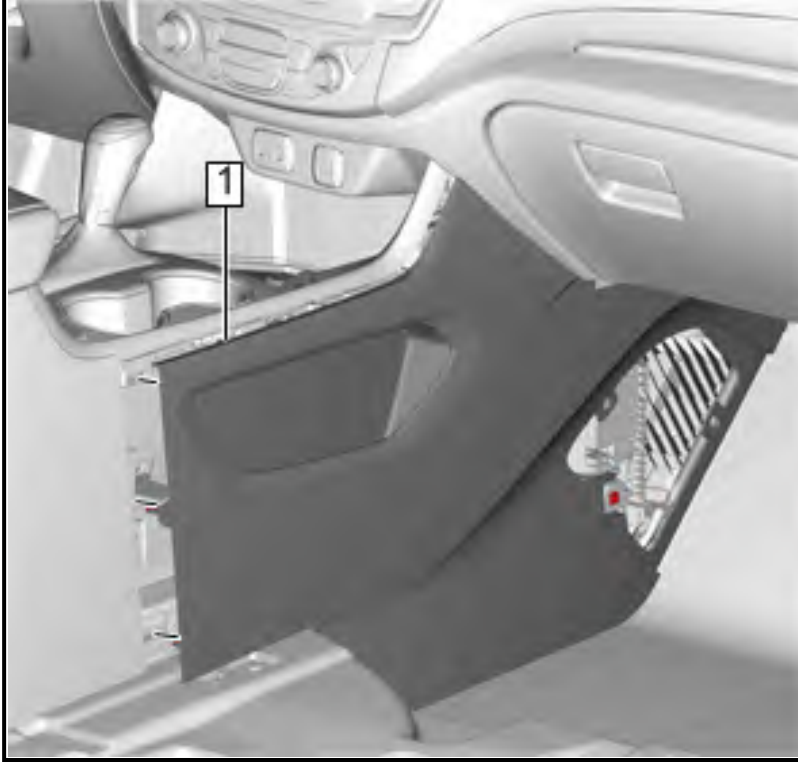
12. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#), [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

13. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

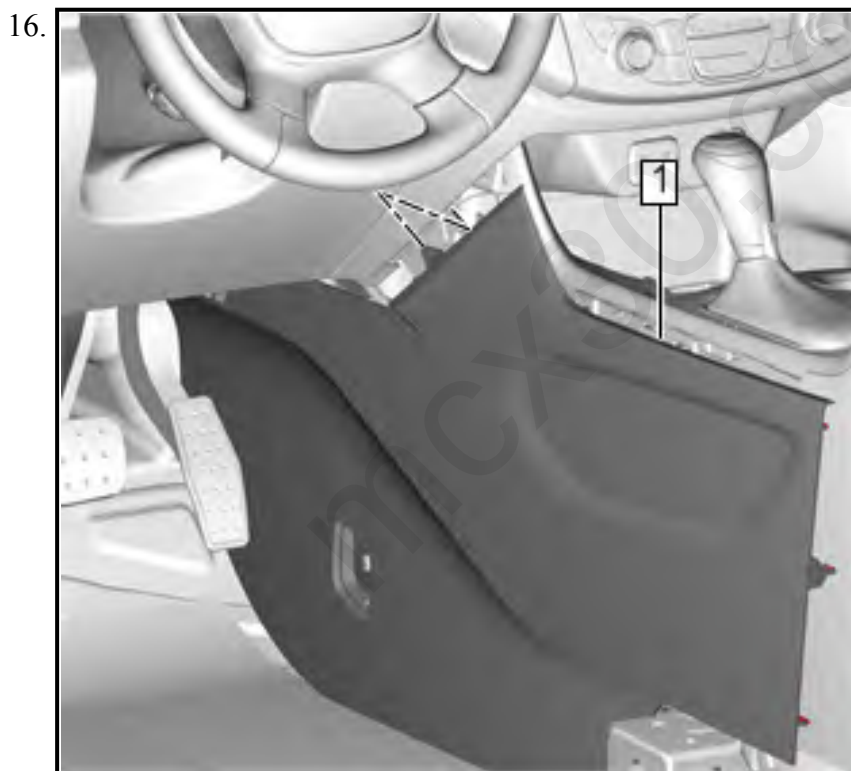


Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)





Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

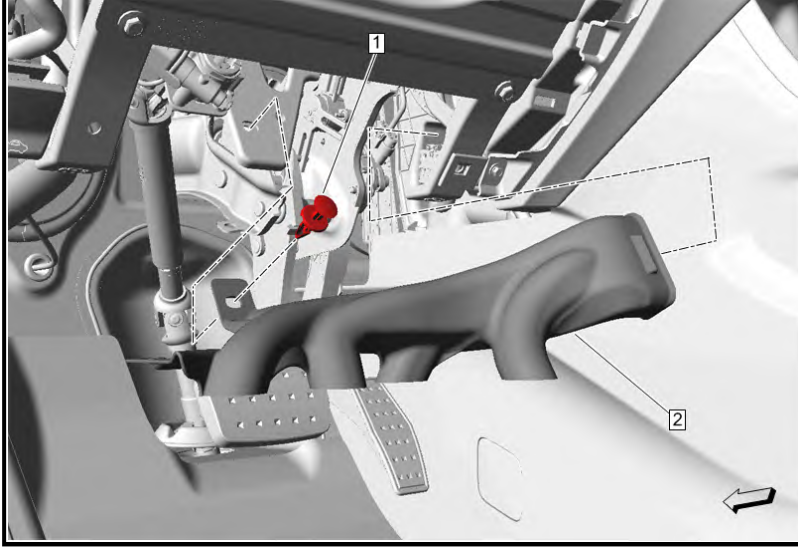
17. Perform the necessary programming and setup procedure: [Control Module References](#)
18. Clear the DTCs from the heater and air conditioning remote control module.
19. Perform the actuator calibration procedure. [Actuator Recalibration](#)

TEMPERATURE VALVE ACTUATOR REPLACEMENT - LEFT SIDE (CJ2)

Removal Procedure

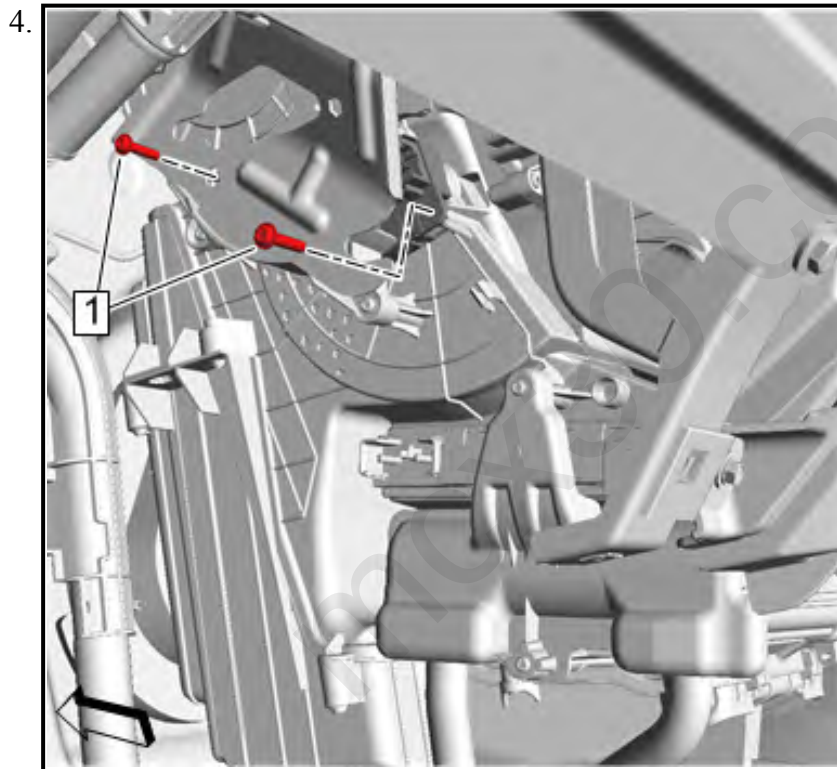
1. Instrument Panel Knee Bolster - Remove - [Instrument Panel Knee Bolster Replacement](#)

2.



Floor Front Air Outlet Duct - Left Side (2) - Remove - [Floor Front Air Outlet Duct Replacement - Left Side](#)

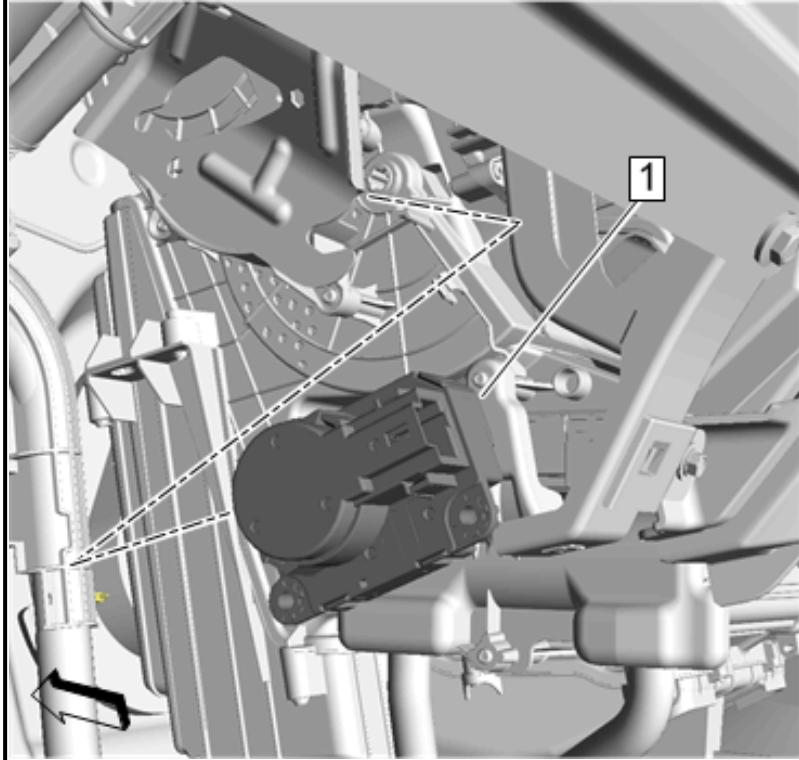
3. Brake and Accelerator Pedal Assembly - Remove - [Brake and Accelerator Pedal Assembly Replacement](#)



Disconnect the electrical connector.

5. Temperature Valve Actuator Bolt (1) - Remove [2x]

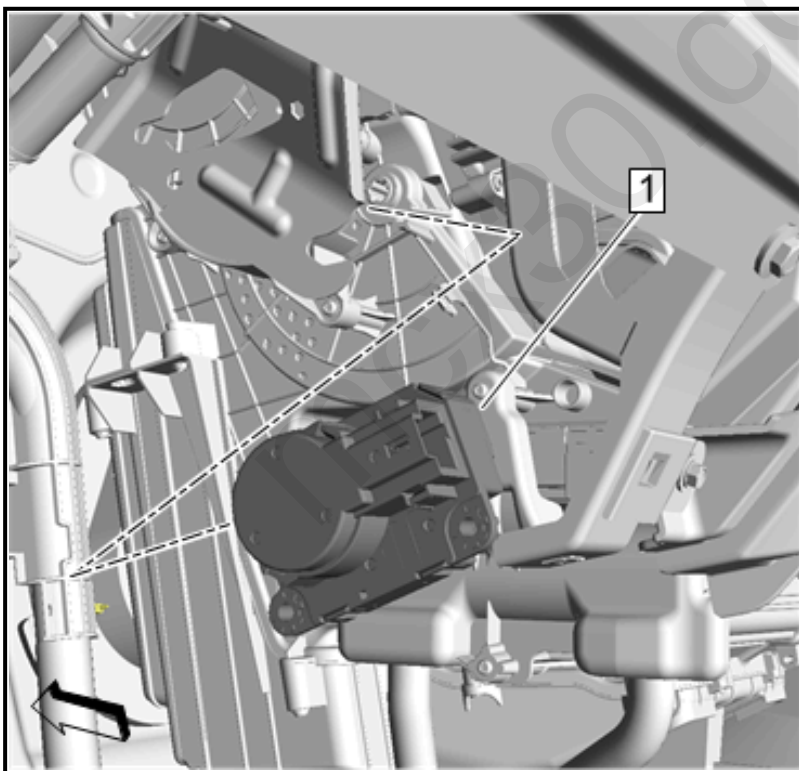




Slide the temperature valve actuator (1) out from in between the mode control cam cover and the air conditioning evaporator and blower module assembly to remove.

Installation Procedure

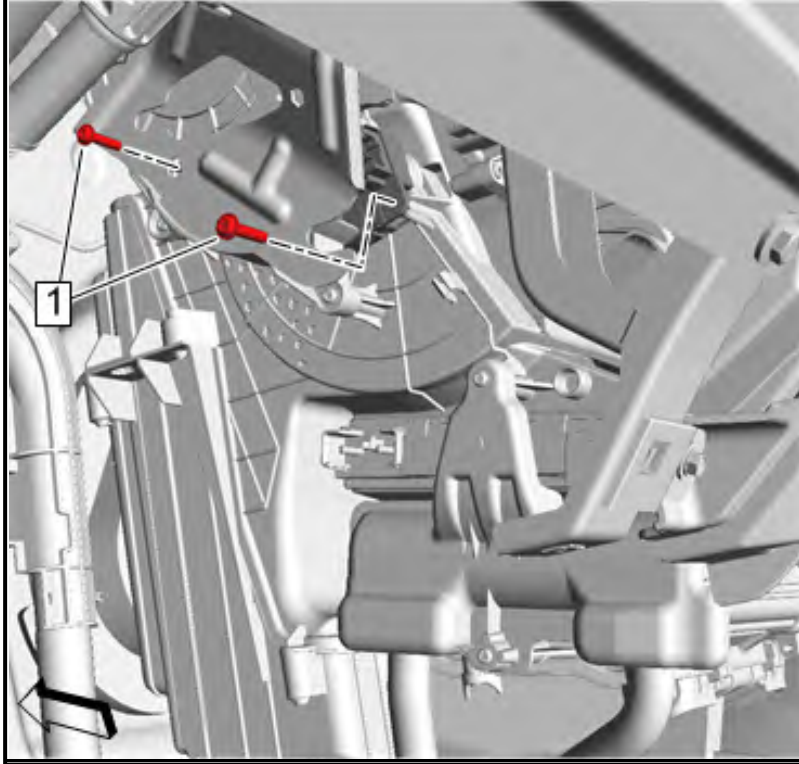
1.



Slide the temperature valve actuator (1) back between the mode control cam cover and the air conditioning evaporator and blower module assembly.

2.

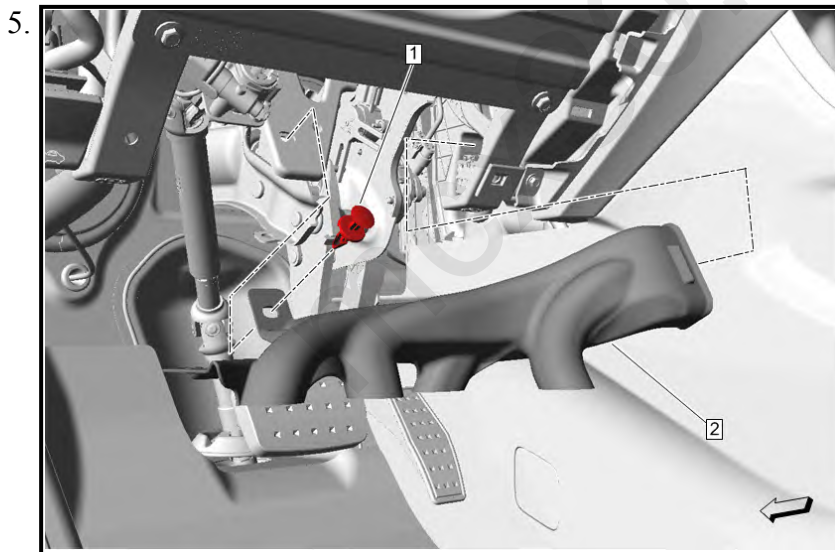




CAUTION: Refer to [Fastener Caution](#) .

Temperature Valve Actuator Bolt (1) - Install and tighten [2x] 1.3 N.m (12 lb in)

3. Connect the electrical connector.
4. Brake and Accelerator Pedal Assembly - Install - [Brake and Accelerator Pedal Assembly Replacement](#)



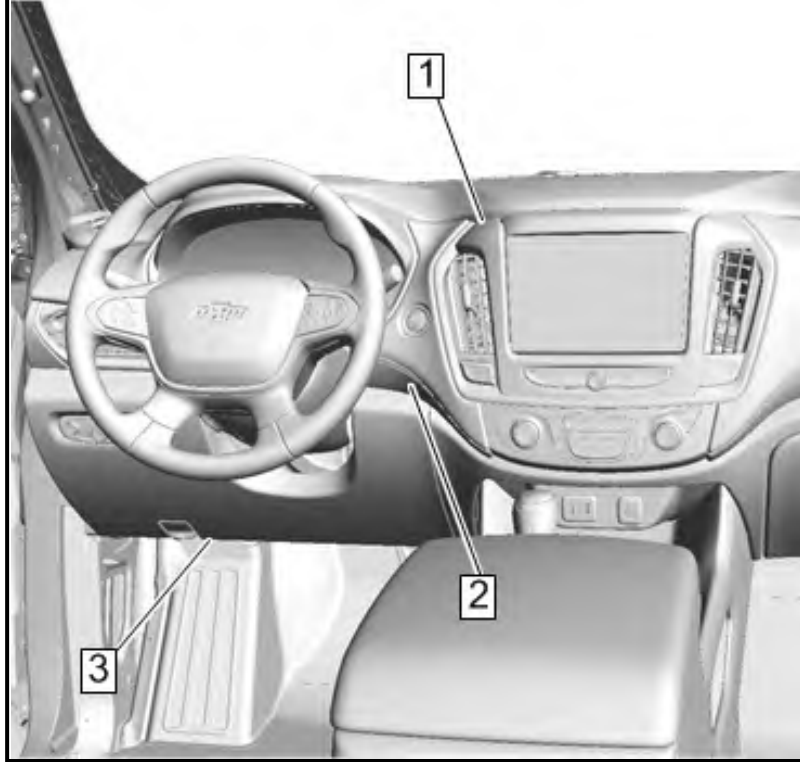
Floor Front Air Outlet Duct - Left Side (2) - Install - [Floor Front Air Outlet Duct Replacement - Left Side](#)

6. Instrument Panel Knee Bolster - Install - [Instrument Panel Knee Bolster Replacement](#)
7. Clear the DTCs from the heater and air conditioning remote control module.
8. Perform the actuator calibration procedure. [Actuator Recalibration](#)

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER RIGHT SIDE

Removal Procedure

1. 



Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

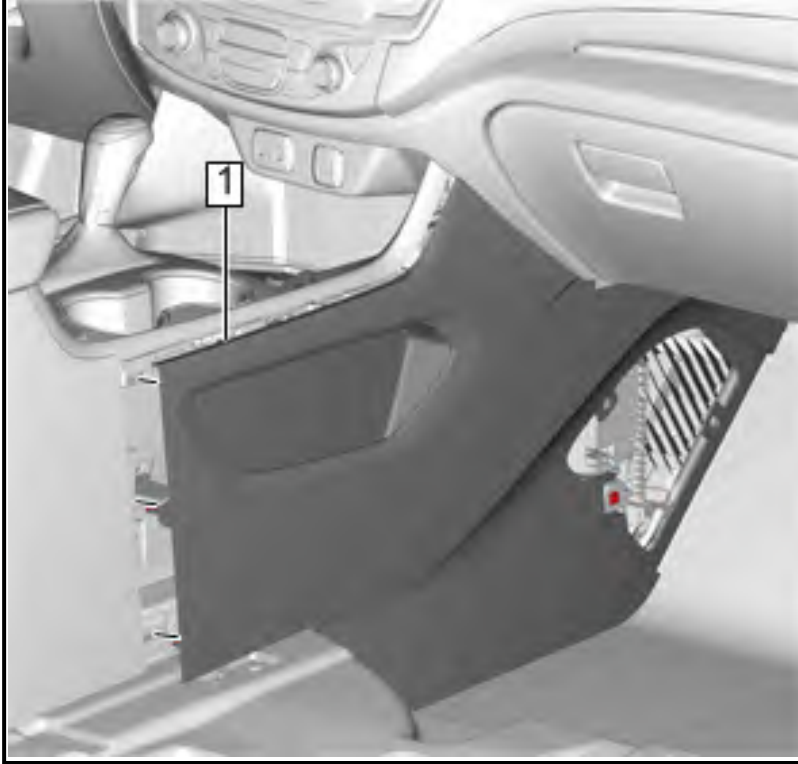
2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

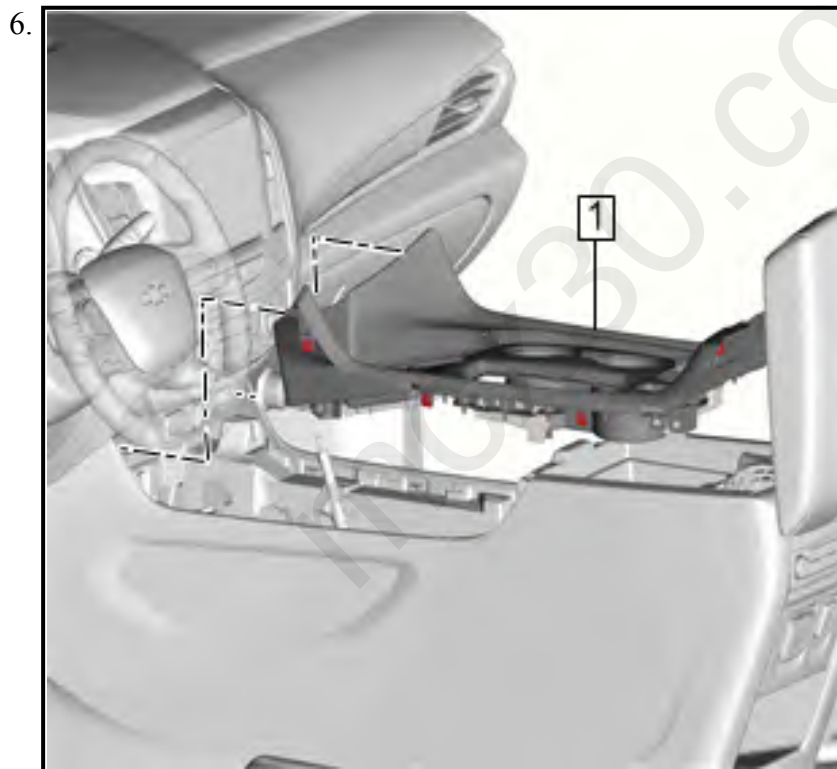


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)



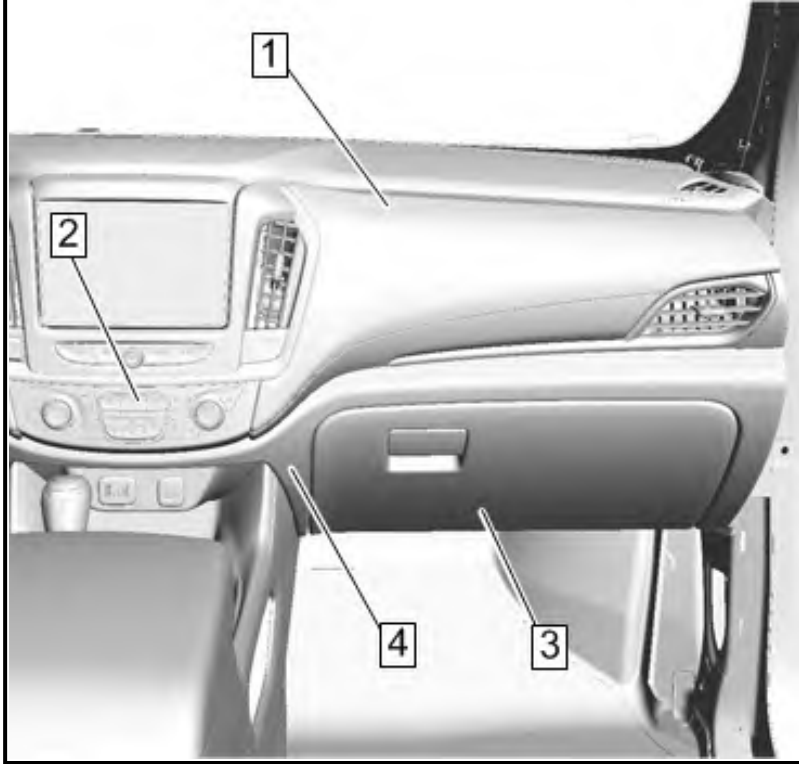


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)





Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect the electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

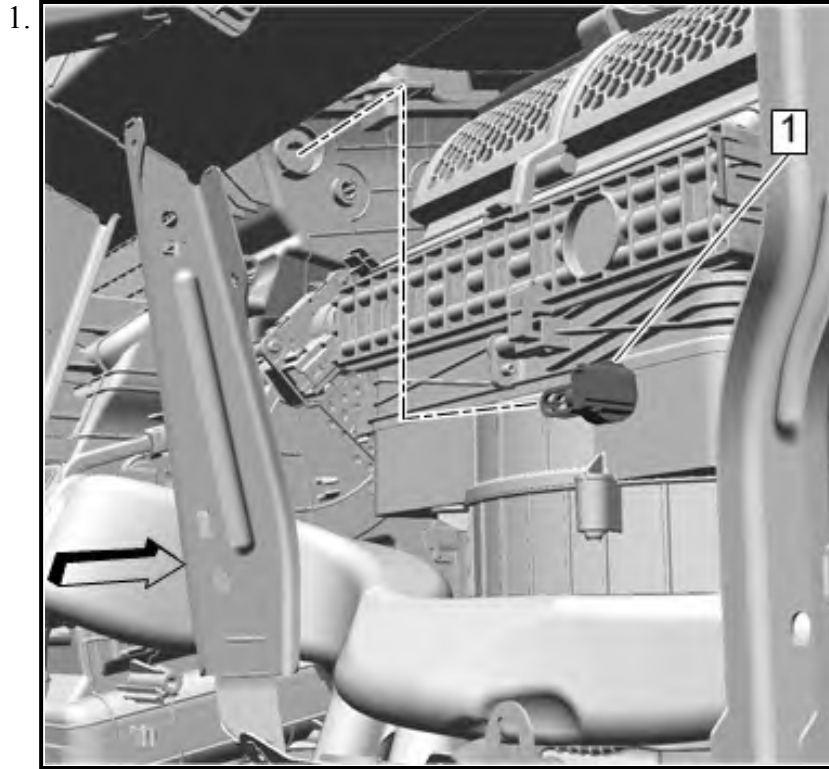
11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)



Duct Air Temperature Sensor - Upper Right Side (1) - Remove

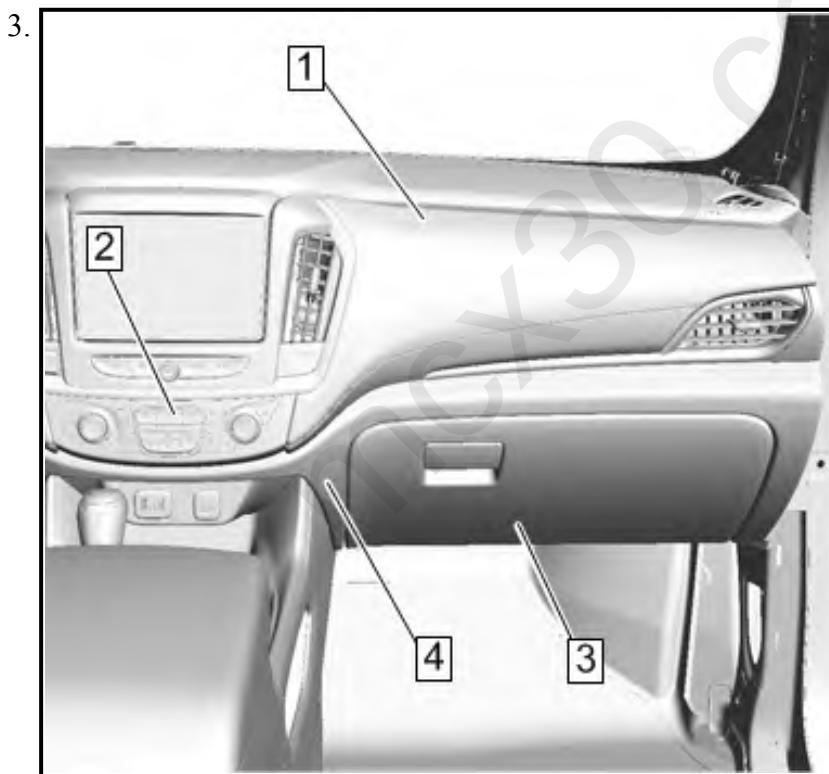
13. Disconnect the electrical connectors.

Installation Procedure



Duct Air Temperature Sensor - Upper Right Side (1) - Install

2. Connect the electrical connectors.



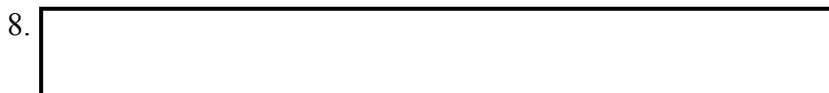
Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

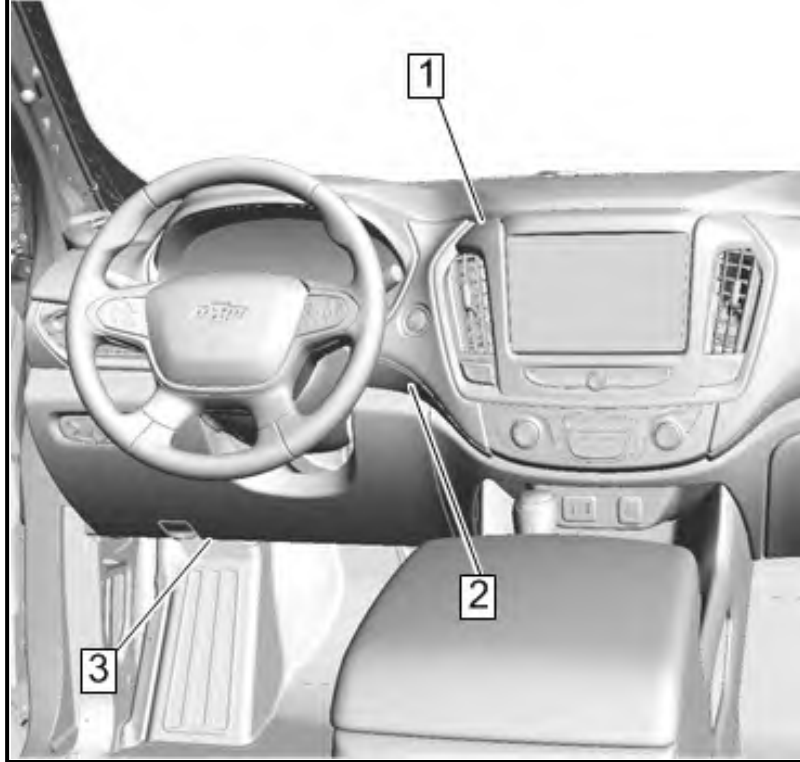
4. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

5. Connect the electrical connectors.

6. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

7. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)



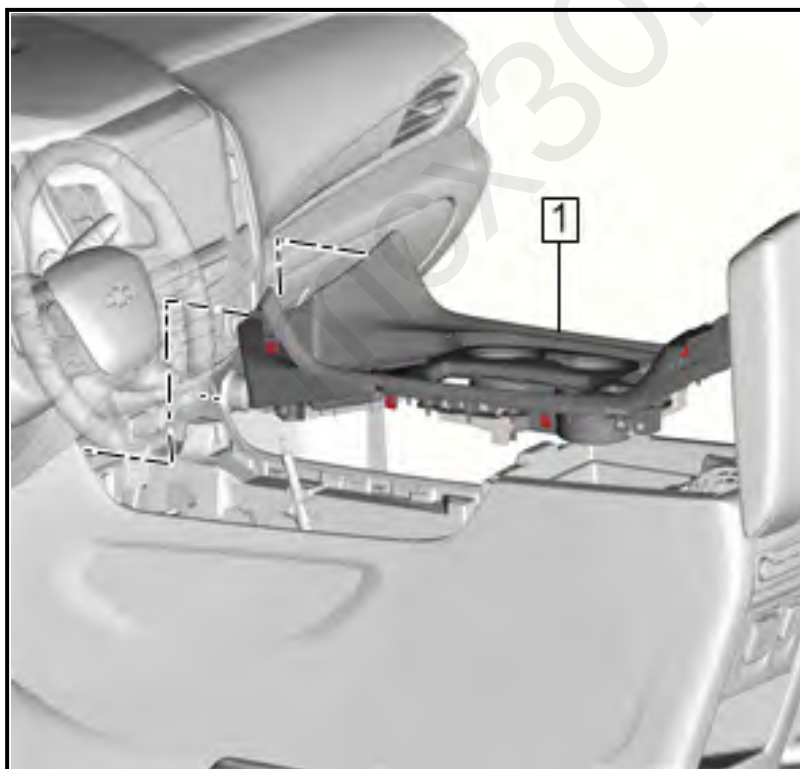


Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

9. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

10. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

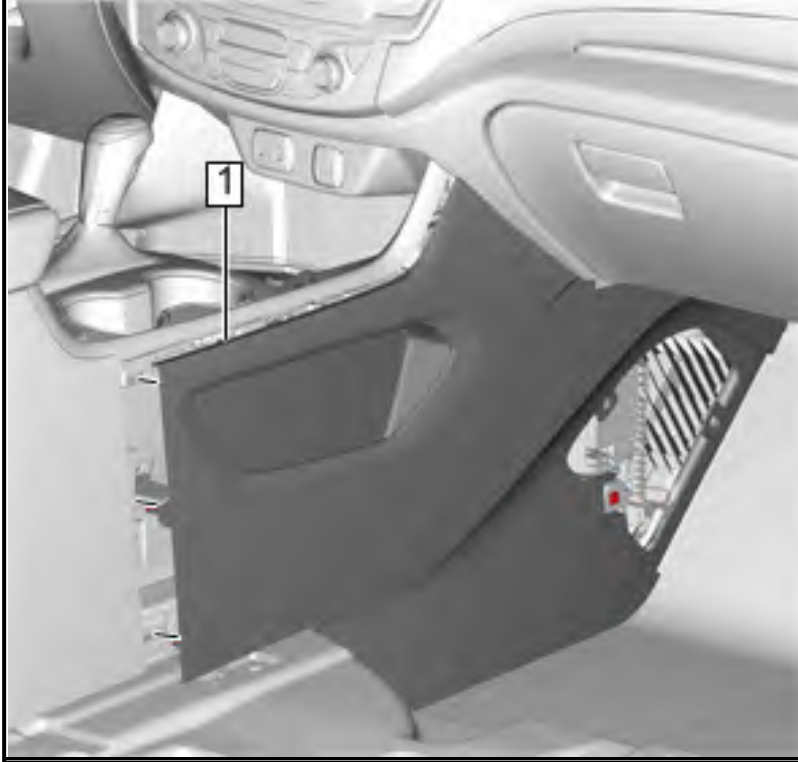
11.



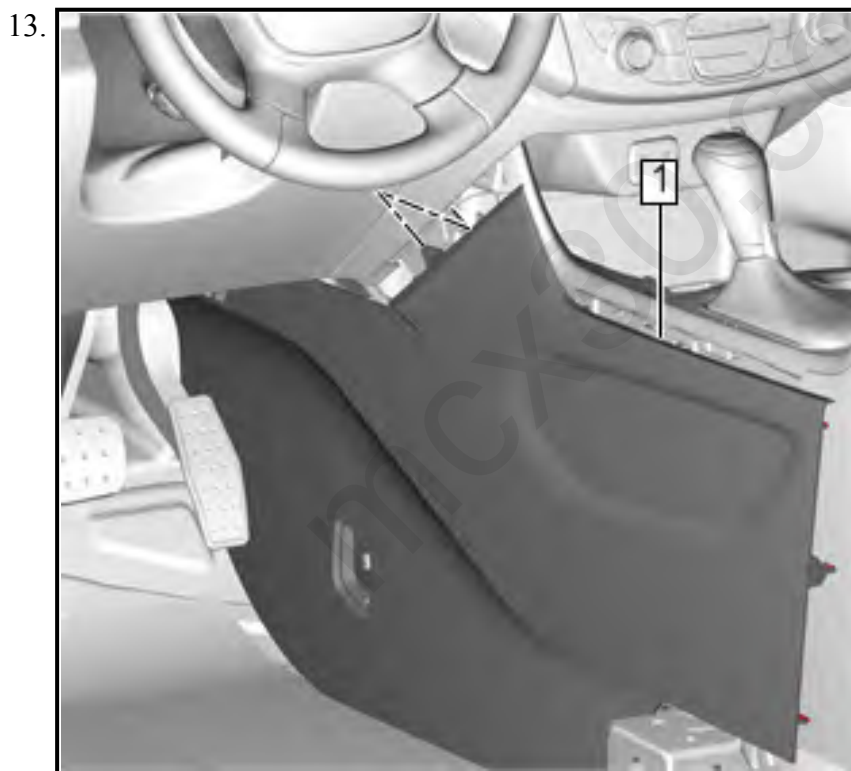
Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)

12.





Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)



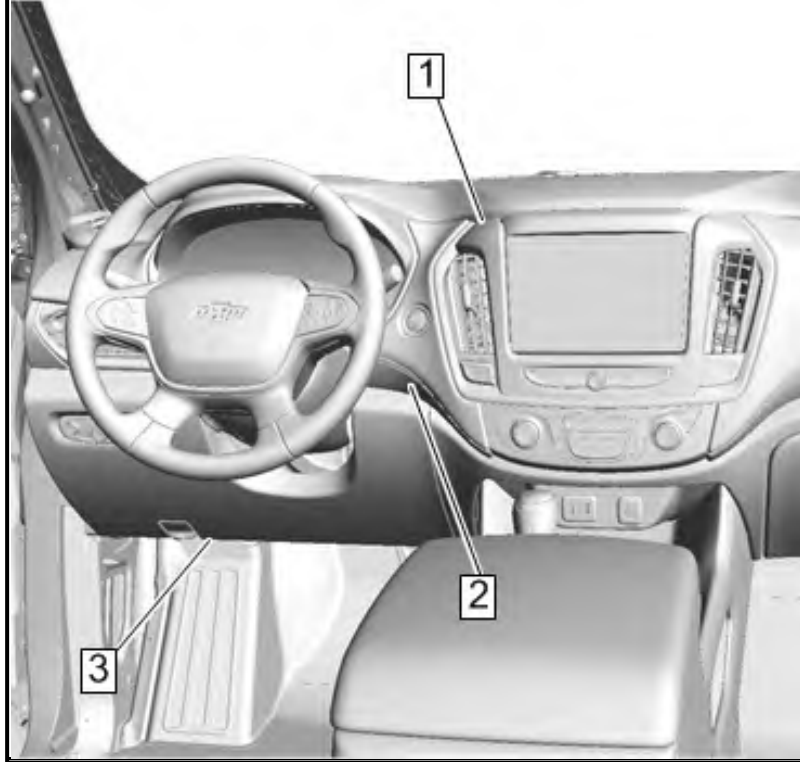
Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

14. Perform the necessary programming and setup procedure: [Control Module References](#)
15. Clear the DTCs from the heater and air conditioning remote control module.
16. Perform the actuator calibration procedure. [Actuator Recalibration](#)

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - UPPER LEFT SIDE

Removal Procedure

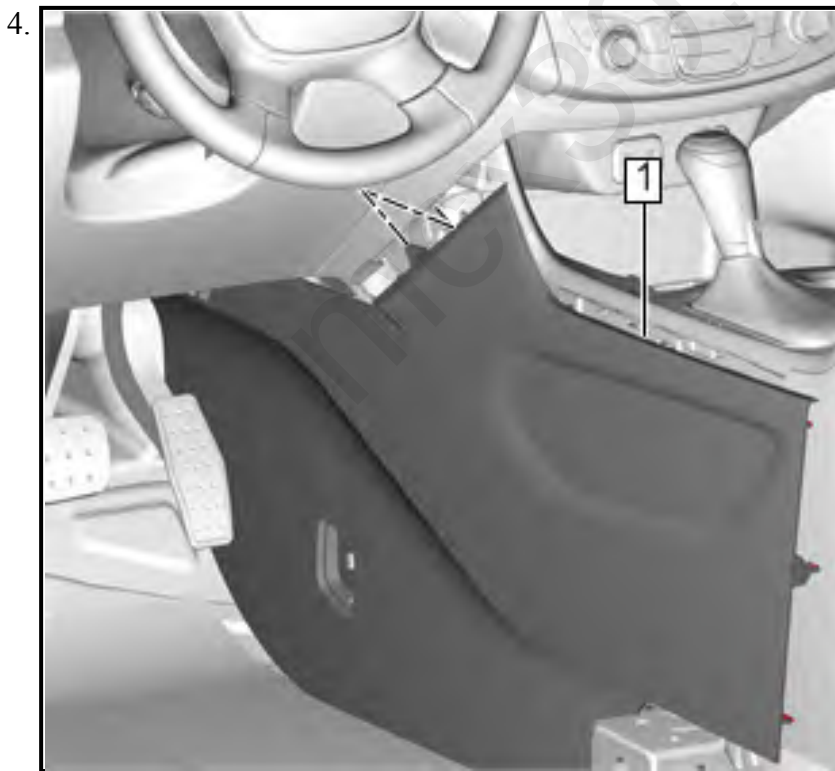
1.



Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

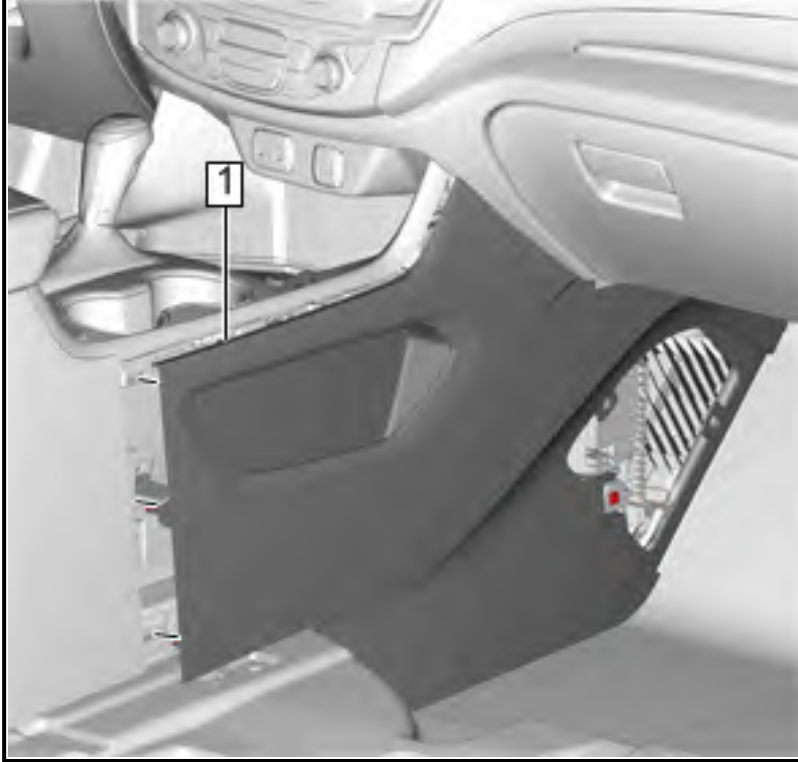
2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

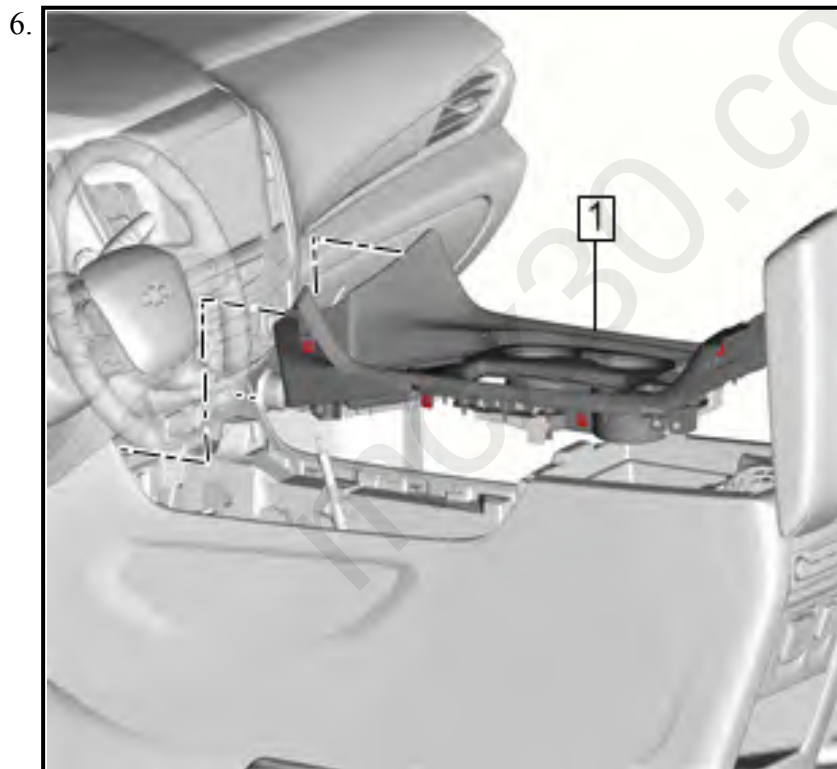


Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)



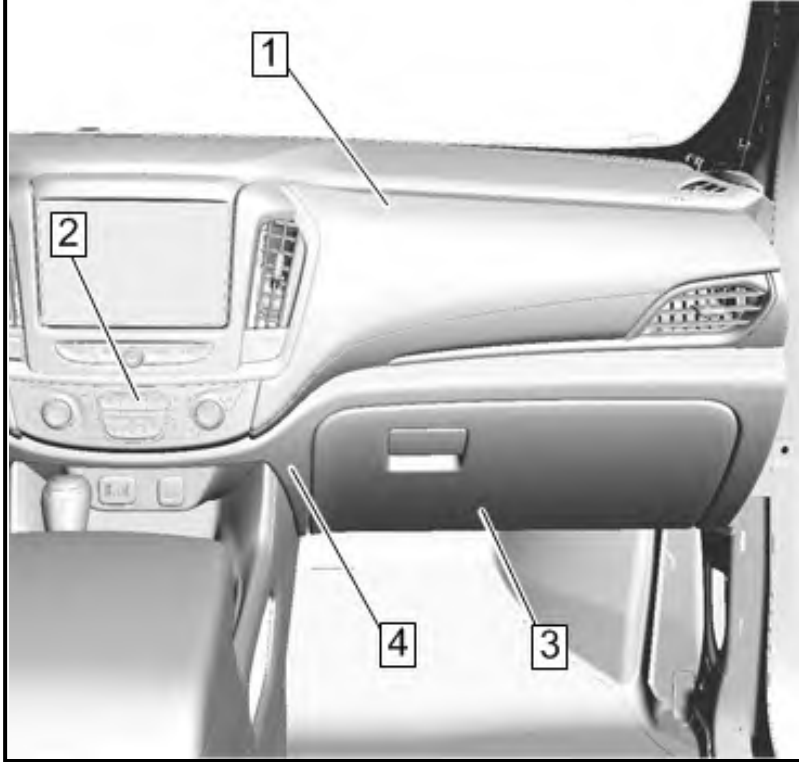


Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)



Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)





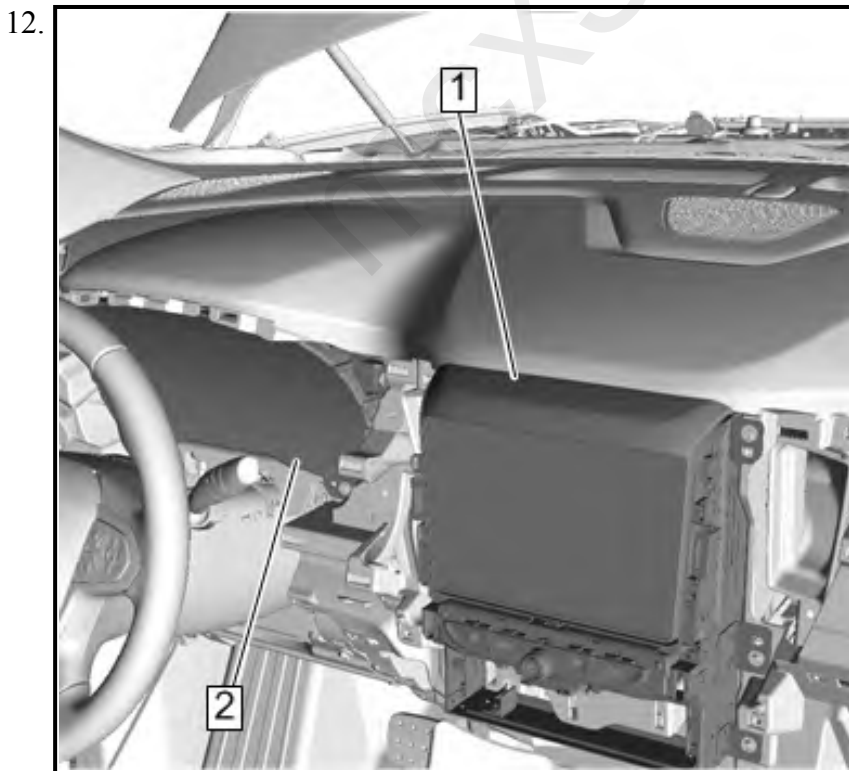
Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect all electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)

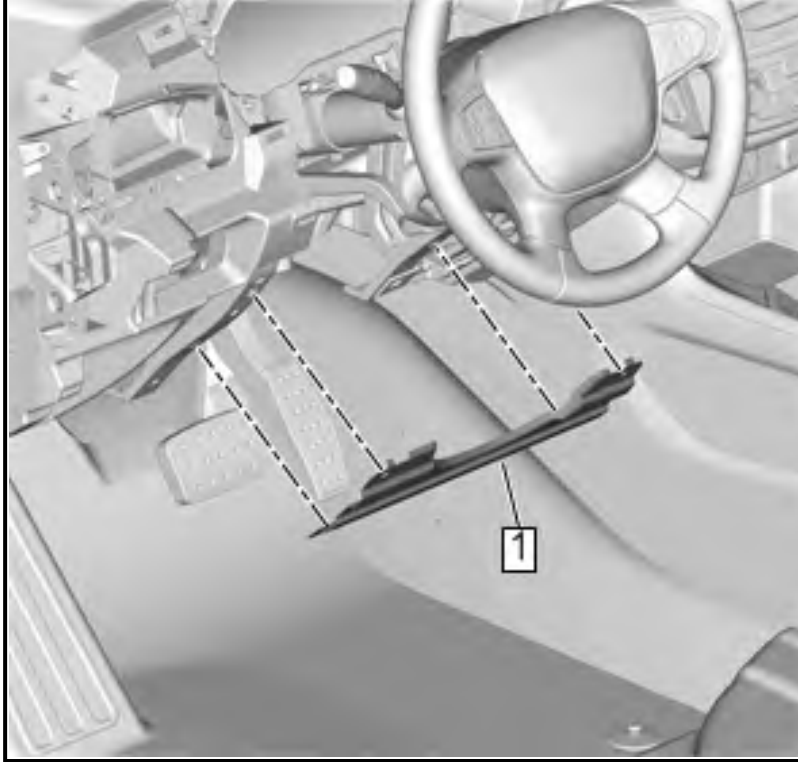


Radio Control (1) - Remove - [Radio Control Assembly Replacement \(With IO5, IO6\)](#)

13. Instrument Cluster (2) - Remove - [Instrument Cluster Replacement](#)

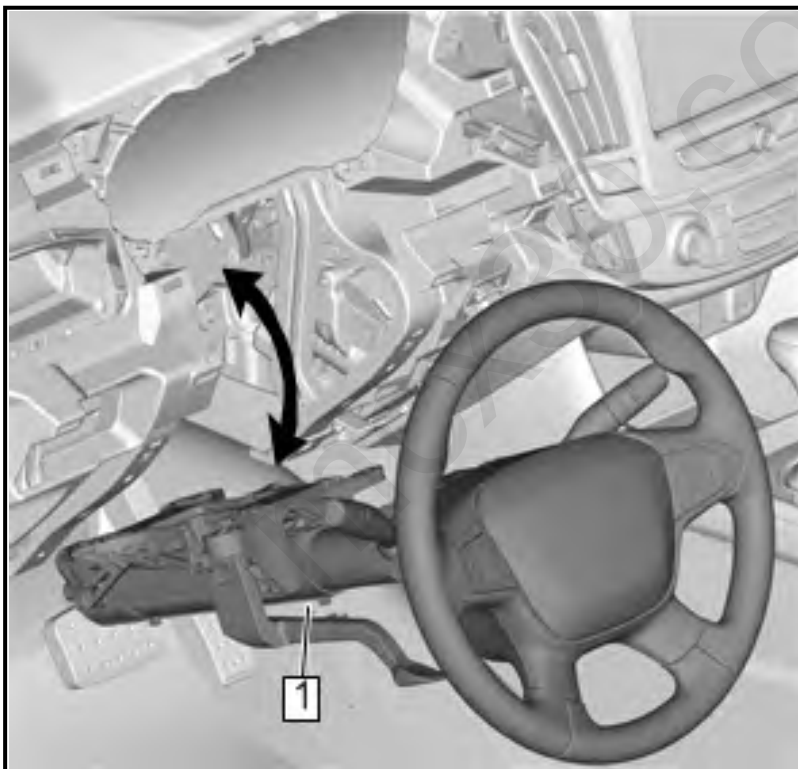
14. Disconnect the electrical connectors.

15.



Instrument Panel Knee Bolster Bracket (1) - Remove - [Instrument Panel Knee Bolster Bracket Replacement](#)

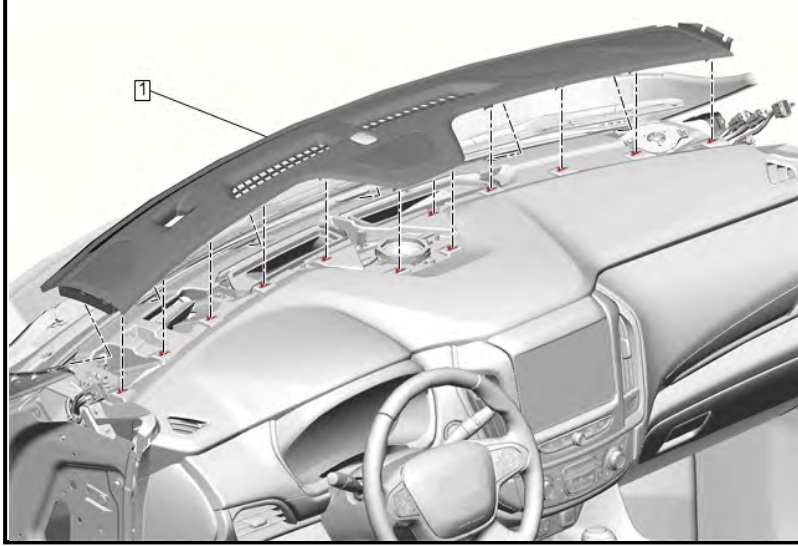
16.



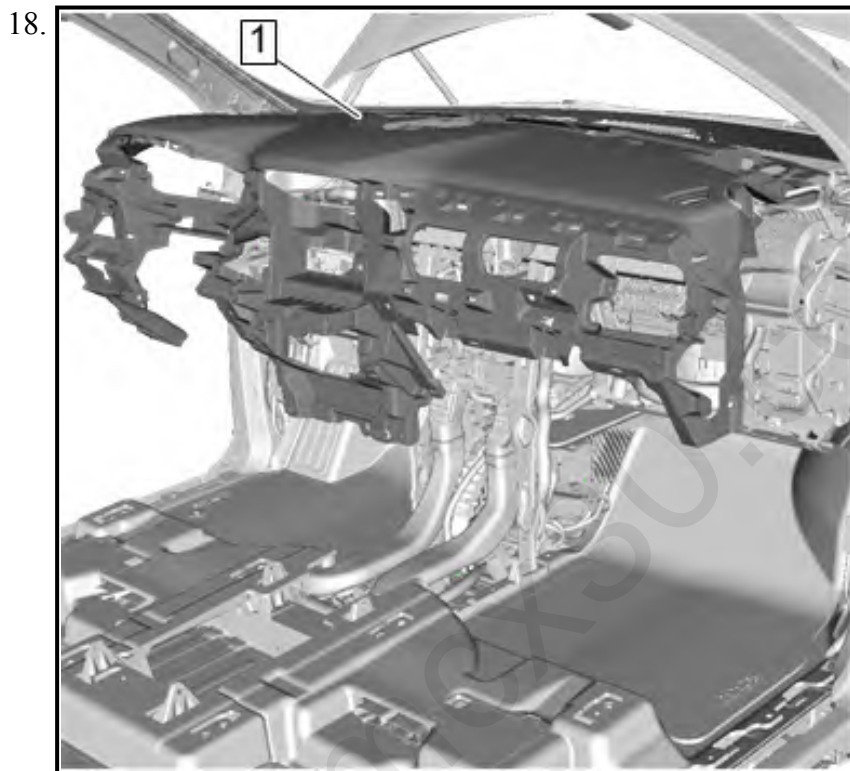
Steering Column (1) - Remove - [Steering Column Replacement \(N37\)](#) [Steering Column Replacement \(N38\)](#)

17.

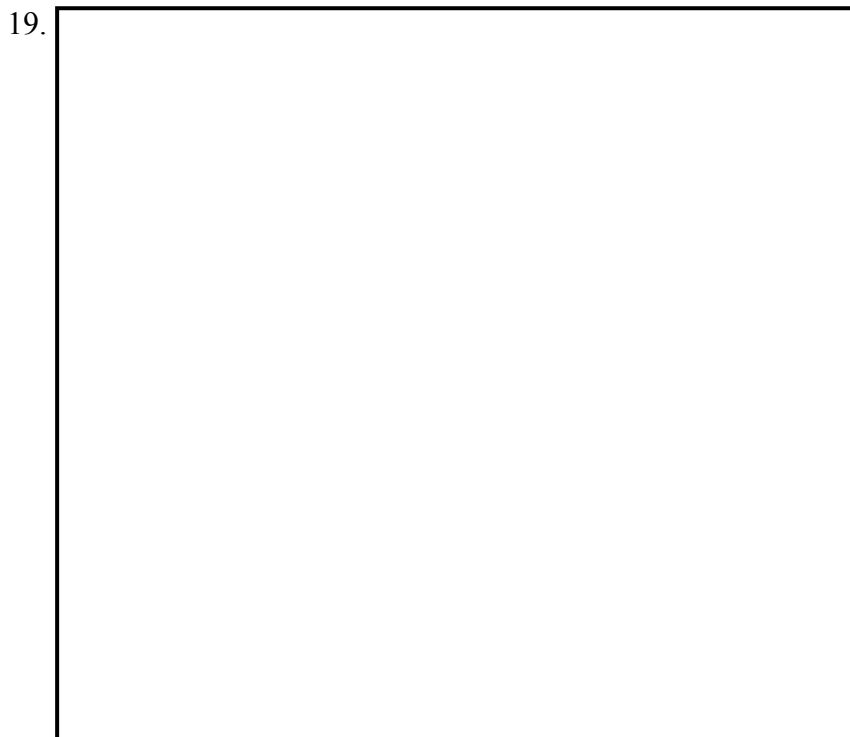


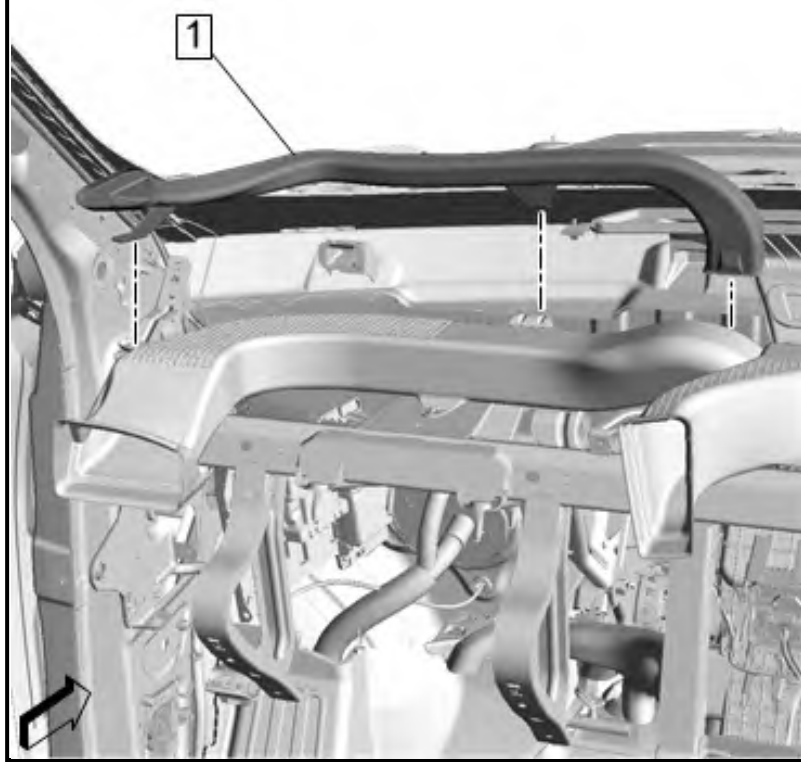


Instrument Panel Extension (1) - Remove - [Instrument Panel Extension Replacement](#)

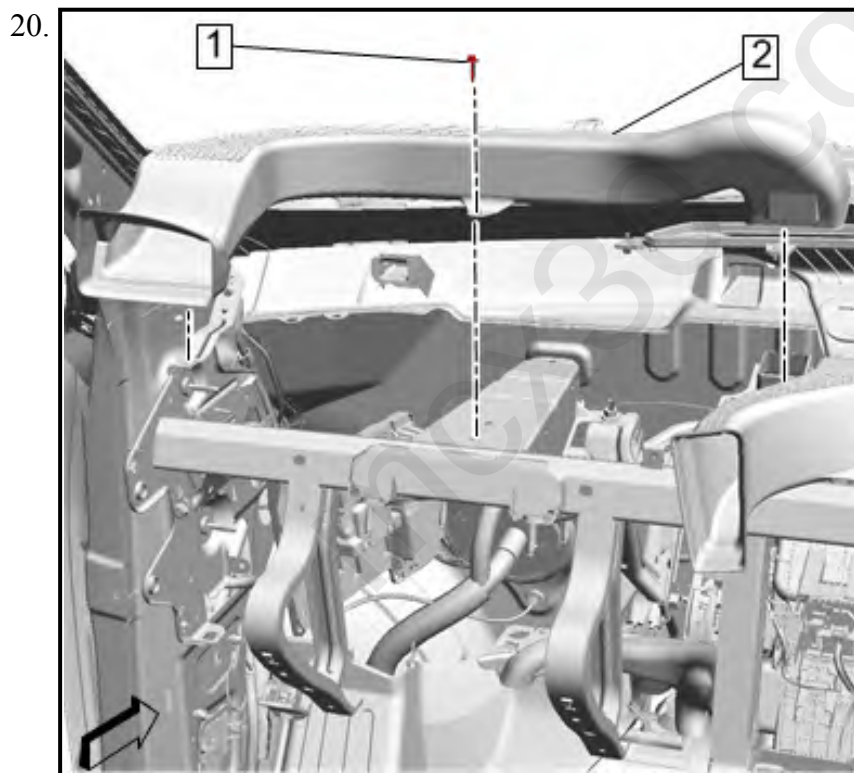


Instrument Panel (1) - Remove - [Instrument Panel Assembly Replacement](#)



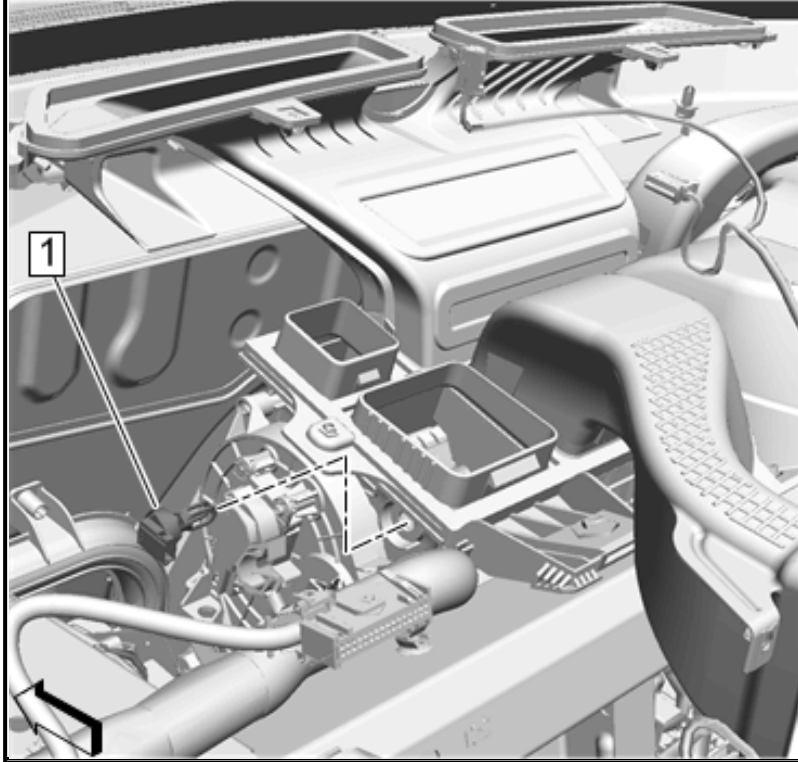


Side Window Defogger Outlet Duct - Left Side (1) - Remove - [Side Window Defogger Outlet Duct Replacement - Left Side](#)



Instrument Panel Outer Air Outlet Duct - Left Side (2) - Remove - [Instrument Panel Outer Air Outlet Duct Replacement - Left Side](#)

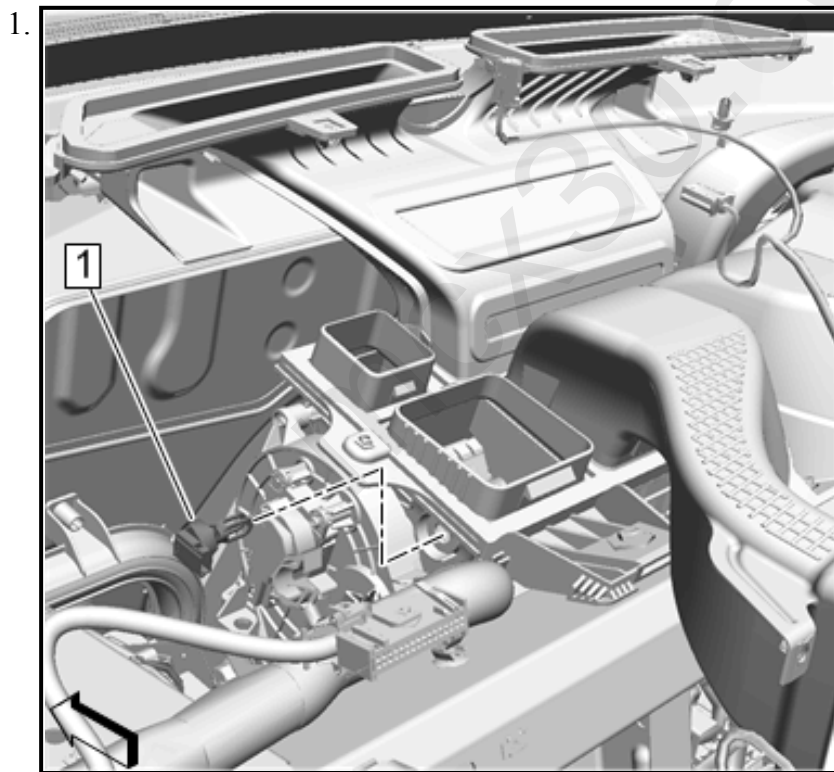




Duct Air Temperature Sensor - Upper Left Side (1) - Remove

22. Disconnect the electrical connector.

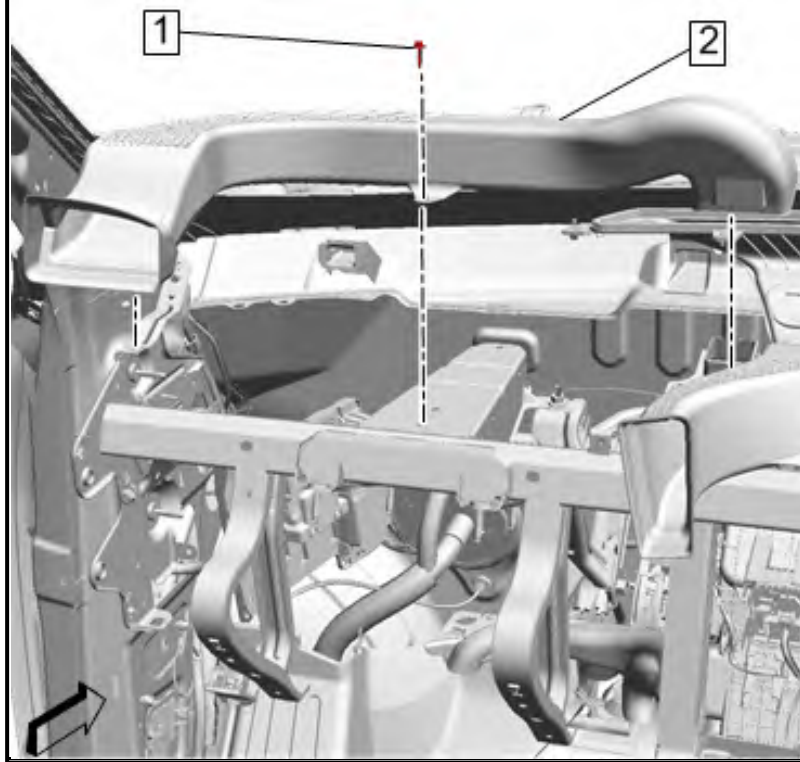
Installation Procedure



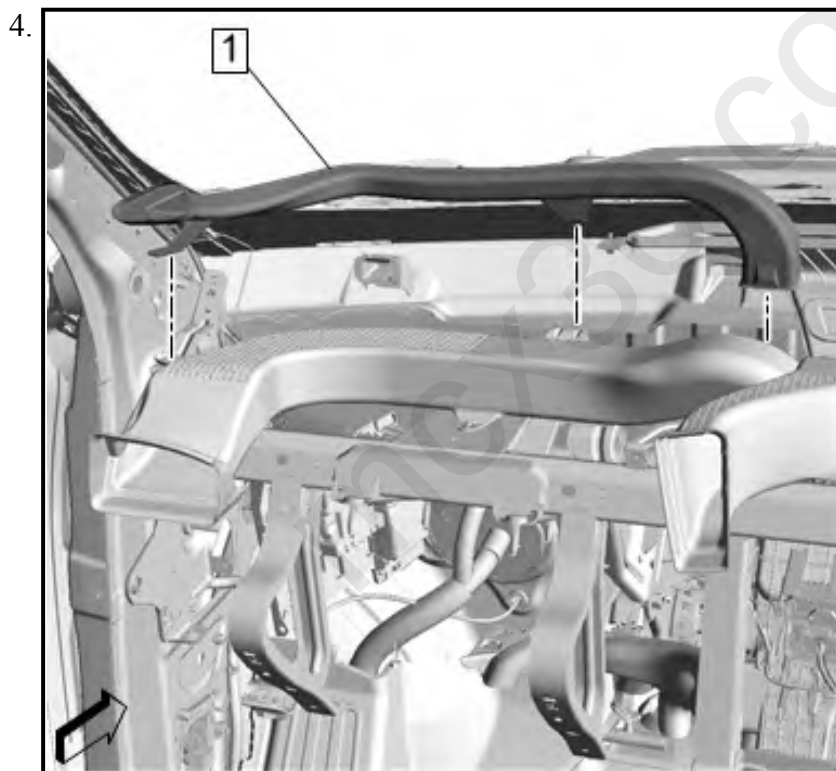
Duct Air Temperature Sensor - Upper Left Side (1) - Install

2. Connect the electrical connector.



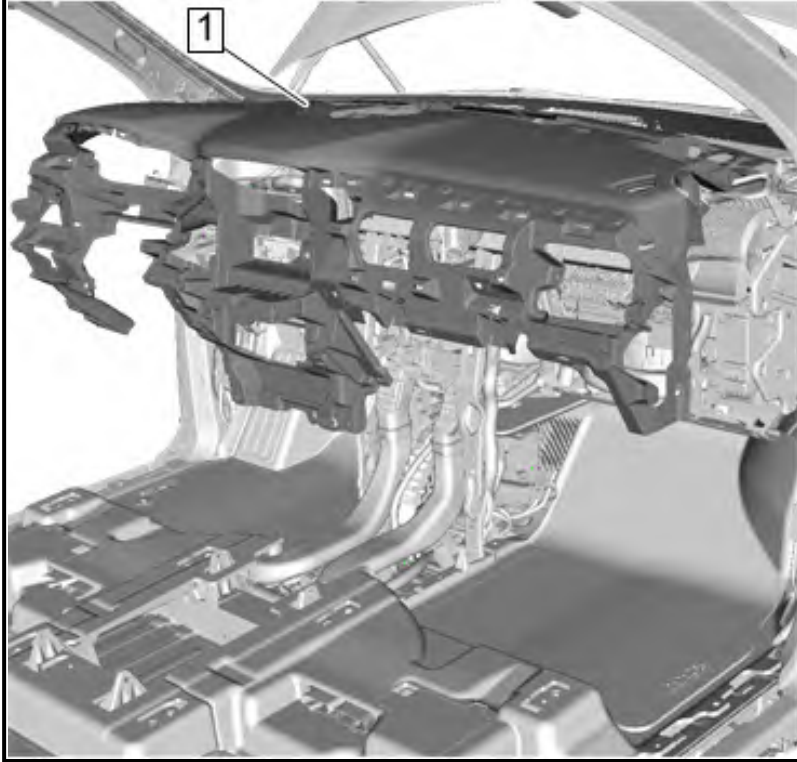


Instrument Panel Outer Air Outlet Duct - Left Side (2) - Install - [Instrument Panel Outer Air Outlet Duct Replacement - Left Side](#)

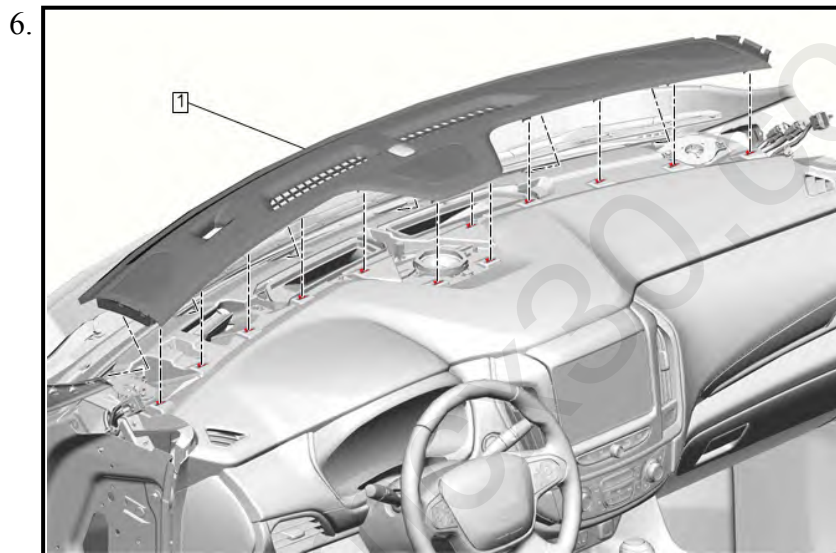


Side Window Defogger Outlet Duct - Left Side (1) - Install - [Side Window Defogger Outlet Duct Replacement - Left Side](#)

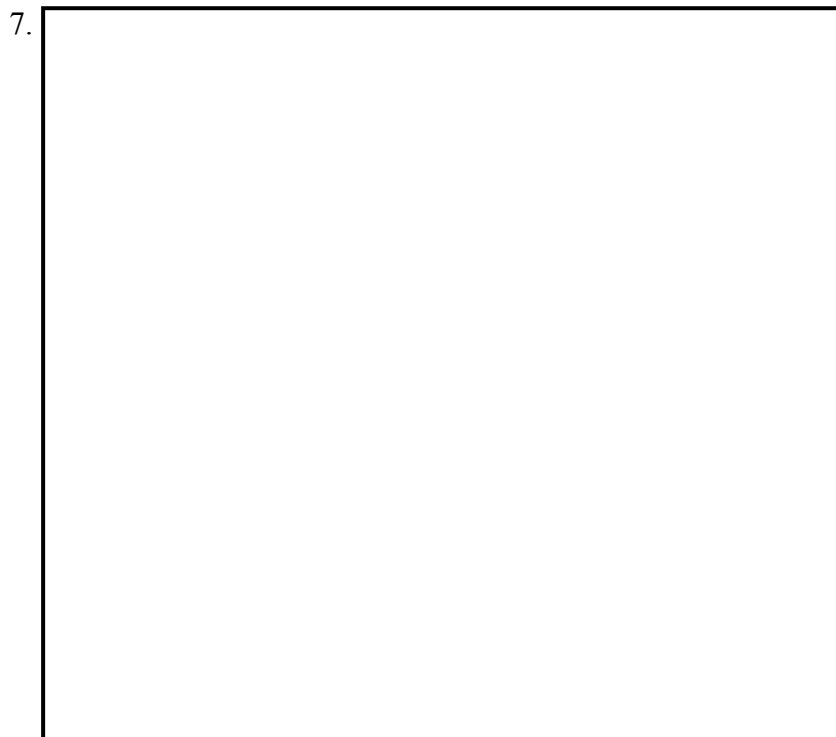


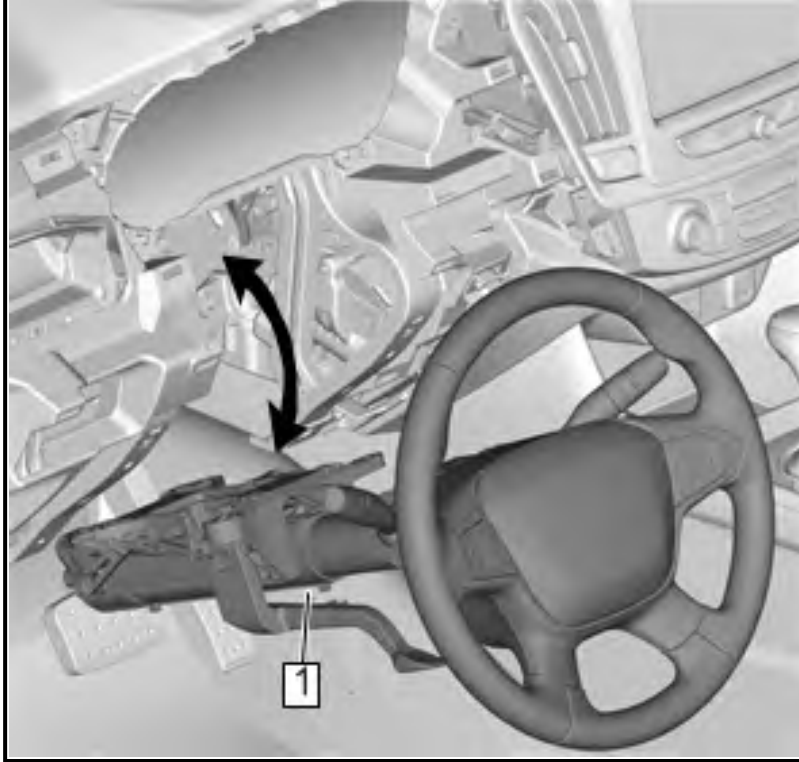


Instrument Panel (1) - Install - [Instrument Panel Assembly Replacement](#)

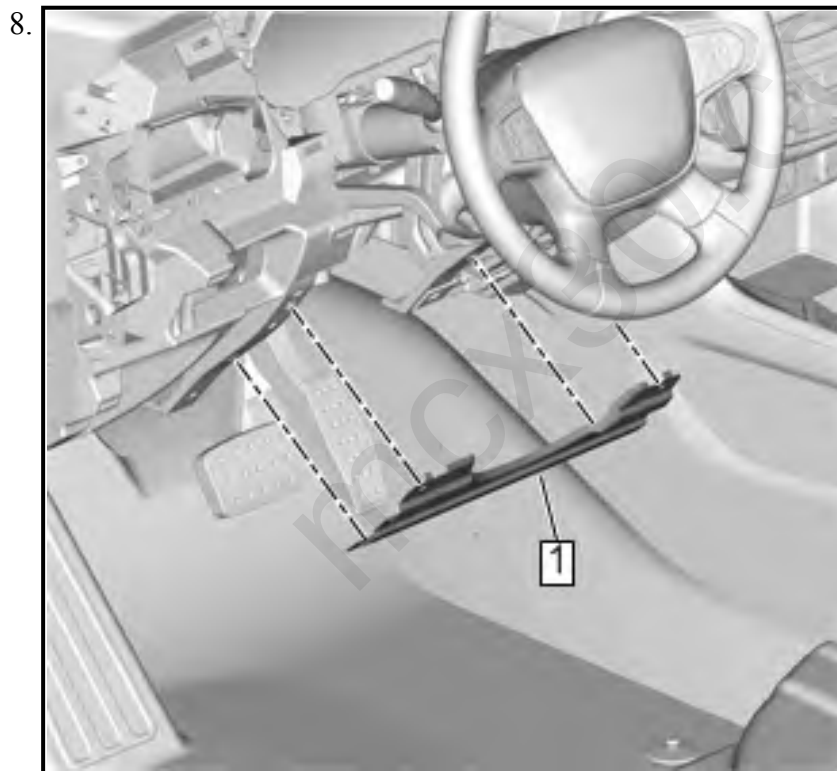


Instrument Panel Extension (1) - Install - [Instrument Panel Extension Replacement](#)



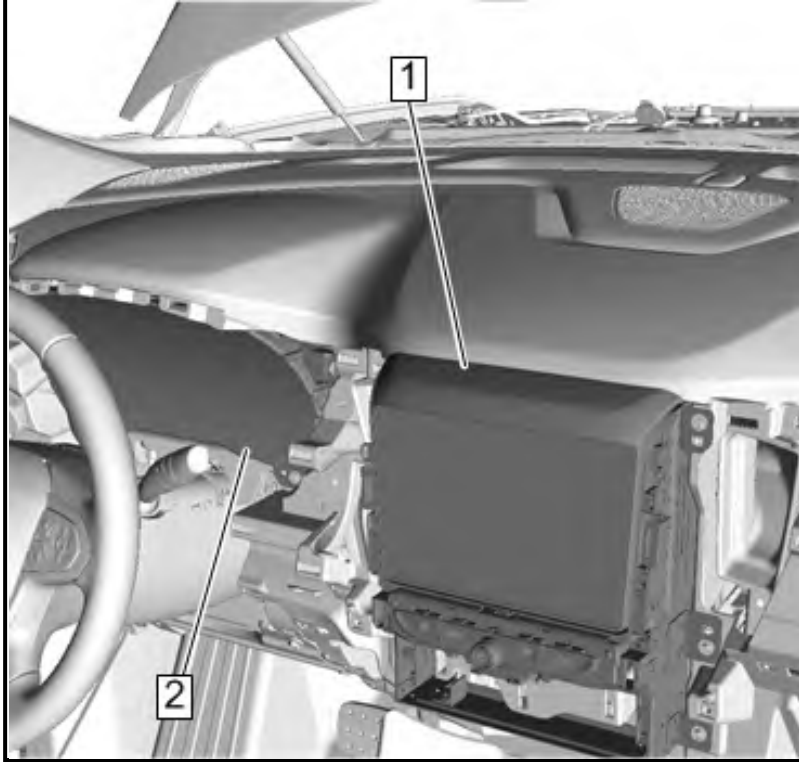


Steering Column (1) - Install - [Steering Column Replacement \(N37\)](#), [Steering Column Replacement \(N38\)](#)



Instrument Panel Knee Bolster Bracket (1) - Install - [Instrument Panel Knee Bolster Bracket Replacement](#)



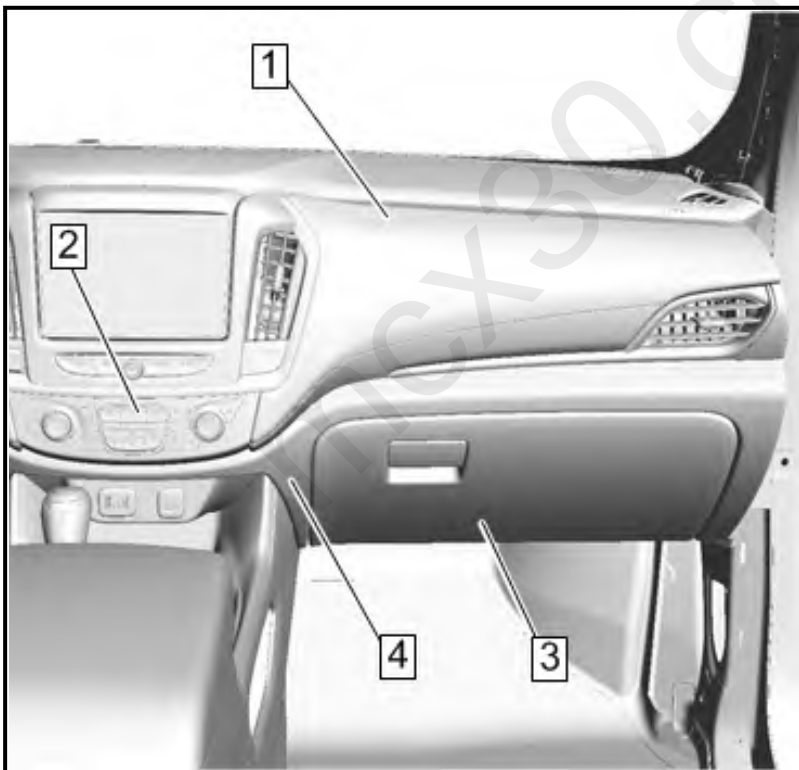


Connect the electrical connectors.

10. Instrument Cluster (2) - Install - [Instrument Cluster Replacement](#)

11. Radio Control (1) - Install - [Radio Control Assembly Replacement \(With IO5, IO6\)](#)

12.



Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

13. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)

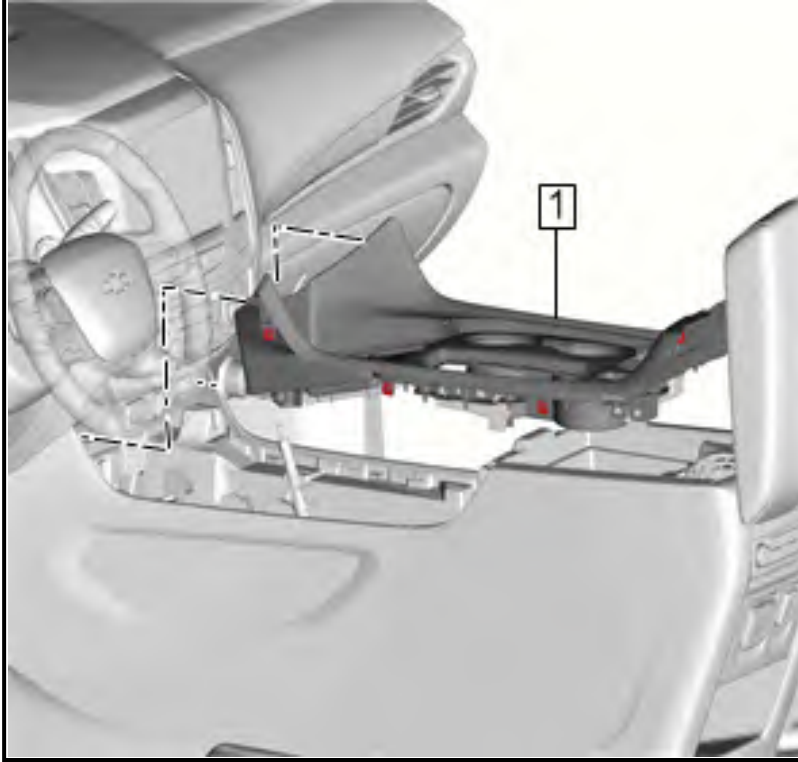
14. Connect the electrical connectors.

15. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)

16. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)

17.





Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)

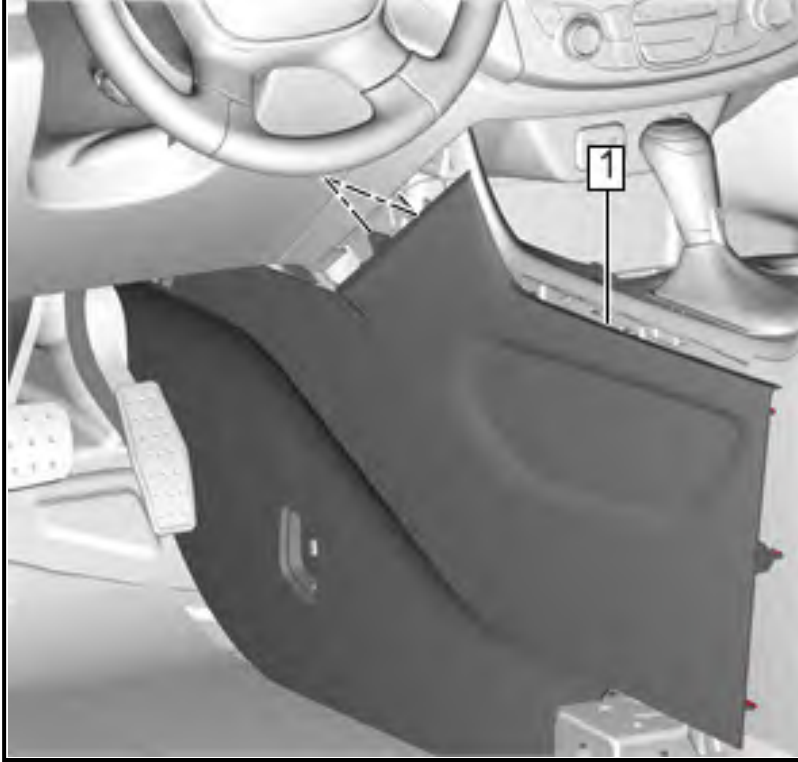
18.



Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)

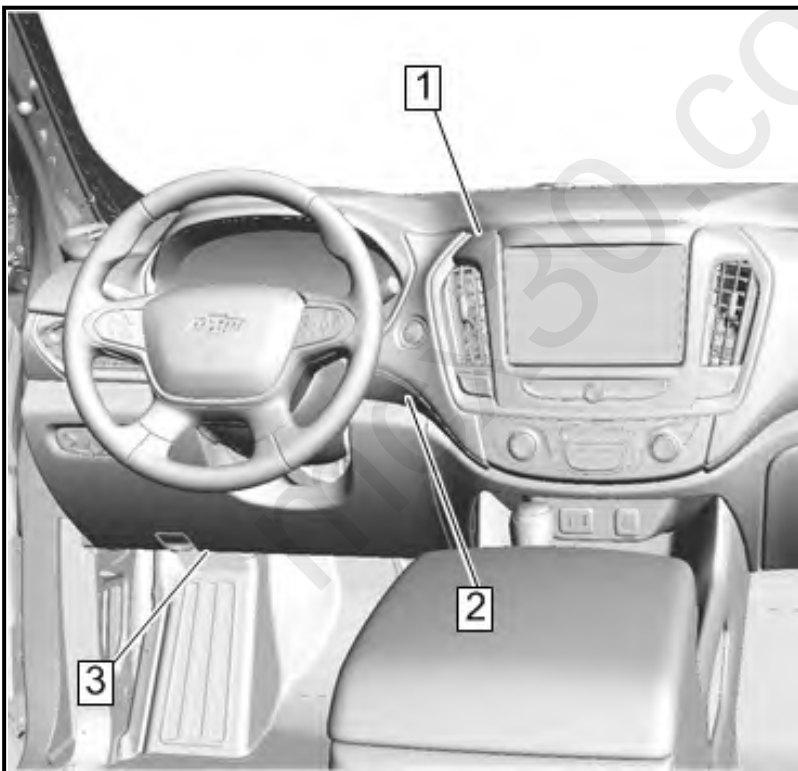
19.





Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

20.



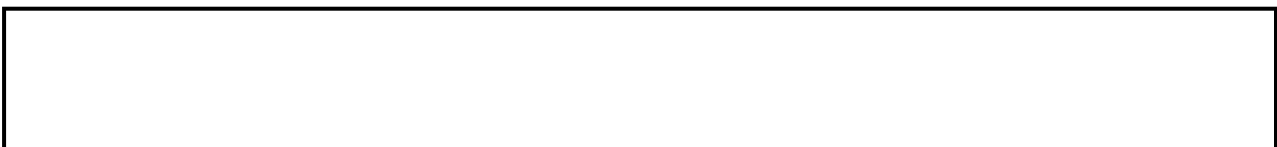
Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

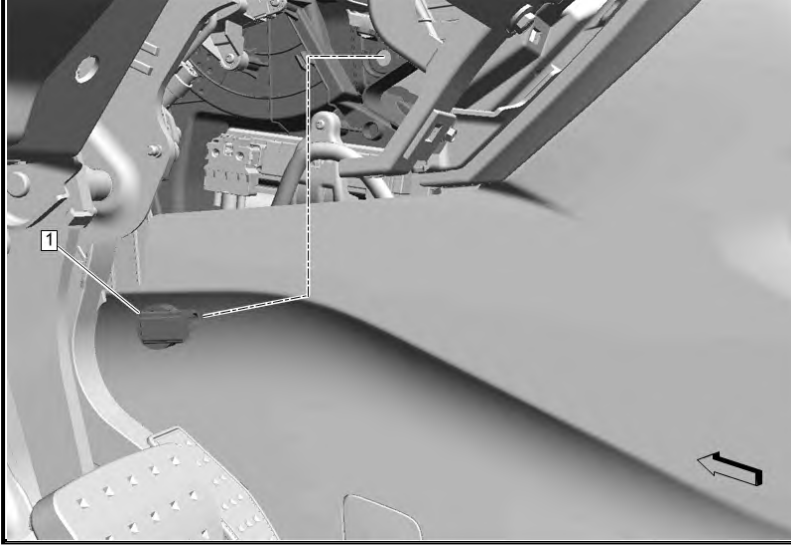
21. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

22. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

23. Clear the DTCs from the heater and air conditioning remote control module.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER LEFT SIDE

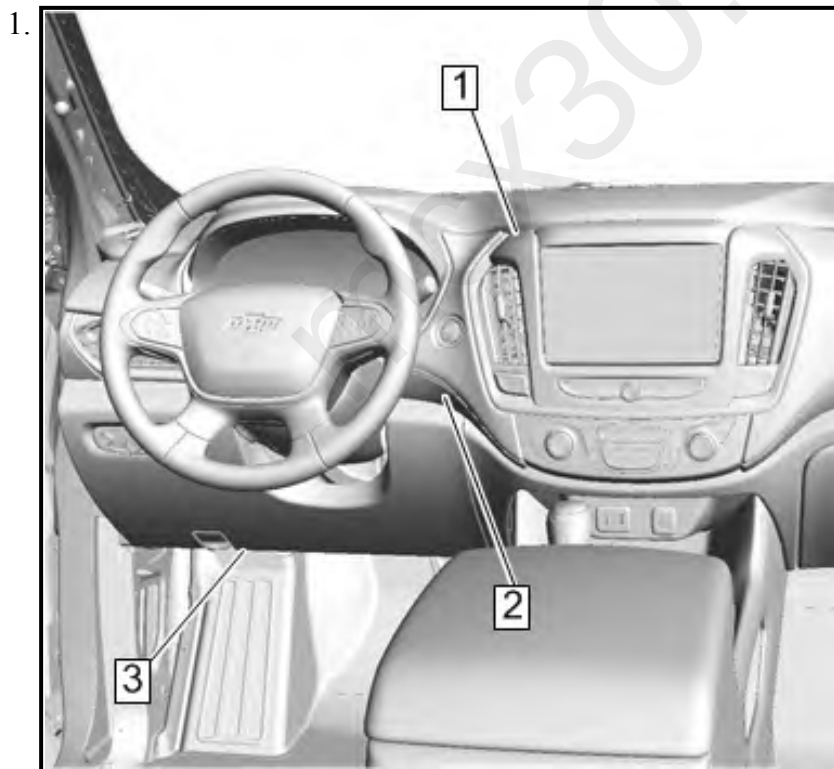




Callout	Component Name
Preliminary Procedures Instrument Panel Knee Bolster Replacement Floor Front Air Outlet Duct Replacement - Left Side	
1	Duct Air Temperature Sensor - Lower Left Side Procedure Disconnect the electrical connector.

DUCT AIR TEMPERATURE SENSOR REPLACEMENT - LOWER RIGHT SIDE

Removal Procedure

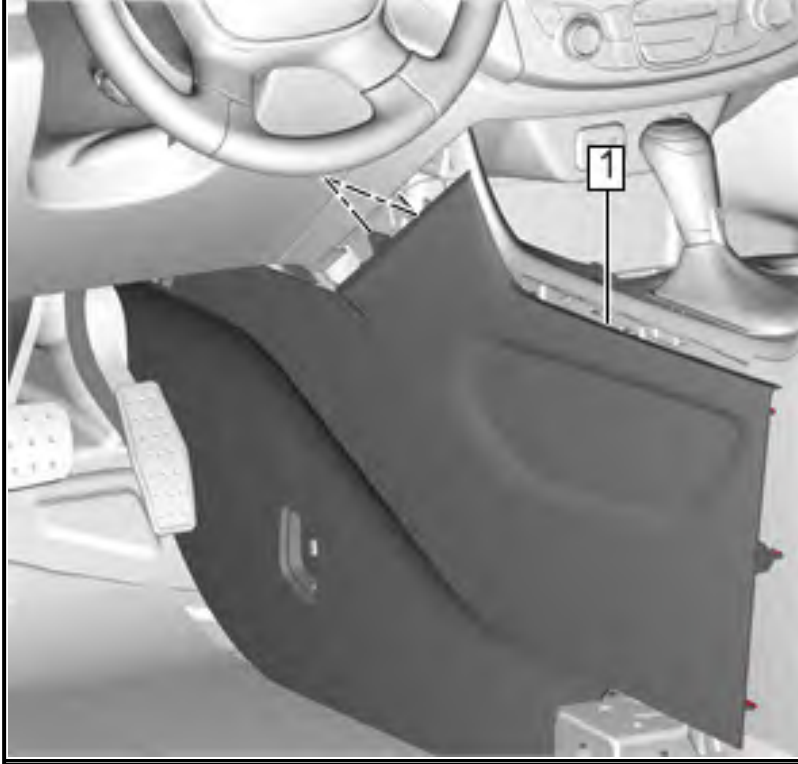


Instrument Panel Radio Front Trim Plate (1) - Remove - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

2. Instrument Panel Trim Pad - Left Side (2) - Remove - [Instrument Panel Trim Pad Replacement - Left Side](#)

3. Instrument Panel Knee Bolster (3) - Remove - [Instrument Panel Knee Bolster Replacement](#)

4.



Front Floor Console Extension Panel - Left Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Left Side](#)

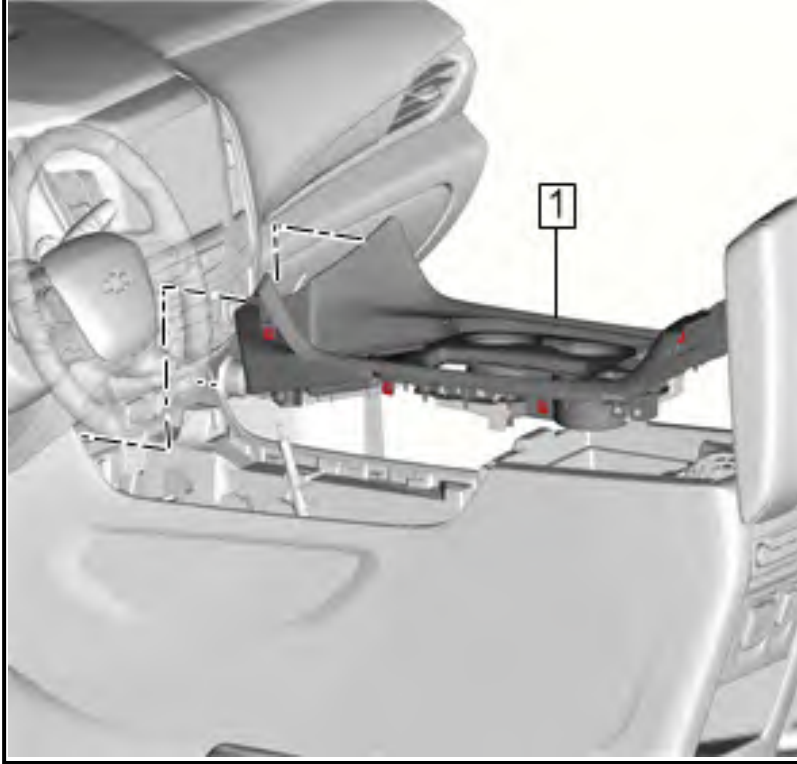
5.



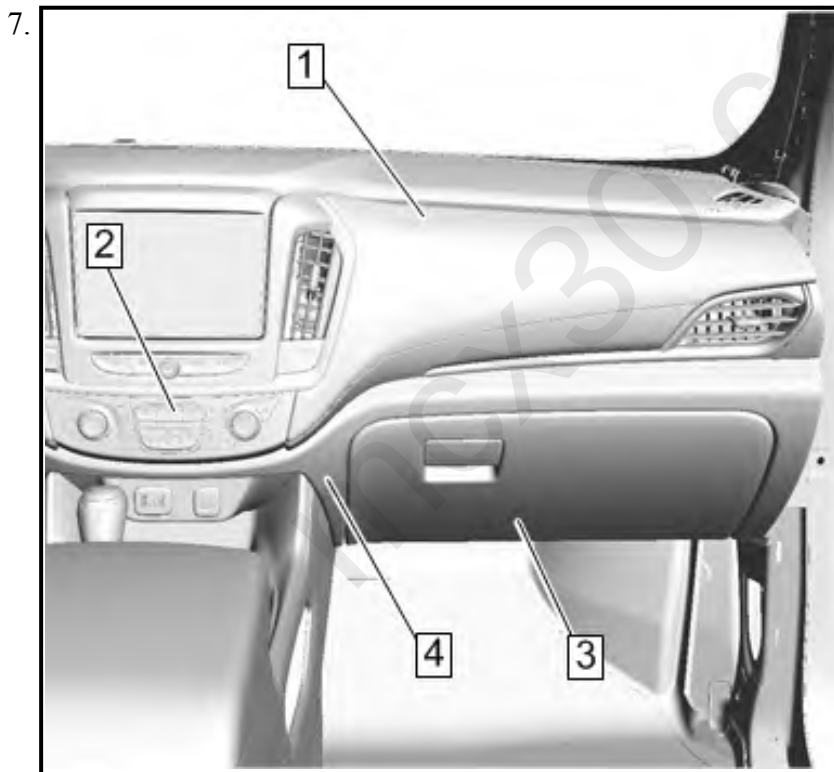
Front Floor Console Extension Panel - Right Side (1) - Remove - [Front Floor Console Extension Panel Replacement - Right Side](#)

6.





Front Floor Console Cup Holder Plate (1) - Remove - [Front Floor Console Cup Holder Plate Replacement](#)



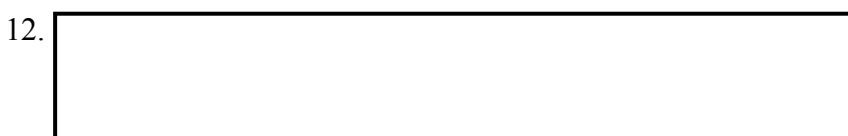
Instrument Panel Trim Pad - Right Side (1) - Remove - [Instrument Panel Trim Pad Replacement - Right Side](#)

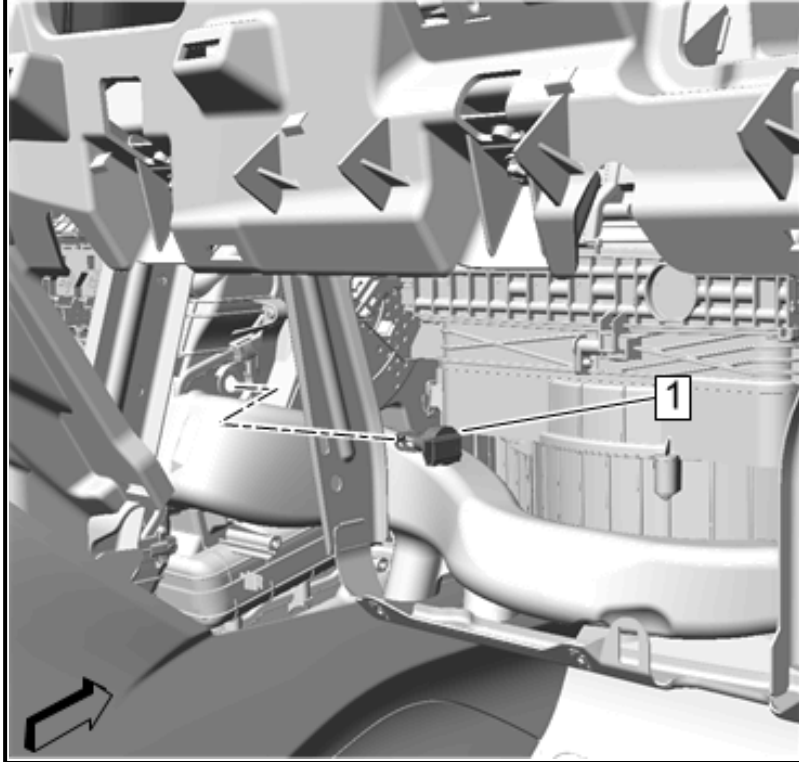
8. Heater and Air Conditioning User Interface Control (2) - Remove - [Heater and Air Conditioning User Interface Control Replacement](#)

9. Disconnect the electrical connectors.

10. Instrument Panel Compartment Door (3) - Remove - [Instrument Panel Compartment Door Replacement](#)

11. Instrument Panel Compartment Door Opening Frame (4) - Remove - [Instrument Panel Compartment Door Opening Frame Replacement](#)



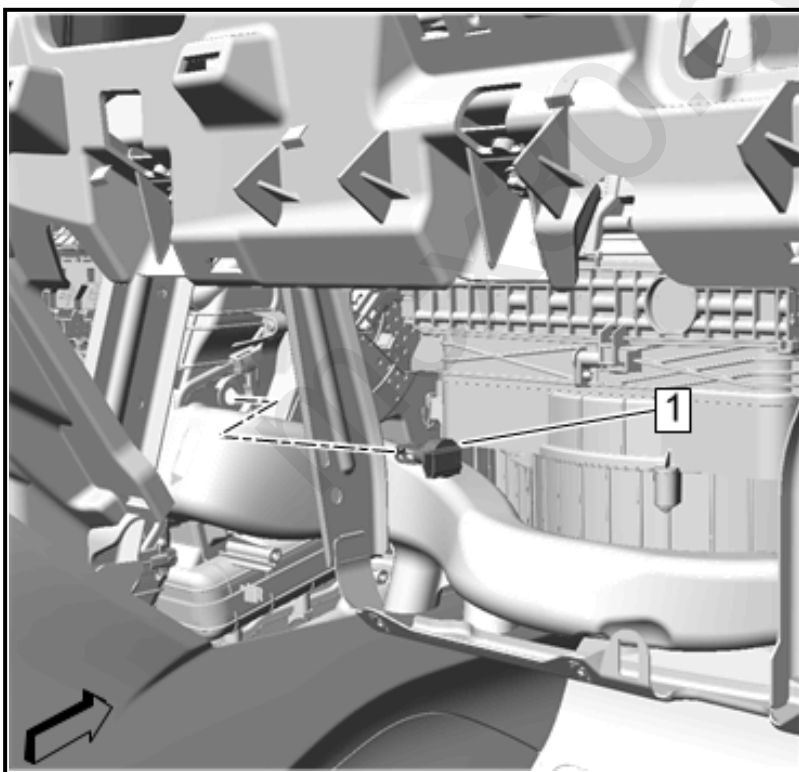


Duct Air Temperature Sensor - Lower Right Side (1) - Remove

13. Disconnect the electrical connectors.

Installation Procedure

1.

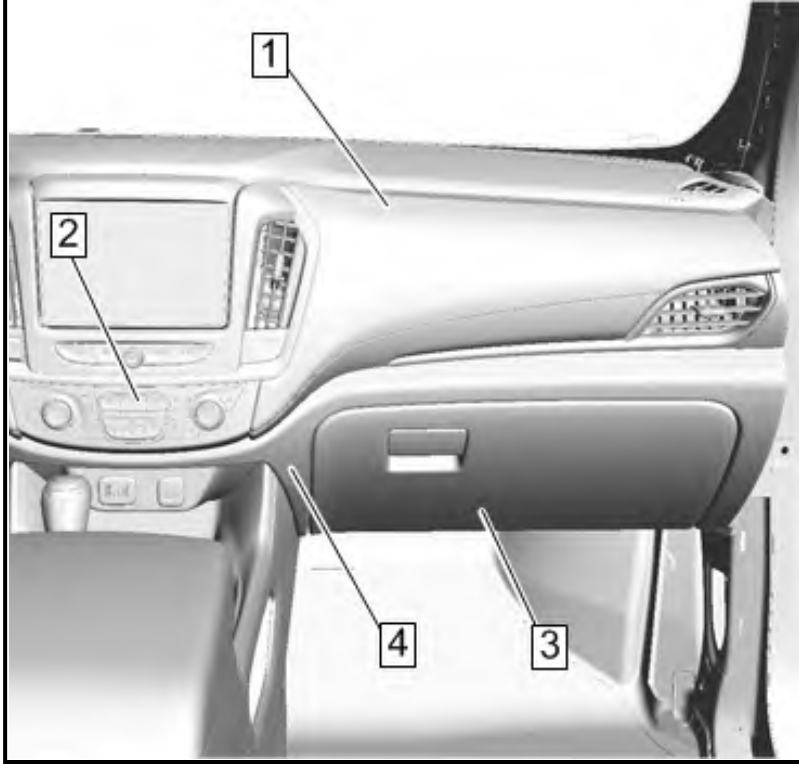


Duct Air Temperature Sensor - Lower Right Side (1) - Install

2. Connect the electrical connectors.

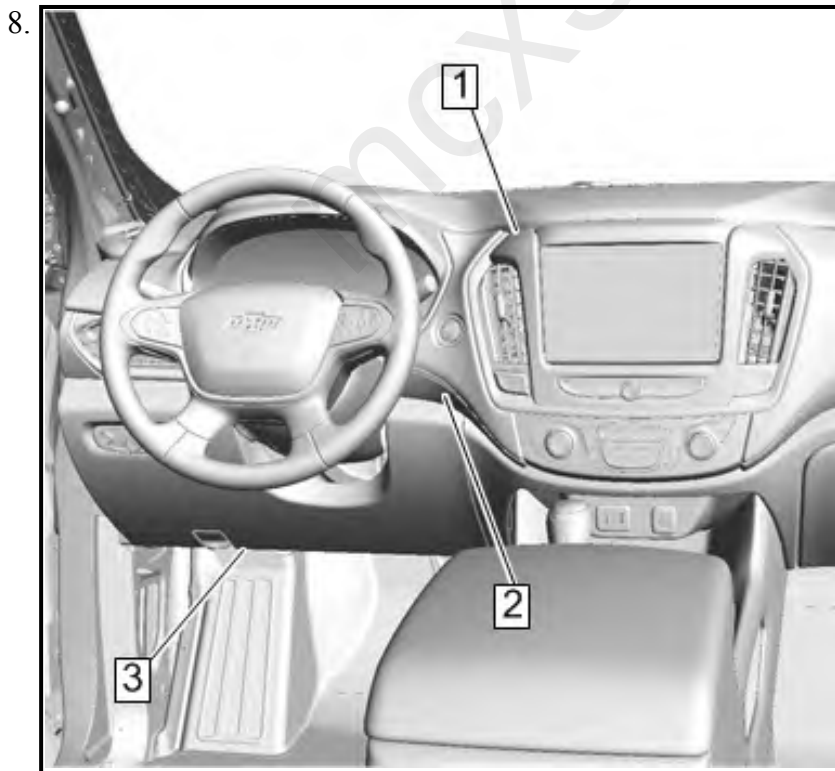
3.





Instrument Panel Compartment Door Opening Frame (4) - Install - [Instrument Panel Compartment Door Opening Frame Replacement](#)

4. Instrument Panel Compartment Door (3) - Install - [Instrument Panel Compartment Door Replacement](#)
5. Connect the electrical connectors.
6. Heater and Air Conditioning User Interface Control (2) - Install - [Heater and Air Conditioning User Interface Control Replacement](#)
7. Instrument Panel Trim Pad - Right Side (1) - Install - [Instrument Panel Trim Pad Replacement - Right Side](#)

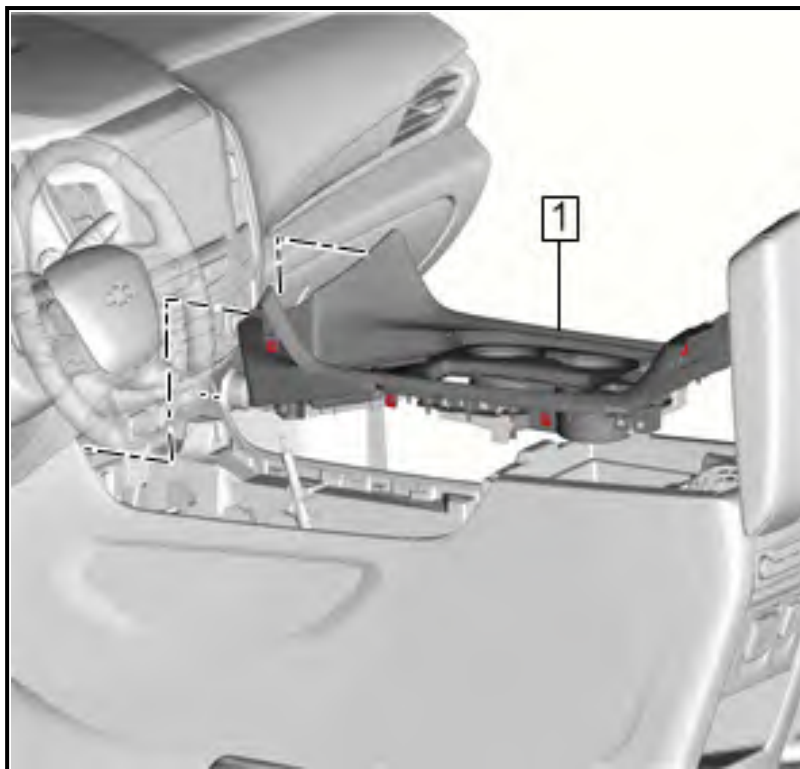


Instrument Panel Trim Pad - Left Side (2) - Install - [Instrument Panel Trim Pad Replacement - Left Side](#)

9. Instrument Panel Radio Front Trim Plate (1) - Install - [Instrument Panel Radio Front Trim Plate Replacement \(RPO IOA\)](#) [Instrument Panel Radio Front Trim Plate Replacement \(RPO IO5, IO6\)](#)

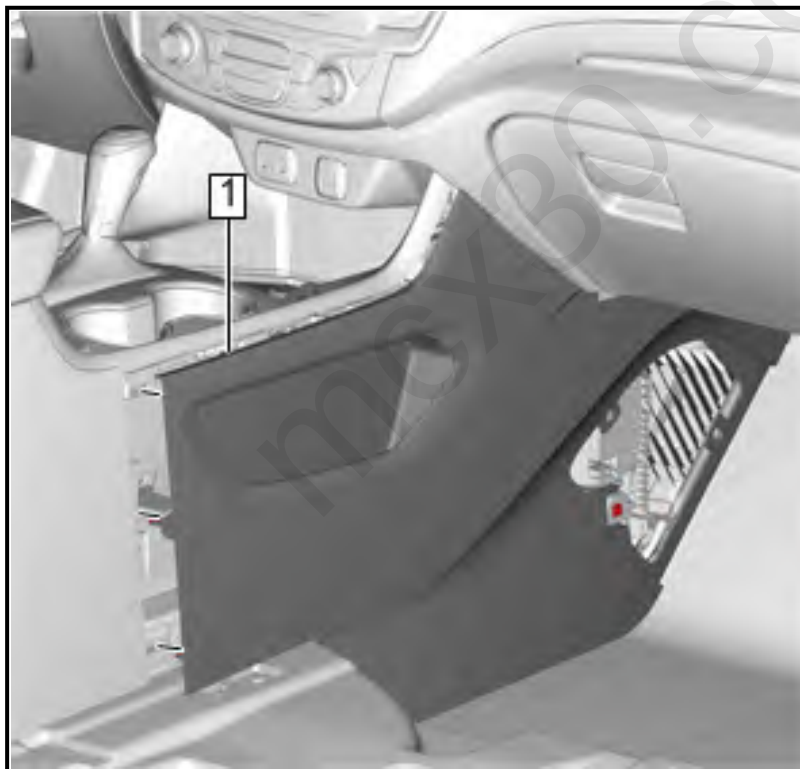
10. Instrument Panel Knee Bolster (3) - Install - [Instrument Panel Knee Bolster Replacement](#)

11.



Front Floor Console Cup Holder Plate (1) - Install - [Front Floor Console Cup Holder Plate Replacement](#)

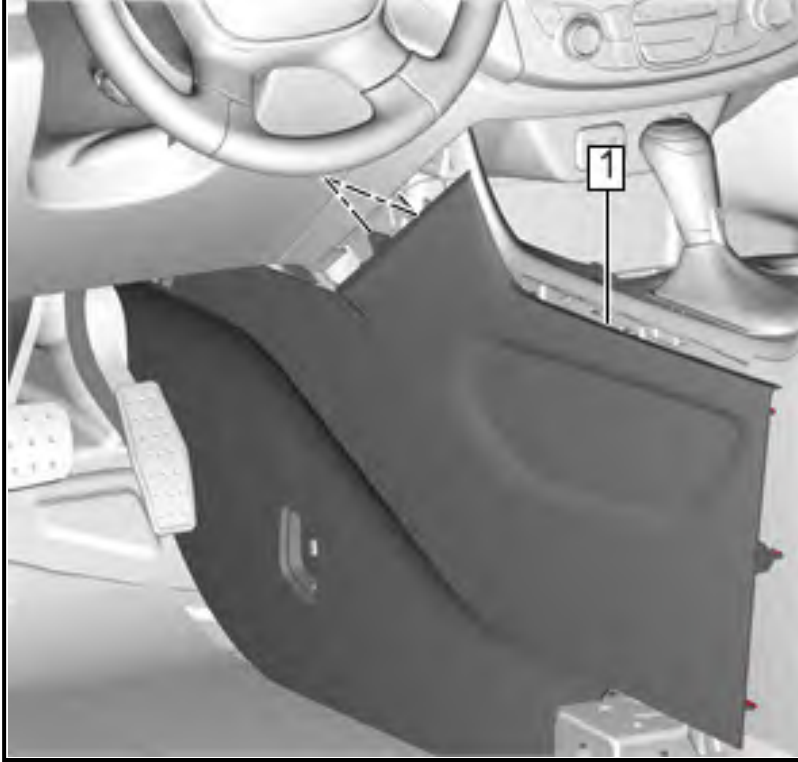
12.



Front Floor Console Extension Panel - Right Side (1) - Install - [Front Floor Console Extension Panel Replacement - Right Side](#)

13.

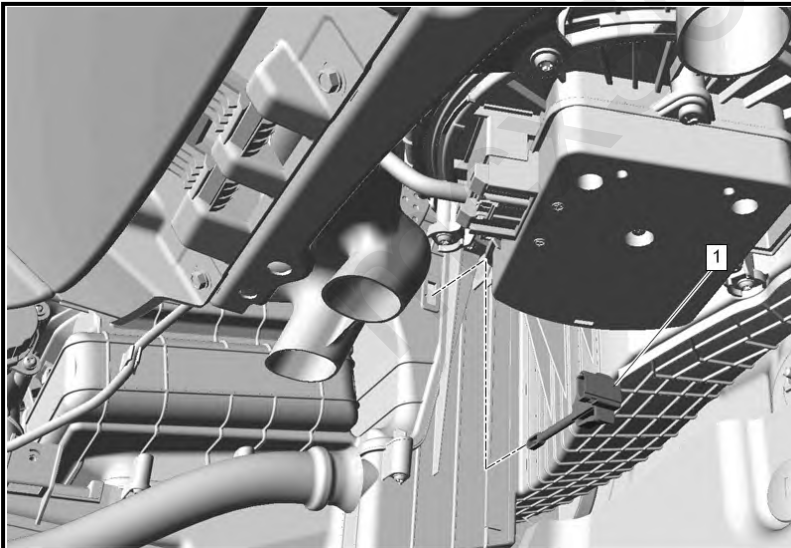




Front Floor Console Extension Panel - Left Side (1) - Install - [Front Floor Console Extension Panel Replacement - Left Side](#)

14. Perform the necessary programming and setup procedure: [Control Module References](#)
15. Clear the DTCs from the heater and air conditioning remote control module.
16. Perform the actuator calibration procedure. [Actuator Recalibration](#)

EVAPORATOR AIR TEMPERATURE SENSOR REPLACEMENT



Callout	Component Name
1	Evaporator Air Temperature Sensor Procedure 1. Disconnect the electrical connector. 2. Clear the DTCs from the heater and air conditioning remote control module.

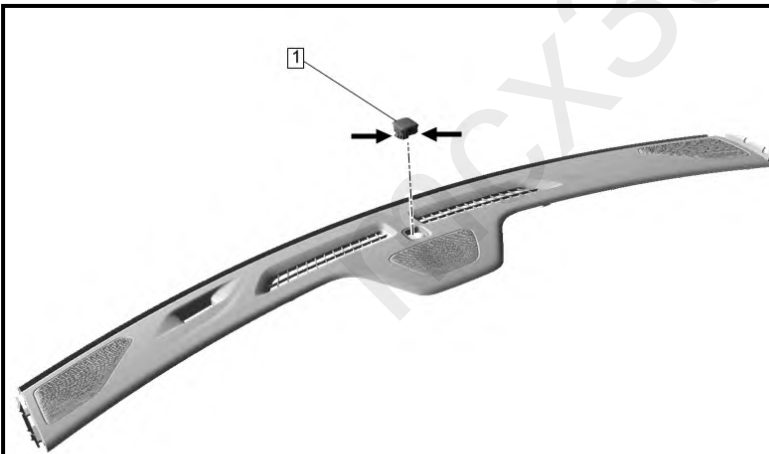
INSIDE AIR MOISTURE AND WINDSHIELD TEMPERATURE SENSOR REPLACEMENT





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

SUN LOAD TEMPERATURE AND AMBIENT LIGHT AND SECURITY INDICATOR SENSOR REPLACEMENT



Callout	Component Name
Preliminary Procedure <u>Instrument Panel Extension Replacement</u>	
1	Sun Load Temperature and Ambient Light and Security Indicator Sensor Procedure Depress the sun load temperature and ambient light and security 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 Speed and Blower Motor (Front)
- Air Speed and Blower Motor (Rear)
- Air Delivery (Front)
- Air Delivery (Rear)
- Heating and A/C Operation
- Recirculation Operation
- Automatic Operation
- Heater Coolant Pump
- 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 (C69 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: mode, left and right 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 door.

Actuators - Rear (C69)

Two additional actuators are added to the system to control the airflow and temperature for the rear seat passengers: rear temperature, and a rear mode.

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 door.

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 (C69)

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

Duct Temperature Sensors

The air temperature sensors are 2-wire negative temperature co-efficient thermistors. The sensors operate within a temperature range of -40 to $+85^{\circ}\text{C}$ (-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 the mixed air door 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 Pressure Sensor

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

A/C Compressor

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.

Windshield Temperature and Inside Moisture Sensor

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

This sensor assembly provides information about:

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

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

Ambient Light/Sunload Sensor

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

This sensor assembly provides information about:

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

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

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

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

Air 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 recirculation and mode door actuator. The modes that may be selected are:

- Defrost
- Defog
- Panel
- Floor

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

The rear window defogger does not affect the HVAC system.

Air Delivery - Rear (CJ2)

Rear air delivery does not include an auxiliary blower, rear controls, or actuators such as Mode and Temperature. It uses only the vents in the console between and under the two front seats. The air temperature and mode from the rear ducts will match the temperature and mode that is chosen for the driver, and when air is directed to the windshield for defrost it will be blocked from the rear ducts.

Air Delivery - Rear (C69)

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

- AUTO
- Floor
- Bi-Level
- Vent

The desired rear air distribution mode can be selected with the Mode switch at the HVAC control - auxiliary. The HVAC control - auxiliary delivers the values to the HVAC control module via LIN-Bus. The HVAC control module controls the mode door actuator - auxiliary so that it drives the door to the calculated position. Depending on the position of the door, air is distributed through various ducts.

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 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 124Â°C (255Â°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 3Â°C (38Â°F)
- ECM does not detect immoderate torque load
- ECM does not detect insufficient idle quality
- The ambient temperature is above 1Â°C (34Â°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 door to induce the airflow. If the interior temperature should be increased, the mixed air door is put into the position in which more air streams through the heater core. If the interior temperature should be decreased, the mixed air door is put into the position in which more air streams through the evaporator core.

Recirculation Operation

The recirculation switch is integrated into the HVAC control. The selected recirculation setting is sent to the HVAC control module via LIN-Bus. The HVAC control module controls the air intake using the recirculation actuator. In recirculation mode the recirculation door is positioned to block outside air from entering and circulate the air within the vehicle. In outside air mode the recirculation door is positioned 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 positions the recirculation door so that outside air is circulated to the windshield to reduce fogging.

In automatic mode the values of the sensors are used as inputs for the HVAC control module to calculate the fog risk on the passenger compartment side of the windshield. The A/C compressor and the defrost mode may be 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.

Electric Auxiliary Heater (C32)

Some models are equipped with an auxiliary electric heater to assist in warming the passenger compartment when the engine coolant has not sufficiently warmed to operating temperature. The heater is a 12 V positive temperature coefficient heating element located in the HVAC case just downstream of the traditional heater core. The HVAC control module will activate it when the outside temperature is less than approximately 8°C (46°F), the engine coolant temperature is less than approximately 75°C (167°F), and the temperature blend door is commanded to the full hot position.

Heater Coolant Pump

The primary purpose of the heater 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 operating. 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.

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](#) .

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