

2017 ELECTRICAL**Hybrid/EV System Heating and Cooling - Bolt EV****SPECIFICATIONS****TEMPERATURE VERSUS RESISTANCE****B204 Hybrid/EV Battery Pack Coolant Temperature Sensor***

Temperature Degrees C (Degrees F)	Resistance k ohm (typical)
-40Â°C (-40Â°F)	75.5
-20Â°C (-4Â°F)	21.6
0Â°C (32Â°F)	7.2
20Â°C (68Â°F)	2.7
40Â°C (104Â°F)	1.2
60Â°C (140Â°F)	0.550
80Â°C (176Â°F)	0.280
100Â°C (212Â°F)	0.155
140Â°C (284Â°F)	0.054

*Part # 55591401

B32 Hybrid/EV Battery Temperature Sensor*

Temperature Degrees C (Degrees F)	Resistance k ohm (typical)
-40Â°C (-40Â°F)	202
-20Â°C (-4Â°F)	71.2
0Â°C (32Â°F)	27.8
20Â°C (68Â°F)	12.1
40Â°C (104Â°F)	5.8
60Â°C (140Â°F)	3
80Â°C (176Â°F)	1.7
90Â°C (194Â°F)	1.2

*Part # 23348948

B202 Hybrid/EV Electronics Coolant Temperature Sensor*

Temperature Degrees C (Degrees F)	Resistance k ohm (typical)
-40Â°C (-40Â°F)	45
-20Â°C (-4Â°F)	15
0Â°C (32Â°F)	5.8
20Â°C (68Â°F)	2.5
40Â°C (104Â°F)	1.2
60Â°C (140Â°F)	0.595
80Â°C (176Â°F)	0.323
100Â°C (212Â°F)	0.187
150Â°C (302Â°F)	0.057

*Part # 12641072

FASTENER SPECIFICATIONS**Reusable Threaded Fastener Tightening Specifications**

Application	Specification
	Metric (English)
cardiagn.com	

Application	Specification
	Metric (English)
NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Cooling Fan Bolt	5 N.m (44 lb in)
Drive Motor Battery Coolant Cooler Bracket Bolt	9 N.m (80 lb in)
Drive Motor Battery Coolant Inlet Hose Nut	5 N.m (44 lb in)
Drive Motor Battery Coolant Port Nut	40 N.m (30 lb ft)
Drive Motor Battery Coolant Pump Bracket Nut	9 N.m (80 lb in)
Drive Motor Battery Radiator Surge Tank Bracket Bolt	9 N.m (80 lb in)
Drive Motor Battery Radiator Surge Tank Bracket Nut	9 N.m (80 lb in)
Drive Motor Battery Coolant Cooler Bracket Nut	9 N.m (80 lb in)
Drive Motor Power Inverter Module Ground Cable Bolt	9 N.m (80 lb in)
Drive Motor Power Inverter Module Shield Bolt	25 N.m (18 lb ft)
High Voltage Battery Heater Bracket Nut	9 N.m (80 lb in)
High Voltage Battery Heater Bracket Bolt	9 N.m (80 lb in)
High Voltage Battery Heater Ground Cable Bolt	9 N.m (80 lb in)
Radiator Air Lower Baffle Bolt	9 N.m (80 lb in)
Radiator Surge Tank Bolt	4.5 N.m (40 lb in)
Radiator Surge Tank Support Bracket Bolt	9 N.m (80 lb in)
Radiator Surge Tank Support Bracket Nut	9 N.m (80 lb in)
Radiator Upper Bracket Fastener	22 N.m (16 lb ft)
Radiator Vent Valve	1.9 N.m (17 lb in)

APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	US English
Cooling System Filling		
High Voltage Battery Pack Cooling	7.0 liters	7.39 Quarts
Power Electronics Cooling	3.8 liters	4.01 Quarts

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS (NORTH AMERICA)

Application	Type of Material	GM Part Number	
		United States	Canada
DEX-COOLÂ® (Premix 50/50 with Deionized Water)	Fluid	12378390	10953456

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS (KOREA)

Application	Type of Material	GM Part Number
DEX-COOLÂ® (Premix 50/50 with Deionized Water)	Fluid	93746926

SCHEMATIC WIRING DIAGRAMS

HYBRID/EV COOLING WIRING SCHEMATICS

Hybrid/EV Electronics Cooling

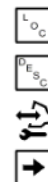


Fig. 1: Hybrid/EV Electronics Cooling
Courtesy of GENERAL MOTORS COMPANY

Hybrid/EV Battery Pack Cooling - Pump and Level Switch

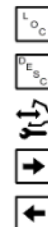


Fig. 2: Hybrid/EV Battery Pack Cooling - Pump and Level Switch
Courtesy of GENERAL MOTORS COMPANY

Hybrid/EV Battery Pack Cooling - Coolant Heater

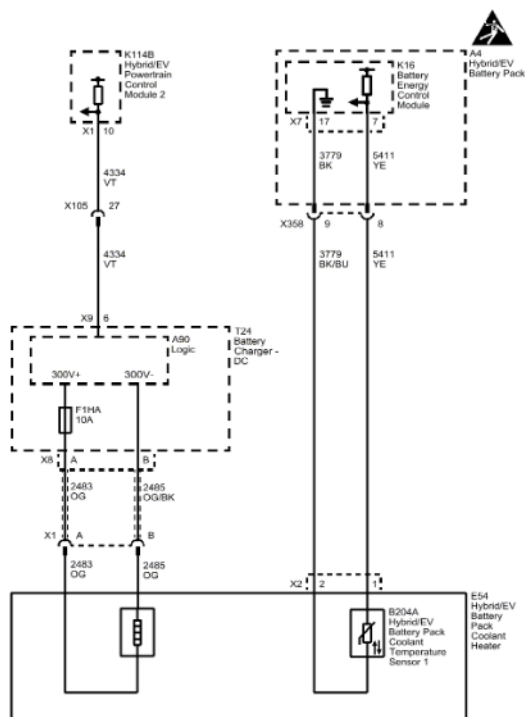


Fig. 3: Hybrid/EV Battery Pack Cooling - Coolant Heater
Courtesy of GENERAL MOTORS COMPANY

Hybrid/EV Battery Temperature Sensors

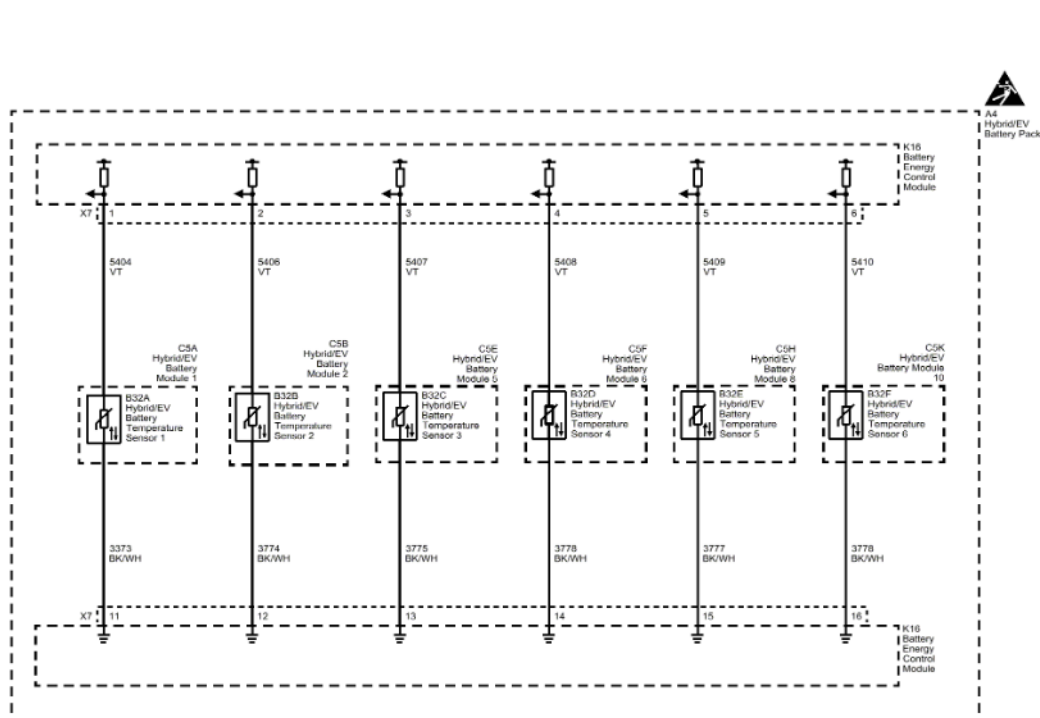


Fig. 4: Hybrid/EV Battery Temperature Sensors
Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0480: COOLING FAN RELAY CONTROL CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P0480

Cooling Fan Relay Control Circuit

Circuit/System Description

The radiator cooling fan is controlled with a pulse width modulated (PWM) signal on the cooling fan control circuit from the hybrid/EV powertrain control module 2. Although the hybrid/EV powertrain control module 2 is directly connected to the cooling fan, the ECM is considered the master controller. The ECM sends a fan command PWM signal to the hybrid/EV powertrain control module 2 through the cooling fan signal hardwire circuit. The hybrid/EV powertrain control module 2 operates in a pass-through mode for any ECM-derived fan request. The higher the duty cycle the higher the cooling fan speed.

Conditions for Running the DTC

The 12 V battery voltage is greater than 10.2 V.

Conditions for Setting the DTC

The Hybrid/EV Powertrain Control Module 2 has detected an open, short to ground or short to voltage fault on the fan control circuit.

Action Taken When the DTC Sets

DTC P0480 is a type B DTC.

Conditions for Clearing the DTC

DTC P0480 is a type B DTC.

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

cardiagn.com

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

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify that the cooling fan is operating at high speed when commanding the Cooling Fan Motor Command to 90% with a scan tool.
 - **If the cooling fan is not operating at high speed**

Refer to Circuit/System Testing
 - **If the cooling fan is operating as commanded**
3. Verify the cooling fan is operating at a low speed when commanding the Cooling Fan Motor Command to 10% with a scan tool.
 - **If the cooling fan is not operating at low speed**

Refer to Circuit/System Testing
 - **If the cooling fan is operating as commanded**
4. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the appropriate G10 Cooling Fan Motor.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
 - **If 10 Ω or greater**

Repair the open/high resistance in the circuit.
 - **If less than 10 Ω**
3. Connect a test lamp between the B+ circuit terminal 1 and ground.
4. 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. Vehicle OFF.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Vehicle OFF.
 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 G10 Cooling Fan Motor and the fuse.
 - **If the test lamp illuminates**
5. Connect a test lamp between the control circuit terminal 4 and the B+ circuit terminal 1.
6. Vehicle in service mode, verify the test lamp changes between dim (10%) and bright (90%) when commanding the Cooling Fan Motor Command ON between 10% and 90% with a scan tool.
 - **If the test lamp is always dim or does not illuminate**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
 2. Vehicle in Service Mode.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Vehicle 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 K114B Hybrid/EV Powertrain Control Module 2
 - **If the test lamp is always bright**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
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 K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp changes illumination between bright (90%) and dim (10%)**
7. Replace the G10 cooling fan motor.

Repair Instructions

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

- Refer to [Cooling Fan and Shroud Replacement](#) for G10 cooling fan motor replacement.
- Refer to [Control Module References](#) for K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P0A7E: HYBRID/EV BATTERY PACK HIGH TEMPERATURE

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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0A7E

Hybrid/EV Battery Pack High Temperature

Circuit/System Description

The hybrid/EV battery pack has 6 hybrid/EV battery module temperature sensors. The hybrid/EV powertrain control module 2 uses the battery temperature sensors to determine the hybrid/EV battery module temperature to control the energy storage cooling system operation.

The energy storage system cooling system uses a 12 V hybrid/EV battery pack coolant pump, a refrigerant/coolant heat exchanger (chiller) and the electric A/C compressor motor control module assembly to cool down the high voltage hybrid/EV battery.

Conditions for Running the DTC

- The hybrid/EV powertrain control module 2 and hybrid/EV battery energy control module are awake and communicating.
- The 12 V battery voltage is greater than or equal to 10.2 V.
- None of the following DTCs are set: P0A9C, P0A9D, P0A9E, P0AC6, P0AC7, P0AC8, P0ACB, P0ACC, P0ACD, P0AE9, P0AEA, P0AEB, P0BC3, P0BC4, P0BC5, P0C34, P0C35, P0C36, or U179C.

Conditions for Setting the DTC

The maximum sensed temperature in the hybrid/EV battery is greater than 53Â°C (127Â°F).

Action Taken When the DTC Sets

- DTC P0A7E is a type A DTC.
- The hybrid/EV powertrain control module 2 opens the high voltage contactors.

Conditions for Clearing the DTC

DTC P0A7E is a type A DTC.

Reference Information

Schematic Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

DTC Type Reference

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

Scan Tool Reference

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

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify that DTC P0480, P0534, P0C47, P148A-P148C, P1EC6, P1E8C or P1E8D is not set.

- If any DTC is set

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

- If none of the DTCs are set

WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

3. Test for proper coolant level and operation of the hybrid/EV battery coolant system, refrigerant system and coolant fan system. Refer to [Hybrid/EV Electronics Cooling Diagnostic \(Drive Motor Generator Power Inverter Module Cooling System\)](#)[Hybrid/EV Electronics Cooling Diagnostic \(Drive Motor Battery Cooling System\)](#), for Drive Motor Battery Cooling System, [Hybrid/EV Battery Pack Coolant Pump Malfunction](#), [Cooling Fan Malfunction](#), [Hybrid Cooling System Loss of Coolant \(Drive Motor Battery Cooling System\)](#)[Hybrid Cooling System Loss of Coolant \(Drive Motor Generator Power Inverter Module Cooling System\)](#), as appropriate.

DTC P0A9C-P0A9E, P0AC6-P0ACD, P0AE9-P0AEB, P0BC3-P0BC5, OR P0C34-P0C36: HYBRID/EV BATTERY TEMPERATURE SENSOR 1-6

[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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

[DTC Descriptors](#)

DTC P0A9C

Hybrid/EV Battery Temperature Sensor 1 Performance

DTC P0A9D

Hybrid/EV Battery Temperature Sensor 1 Circuit Low Voltage

DTC P0A9E

Hybrid/EV Battery Temperature Sensor 1 Circuit High Voltage

DTC P0AC6

DTC P0AC7

Hybrid/EV Battery Temperature Sensor 2 Circuit Low Voltage

DTC P0AC8

Hybrid/EV Battery Temperature Sensor 2 Circuit High Voltage

DTC P0ACB

Hybrid/EV Battery Temperature Sensor 3 Performance

DTC P0ACC

Hybrid/EV Battery Temperature Sensor 3 Circuit Low Voltage

DTC P0ACD

Hybrid/EV Battery Temperature Sensor 3 Circuit High Voltage

DTC P0AE9

Hybrid/EV Battery Temperature Sensor 4 Performance

DTC P0AEA

Hybrid/EV Battery Temperature Sensor 4 Circuit Low Voltage

DTC P0AEB

Hybrid/EV Battery Temperature Sensor 4 Circuit High Voltage

DTC P0BC3

Hybrid/EV Battery Temperature Sensor 5 Performance

DTC P0BC4

Hybrid/EV Battery Temperature Sensor 5 Circuit Low Voltage

DTC P0BC5

Hybrid/EV Battery Temperature Sensor 5 Circuit High Voltage

DTC P0C34

Hybrid/EV Battery Temperature Sensor 6 Performance

DTC P0C35

Hybrid/EV Battery Temperature Sensor 6 Circuit Low Voltage

DTC P0C36

Hybrid/EV Battery Temperature Sensor 6 Circuit High Voltage

Circuit/System Description

The hybrid/EV battery pack has 6 hybrid/EV battery temperature sensors. The temperature sensor is a variable resistor that measures the temperature of the hybrid/EV battery cell groups. The battery energy control module supplies 5 V to the signal circuit and a ground for the low reference circuit. The hybrid/EV battery temperature sensor resistance changes with battery temperature. The lower the temperature, the higher the resistance of the sensor. The higher the temperature, the lower the resistance of the sensor. The hybrid/EV powertrain control module 2 uses the battery temperature sensors to determine the hybrid/EV battery module temperature to control the battery cooling system operation.

Conditions for Running the DTC

P0A9C, P0AC6, P0ACB, P0AE9, P0BC3, and P0C34

None of the following DTCs are set: P0A9C, P0A9D, P0A9E, P0AC6, P0AC7, P0AC8, P0ACB, P0ACC, P0ACD, P0AE9, P0AEA, P0AEB, P0BC3, P0BC4, P0BC5, P0C34, P0C35, P0C36, P0C89, P0C8A, P0C8B, P0C8E, P0C8F, P0C90, P0C93, P0C94, P0C95, P0C98, P0C99, P0C9A, P0CA9, P0CAA, P0CAB, P0CAE, P0CAF, P0CB0, P0CB3, P0CB4, P0CB5, P0CB8, P0CB9, P0CBA, P1E8E, P1E8F, P1E90, P1E91, P1E93, P1E94, P1E95, P1E96, P1E97, P1E99, P1E9A, P1E9B, P1E9C, P1E9D, P1E9F, P1EA0, P1EA1, P1EA2, P1EA3, P1EA5, P1EB1, P1EB2, P1EB3, P1EB4, P1EB5, U2401, U2603, U2604, U2605, or U2606.

P0A9D, P0A9E, P0AC7, P0AC8, P0ACC, P0ACD, P0AEA, P0AEB, P0BC4, P0BC5, P0C35, and P0C36

- Hybrid/EV Powertrain Control Module 2 and Battery Energy Control Module are awake and communicating
- None of the following DTCs are set: P1E8E, P1E94, P1E9A, P1EA0, P1FBD, P1FBE, P1FBF, P1FC0, U2603, U2604, U2605, U2606, U2617, U2618, U2619, or U2620.

Conditions for Setting the DTC

P0A9C, P0AC6, P0ACB, P0AE9, P0BC3, and P0C34

The difference between a hybrid/EV battery temperature sensor and the average of the other hybrid/EV battery temperature sensors is greater than a 20Â°C (36Â°F).

P0A9D, P0AC7, P0ACC, P0AEA, P0BC4, and P0C35

The hybrid/EV battery temperature sensor is greater than 87.5Â°C (189.5Â°F).

P0A9E, P0AC8, P0ACD, P0AEB, P0BC5, and P0C36

The hybrid/EV battery temperature sensor is -40Â°C (-40Â°F).

Action Taken When the DTC Sets

- DTCs P0A9C, P0A9D, P0A9E, P0AC6, P0AC7, P0AC8, P0ACB, P0ACC, P0ACD, P0AE9, P0AEA, P0AEB, P0BC3, P0BC4, P0BC5, P0C34, P0C35, and P0C36 are Type B DTCs.
- If six sensors fail, the vehicle will operate in a reduced power mode.

Conditions for Clearing the DTC

DTCs P0A9C, P0A9D, P0A9E, P0AC6, P0AC7, P0AC8, P0ACB, P0ACC, P0ACD, P0AE9, P0AEA, P0AEB, P0BC3, P0BC4, P0BC5, P0C34, P0C35, and P0C36 are Type B DTCs.

Diagnostic Aids

CAUTION:

The battery energy control modules internal cell balancing circuitry is powered by the cell group voltage sense circuits. In order to prevent an unrecoverable, unbalanced Hybrid/EV battery section or internal control module damage, always take the following actions:

1. Disconnect ALL of the battery energy control module connectors prior to disconnecting any Hybrid/EV battery section connector.
2. Reconnect all the Hybrid/EV battery section connectors prior to reconnecting the battery energy control module connectors.
3. Disconnect and reconnect the battery energy control module connectors ONLY in the sequence provided in Repair Instructions.

- Low or no coolant in the system may set a DTC P0A9D, P0AC7, P0ACC, P0AEA, P0BC4, or P0C35.
- The B32 Hybrid/EV Battery Temperature Sensors are non-serviceable components of the Hybrid/EV Battery Pack internal wiring harness.

Reference Information

cardiagn.com

- [Hybrid/EV Cooling Schematics](#)
- [Hybrid/EV Energy Storage Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

- [Temperature Versus Resistance](#) for B32 Hybrid/EV Battery Temperature Sensor
- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

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

Scan Tool Reference

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

Special Tools

EL-48900 HEV Safety Kit

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

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify that DTC P0C47, P1E8C, or P1EC6 is not set.
 - **If any of the DTCs are set**

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

- **If none of the DTCs are set**
3. Observe the scan tool Hybrid Battery 1 - 6 temperature parameters. The sensor readings should be between -39 and +87°C (-38.2 and +188.6°F) with less than a 15°C (27°F) difference between any of the temperature sensor readings.
 - **If not within the specified range**

Refer to Circuit/System Testing.

- **If within the specified range**
4. All OK.

[Circuit/System Testing](#)

WARNING:

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

The High Voltage Disabling procedure will perform the following tasks:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.

- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

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

1. Vehicle OFF, disable the high voltage at the A4 Hybrid/EV Battery Pack. Refer to [High Voltage Disabling](#) . Remove the A4 Hybrid/EV Battery Pack cover. Refer to [Battery Upper Cover Replacement](#) .

CAUTION: The battery energy control modules internal cell balancing circuitry is powered by the cell group voltage sense circuits. In order to prevent an unrecoverable, unbalanced Hybrid/EV battery section or internal control module damage, always take the following actions:

1. Disconnect ALL of the battery energy control module connectors prior to disconnecting any Hybrid/EV battery section connector.
 2. Reconnect all the Hybrid/EV battery section connectors prior to reconnecting the battery energy control module connectors.
 3. Disconnect and reconnect the battery energy control module connectors ONLY in the sequence provided in Repair Instructions.
2. Disconnect all K16 battery energy control module connectors in the sequence provided in Repair Instructions. Refer to [Battery Energy Control Module Replacement](#) .
 3. At the appropriate K16 battery energy control module connector, test for infinite resistance between the signal circuit terminal of the applicable B32 Hybrid/EV Battery Temperature Sensor and chassis ground of the A4 Hybrid/EV Battery Pack.
 - **If less than infinite resistance**
Replace the Hybrid/EV Battery Pack internal wiring harness.
 - **If infinite resistance**
 4. At the appropriate K16 battery energy control module connector, test for 9.9 - 13.4 k Ω at approximately 21.11 $^{\circ}\text{C}$ (70 $^{\circ}\text{F}$) between the signal terminal and the low reference terminal. Refer to [Temperature Versus Resistance](#) for B32 Hybrid/EV Battery Temperature Sensor.
 - **If not within the specified range**
Replace the Hybrid/EV Battery Pack internal wiring harness.
 - **If within the specified range**
 5. Replace the K16 Battery Energy Control Module.

Repair Instructions

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

- Refer to [Drive Motor Battery Control Module Wiring Harness Replacement](#) for B32 Hybrid/EV Battery Temperature Sensor replacement
- Refer to [Control Module References](#) for K16 battery energy control module replacement, programming and setup.

DTC P0C43-P0C46: HYBRID/EV BATTERY PACK COOLANT TEMPERATURE SENSOR 1

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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0C43

DTC P0C44

Hybrid/EV Battery Pack Coolant Temperature Sensor 1 Circuit Low Voltage

DTC P0C45

Hybrid/EV Battery Pack Coolant Temperature Sensor 1 Circuit High Voltage

DTC P0C46

Hybrid/EV Battery Pack Coolant Temperature Sensor 1 Circuit Erratic

Circuit/System Description

The hybrid/EV battery pack coolant temperature sensor is located in the coolant outlet of the hybrid/EV battery heater assembly. The temperature sensor is a variable resistor that measures the temperature of the hybrid/EV battery coolant. The hybrid/EV battery pack coolant temperature sensor resistance changes with battery coolant temperature. The lower the temperature, the higher the resistance of the sensor. The higher the temperature, the lower the resistance of the sensor. The battery energy control module uses the hybrid/EV battery temperature sensor to determine the hybrid/EV battery pack temperature to control the battery cooling and heating operations.

Conditions for Running the DTC**P0C43**

- Vehicle ON after all high voltage contactor relays had been Open for at least 5 hours.
- The 12 V battery voltage is greater than or equal 10.2 V.
- None of the following DTCs are set: P0A9C, P0A9D, P0A9E, P0C44, P0C45, P0C46, P0C47, P1E8C, P1E8D, P19FD, P19FE, P19FF, or U0111.

P0C44 and P0C45

- The 12 V battery voltage is greater than or equal to 9 V.
- The Battery Energy Control Module is awake and communicating.

P0C46

- The 12 V battery voltage is greater than or equal 10.2 V.
- The Battery Energy Control Module is awake and communicating.
- None of the following DTCs are set: P0C44, P0C45, or U185A.

Conditions for Setting the DTC**P0C43**

The hybrid/EV battery pack coolant temperature sensor reading is not within 25Â°C (45Â°F) of the Average Hybrid Battery Pack Temperature AND is not within 20Â°C (36Â°F) of the outside air temperature.

P0C44

The Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is greater than or equal to 87.9Â°C (190.2Â°F).

P0C45

The Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is less than -40Â°C (-40Â°F).

P0C46

The hybrid/EV battery pack coolant temperature sensor is intermittent or has changed by 60Â°C (108Â°F) or greater within 4 s.

Action Taken When the DTC Sets

- DTC P0C43-P0C46 are type B DTCs.
- The active heating mode is disabled.
- The hybrid/EV battery pack coolant pump is commanded to a fixed speed.

Conditions for Clearing the DTC

DTC P0C43-P0C46 are type B DTCs.

Diagnostic Aids

- Low or no coolant in the system may set a DTC P0C43.
- DTC P0C43-P0C46 will prevent battery heating and the vehicle will be unable to start in cold weather with battery temperatures below -25°C (-13°F).

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

- [Temperature Versus Resistance](#) for Hybrid/EV Battery Pack Coolant Temperature Sensor
- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Special Tools

EL-48900 HEV Safety Kit

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

Circuit/System Verification

1. Vehicle in Service Mode.
2. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 parameter is between -40 and $+87.9^{\circ}\text{C}$ (-40 and $+190^{\circ}\text{F}$).
 - **If not within the specified range**
Refer to Circuit/System Testing.
 - **If within the specified range**
3. Verify the Hybrid/EV Battery Pack Coolant Temperature Sensor 1 and Outside Air Temperature Sensor parameters are within 25°C (45°F) of each other after the vehicle has been OFF and not charging for 5 hours or greater.

- **If not within the specified range**

Refer to Circuit/System Testing.

- **If within the specified range**

4. All OK.

Circuit/System Testing

WARNING:

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

The High Voltage Disabling procedure will perform the following tasks:

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

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

NOTE:

Perform Component Testing of the temperature sensor first and if a sensor fault is found you do not need to perform Circuit/System Testing.

1. Disconnect the harness X2 connector at the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.
2. Vehicle in Service Mode. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Vehicle OFF, disconnect A4 Hybrid/EV Battery Pack connector X358.
2. Test for less than 2 Ω in the low reference circuit from X358 terminal 9 to B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1 harness connector terminal 2.
 - If 2 Ω or greater, repair or replace the battery pack external wiring harness.
 - If less than 2 Ω

Refer to Internal Hybrid/EV Battery Testing.

- **If less than 10 Ω**

3. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is less than -40°C (-40°F).

- **If -40°C (-40°F) or greater**

1. Vehicle OFF, disconnect A4 Hybrid/EV Battery Pack connector X358.
2. Test for infinite resistance between the signal circuit terminal 8 X358 and ground.
 - If less than infinite resistance, repair or replace the short to ground on the battery pack external wiring harness.
 - If infinite resistance

Refer to Internal Hybrid/EV Battery Testing.

- **If less than -40°C (-40°F)**

4. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is greater than 87.9°C (190°F).

- **If less than 87.9°C (190°F)**

1. Vehicle OFF, disconnect the A4 Hybrid/EV Battery Pack connector X358. Vehicle in Service Mode.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair or replace the battery pack external wiring harness.
 - If less than 1 V
3. Vehicle OFF.

4. Test for less than 2 Ω in the signal circuit from X358 terminal 8 to B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1 harness connector terminal.

- If 2 Ω or greater, repair or replace the battery pack external wiring harness.
- If less than 2 Ω

Refer to Internal Hybrid/EV Battery Testing

- **If 87.9 $^{\circ}$ C (190 $^{\circ}$ F) or greater**

5. Test or replace the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.

Internal Hybrid/EV Battery Testing

1. Disable the high voltage. Refer to [High Voltage Disabling](#) . Remove the A4 Hybrid/EV Battery Pack cover. Refer to [Battery Upper Cover Replacement](#) .
2. Disconnect the harness X2 connector at the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.

NOTE: With the S15 manual service disconnect removed, the 12 V battery connected, and the Vehicle in Service Mode, additional DTCs may set. Continue with diagnostics and clear any additional DTCs when repairs are complete.

3. Connect the **EL-50214** Low Voltage Jumper Harness Extension. Connect the 12 V battery.
4. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Test for less than 2 Ω in the low reference circuit end to end.

- If 2 Ω or greater

Replace the Hybrid/EV Battery Pack internal wiring harness or repair the external wiring harness as necessary.

- If less than 2 Ω

2. Replace the K16 Battery Energy Control Module.

- **If less than 10 Ω**

5. Vehicle in Service Mode.

6. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is less than -40 $^{\circ}$ C (-40 $^{\circ}$ F).

- **If -40 $^{\circ}$ C (-40 $^{\circ}$ F) or greater**

1. Vehicle OFF, test for infinite resistance between the signal circuit terminal 7 and ground.

- If less than infinite resistance

Replace the Hybrid/EV Battery Pack internal wiring harness or repair the short to ground on the external wiring harness as necessary.

- If infinite resistance

2. Replace the K16 Battery Energy Control Module.

- **If less than -40 $^{\circ}$ C (-40 $^{\circ}$ F)**

7. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor 1 is greater than 87.9 $^{\circ}$ C (190 $^{\circ}$ F).

- **If less than 87.9 $^{\circ}$ C (190 $^{\circ}$ F)**

1. Vehicle OFF, disconnect the harness connector at the K16 Battery Energy Control Module. Vehicle in Service Mode.

2. Test for less than 1 V between the signal circuit and ground.

- If 1 V or greater, replace the Hybrid/EV Battery Pack internal wiring harness or repair the external wiring harness as necessary.
- If less than 1 V

3. Vehicle OFF.

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

- If 2 Ω or greater, replace the Hybrid/EV Battery Pack internal wiring harness or repair the external wiring harness as necessary.

- If less than 2 Ω

Replace the K16 Battery Energy Control Module.

- **If 87.9 $^{\circ}$ C (190 $^{\circ}$ F) or greater**

8. Test or replace the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.

Component Testing

1. Vehicle OFF, disconnect the harness connector at the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.
2. Test for 2.2 - 3.0k Ω at approximately 21.11 $^{\circ}$ C (70 $^{\circ}$ F) between the signal terminal and the low reference terminal. Refer to [Temperature Versus Resistance](#) for Hybrid/EV Battery Pack Coolant Temperature Sensor.
 - **If not within the specified range**

Replace the B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1.

- **If within the specified range**

3. All OK.

Repair Instructions

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

- Refer to [High Voltage Battery Heater Replacement](#) for B204A Hybrid/EV Battery Pack Coolant Temperature Sensor 1 replacement
- Refer to [Drive Motor Battery Replacement and Shipping Preparation \(Old Design Battery Pack in Vehicles built before 1G1FX6S06H4163254\)](#) [Drive Motor Battery Replacement and Shipping Preparation \(New Design Battery Pack in Vehicles built before 1G1FX6S06H4163254\)](#) [Drive Motor Battery Replacement and Shipping Preparation \(New Design Battery Pack in Vehicles built after 1G1FX6S06H4163254\)](#)
- Refer to [Control Module References](#) for battery energy control module replacement, programming and setup.

DTC P0C47, P1E8C, OR P1E8D: HYBRID/EV BATTERY PACK COOLANT PUMP

Diagnostic Instructions

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

DTC Descriptors

DTC P0C47

Hybrid/EV Battery Pack Coolant Pump Control Circuit

DTC P1E8C

Hybrid/EV Battery Pack Coolant Pump Enable Circuit Low Voltage

DTC P1E8D

Hybrid/EV Battery Pack Coolant Pump Enable Circuit High Voltage

Circuit/System Description

The hybrid/EV battery pack coolant pump circulates coolant through the hybrid/EV battery refrigerant/coolant heat exchanger, external high voltage battery heater assembly, and the hybrid/EV battery pack to control the temperature of the hybrid/EV battery pack.

The Enable, Control and Feedback circuits connect the hybrid/EV powertrain control module 2 to the hybrid/EV battery pack coolant pump.

When the Enable circuit is high, the pump is allowed to operate as specified by the Control circuit signal. The pulse-width modulated Control circuit signal from the hybrid/EV powertrain control module 2 determines the hybrid/EV battery pack coolant pump speed. The higher the duty cycle the higher the pump speed. The hybrid/EV battery pack coolant pump utilizes a pulse-width modulated signal on the Feedback circuit to the hybrid/EV powertrain control module 2. During normal operation, the feedback circuit provides pump speed information to the hybrid/EV powertrain control module 2. If the hybrid/EV battery pack coolant pump determines there is an internal fault it provides this information on the same feedback circuit instead of pump speed information.

Conditions for Running the DTC

P0C47

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

P1E8C

- The 12 V battery voltage is greater than or equal to 10.2 V.
- The hybrid/EV battery pack coolant pump enable is commanded ON.

P1E8D

- The 12 V battery voltage is greater than or equal to 10.2 V.
- The hybrid/EV battery pack coolant pump enable is OFF.

Conditions for Setting the DTC

P0C47

The hybrid/EV powertrain control module 2 detects the hybrid/EV battery pack coolant pump Control circuit is open, shorted to voltage or shorted to ground.

P1E8C

The hybrid/EV powertrain control module 2 detects the hybrid/EV battery pack coolant pump Enable circuit is shorted to ground.

P1E8D

The hybrid/EV powertrain control module 2 detects the hybrid/EV battery pack coolant pump Enable circuit is open or shorted to voltage.

Action Taken When the DTC Sets

- DTCs P0C47, P1E8C, and P1E8D are type B DTCs.
- DTC P1E8D Hybrid/EV battery pack active heating is disabled.

Conditions for Clearing the DTC

DTCs P0C47, P1E8C, and P1E8D are type B DTCs.

Diagnostic Aids

- Always verify coolant freeze point protection if a fault occurs in cold climate conditions. An improper coolant to water ratio may result in slushy or frozen coolant, resulting in DTCs or overheating. Measure coolant concentration using the **J-26568** refractometer or equivalent to verify a 50/50 mix and freeze protection to -37Â°C (-34Â°F).
- The Coolant Pump Feedback parameter on the scan tool indicates the status of the pump. When the pump self-diagnostics indicate normal operation, the parameter will indicate a PWM between 45 and 55 percent. Different PWM values will identify when a pump self-diagnostic has failed:

Coolant Pump Feedback Parameter

Displayed PWM Value	Pump Self-Diagnostic Indication
0%	Pump has lost power/ground, feedback circuit open, or Vehicle is in Service Mode*

Displayed PWM Value	Pump Self-Diagnostic Indication
10%	Pump Under Voltage detected*
20%	Pump Under/Over Current detected*
30%	Blocked or Dry pump detected*
45 - 55%	Normal operation, actual pump speed provided by circuit frequency
80%	Pump Over Voltage detected*
90%	Pump Over Temperature detected*
100%	Feedback circuit shorted to ground*
*Coolant Pump Speed parameter defaults to 50 RPM, actual pump speed is 0 RPM.	

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Verify that DTC P0C43, P0C44, P0C45, P0C46, P1FFB, P1FFC, P1FFD, P1FFE, U0111, U185B, or U2602 is not set.
 - **If any of the DTCs are set**
 Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If none of the DTCs are set**
2. Verify the hybrid/EV powertrain control module 2 parameters listed below when commanding the hybrid/EV battery pack coolant pump between 20% and 80% with a scan tool.
 - Hybrid/EV Battery Pack Coolant Pump Command to be 10% or greater.
 - Hybrid/EV Battery Pack Coolant Pump Feedback to be 50% +/-5%.
 - Hybrid/EV Battery Pack Coolant Pump Speed is greater than 500 RPM.
 - **The scan tool parameters listed are not the specified values**
 Refer to Circuit/System Testing.
 - **The scan tool parameters listed are within the specified values**
3. All OK.

1. Vehicle OFF, disconnect the harness connector at the G37 Hybrid/EV Battery Pack Coolant Pump.
2. Test for less than 5 Ω between the ground circuit terminal 4 and ground.

- **If 5 Ω or greater**

Repair the open/high resistance on the ground circuit.

- **If less than 5 Ω**

3. Vehicle ON.

4. Test for B+ between the B+ circuit terminal 5 and the ground circuit terminal 4.

- **If less than B+**

1. Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

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 and the fuse is blown, replace the G37 Hybrid/EV Battery Pack Coolant Pump.

- **If B+**

5. Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.

6. Vehicle OFF, charge cord removed. Verify the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for less than 1 V between the pump enable circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is OFF**

7. Vehicle ON, verify the test lamp illuminates. Command the Hybrid Battery Pack Coolant Pump ON (20 - 80%) with a scan tool if necessary.

- **If the test lamp is OFF**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for infinite resistance between the enable circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is ON**

8. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.

9. Verify that a test lamp changes illumination between bright (20%) and dim (80%) when commanding the Hybrid Battery Pack Coolant Pump ON between 20% and 80% with a scan tool.

- **If the test lamp is always dim or does not illuminate**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Vehicle ON.

2. Test for less than 1 V between the control circuit terminal and ground

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

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

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **The test lamp changes illumination between bright (20%) and dim (80%)**

10. Remove the test lamp.

11. Verify the scan tool, Hybrid Battery Pack Coolant Pump Feedback parameter is 0%.

- **If greater than 0%**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If 0%**

12. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.

13. Verify the scan tool Hybrid Battery Pack Coolant Pump Feedback parameter is greater than 90%.

- **If 90% or less**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for less than 1 V between the feedback circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Test for less than 2 Ω in the feedback circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If greater than 90%**

14. Replace the G37 Hybrid/EV Battery Pack Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#) (RESS Pump) for G37 Hybrid/EV Battery Pack Coolant Pump replacement.
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P0CE9, P1F44, OR P1F45: HYBRID/EV ELECTRONICS COOLANT PUMP

Diagnostic Instructions

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

DTC Descriptors

DTC P0CE9

DTC P1F44

Hybrid/EV Electronics Coolant Pump Enable Circuit Low Voltage

DTC P1F45

Hybrid/EV Electronics Coolant Pump Enable Circuit High Voltage

Circuit/System Description

The Enable, Control and Feedback circuits connect the hybrid/EV powertrain control module 2 to the hybrid/EV electronics coolant pump. When the Enable circuit is high, the pump is allowed to operate as specified by the Control circuit signal. The pulse-width modulated Control circuit signal from the hybrid/EV powertrain control module 2 determines the hybrid/EV electronics coolant pump speed. The higher the duty cycle the higher the pump speed. The hybrid/EV electronics coolant pump utilizes a pulse-width modulated signal on the Feedback circuit to the hybrid/EV powertrain control module 2. During normal operation, the feedback circuit provides pump speed information to the hybrid/EV powertrain control module 2. If the hybrid/EV electronics coolant pump determines there is an internal fault it provides this information on the same feedback circuit instead of pump speed information.

Conditions for Running the DTC

P0CE9

The 12 V battery voltage is greater than 10.2 V.

P1F44

- The 12 V battery voltage is greater than 10.2 V.
- The hybrid/EV electronics coolant pump is enabled.

P1F45

- The 12 V battery voltage is greater than 10.2 V.
- The Hybrid/EV Electronics Coolant Pump is disabled.

Conditions for Setting the DTC

P0CE9

The Hybrid/EV Powertrain Control Module 2 has detected an open, short to voltage or short to ground on the Hybrid/EV electronics coolant pump control circuit.

P1F44

The Hybrid/EV Powertrain Control Module 2 has detected an open, or short to voltage on the Hybrid/EV electronics coolant pump enable circuit.

P1F45

The Hybrid/EV Powertrain Control Module 2 has detected an open or short to voltage on the Hybrid/EV electronics coolant pump enable circuit.

Action Taken When the DTC Sets

DTCs P0CE9, P1F44, and P1F45 are type B DTCs.

P0CE9

Hybrid/EV electronics coolant pump is commanded Off or to Maximum speed.

P1F44 and P1F45

Hybrid/EV electronics coolant pump is commanded Off.

Conditions for Clearing the DTC

DTCs P0CE9, P1F44, and P1F45 are type B DTCs.

Diagnostic Aids

- DTC P1F44 and P1F45 may cause DTC P0CE9 to set.
- Always verify coolant freeze point protection if a fault occurs in cold climate conditions. An improper coolant to water ratio may result in slushy or frozen coolant, resulting in DTCs or overheating. Measure coolant concentration using the **J-26568** refractometer or equivalent to verify a 50/50 mix and freeze protection to -37Â°C (-34Â°F).
- The Coolant Pump Feedback parameter on the scan tool indicates the status of the pump. When the pump self-diagnostics indicate normal operation, the parameter will indicate a PWM between 45 and 55 percent. Different PWM values will identify when a pump self-diagnostic has failed:

Hybrid/EV Electronics Coolant Pump Feedback Parameter

Displayed PWM Value	Pump Self-Diagnostic Indication
0%	Pump has lost power/ground, feedback circuit open, or Vehicle is in Service Mode*
10%	Pump Under Voltage detected*
20%	Pump Under/Over Current detected*
30%	Blocked or Dry pump detected*
45 - 55%	Normal operation, actual pump speed provided by circuit frequency
80%	Pump Over Voltage detected*
90%	Pump Over Temperature detected*
100%	Feedback circuit shorted to ground*
*Coolant Pump Speed parameter defaults to 50 RPM, actual pump speed is 0 RPM.	

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Verify the hybrid/EV powertrain control module 2 parameters listed below when commanding the hybrid/EV electronics coolant pump between 20% and 80% with a scan tool.
 - Hybrid/EV Battery Pack Coolant Pump Command to be 10% or greater.
 - Hybrid/EV Battery Pack Coolant Pump Feedback to be 50% +/-5%.

- Hybrid/EV Battery Pack Coolant Pump Speed is greater than 500 RPM.
- **The scan tool parameters listed are not within the specified ranges**

Refer to Circuit/System Testing.

- **The scan tool parameters listed are within the specified range**

2. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the G35 Hybrid/EV Electronics Coolant Pump.
2. Test for less than 5 Ω between the ground circuit terminal 4 and ground.

- **If 5 Ω or greater**

Repair the open/high resistance on the ground circuit.

- **If less than 5 Ω**

3. Vehicle ON.

4. Test for B+ between the B+ circuit terminal 5 and the ground circuit terminal 4.

- **If less than B+**

1. Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

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 and the fuse is blown, replace the G35 Hybrid/EV Electronics Coolant Pump.

- **If B+**

5. Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.

6. Vehicle OFF, charge cord removed. Verify the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
2. Vehicle ON.

2. Test for less than 1 V between the pump enable circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is OFF**

7. Vehicle ON. Verify the test lamp illuminates. Command the Hybrid/EV electronics coolant pump ON (20 - 80%) if necessary.

- **If the test lamp is OFF**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
- 2.

2. Test for infinite resistance between the pump enable circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

3. Test for less than 2 Ω in the pump enable circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is ON**

8. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.

9. Verify the test lamp changes illumination between bright (20%) and dim (80%) when commanding the hybrid/EV electronics coolant pump ON between 20% and 80% with a scan tool.

- **If the test lamp is always dim or does not illuminate**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
2. Vehicle ON.

2. Test for less than 1 V between the control circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Vehicle OFF.
4. Test for less than 2 Ω in the 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 K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp is always bright**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 K114B Hybrid/EV Powertrain Control Module 2.
- **The test lamp changes illumination between bright (20%) and dim (80%)**
10. Remove the test lamp.
11. Verify the scan tool Hybrid/EV Electronics Coolant Pump Feedback parameter is 0%.
 - **If greater than 0%**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 0%**
12. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.
13. Verify the scan tool, Hybrid/EV Electronics Coolant Pump Feedback parameter is greater than 90%.
 - **If 90% or less**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Vehicle ON.
 2. Test for less than 1 V between the feedback circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Vehicle OFF.
 4. Test for less than 2 Ω in the feedback circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 90%**
14. Replace the G35 Hybrid/EV Electronics Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#) (PE Pump) for G35 Hybrid/EV Electronics Coolant Pump replacement.
- Refer to [Control Module References](#) for K114B Hybrid/EV Powertrain Control Module 2 replacement, programming and setup.

DTC P0CEF-P0CF2: HYBRID/EV ELECTRONICS COOLANT TEMPERATURE SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0CEF

Hybrid/EV Electronics Coolant Temperature Sensor Performance

DTC P0CF0

Hybrid/EV Electronics Coolant Temperature Sensor Circuit Low Voltage

DTC P0CF1

Hybrid/EV Electronics Coolant Temperature Sensor Circuit High Voltage

DTC P0CF2

Hybrid/EV Electronics Coolant Temperature Sensor Circuit Erratic

Circuit/System Description

The hybrid/EV electronics coolant temperature sensor is located in the coolant radiator. The temperature sensor is a variable resistor that measures the temperature of the hybrid/EV electronics coolant. The hybrid/EV electronics coolant temperature sensor resistance changes with coolant temperature. The lower the temperature, the higher the resistance of the sensor. The higher the temperature, the lower the resistance of the sensor. The Hybrid/EV Powertrain Control Module 2 uses the hybrid/EV electronics coolant temperature sensor to determine the hybrid/EV electronics temperature to control the hybrid/EV electronics cooling operation.

Conditions for Running the DTC

P0CEF

- The 12 V battery voltage is greater than or equal to 10.2 V.
- Vehicle ON for less than 20 s.
- Propulsion system inactive time is greater than 2 hours.
- The hybrid/EV electronics coolant pump off soak time is greater than 2 hours.
- Air conditioning compressor off soak time is greater than 1 hour.
- The On Board Charger module off soak time is greater than 4 hours.
- None of the following DTCs are set; P0071-P0074, P0532, P0533, P0606, P0711-P0713, P0CE9, P0CF0, P0CF1, P0CF2, P1F44, or P1F45.

P0CF0, P0CF1 and P0CF2

- Vehicle ON.
- The 12 V battery voltage is greater than or equal to 10.2 V.

Conditions for Setting the DTC

P0CEF

- The hybrid/EV electronics coolant temperature does not fall within 23Â°C (41Â°F) of the outside air temperature.

AND

- The hybrid/EV electronics coolant temperature does not fall within 23Â°C (41Â°F) of the transmission fluid temperature.

AND

- The hybrid/EV electronics coolant temperature does not fall within 24Â°C (43Â°F) of the air conditioning high side pressure, converted to temperature.

P0CF0

The hybrid/EV electronics coolant temperature signal circuit voltage is less than 0.25 V.

P0CF1

The hybrid/EV electronics temperature signal circuit voltage is greater than 4.9 V.

P0CF2

- The hybrid/EV electronics coolant temperature is intermittent or has changed greater than 75Â°C (135Â°F).
- Condition exists for 4 seconds or more.

Action Taken When the DTC Sets

- DTC P0CEF-P0CF2 are type B DTCs.
- The Hybrid/EV Electronics Coolant Pump is commanded to a fixed speed.
- The radiator cooling fan is commanded to a fixed speed.

Conditions for Clearing the DTC

DTC P0CEF-P0CF2 are type B DTCs.

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC P0CE9 is not set.
 - **If the DTC is set**
Refer to **DTC P0CE9, P1F44, or P1F45**
 - **If the DTC is not set**
2. Observe the scan tool Hybrid/EV Powertrain Control Module 2 Hybrid Electronics Coolant Temperature parameter. The readings should be between -40Â° and +87.9Â°C (-40Â° and +190Â°F).
 - **The readings are not within the specified range**

Refer to Circuit/System Testing

- The readings are within the specified range

3. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B202 Hybrid/EV Electronics Coolant Temperature Sensor.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.
 - **If 10 Ω or greater**
 1. Disconnect the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
4. Verify the scan tool Hybrid Electronics Coolant Temperature is less than -40 $^{\circ}$ C (-40 $^{\circ}$ F).
 - **If -40 $^{\circ}$ C (-40 $^{\circ}$ F) or greater**
 1. Vehicle OFF, disconnect the harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than -40 $^{\circ}$ C (-40 $^{\circ}$ F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2. Verify the scan tool Hybrid Electronics Coolant Temperature parameter is greater than 87.9 $^{\circ}$ C (190 $^{\circ}$ F).
 - **If less than 87.9 $^{\circ}$ C (190 $^{\circ}$ F)**
 1. Vehicle OFF, disconnect the harness connector at the K114B Hybrid/EV Powertrain Control Module 2. Vehicle in Service Mode.
 2. Test for less than 1 V between the control circuit and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 87.9 $^{\circ}$ C (190 $^{\circ}$ F) or greater**
6. Test or replace the B202 Hybrid/EV Electronics Coolant Temperature Sensor.

Component Testing

1. Vehicle OFF, disconnect the harness connector at the B202 Hybrid/EV Electronics Coolant Temperature Sensor.
2. Test for 2.2 - 3.0k Ω at approximately 21.11 $^{\circ}$ C (70 $^{\circ}$ F) between the signal terminal and the low reference terminal.
 - **If not within the specified range**
Replace the B202 Hybrid/EV Electronics Coolant Temperature Sensor.
 - **If within the specified range**
3. All OK.

Repair Instructions

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

- Refer to [Engine Coolant Temperature Sensor Replacement - Radiator Side](#)
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P1485-P1487: COOLING FAN OUTPUT CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P1485

Cooling Fan Output Circuit

DTC P1486

Cooling Fan Output Circuit Low Voltage

DTC P1487

Cooling Fan Output Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cooling Fan Speed Signal Circuit	P148B, P1486	P148A, P1485	P148C, P1487	-
Fans operate at 90% with all malfunctions				

Circuit/System Description

The hybrid/EV powertrain control module 2 indirectly controls the radiator fans. When propulsion is active, the engine control module (ECM) processes all requests for the cooling fans to be turned ON regardless of which module originates the request. The ECM decides if and at what speed the cooling fans should operate. The ECM sends the cooling fan command to the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 sends the signal to the cooling fans to operate and at what speed. If the vehicle is in Charge Mode and the hybrid/EV powertrain control module 2 requests the cooling fans to operate and the ECM is not awake, the hybrid/EV powertrain control module 2 will control the cooling fans without ECM intervention.

The ECM communicates the fan command PWM signal to the hybrid/EV powertrain control module 2 through the cooling fan speed signal circuit/hardwire circuit and also sends a redundant serial data signal. Since the hardwire circuit is an output from the ECM but an input to the hybrid/EV powertrain control module 2, each module has unique DTCs to monitor the same circuit.

Conditions for Running the DTC

- DTC P2537 is not set.
- The 12 V battery voltage is equal to or greater than 11 V.
- The accessory circuit is active for greater than 5 s.
- The DTCs run continuously when the conditions above are met.

Conditions for Setting the DTC

The ECM detects that the commanded state of the driver and the actual state of the output circuit do not match for greater than 5 s.

Action Taken When the DTC Sets

DTCs P1485, P1486 and P1487 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P1485, P1486 and P1487 are Type B DTCs.

Diagnostic Aids

DTCs P1485, P1486 and P1487 will not keep the cooling fan from operating. If one of these DTCs is set the hybrid/EV powertrain control module 2 will command the cooling fan to 90%. If the cooling fan does not operate, refer to [DTC P148A-P148C](#) for further diagnosis.

Reference Information

Schematic Reference

[Hybrid/EV Cooling Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Vehicle ON.
2. Verify DTC P1485, P1486, P1487, P148A, P148B, or P148C is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing.
 - **If the DTC is not set**
3. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.

NOTE: The cooling fan circuit is pulled up to a voltage within the ECM. 3 - 4 V measured on this circuit with the hybrid/EV powertrain control module 2 disconnected is normal.

2. Test for 3 - 4 V between the cooling fan circuit terminal 9 and ground.
 - **If less than 3 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the cooling fan circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.

- If less than 2 Ω , replace the K20 Engine Control Module.

- **If 4V or greater**

1. Vehicle OFF. Disconnect the X1 harness connector at the K20 Engine Control Module, vehicle in Service Mode.
2. Test for less than 1 V between the cooling fan circuit and ground.
 - If greater than 1 V, repair the short to voltage on the circuit.
 - If 1 V or less, replace the K20 Engine Control Module.

- **If 3 - 4 V**

3. Vehicle OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
4. Reconnect the K114B Hybrid/EV Powertrain Control Module 2 connector X2.
5. Vehicle in Service Mode. Test for greater than 10 V between the signal circuit and ground.

- **If 10 V or less**

Replace the Hybrid/EV Powertrain Control Module 2.

- **If greater than 10 V**

6. Replace the K20 Engine Control Module.

Repair Instructions

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

Refer to [Control Module References](#) for K20 engine control module or K114B hybrid powertrain control module 2 replacement, programming and setup

DTC P19FA-P19FC: HYBRID/EV ELECTRONICS COOLANT PUMP FEEDBACK CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P19FA

Hybrid/EV Electronics Coolant Pump Feedback Circuit High Frequency

DTC P19FB

Hybrid/EV Electronics Coolant Pump Feedback Circuit Low Frequency

DTC P19FC

Hybrid/EV Electronics Coolant Pump Feedback Circuit Performance

Circuit/System Description

The Enable, Control and Feedback circuits connect the hybrid/EV powertrain control module 2 to the hybrid/EV electronics coolant pump.

When the Enable circuit is high, the pump is allowed to operate as specified by the Control circuit signal. The pulse-width modulated Control circuit signal from the hybrid/EV powertrain control module 2 determines the hybrid/EV electronics coolant pump speed. The higher the duty cycle the higher the pump speed. The hybrid/EV electronics coolant pump utilizes a pulse-width modulated signal on the Feedback circuit to the hybrid/EV powertrain control module 2. During normal operation, the feedback circuit provides pump speed information to the hybrid/EV powertrain control module 2. If the hybrid/EV electronics coolant pump determines there is an internal fault it provides this information on the same feedback circuit instead of pump speed information.

Conditions for Running the DTC

P19FA and P19FB

- The 12 V battery voltage is greater than 10.2 V.
- The coolant pump is enabled.
- The coolant pump is commanded between 11 - 100%.
- The coolant pump On time is greater than 3 s.

P19FC

- The 12 V battery voltage is greater than 10.2 V.
- The coolant pump is disabled for at least 10 s.
- DTC P19FC has not already failed when coolant pump was enabled.
- None of the following DTCs are set: P0CE9, P0CEF, P0CF0, P0CF1, P0CF2, P1F44, or P1F45.

OR

- The 12 V battery voltage is greater than 10.2 V.
- The coolant pump is enabled.
- The coolant pump PWM command is 10.5 - 90%.
- The coolant pump On delay time is greater than 10 s.
- Hybrid/EV electronics coolant temperature sensor is greater than -30Â°C (-22Â°F).
- All above conditions met for at least 5 seconds.
- None of the following DTCs are set: P0CE9, P0CEF, P0CF0, P0CF1, P0CF2, P1F44, or P1F45.

Conditions for Setting the DTC

P19FA

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit frequency is greater than 750 Hz.

P19FB

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit frequency is less than 8.6 Hz.

P19FC

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit indicated pump speed is greater than 215 RPM when the pump is not enabled.

OR

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit indicated pump speed is more than 800 RPM different than the expected pump speed when the pump is commanded between 11 - 90% PWM.

Action Taken When the DTC Sets

DTCs P19FA, P19FB and P19FC are type B DTCs.

Conditions for Clearing the DTC

DTCs P19FA, P19FB and P19FC are type B DTCs.

Diagnostic Aids

- Always verify coolant freeze point protection if a fault occurs in cold climate conditions. An improper coolant to water ratio may result in slushy or frozen coolant, resulting in DTCs or overheating. Measure coolant concentration using the **J-26568** refractometer or equivalent to verify a 50/50 mix and freeze protection to -37Â°C (-34Â°F).

- The Coolant Pump Feedback parameter on the scan tool indicates the status of the pump. When the pump self-diagnostics indicate normal operation, the parameter will indicate a PWM between 45 and 55%. Different PWM values will identify when a pump self-diagnostic has failed:

Coolant Pump Feedback Parameter

Displayed PWM Value	Pump Self-Diagnostic Indication
0%	Pump has lost power/ground, feedback circuit open, or Vehicle is in Service Mode*
10%	Pump Under Voltage detected*
20%	Pump Under/Over Current detected*
30%	Blocked or Dry pump detected*
45-55%	Normal operation, actual pump speed provided by circuit frequency
80%	Pump Over Voltage detected*
90%	Pump Over Temperature detected*
100%	Feedback circuit shorted to ground*
*Coolant Pump Speed parameter defaults to 50 RPM, actual pump speed is 0 RPM.	

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC P0C43, P0C44, P0C45, P0C46, or P0C47 is not set.
 - **If any DTC is set**
 Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **If none of the DTCs are set**
2. Verify the hybrid/EV powertrain control module 2 parameters listed below when commanding the hybrid/EV electronics coolant pump between 20% and 80% with a scan tool.
 - Hybrid/EV Electronics Coolant Pump Command to be 10% or greater.
 - Hybrid/EV Electronics Coolant Pump Feedback to be 50% +/-5%.
 - Hybrid/EV Electronics Coolant Pump Speed is greater than 500 RPM.
 - **The scan tool parameters listed are not within the specified ranges**

- **The scan tool parameters listed are within the specified ranges**

3. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the G35 Hybrid/EV Electronics Coolant Pump.
2. Test for less than 5 Ω between the ground circuit terminal 4 and ground.

- **If 5 Ω or greater**

Repair the open/high resistance on the ground circuit.

- **If less than 5 Ω**

3. Vehicle ON.

4. Test for B+ between the B+ circuit terminal 5 and the ground circuit terminal 4.

- **If less than B+**

1. Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

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 and the fuse is blown, replace the G35 Hybrid/EV Electronics Coolant Pump.

- **If B+**

5. Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.

6. Vehicle OFF, charge cord removed. Verify the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for less than 1 V between the pump enable circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K114B hybrid/EV powertrain control module 2.

- **If the test lamp is OFF**

7. Vehicle ON. Verify the test lamp illuminates. Command the Hybrid/EV Electronics Coolant Pump ON (20 - 80%) with a scan tool if necessary.

- **If the test lamp is OFF**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for infinite resistance between the pump enable circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

3. Test for less than 2 Ω in the pump enable circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is ON**

8. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.

9. Verify that a test lamp changes illumination between bright (20%) and dim (80%) when commanding the Hybrid/EV Electronics Coolant Pump ON between 20% and 80% with a scan tool.

- **If the test lamp is always dim or does not illuminate**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for less than 1 V between the control circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.

- If less than 1 V
3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is always bright**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **The test lamp changes illumination between bright (20%) and dim (80%)**
10. Remove the test lamp.
 11. Verify the scan tool Hybrid/EV Electronics Coolant Pump Feedback parameter is 0%.
 - **If greater than 0%**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 0%**
 12. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.
 13. Verify the scan tool Hybrid/EV Electronics Coolant Pump Feedback parameter is greater than 90%.
 - **If 90% or less**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 1 V between the feedback circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 90%**
 14. Replace the G35 Hybrid/EV Electronics Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)/[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#) (PE Pump) for G35 Hybrid/EV electronics coolant pump replacement.
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P19FD-P19FF: HYBRID/EV BATTERY PACK COOLANT PUMP FEEDBACK CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P19FD

cardiagn.com

DTC P19FE

Hybrid/EV Battery Pack Coolant Pump Feedback Circuit Low Frequency

DTC P19FF

Hybrid/EV Battery Pack Coolant Pump Feedback Circuit Performance

Circuit/System Description

The Enable, Control and Feedback circuits connect the hybrid/EV powertrain control module 2 to the hybrid/EV battery pack coolant pump.

When the Enable circuit is high, the pump is allowed to operate as specified by the Control circuit signal. The pulse-width modulated Control circuit signal from the hybrid/EV powertrain control module 2 determines the hybrid/EV battery pack coolant pump speed. The higher the duty cycle the higher the pump speed. The hybrid/EV battery pack coolant pump utilizes a pulse-width modulated signal on the Feedback circuit to the hybrid/EV powertrain control module 2. During normal operation, the feedback circuit provides pump speed information to the hybrid/EV powertrain control module 2. If the hybrid/EV battery pack coolant pump determines there is an internal fault it provides this information on the same feedback circuit instead of pump speed information.

Conditions for Running the DTC

P19FD and P19FE

- The 12 V battery voltage is greater than 10.2 V.
- The coolant pump is enabled.
- The coolant pump is commanded between 11 - 100%.
- All above conditions met for at least 3 s.

P19FF

- The 12 V battery voltage is greater than 10.2 V.
- The coolant pump is enabled.
- The coolant pump is commanded between 10.5 - 90%.
- The coolant pump is disabled for at least 11 s.

OR

- The 12 V battery voltage is greater than or equal to 10.2 V.
- The coolant pump is enabled.
- The coolant pump is commanded between 10.5 - 90%.
- Hybrid/EV battery pack coolant inlet temperature sensor is greater than -20°C (-4°F).
- All above conditions met for at least 5 seconds.
- None of the following DTCs are set: P0C43, P0C44, P0C45, P0C47, P1E8C, P1E8D, P19FD or P19FE.

Conditions for Setting the DTC

P19FD

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit frequency is greater than 750 Hz.

P19FE

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit frequency is less than 8.6 Hz.

P19FF

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit indicated pump speed is greater than 215 RPM when the pump is not enabled.

OR

The hybrid/EV powertrain control module 2 detects the Coolant Pump Feedback circuit indicated pump speed is more than 800 RPM different than the expected pump speed when the pump is commanded between 11 - 90% PWM.

Action Taken When the DTC Sets

DTCs P19FD, P19FE and P19FF are type B DTCs.

Conditions for Clearing the DTC

DTCs P19FD, P19FE and P19FF are type B DTCs.

Diagnostic Aids

- Always verify coolant freeze point protection if a fault occurs in cold climate conditions. An improper coolant to water ratio may result in slushy or frozen coolant, resulting in DTCs or overheating. Measure coolant concentration using the **J-26568** refractometer or equivalent to verify a 50/50 mix and freeze protection to -37Â°C (-34Â°F).
- The Coolant Pump Feedback parameter on the scan tool indicates the status of the pump. When the pump self-diagnostics indicate normal operation, the parameter will indicate a PWM between 45 and 55%. Different PWM values will identify when a pump self-diagnostic has failed:

Coolant Pump Feedback Parameter

Displayed PWM Value	Pump Self-Diagnostic Indication
0%	Pump has lost power/ground, feedback circuit open, or Vehicle is in Service Mode*
10%	Pump Under Voltage detected*
20%	Pump Under/Over Current detected*
30%	Blocked or Dry pump detected*
45-55%	Normal operation, actual pump speed provided by circuit frequency
80%	Pump Over Voltage detected*
90%	Pump Over Temperature detected*
100%	Feedback circuit shorted to ground*
*Coolant Pump Speed parameter defaults to 50 RPM, actual pump speed is 0 RPM.	

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC P0C43, P0C44, P0C45, P0C46, P1FFB, P1FFC, P1FFD, P1FFE, U0111, U185B, or U2602 is not set.

- **If any DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

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

2. Verify the hybrid/EV powertrain control module 2 parameters listed below when commanding the hybrid/EV battery pack coolant pump between 20% and 80% with a scan tool.

- Hybrid/EV Battery Pack Coolant Pump Command to be 10% or greater.
- Hybrid/EV Battery Pack Coolant Pump Feedback to be 50% +/-5%.
- Hybrid/EV Battery Pack Coolant Pump Speed is greater than 500 RPM.
- **The scan tool parameters listed are not within the specified ranges**

Refer to Circuit/System Testing.

- **The scan tool parameters listed are within the specified ranges**

3. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the G37 Hybrid/EV Battery Pack Coolant Pump.
2. Test for less than 5 Ω between the ground circuit terminal 4 and ground.

- **If 5 Ω or greater**

Repair the open/high resistance on the ground circuit.

- **If less than 5 Ω**

3. Vehicle ON.

4. Test for B+ between the B+ circuit terminal 5 and the ground circuit terminal 4.

- **If less than B+**

1. Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

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 and the fuse is blown, replace the G37 Hybrid/EV Battery Pack Coolant Pump.

- **If B+**

5. Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.

6. Vehicle OFF, charge cord removed. Verify the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for less than 1 V between the pump enable circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K114B hybrid/EV powertrain control module 2.

- **If the test lamp is OFF**

7. Vehicle ON. Verify the test lamp illuminates. Command the Hybrid Battery Pack Coolant Pump ON (20 - 80%) with a scan tool if necessary.

- **If the test lamp is OFF**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the pump enable circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the pump enable circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp is ON**
8. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.
9. Verify that a test lamp changes illumination between bright (20%) and dim (80%) when commanding the Hybrid Battery Pack Coolant Pump ON between 20% and 80% with a scan tool.
 - **If the test lamp is always dim or does not illuminate**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Test for less than 1 V between the control circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 - 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is always bright**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **The test lamp changes illumination between bright (20%) and dim (80%)**
10. Remove the test lamp.
11. Verify the scan tool Hybrid Battery Pack Coolant Pump Feedback parameter is 0%.
 - **If greater than 0%**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 0%**
12. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.
13. Verify the scan tool Hybrid Battery Pack Coolant Pump Feedback parameter is greater than 90%.
 - **If 90% or less**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Test for less than 1 V between the feedback circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 - 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 90%**
14. Replace the G37 Hybrid/EV Battery Pack Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#) (RESS Pump) for G37 Hybrid/EV battery pack coolant pump replacement.
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P148A-P148C: COOLING FAN SIGNAL CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P148A

Cooling Fan Signal Circuit Performance

DTC P148B

Cooling Fan Signal Circuit Low Voltage

DTC P148C

Cooling Fan Signal Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cooling Fan Speed Signal Circuit	P148B, P1486	P148A, P1485	P148C, P1487	-
Fans operate at 90% with all malfunctions				

Circuit/System Description

The hybrid/EV powertrain control module 2 indirectly controls the radiator fans. When propulsion is active, the engine control module (ECM) processes all requests for the cooling fans to be turned ON regardless of which module originates the request. The ECM decides if and at what speed the cooling fans should operate. The ECM sends the cooling fan command to the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 sends the signal to the cooling fans to operate and at what speed. If the vehicle is in Charge Mode and the hybrid/EV powertrain control module 2 requests the cooling fans to operate and the ECM is not awake, the hybrid/EV powertrain control module 2 will control the cooling fans without ECM intervention.

The ECM communicates the fan command PWM signal to the hybrid/EV powertrain control module 2 through the cooling fan speed signal circuit/hardwire circuit and also sends a redundant serial data signal. Since the hardwire circuit is an output from the ECM but an input to the hybrid/EV powertrain control module 2, each module has unique DTCs to monitor the same circuit.

Conditions for Running the DTC

P148A

- The 12 V battery voltage is greater than 10.2 V.
- The propulsion system is active for more than 44 s.
- The cooling fan speed has not changed by greater than 5%.
- None of the following DTCs are set: P148B, P148C, or U0293.

OR

- The 12 V battery voltage is greater than or equal to 10.2 V.
- The propulsion system is inactive.
- The energy storage system thermal condition request is ActiveCool.
- The cooling fan is enabled for more than 49 s.
- The cooling fan speed has not changed by greater than 5%.
- None of the following DTCs are set: P148B, P148C, or U0293.

P148B

The 12 V battery voltage is greater than 10.2 V.

P148C

- The 12 V battery voltage is greater than 10.2 V.
- The propulsion system is active for more than 49 s.

OR

- The 12 V battery voltage is greater 10.2 V.
- The propulsion system is inactive.
- The energy storage system thermal condition request is ActiveCool.
- The cooling fan is enabled for more than 49 s.

Conditions for Setting the DTC

P148A

The PWM cooling fan signal duty cycle request from Engine Control Module (Hardwire) is not within 25% of the redundant engine cooling fan speed sent to the hybrid/EV powertrain control module 2 via serial data.

P148B

The Hybrid/EV Powertrain Control Module 2 has detected a cooling fan signal circuit duty cycle of less than 3% from the engine control module.

P148C

The Hybrid/EV Powertrain Control Module 2 has detected a cooling fan signal circuit duty cycle of greater than 97% from the engine control module.

Action Taken When the DTC Sets

DTCs P148A, P148B and P148C are type B DTCs.

Conditions for Clearing the DTC

DTCs P148A, P148B and P148C are type B DTCs.

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Vehicle ON.
2. Verify DTC P1485, P1486, P1487, P148A, P148B, or P148C is not set.
 - **If the DTC is set**
Refer to Circuit/System Testing.
 - **If the DTC is not set**
3. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2, vehicle in Service Mode.

NOTE: The cooling fan circuit is pulled up to a voltage within the ECM. 3 - 4 V measured on this circuit with the hybrid/EV powertrain control module 2 disconnected is normal.

2. Test for 3 - 4 V between the cooling fan circuit terminal 9 and ground.
 - **If less than 3 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the cooling fan circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If 4V or greater**
 1. Vehicle OFF. Disconnect the X1 harness connector at the K20 Engine Control Module, vehicle in Service Mode.
 2. Test for less than 1 V between the cooling fan circuit and ground.
 - If greater than 1 V, repair the short to voltage on the circuit.
 - If 1 V or less, replace the K20 Engine Control Module.
 - **If 3 - 4 V**
3. Vehicle OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
4. Reconnect the K114B Hybrid/EV Powertrain Control Module 2 connector X2.
5. Vehicle in Service Mode. Test for greater than 10 V between the signal circuit and ground.
 - **If 10 V or less**
Replace the Hybrid/EV Powertrain Control Module 2.
 - **If greater than 10 V**
6. Replace the K20 Engine Control Module.

Repair Instructions

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

Refer to [Control Module References](#) for engine control module, hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P1EC6: HYBRID/EV BATTERY PACK HEATER PERFORMANCE

Diagnostic Instructions

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

DTC Descriptor

DTC P1EC6

Hybrid/EV Battery Pack Heater Performance

Circuit/System Description

The Hybrid/EV Battery Pack Coolant Heater is mounted to the coolant inlet external of the battery pack. The Hybrid/EV Battery Pack Coolant Heater uses high voltage as the power source. The T24 Battery Charger controls the Hybrid/EV Battery Pack Coolant Heater and contains a non-serviceable fuse to protect the high voltage circuits.

When the Conditions for Running the DTC are met, the Hybrid/EV Battery Pack Coolant Heater is commanded ON. The Hybrid/EV Powertrain Control Module 2 then monitors for a temperature change at the Hybrid/EV Battery Pack coolant temperature sensor 1 to determine if the Hybrid/EV Battery Pack Coolant Heater is functioning properly.

Conditions for Running the DTC

- The 12 V battery voltage is greater than 10.2 V.
- The hybrid/EV battery pack coolant temperature sensor is less than 21Â°C (70Â°F).
- Runs once per drive cycle, either in propulsion system active or in Charge Mode.
- Hybrid/EV battery pack Active Heating is requested.
- Hybrid/EV battery pack voltage is greater than 221 V.
- None of the following DTCs are set; P0C43, P0C44, P0C45, P0C47, P19FD, P19FE, P19FF, P1EC3, P1E8C, P1E8D, P1FFB, P1FFC, P1FFD, or P1FFE.

Conditions for Setting the DTC

- The hybrid/EV powertrain control module 2 commands the hybrid/EV battery pack coolant pump OFF and the battery heater ON to 100% for 5.5 seconds, then varies battery heater output in relation to battery voltage for a maximum of 2.5 minutes.
- The hybrid/EV powertrain control module 2 did not see the battery pack coolant temperature rise more than 2.75Â°C (4.9Â°F) within 85 seconds of commanding the battery heater OFF.

Action Taken When the DTC Sets

- DTC P1EC6 is a type B DTC.
- Hybrid/EV battery pack active heating is disabled.

Conditions for Clearing the DTC

DTC P1EC6 is a type B DTC.

Diagnostic Aids

P1EC6 will prevent battery heating and the vehicle will be unable to start in cold weather with battery temperatures below -25Â°C (-13Â°F).

Reference Information

Schematic Reference

- [Hybrid/EV Cooling Schematics](#)
- [Hybrid/EV Energy Storage Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Special Tools

- **EL-48900** HEV Safety Kit
- **EL-50772** Insulation Multimeter

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

[Circuit/System Verification](#)

1. Vehicle in Service Mode.
2. Verify that DTC P0AA1, P0AA4, P0AD9, P0ADD, P0AE1, P0AE3, P0D0A, P0D09, P1EBD, P1EC0, or P1EC3 is not set.

- **If any DTC is set**

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

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

NOTE: Other DTCs will set.

3. Vehicle OFF. Remove the G37 Hybrid/EV Battery Pack Coolant Pump fuse. Set the vehicle Charge Mode to IMMEDIATE. Connect the charge cord set. With the vehicle in Charge Mode, Vehicle in Service Mode.
4. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor parameter increases 2.75Â°C (4.9Â°F) within 120 s when commanding the hybrid/EV battery pack coolant heater ON with a scan tool.

- **If the Hybrid/EV Battery Pack Coolant Temperature Sensor did not increase 2.75Â°C (4.9Â°F) within 120 s**

Refer to Circuit/System Testing.

- **If the Hybrid/EV Battery Pack Coolant Temperature Sensor did increase 2.75Â°C (4.9Â°F) within 120 s**

5. All OK.

[Circuit/System Testing](#)

WARNING:

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

The High Voltage Disabling procedure includes the following steps:

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

Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:

- Safety glasses with appropriate side shields when within 15 meters (50 feet) of the vehicle, either indoors or outdoors.
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
 - Visually and functionally inspect the gloves before use.
 - Wear the Insulation gloves with leather protectors at all times when working with the high voltage battery assembly, whether the system is energized or not.

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

1. Vehicle OFF, disable the high voltage. Refer to [High Voltage Disabling](#) . Disconnect the high voltage harness connector at the E54 Hybrid/EV Battery Pack Coolant Heater.
2. Test for 61 - 75 Ω between terminal A and terminal B at the E54 Hybrid/EV Battery Pack Coolant Heater.

- If not within the specified range

Replace the T24 Battery Charger and the E54 Hybrid/EV Battery Pack Coolant Heater.

- If within the specified range

NOTE: The following continuity tests must be performed using an EL-50772 Insulation Multimeter. Select the Isolation test setting, then select the 500 V range.

3. With the EL-50772 set on the Isolation test setting, test for 26 - 550M Ω between the E54 Hybrid/EV Battery Pack Coolant Heater terminals listed below and the coolant heater assembly ground:

- Terminal A
- Terminal B
- If less than the specified value

Replace the E54 Hybrid/EV Battery Pack Coolant Heater.

- If within the specified value

4. Replace the T24 Battery Charger.

Repair Instructions

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

- Refer to [High Voltage Battery Control Wiring Junction Block Replacement \(With quick charge\)](#) [High Voltage Battery Control Wiring Junction Block Replacement \(Without quick charge\)](#) for T24 battery charger replacement.
- Refer to [High Voltage Battery Heater Replacement](#) for E54 Hybrid/EV battery pack coolant heater replacement.

DTC P1FFB-P1FFE: HYBRID/EV BATTERY PACK COOLANT LEVEL SENSOR CIRCUIT OR HYBRID/EV BATTERY PACK COOLANT LEVEL LOW

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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1FFB

Hybrid/EV Battery Pack Coolant Level Sensor Circuit

DTC P1FFC

Hybrid/EV Battery Pack Coolant Level Sensor Circuit Low Voltage

DTC P1FFD

Hybrid/EV Battery Pack Coolant Level Sensor Circuit High Voltage

DTC P1FFE

Hybrid/EV Battery Pack Coolant Level Low

Circuit/System Description

The hybrid/EV battery pack coolant system has a level sensor. The hybrid/EV battery pack coolant level sensor is attached to the coolant surge tank. The level sensor is a 2-state bi-metallic reed switch which changes state when the switch reed is exposed to magnetism. The level of the hybrid/EV battery pack coolant in the surge tank causes a magnet-equipped float to move towards and away from the sensor as coolant level decreases or increases. The hybrid/EV powertrain control module 2 supplies 5 V to the signal circuit and a ground for the low reference circuit. The hybrid/EV battery pack coolant level sensor resistance decreases when the battery coolant level in the surge tank gets low. The hybrid/EV powertrain control module 2 uses the hybrid/EV battery pack coolant level sensor to determine if disabling the hybrid/EV battery pack because the coolant system is low on coolant.

Conditions for Running the DTC

P1FFB, P1FFC, and P1FFD

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

P1FFE

- The vehicle speed is zero for more than 40 s.

AND

- The battery pack temperature is less than -7°C ($+32^{\circ}\text{F}$) for greater than 30 s.
- None of the following DTCs are set: P0ABC, P0ABD, P0ABB, P0721, P077B, P1FFB, P1FFC, P1FFD, P1FFE, P215C, P2610, U0100, U0101, U0111, or U185A.

Conditions for Setting the DTC

P1FFB

The Hybrid/EV Battery Pack Coolant Level Sensor voltage is between 2.8 - 3.1 V

P1FFC

The Hybrid/EV Battery Pack Coolant Level Sensor voltage is below 1.37 V

P1FFD

The Hybrid/EV Battery Pack Coolant Level Sensor voltage is above 4.0 V

P1FFE

The Hybrid/EV Battery Pack Coolant Level Sensor voltage is between 1.38 - 2.84 V for more than 2 consecutive key cycles

Action Taken When the DTC Sets

- DTC P1FFB, P1FFC, P1FFD, and P1FFE are type A DTCs.
- Hybrid/EV Battery Pack charging is disabled.

Conditions for Clearing the DTC

DTC P1FFB, P1FFC, and P1FFD are type A DTCs.

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hybrid/EV Cooling System Description and Operation

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Verify that the vehicle hybrid/EV battery cooling system is full.
 - If the hybrid/EV battery cooling system is low

WARNING:

Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

Refer to [Hybrid Cooling System Loss of Coolant \(Drive Motor Battery Cooling System\)](#)[Hybrid Cooling System Loss of Coolant \(Drive Motor Generator Power Inverter Module Cooling System\)](#) for the Drive Motor Battery Cooling System

- The hybrid/EV battery cooling system is full

Refer to Circuit/System Testing.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B258 Hybrid/EV Battery Coolant Level Sensor.
2. Test for less than 10 Ω between the low reference circuit terminal B and ground.

- **If 10 Ω or greater**

1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If less than 10 Ω**

3. Vehicle in Service Mode.

4. Test for 4.8 - 5.2 V between the 5 V signal circuit terminal A and ground.

- **If 5.2 V or greater**

1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Vehicle in Service Mode.
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 K114B Hybrid/EV Powertrain Control Module 2.

- **If 4.8 V or less**

1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If within the specified range**

5. Vehicle OFF, remove the B258 Hybrid/EV Battery Coolant Level Sensor from the coolant surge tank

6. Test for 24 - 25.4k Ω between the signal terminal A and the low reference terminal B.

- **If not within the specified range**

Replace the B258 Hybrid/EV Battery Coolant Level Sensor.

- **If within the specified range**

NOTE: Moving the magnet slightly along the bottom of the sensor will assist closing the internal switch.

7. Using a magnet, place the magnet off center of the sensor, opposite of the terminals on the epoxy side, test for 7.1 - 7.54k Ω between the signal terminal A and the low reference terminal B.

- **If not within the specified range**

Replace the B258 Hybrid/EV Battery Coolant Level Sensor.

- **If within the specified range**

8. Replace the coolant surge tank.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Level Sensor Replacement](#) for B258 Hybrid/EV battery coolant level sensor replacement.
- Refer to [Radiator Surge Tank Replacement](#)
- Refer to [Control Module References](#) for K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P1FFF: SYSTEM ISOLATION/COOLANT LEVEL SENSOR FAULT - HYBRID/EV BATTERY CHARGING SYSTEM DISABLED

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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P1FFF

System Isolation/Coolant Level Sensor Fault - Hybrid/EV Battery Charging System Disabled

Circuit/System Description

This diagnostic is an indicator that hybrid/EV battery pack charging is disabled because the hybrid/EV powertrain control module 2 detected one of the following conditions:

WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

- A loss of isolation between the hybrid/EV battery pack high voltage circuits and vehicle chassis
- A low coolant condition of the hybrid/EV battery pack coolant system
- A fault in the hybrid/EV battery pack coolant level sensor/circuit

Conditions for Running the DTC

- The hybrid powertrain control module 2 and battery energy control module are awake and communicating.
- Once set, the DTC will not run again until a scan tool clear code command is sent.

Conditions for Setting the DTC

NOTE: DTC P1FFF will never set alone.

When DTC P0AA6, P1AE6, P1FFB, P1FFC, P1FFD, or P1FFE is set, DTC P1FFF will also be set.

Action Taken When the DTC Sets

- DTC P1FFF is a type A DTC.
- The driver information center displays the SERVICE HIGH VOLTAGE CHARGING SYSTEM message.
- Hybrid/EV battery pack charging will be reduced.

Conditions for Clearing the DTC

DTC P1FFF is a type A DTC but will only clear with a scan tool clear code command.

Diagnostic Aids

DTC P1FFF will not clear or go to history with ignition cycles once DTC is set. DTC P1FFF will only clear with a clear code command from the scan tool.

Reference Information

Schematic Reference

Hybrid/EV Cooling Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Drive Motor Battery System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information**Circuit/System Verification**

1. Vehicle in Service Mode.
2. Verify DTC P0AA6, P1AE6, P1FFB, P1FFC, P1FFD or P1FFE is not set.

- If DTC P0AA6 or P1AE6 is set

Refer to [DTC P0AA6 or P1AE6](#) .

- If DTC P1FFB, P1FFC, P1FFD, or P1FFE is set

Refer to [DTC P1FFB-P1FFE](#).

- If none of the DTCs are set

NOTE: If DTC P1FFF will not clear, the K114B Hybrid/EV Powertrain Control Module 2 may have to be programmed or replaced if the module contains the current calibration level.

3. Clear codes.
4. Verify DTC P0AA6, P1AE6, P1FFB, P1FFC, P1FFD or P1FFE is not set.

- If any DTC is set

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

- If none of the DTCs are set

5. All OK.

HYBRID/EV ELECTRONICS COOLING DIAGNOSTIC (DRIVE MOTOR GENERATOR POWER INVERTER MODULE COOLING SYSTEM)

Step	Action	Yes	No
1	Were you sent here from Symptoms or another diagnostic table?	Go to Step 2	Go to Diagnostic System Check - Vehicle

Step	Action	Yes	No
2	WARNING: Refer to Moving Parts and Hot Surfaces Warning . WARNING: Wear safety glasses in order to avoid eye damage. 1. Add coolant to the coolant surge tank as needed. Refer to Drive Motor Generator Power Inverter Module Cooling System Draining and Filling. 2. Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. 3. Quickly remove and instal the generator control module coolant tank hose from the automatic transmission. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank). Is there coolant flowing out of the automatic transmission?		
		Go to Step 14	Go to Step 3
3	Quickly remove and install the drive motor power inverter module cooling inlet hose from the automatic transmission. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU). Is there coolant flowing out of the drive motor power inverter module cooling inlet hose?	Go to Step 16	Go to Step 4
4	Quickly remove and install the drive motor power inverter module cooling inlet hose from the drive motor battery charger. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU). Is there coolant flowing out of the drive motor battery charger?	Go to Step 18	Go to Step 5
5	Quickly remove and install the electric differential drive motor power inverter module cooling hose from the drive motor battery charger. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM). Is there coolant flowing out of the electric differential drive motor power inverter module cooling hose?	Go to Step 19	Go to Step 6
6	Quickly remove and install the electric differential drive motor power inverter module cooling hose from the accessory DC power control module. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM). Is there coolant flowing out of the accessory DC power control module?	Go to Step 21	Go to Step 7
7	Quickly remove and install the drive motor generator control module cooling outlet hose from the accessory DC power control module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM). Is there coolant flowing out of the drive motor generator control module cooling outlet hose?	Go to Step 22	Go to Step 8

Step	Action	Yes	No
8	Quickly remove and install the drive motor generator control module cooling outlet hose from the drive motor power inverter module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM) Is there coolant flowing out of the drive motor power inverter module?	Go to Step 24	Go to Step 9
9	Quickly remove and install the drive motor generator control module radiator outlet hose from the drive motor power inverter module. Refer to Drive Motor Generator Control Module Radiator Outlet Hose Replacement (Radiator To SPIM) Is there coolant flowing out of the drive motor generator control module radiator outlet hose?	Go to Step 25	Go to Step 10
10	Quickly remove and install the drive motor generator control module radiator outlet hose from the radiator. Refer to Drive Motor Generator Control Module Radiator Outlet Hose Replacement (Radiator To SPIM) Is there coolant flowing out of the drive motor battery coolant radiator?	Go to Step 27	Go to Step 11
11	Quickly remove and install the drive motor generator control module radiator inlet hose from the radiator. Refer to Drive Motor Generator Control Module Radiator Inlet Hose Replacement (Pump To Radiator) Is there coolant flowing out of the drive motor generator control module radiator inlet hose?	Go to Step 28	Go to Step 12
12	Quickly remove and install the drive motor generator control module radiator inlet hose from the generator control module coolant pump. Refer to Drive Motor Generator Control Module Radiator Inlet Hose Replacement (Pump To Radiator) Is there coolant flowing out of the generator control module coolant pump?	Go to Step 29	Go to Step 13
13	Replace the drive motor battery coolant pump (PE Pump). Refer to Drive Motor Battery Coolant Pump Replacement (RESS Pump) Drive Motor Battery Coolant Pump Replacement (PE Pump) Is the repair complete?	Go to Step 30	Go to Step 1
14	Inspect for kinks or obstructions in the generator control module coolant tank hose or the drive motor generator control module coolant pump hose. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank) , or Drive Motor Generator Control Module Coolant Pump Hose Replacement (Surge Tank To Pump) Is there a kink or obstruction?	Go to Step 15	Go to Step 1
15	Replace the generator control module coolant tank hose or the drive motor generator control module coolant pump hose. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank) , or Drive Motor Generator Control Module Coolant Pump Hose Replacement (Surge Tank To Pump) Is the repair complete?	Go to Step 30	Go to Step 1

Step	Action	Yes	No
16	- Using GDS, turn off the hybrid electronics coolant pump. - Remove the generator control module coolant tank hose from the automatic transmission. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank) - Remove the drive motor power inverter module cooling inlet hose from the automatic transmission. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) - Back flush the automatic transmission cooling passages. - Install the generator control module coolant tank hose to the automatic transmission. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank) - Install the drive motor power inverter module cooling inlet hose to the automatic transmission. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) - Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. - Quickly remove and install the generator control module coolant tank hose from the automatic transmission. Refer to Generator Control Module Coolant Tank Hose Replacement (DU To Surge Tank) Is there coolant flowing out of the automatic transmission?	Go to Step 30	Go to Step 17
17	Replace the automatic transmission. Refer to Transmission Replacement . Is the repair complete?	Go to Step 30	Go to Step 1
18	Replace the drive motor power inverter module cooling inlet hose. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) Is the repair complete?	Go to Step 30	Go to Step 1

Step	Action	Yes	No
19	- Using GDS, turn off the hybrid electronics coolant pump. - Remove the drive motor power inverter module cooling inlet hose from the drive motor battery charger. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) - Remove the electric differential drive motor power inverter module cooling hose from the drive motor battery charger. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM) - Back flush the drive motor battery charger cooling passages. - Install the drive motor power inverter module cooling inlet hose to the drive motor battery charger. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) - Install the electric differential drive motor power inverter module cooling hose to the drive motor battery charger. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM) - Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. - Quickly remove and install the drive motor power inverter module cooling inlet hose from the drive motor battery charger. Refer to Drive Motor Power Inverter Module Cooling Inlet Hose Replacement (OBCM To DU) Is there coolant flowing out of the drive motor battery charger?	Go to Step 30	Go to Step 20
20	Replace the drive motor battery charger. Refer to Drive Motor Battery Charger Replacement (Except Dubai) Drive Motor Battery Charger Replacement (Dubai) Is the repair complete?	Go to Step 30	Go to Step 1
21	Replace the electric differential drive motor power inverter module cooling hose. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM) Is the repair complete?	Go to Step 30	Go to Step 1

Step	Action	Yes	No
22	- Using GDS, turn off the hybrid electronics coolant pump. - Remove the electric differential drive motor power inverter module cooling hose from the accessory DC power control module. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM). - Remove the drive motor generator control module cooling outlet hose from the accessory DC power control module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM). - Back flush the accessory DC power control module cooling passages. - Install the electric differential drive motor power inverter module cooling hose to the accessory DC power control module. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM). - Install the drive motor generator control module cooling outlet hose to the accessory DC power control module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM). - Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. - Quickly remove and install the electric differential drive motor power inverter module cooling hose. Refer to Electric Differential Drive Motor Power Inverter Module Cooling Hose Replacement (APM To OBCM). Is there coolant flowing out of the accessory DC power control module?	Go to Step 30	Go to Step 23
23	Replace the accessory DC power control module. Refer to Accessory DC Power Control Module Replacement. Is the repair complete?	Go to Step 30	Go to Step 1
24	Replace the drive motor generator control module cooling outlet hose. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM). Is the repair complete?	Go to Step 30	Go to Step 1

Step	Action	Yes	No
25	- Using GDS, turn off the hybrid electronics coolant pump. - Remove the drive motor generator control module cooling outlet hose from the drive motor power inverter module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM) - Remove the drive motor generator control module radiator outlet hose from the drive motor power inverter module. Refer to Drive Motor Generator Control Module Radiator Outlet Hose Replacement (Radiator To SPIM) - Back flush the drive motor power inverter module cooling passages. - Install the drive motor generator control module cooling outlet hose to the drive motor power inverter module. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM) - Install the drive motor generator control module radiator outlet hose to the drive motor power inverter module. Refer to Drive Motor Generator Control Module Radiator Outlet Hose Replacement (Radiator To SPIM) - Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. - Quickly remove and install the drive motor generator control module cooling outlet hose. Refer to Drive Motor Generator Control Module Cooling Outlet Hose Replacement (SPIM To APM) Is there coolant flowing out of the drive motor power inverter module?	Go to Step 30	Go to Step 26
26	Replace the drive motor power inverter module. Refer to Drive Motor Power Inverter Module Replacement Is the repair complete?	Go to Step 30	Go to Step 1
27	Replace the drive motor generator control module radiator outlet hose. Refer to Drive Motor Generator Control Module Radiator Outlet Hose Replacement (Radiator To SPIM) Is the repair complete?	Go to Step 30	Go to Step 1
28	Replace the radiator. Refer to Radiator Replacement Is the repair complete?	Go to Step 30	Go to Step 1
29	Replace the drive motor generator control module radiator inlet hose. Refer to Drive Motor Generator Control Module Radiator Inlet Hose Replacement (Pump To Radiator) Is the repair complete?	Go to Step 30	Go to Step 1
30	- Add coolant to the coolant surge tank as needed. Refer to Drive Motor Generator Power Inverter Module Cooling System Draining and Filling. - Operate the system in order to verify the repair. Did you find and correct the condition?	System OK	Go to Step 1

HYBRID/EV ELECTRONICS COOLING DIAGNOSTIC (DRIVE MOTOR BATTERY COOLING SYSTEM)

Step	Action	Yes	No
1	Were you sent here from Symptoms or another diagnostic table?	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	WARNING: Refer to Moving Parts and Hot Surfaces Warning . WARNING: Wear safety glasses in order to avoid eye damage. 1. Add coolant to the coolant surge tank as needed. Refer to Drive Motor Battery Cooling System Draining and Filling 2. Using GDS, turn on the hybrid electronics coolant pump and increase the RPM to 1000. 3. Quickly remove and install the drive motor battery coolant cooler inlet hose from the drive motor battery coolant pump. Refer to Drive Motor Battery Coolant Cooler Inlet Hose Replacement (Pump To RESS Heater) Is there coolant flowing out of the drive motor battery coolant pump?	Go to Step 3	Go to Step 1
3	Quickly remove and install the drive motor battery coolant cooler inlet hose from the high voltage battery heater. Refer to Drive Motor Battery Coolant Cooler Inlet Hose Replacement (Pump To RESS Heater) Is there coolant flowing out of the drive motor battery coolant cooler inlet hose?	Go to Step 4	Go to Step 11
4	Quickly remove and install the battery vent hose from the high voltage battery. Refer to Battery Vent Hose Replacement (RESS HTR To RESS) Is there coolant flowing out of the battery vent hose?	Go to Step 6	Go to Step 12
5	Quickly remove and install the battery vent hose from the high voltage battery. Refer to Battery Vent Hose Replacement (RESS HTR To RESS) Is there coolant flowing out of the battery vent hose?	Go to Step 6	Go to Step 13
6	Quickly remove and install the drive motor battery coolant cooler outlet hose from the drive motor battery. Refer to Drive Motor Battery Coolant Cooler Outlet Hose Replacement (CHILLER TO RESS) Is there coolant flowing out of the drive motor battery?	Go to Step 7	Go to Step 14
7	Quickly remove and install the drive motor battery coolant cooler outlet hose from the drive motor battery coolant cooler. Refer to Drive Motor Battery Coolant Cooler Outlet Hose Replacement (CHILLER TO RESS) Is there coolant flowing out of the drive motor battery coolant cooler outlet hose?	Go to Step 8	Go to Step 15
8	Quickly remove and install the drive motor battery radiator outlet hose from the drive motor battery coolant cooler. Refer to Drive Motor Battery Radiator Outlet Hose Replacement (Surge Tank To Chiller) Is there coolant flowing out of the drive motor battery coolant cooler?	Go to Step 9	cardiagn.com Go to Step 16

Step	Action	Yes	No
9	Quickly remove and install the drive motor battery radiator outlet hose from the radiator surge tank. Refer to Drive Motor Battery Radiator Outlet Hose Replacement (Surge Tank To Chiller) . Is there coolant flowing out of the drive motor battery radiator outlet hose?	Go to Step 10	Go to Step 17
10	Quickly remove and install the drive motor battery coolant pump inlet hose from the drive motor battery coolant pump. Refer to Drive Motor Battery Coolant Pump Inlet Hose Replacement (Surge Tank To Pump) . Is there coolant flowing out of the drive motor battery coolant pump inlet hose?	Go to Step 19	Go to Step 18
11	Replace the drive motor battery coolant cooler inlet hose. Refer to Drive Motor Battery Coolant Cooler Inlet Hose Replacement (Pump To RESS Heater) . Is the repair complete?	Go to Step 19	Go to Step 1
12	Replace the high voltage battery heater. Refer to High Voltage Battery Heater Replacement . Is the repair complete?	Go to Step 19	Go to Step 1
13	Replace the battery vent hose. Refer to Battery Vent Hose Replacement (RESS HTR To RESS) . Is the repair complete?	Go to Step 19	Go to Step 1
14	Replace the drive motor battery. Refer to Drive Motor Battery Replacement and Shipping Preparation (Old Design Battery Pack in Vehicles built before 1G1FX6S06H4163254) Drive Motor Battery Replacement and Shipping Preparation (New Design Battery Pack in Vehicles built before 1G1FX6S06H4163254) Drive Motor Battery Replacement and Shipping Preparation (New Design Battery Pack in Vehicles built after 1G1FX6S06H4163254) . Is the repair complete?	Go to Step 19	Go to Step 1
15	Refer to Drive Motor Battery Coolant Cooler Outlet Hose Replacement (CHILLER TO RESS) . Is the repair complete?	Go to Step 19	Go to Step 1
16	Replace the drive motor battery coolant cooler. Refer to Drive Motor Battery Coolant Cooler Replacement . Is the repair complete?	Go to Step 19	Go to Step 1
17	Replace the drive motor battery radiator outlet hose. Refer to Drive Motor Battery Radiator Outlet Hose Replacement (Surge Tank To Chiller) . Is the repair complete?	Go to Step 19	Go to Step 1
18	Replace the drive motor battery coolant pump inlet hose. Refer to Drive Motor Battery Coolant Pump Inlet Hose Replacement (Surge Tank To Pump) . Is the repair complete?	Go to Step 19	Go to Step 1
19	1. Add coolant to the coolant surge tank as needed. Refer to Drive Motor Battery Cooling System Draining and Filling . 2. Operate the system in order to verify the repair. Is there coolant flowing out of the drive motor battery coolant pump?	System OK	Go to Step 1

HYBRID/EV BATTERY PACK COOLANT PUMP MALFUNCTION

Diagnostic Instructions

cardiagn.com

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.

- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

Circuit/System Description

The hybrid/EV battery pack coolant pump circulates coolant through the drive motor battery coolant radiator, drive motor battery coolant cooler, and the hybrid/EV battery pack to control the temperature of the hybrid/EV battery pack. An enable signal from the hybrid/EV powertrain control module 2 to the hybrid/EV battery pack coolant pump provides overall control of the pump. When this circuit is high, the pump can operate. The pump is controlled with a pulse-width modulated signal from the hybrid/EV powertrain control module 2 to the hybrid/EV battery pack coolant pump. The higher the duty cycle the higher the pump speed. The hybrid/EV battery pack coolant pump provides a hard-wired pulse-width modulated feedback signal to the hybrid/EV powertrain control module 2. During normal operation, this feedback signal provides pump speed information to the hybrid/EV powertrain control module 2. The hybrid/EV battery pack coolant pump has some self-diagnostic capability. If the hybrid/EV battery pack coolant pump determines there is an internal fault it provides this information on this same feedback circuit instead of pump speed information.

Diagnostic Aids

A malfunctioning coolant pump may cause a battery pack overheat condition.

Reference Information

Schematic Reference

[Hybrid/EV Cooling Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Circuit/System Verification

1. Vehicle On.
2. Verify that DTC P0C43, P0C44, P0C45, P0CE0, P0CE2, P0CE3, P0D0A, P0D11, P1EBC, P1EC3, P1EC4, P1EC5, P1EC6, P1EC7, P1EC8, U0111, U185B, or U2602 is not set.
 - **If any of the DTCs are set**

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

- **If none of the DTCs are set**
3. With the Hybrid/Ev Battery Pack Coolant Pump disabled and not running, verify the scan tool parameters listed below:
 - Hybrid/EV Battery Pack Coolant Pump Command is less than 10%.

- Hybrid/EV Battery Pack Coolant Pump Feedback is 0%.
- Hybrid/EV Battery Pack Coolant Pump Speed is 25 RPM.
- **The scan tool parameters listed are not the specified values**

Refer to Circuit/System Testing.

- **The scan tool parameters listed are within the specified values**

- Set the vehicle Charge Mode to IMMEDIATE.
- Vehicle OFF, connect the charge cord set.
- With the vehicle charging, the hybrid/EV battery pack coolant pump enabled and not running, verify the scan tool parameters listed below:
 - Hybrid/EV Battery Pack Coolant Pump Command is 10%.
 - Hybrid/EV Battery Pack Coolant Pump Feedback to be 50% +/-5%.
 - Hybrid/EV Battery Pack Coolant Pump Speed is 50 RPM.
 - **The scan tool parameters listed are not the specified values**

Refer to Circuit/System Testing.

- **The scan tool parameters listed are within the specified values**

- Command the Hybrid/EV Battery Pack Coolant Pump to 90%, verify the scan tool parameters listed below:
 - Hybrid/EV Battery Pack Coolant Pump Command to be greater than 10%.
 - Hybrid/EV Battery Pack Coolant Pump Feedback to be 50% +/-5%.
 - Hybrid/EV Battery Pack Coolant Pump Speed is greater than 50 RPM.
 - **The scan tool parameters listed are not the specified values**

Refer to Circuit/System Testing.

- **The scan tool parameters listed are within the specified values**

- All OK.

Circuit/System Testing

- Vehicle OFF, disconnect the harness connector at the G37 Hybrid/EV Battery Pack Coolant Pump.
- Test for less than 10 Ω between the ground circuit terminal 4 and ground.

- **If 10 Ω or greater**

Repair the open/high resistance on the ground circuit.

- **If less than 10 Ω**

- Vehicle On.
- Test for greater than 11.5 V between the B+ circuit terminal 5 and the ground circuit terminal 4.

- **If 11.5 V or less**

- Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

- 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 and the fuse is blown, replace the G37 Hybrid/EV Battery Pack Coolant Pump.

- **If greater than 11.5 V**

- Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.
- Command the Hybrid Battery Pack Coolant Pump Command OFF (10%) and ON (90%) with a scan tool. The test lamp should turn OFF and ON when changing between the commanded states.

- **If the test lamp is always illuminated at 10%**

- Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
- Vehicle On.

- Test for less than 1 V between the enable circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp does not illuminate at 90%**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the enable circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the enable circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp turns OFF and ON when changing between the commanded states**
 7. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.
 8. Command the Hybrid Battery Pack Coolant Pump Command ON between 20% and 90% with a scan tool. Verify that a test lamp changes illumination between bright (20%) and dim (90%) between the control circuit terminal 3 and the B+ circuit terminal 5.
 - **If the test lamp is always dim or does not illuminate**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2. Vehicle On.
 2. Test for less than 1 V between the control circuit terminal and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Vehicle OFF.
 4. Test for less than 2 Ω in the 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is always bright**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **The test lamp changes illumination between bright (20%) and dim (90%)**
 9. Command the Hybrid Battery Pack Coolant Pump Command OFF.
- 10. Verify the scan tool, Hybrid Battery Pack Coolant Pump Feedback parameter is less than 10%.
 - **If 10% or greater**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10%**
 11. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.
 12. Verify the scan tool, Hybrid Battery Pack Coolant Pump Feedback parameter is greater than 90%.
 - **If less than 90%**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 1 V between the feedback circuit terminal and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
- **If 90% or greater**
13. Replace the G37 Hybrid/EV Battery Pack Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#)
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

HYBRID/EV ELECTRONICS COOLANT PUMP MALFUNCTION

Diagnostic Instructions

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

Circuit/System Description

The hybrid/EV electronics coolant pump circulates coolant through the power electronics coolant radiator, hybrid/EV powertrain control module 1, and the battery charger to control the temperature of the hybrid/EV powertrain control module 1 and the battery charger. An enable signal from the hybrid/EV powertrain control module 2 to the hybrid/EV electronics coolant pump provides overall control of the pump. When this circuit is high, the pump can operate. The pump is controlled with a pulse-width modulated signal from the hybrid/EV powertrain control module 2 to the hybrid/EV electronics coolant pump. The higher the duty cycle the higher the pump speed. The hybrid/EV electronics coolant pump provides a hard-wired pulse-width modulated feedback signal to the hybrid/EV powertrain control module 2. During normal operation, this feedback signal provides pump speed information. The hybrid/EV electronics coolant pump has some self-diagnostic capability. If it determines there is an internal fault it provides this information on this same feedback circuit instead of pump speed information.

Diagnostic Aids

A malfunctioning coolant pump may cause an electronics overheat condition.

Reference Information

Schematic Reference

[Hybrid/EV Cooling Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

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

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle On
2. Verify that DTC P0C43, P0C44, P0C45, P0C47, or P1EC6 is not set.
 - **If any of the DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**
 - **If none of the DTCs are set**
3. Vehicle On.
4. With a scan tool, verify that the Hybrid/EV Electronics Coolant Pump Command is between 20%-90% and Hybrid Electronics Coolant Pump Feedback is 50% +/-5%.
 - **The readings are not within the specified range**

Refer to Circuit/System Testing.
 - **The readings are within the specified range**
5. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the G35 Hybrid/EV Electronics Coolant Pump.
2. Test for less than 10 Ω between the ground circuit terminal 4 and ground.
 - **If 10 Ω or greater**

Repair the open/high resistance on the ground circuit.
 - **If less than 10 Ω**
3. Vehicle On.
4. Test for B+ between the B+ circuit terminal 5 and the ground circuit terminal 4.
 - **If less than B+**
 1. Vehicle OFF, test for infinite resistance between the B+ circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 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 and the fuse is blown, replace the G35 Hybrid/EV Electronics Coolant Pump.
 - **If B+**
5. Connect a test lamp between the enable circuit terminal 1 and the ground circuit terminal 4.
6. Command the Hybrid/EV Electronics Coolant Pump OFF (10%) and ON (90%) with a scan tool. The test lamp should turn OFF and ON when changing between the commanded states.
 - **If the test lamp is always illuminated at 10%**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
 2. Vehicle On.
 2. Test for less than 1 V between the enable circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp does not illuminate at 90%**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the enable circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the pump enable circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
- **If the test lamp turns OFF and ON when changing between the commanded states**
7. Connect a test lamp between the control circuit terminal 3 and the B+ circuit terminal 5.
8. Command the Hybrid/EV Electronics Coolant Pump ON between 20% and 90% with a scan tool. Verify that a test lamp changes illumination between bright (20%) and dim (90%) between the control circuit terminal 3 and the B+ circuit terminal 5.
 - **If the test lamp is always dim or does not illuminate**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Vehicle On.
 - 2. Test for less than 1 V between the control circuit terminal and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 - 3. Vehicle OFF.
 - 4. Test for less than 2 Ω in the 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is always bright**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **The test lamp changes illumination between bright (20%) and dim (90%)**
9. Remove the test lamp.
10. Verify the scan tool, Hybrid/EV Electronics Coolant Pump Feedback parameter is less than 10%.
 - **If greater than 10%**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Test for infinite resistance between the feedback circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 10%**
11. Install a 3 A fused jumper wire between the feedback circuit terminal 2 and the ground circuit terminal 4.
12. Verify the scan tool, Hybrid/EV Electronics Coolant Pump Feedback parameter is greater than 90%.
 - **If less than 90%**
 - 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 - 2. Vehicle On.
 - 2. Test for less than 1 V between the feedback circuit terminal and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 - 3. Vehicle OFF.
 - 4. Test for less than 2 Ω in the 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 K114B Hybrid/EV Powertrain Control Module 2.

- If 90% or greater

13. Replace the G35 Hybrid/EV Electronics Coolant Pump.

Repair Instructions

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

- Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#).
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

COOLING FAN 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.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

Circuit/System Description

The Hybrid/EV Powertrain Control Module 2 controls the radiator cooling fan. The cooling fan are controlled with a pulse width modulated signal. The Hybrid/EV Powertrain Control Module 2 diagnoses any faults with the hardwire circuit to the engine control module. The engine control module sends a fan request pulse width modulated signal to the Hybrid/EV Powertrain Control Module 2 through a hardwire circuit. The Hybrid/EV Powertrain Control Module 2 operates in a pass-through mode for the engine control module fan request. The higher the duty cycle the higher the cooling fan speed.

The Hybrid/EV Powertrain Control Module 2 sends a request to the engine control module for the cooling fan to be enabled. The engine control module uses this request and other vehicle inputs to decide if and what speed the cooling fan should operate. The engine control module sends the cooling fan command to the hybrid/EV powertrain control module 2. The Hybrid/EV Powertrain Control Module 2 sends the signal to the cooling fan to operate and at what speed.

If the vehicle is in Charge Mode and the Hybrid/EV Powertrain Control Module 2 requests the cooling fan to operate, if the engine control module is not awake, the Hybrid/EV Powertrain Control Module 2 will control the cooling fan. If active cooling is needed, the engine control module wakes up to operate the air conditioning control module and then the engine control module is the master controller for the fan.

Reference Information

Schematic Reference

[Hybrid/EV Cooling Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

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

Electrical Information Reference

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

DTC Type Reference

cardiagn.com

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

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle in Service Mode.
2. Command the Cooling Fan Motor Command to 90% with a scan tool. Verify that the cooling fan is operating.
 - **The cooling fan is not operating**

Refer to Circuit/System Testing
 - **The cooling fan is operating**
3. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the G10 Cooling Fan Motor.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
 - **If 10 Ω or greater**

Test the ground circuit for an open/high resistance.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
4. Test for B+ between the B+ circuit terminal 1 and ground.
 - **If less than B+**
 1. Vehicle OFF, 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
 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 and the fuse is blown, replace the G10 Cooling Fan Motor.
 - **If B+**
5. Connect a test lamp between the control circuit terminal 4 and the B+ circuit terminal 1.
6. Command the Cooling Fan Motor Command ON between 10% and 90% with a scan tool. Verify the test lamp changes between dim (10%) and bright (90%).
 - **If the test lamp is always dim or does not illuminate**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 1 V between the control circuit and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is always bright**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 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 K114B Hybrid/EV Powertrain Control Module 2.
 - **The test lamp changes illumination between bright (20%) and dim (90%)**
7. Replace the G10 Cooling Fan Motor.

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

- Refer to [Cooling Fan and Shroud Replacement](#)
- Refer to [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

HYBRID COOLING SYSTEM LOSS OF COOLANT (DRIVE MOTOR BATTERY COOLING SYSTEM)

Step	Action	Yes	No
DEFINITION: Perform this procedure in conjunction with a high-voltage battery overheating condition, low coolant in the high-voltage battery surge tank, or when instructed to by DTC P1AE6, or P0AA6 diagnostic procedures. WARNING: Before working on any high voltage system, be sure to wear the following Personal Protection Equipment: • Safety glasses with appropriate side shields when within 50 feet of the vehicle, either indoors or outdoors • Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors • Visually and functionally inspect the gloves before use. • Wear the Insulation gloves at all times when working with the high voltage battery assembly, whether the system is energized or not. Failure to follow the procedure exactly as written may result in serious injury or death. WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.			
1	Raise and support the hood with prop rod. Was the hood raised and supported with the prop rod?	Go to Step 2	Go to Step 1
2	Visually inspect the coolant level in the high-voltage battery surge tank. Is the coolant level at or above the seam on the side of the surge tank?	Go to Step 3	Go to Step 4
3	Are any of the following DTCs present? • P0AA6 (Hybrid/EV Battery Voltage System Isolation Lost) • P1AE6 (Battery Energy Control Module Hybrid/EV Battery Voltage Isolation Sensor Circuit)	Perform DTC Diagnostics.	Go to Step 4
4	Call the GM Technical Assistance Center (TAC) for further instructions. Refer to DO NOT ATTEMPT TO REPAIR VEHICLE WITHOUT CALLING TAC. Was TAC called?	Go to Step 5	Go to Step 4

Step	Action	Yes	No
5	Special Tools: • EN-24460-A cooling system pressure tester • GE-46143-2 radiator cap and surge tank test adapter Pressure test high-voltage battery cooling loop and pressure cap to 34.4 kPa (5 psi). Does the system hold pressure for at least 5 minutes?	Go to Step 9	Go to Step 6
6	NOTE: When raising vehicle on hoist, vehicle must be level. Visually inspect the following components. Also inspect their hoses, clamps, and hose connections for coolant leaks: • Coolant surge tank • HV battery coolant pump • HV battery chiller • HV battery assembly Was a coolant leak found?	Replace component(s), hose(s), or clamp(s) that is/are leaking. Refer to appropriate procedure(s). Validate repair with additional pressure test. Then Go to Step 9	Go to Step 7
7	If no external leaks are found ensure leak is not coming from test equipment. Is equipment faulty?	Repair Equipment. Go to Step 6	Go to Step 8
8	Visually inspect the following components internal to the drive motor battery. Also inspect their hoses, clamps, and hose connections for coolant leaks: • Battery Heater • Cell Battery Cooling Manifold Inlet Hose • Cell Battery Cooling Manifold Outlet Hose • Coolant Temperature Sensor Is leak repair complete?	Go to Step 9	Go to Step 5
9	Special Tools: • GE-26568 Coolant and Battery Tester • GE-47716-A Vac-N-Fill Coolant Refill Tool • GE-46143-2 Radiator Cap and Surge Tank Test Adapter Fill and adjust high-voltage battery cooling system level at the surge tank. Refer to Drive Motor Battery Cooling System Draining and Filling. Was a coolant leak found?	Go to Step 10	Go to Step 6
10	Verify the following before returning vehicle to customer: Coolant level is at the top of the seam of the high-voltage battery surge tank. Did you find and correct the condition?	System OK	Go to Step 1

Step	Action	Yes	No
DEFINITION: The power inverter module (PIM) cooling system is losing coolant either internally or externally.			
1	Inspect the coolant level. Is the coolant at the proper level?	Go to Step 13	Go to Step 2
2	Fill the cooling system to the proper level. Refer to <u>Drive Motor Generator Power Inverter Module Cooling System Draining and Filling</u> . Is the action complete?	Go to Step 3	-
3	Overheating can cause a loss of coolant. Is the PIM Cooling system overheating?	Go to Step 11	Go to Step 4
4	Visually inspect the hoses, pipes and hose clamps. Are any of the hoses, clamps or pipes leaking?	Go to Step 12	Go to Step 5
5	Visually inspect the following components: • Coolant surge tank • Coolant pressure cap • Drive motor generator power inverter module • Accessory DC power control module • Automatic transmission • Radiator • Coolant pump • Coolant valves • Drive motor battery charger Are any of the listed components leaking?	Go to Step 12	Go to Step 6
6	1. Pressure test the cooling system. Refer to <u>Hybrid Cooling System Leak Test</u> . 2. With the cooling system pressurized, visually inspect the components listed in step 5. Are any leaks present?	Go to Step 12	Go to Step 7
7	Pressure test the coolant pressure cap. Refer to <u>Hybrid Cooling System Pressure Cap Testing</u> . Does the coolant pressure cap hold pressure?	Go to Step 9	Go to Step 8
8	Replace the coolant pressure cap. Is the repair complete?	Go to Step 13	-
9	1. Pressure test the cooling system. Refer to <u>Hybrid Cooling System Leak Test</u> . 2. With the cooling system pressurized, remove the engine cooling system pressure cap. Does the hybrid cooling system hold pressure?	-	Go to Step 10
10	Replace the surge tank. Refer to <u>Radiator Surge Tank Replacement</u> . Is the repair complete?	Go to Step 13	-
11	Repair the hybrid cooling system overheating condition. Is the repair complete?	Go to Step 13	-
12	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	Go to Step 13	-

Step	Action	Yes	No
13	Operate the system in order to verify the repair. NOTE: Do not use stop leak or any other chemicals. Only use premix Dexcool (50/50 mixture of Dexcool and deionized) Did you find and correct the condition?	System OK	Go to Step 2

HYBRID COOLING SYSTEM PRESSURE CAP TESTING

Special Tools

- GE-46143-2 Radiator Cap and Surge Tank Test Adapter
- EN-24460-A Cooling System Pressure Tester

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

Pressure Cap Testing

WARNING: To help avoid being burned, do not remove the hybrid cooling system pressure cap while the hybrid cooling system is hot. Scalding fluid and steam can be blown out under pressure if the cap is removed while the system is still hot.

1. Remove the pressure cap.
2. Wash the pressure cap sealing surface with water.

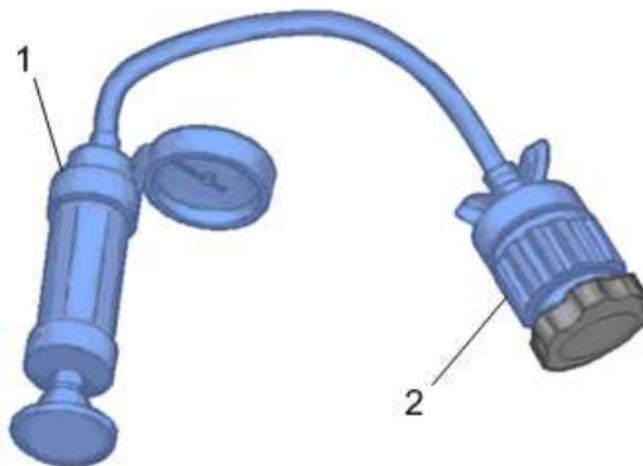


Fig. 5: Cooling System Pressure Tester & Radiator Cap/Surge Tank Test Adapter Kit
Courtesy of GENERAL MOTORS COMPANY

NOTE: Lubricate GE-46143-2 Radiator Cap and Surge Tank Test Adapter and pressure cap O-rings with coolant and press cap to seat O-ring on GE-46143-2 Radiator Cap and Surge Tank Test Adapter before turning to engage threads.

3. Use the EN-24460-A Cooling System Pressure Tester (1) with GE-46143-2 Radiator Cap and Surge Tank Test Adapter (2) in order to test the pressure cap.
4. Test the pressure cap for the following conditions:

- Pressure release when the **EN-24460-A** Cooling System Pressure Tester exceeds the pressure rating of the pressure cap.
- Maintain the rated pressure for at least 10 seconds.

Note the rate of pressure loss.

5. Replace the pressure cap under the following conditions:

- The pressure cap does not release pressure which exceeds the rated pressure of the cap.
- The pressure cap does not hold the rated pressure.

HYBRID COOLING SYSTEM LEAK TEST

Special Tools

- **EN-24460-A** Cooling System Pressure Tester
- **GE-46143-2** Radiator Cap and Surge Tank Test Adapter

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

WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

WARNING: To help avoid being burned, do not remove the hybrid cooling system pressure cap while the hybrid cooling system is hot. Scalding fluid and steam can be blown out under pressure if the cap is removed while the system is still hot.

WARNING: In order to avoid personal injury, do not remove the cap or open the cooling system drains from a hot system. Allow the system to cool first.

1. Remove the pressure cap.
2. Test the operation of the pressure cap. Refer to [Hybrid Cooling System Pressure Cap Testing](#).
3. Wash the pressure cap mating surface with water.

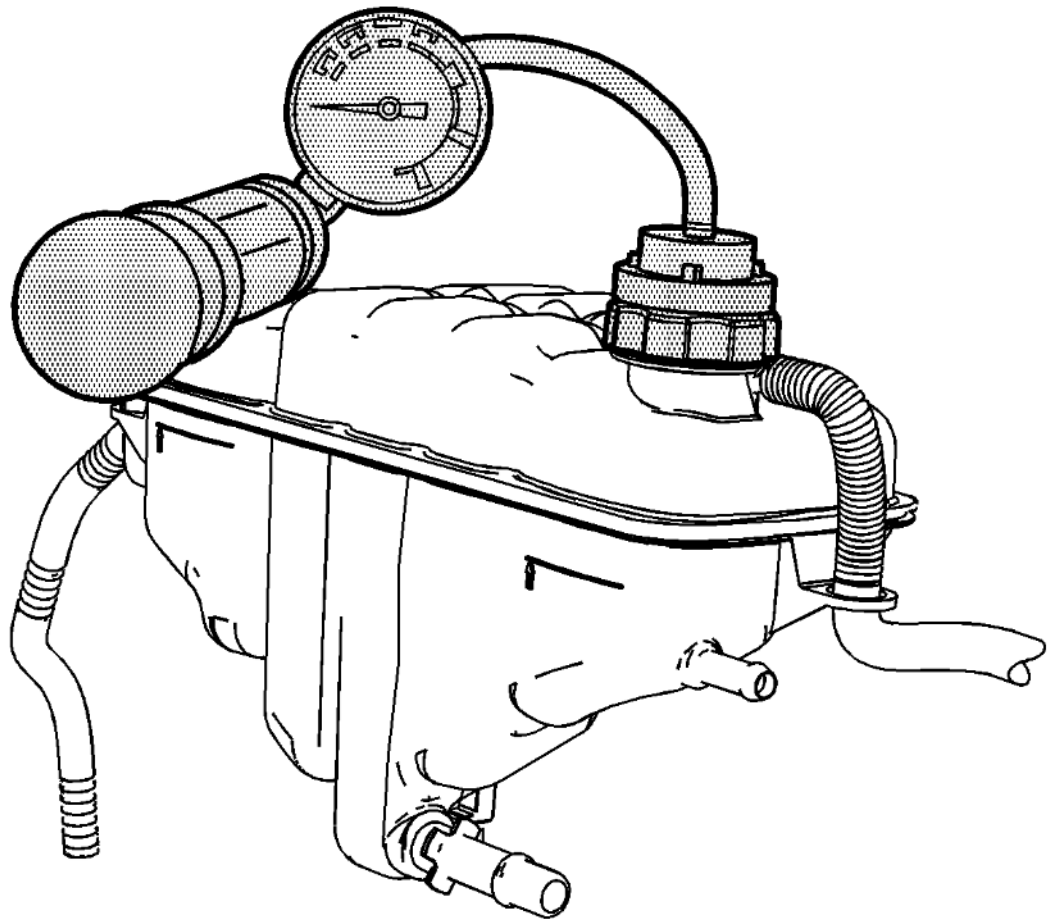


Fig. 6: Cooling System Pressure Tester Components

Courtesy of GENERAL MOTORS COMPANY

4. Use the **EN-24460-A** Cooling System Pressure Tester with the **GE-46143-2** Radiator Cap and Surge Tank Test Adapter in order to apply pressure to the cooling system.

Do not exceed the pressure cap rating.

5. The cooling system should hold the rated pressure for at least 2 minutes.

Observe the gauge for any pressure loss.

NOTE: Do not use stop leak or any other chemicals. Only use premix Dexcool (50/50 mixture of Dexcool and deionized)

6. Repair any leaks as required.

HYBRID BATTERY PACK COOLANT PASSAGE LEAK TEST

Special Tools

- **EN-24460-A** Cooling System Pressure Tester
- **GE-47716** Vac-N-Fill Coolant Refill Tool
- **EL-52016-A** Battery Pack Coolant Passage Pressure Test Adapter
- **GE-50389** Coolant Pressure Test Quick Connector

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

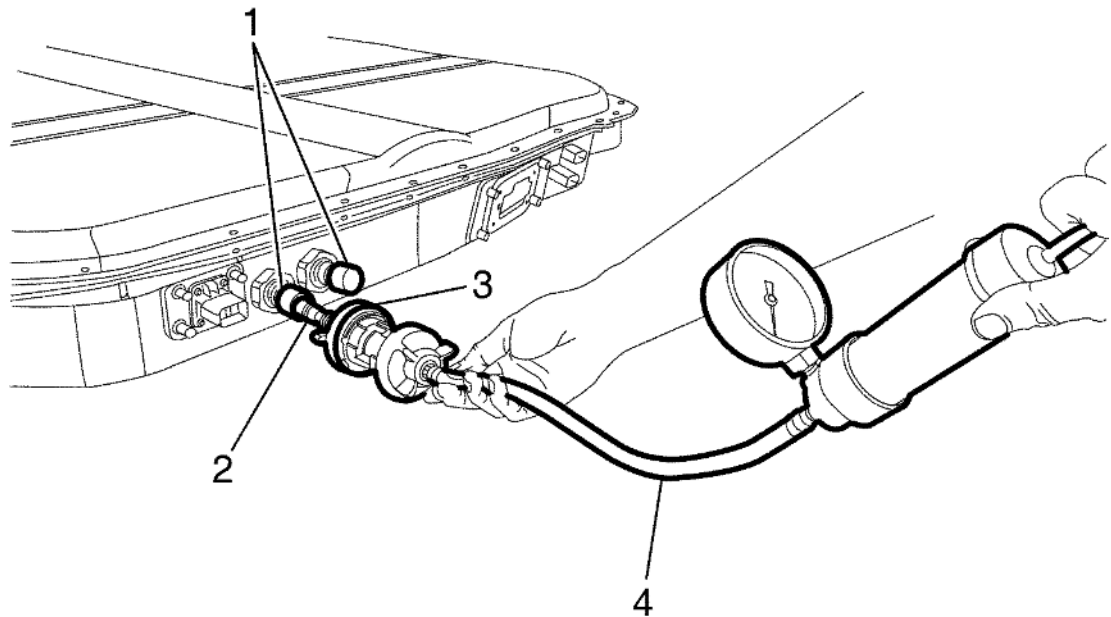


Fig. 7: Cooling System Pressure Tester And Components

Courtesy of GENERAL MOTORS COMPANY

WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

WARNING: To help avoid being burned, do not remove the hybrid cooling system pressure cap while the hybrid cooling system is hot. Scalding fluid and steam can be blown out under pressure if the cap is removed while the system is still hot.

WARNING: In order to avoid personal injury, do not remove the cap or open the cooling system drains from a hot system. Allow the system to cool first.

1. Install Cooling System Pressure Tester Cap Adapter to **EN-24460-A** Cooling System Pressure Tester (4).
2. Install **GE-47716-8** Vac-N-Fill Cap (3) to Cooling System Pressure Tester Cap Adapter.
3. Install **GE-50389** Coolant Pressure Test Quick Connector (2) to **GE-47716-8** Vac-N-Fill Cap (3).
4. Install **EL-52016-1A** Coolant Pressure Tester Adapter (1) to **GE-50389** Quick Connector (2).
5. Install **EL-52016-1A** Coolant Pressure Tester Adapter (1) to battery pack inlet connector.
6. Install **EL-52016-2A** Coolant Pressure Tester Adapter (1) to battery pack outlet connector.
7. Apply pressure to the battery pack coolant passages.

Do not exceed the pressure cap rating.

8. The cooling passages should hold the rated pressure for at least 2 minutes.

Observe the gauge for any pressure loss.

9. Repair any leaks as required.

REPAIR INSTRUCTIONS

HOSE CLAMP REPLACEMENT GUIDELINES - SPRING TYPE

Special Tools

- **BO-38185** Hose Clamp Pliers
- **GE-47622** Hose Clamp Pliers.

Equivalent regional tools: [Special Tools](#)

Spring Type Hose Clamp Replacement Guidelines

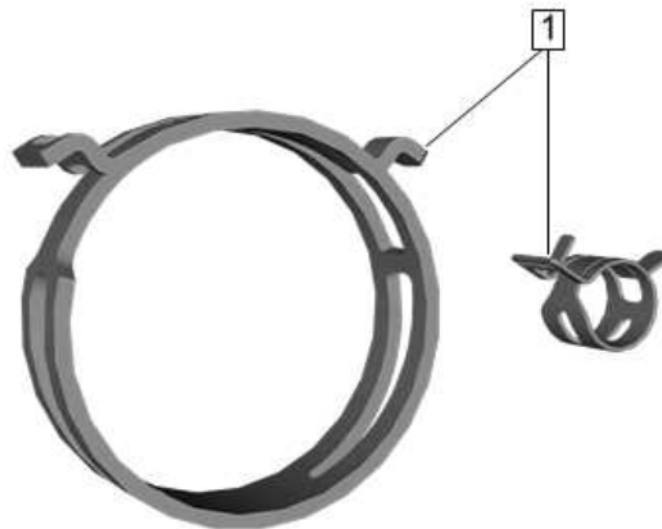


Fig. 8: Spring Type Hose Clamps

Courtesy of **GENERAL MOTORS COMPANY**

Vehicles utilize spring type hose clamps (1) to secure joints in which fluids, gases, or engine vacuum can travel to various vehicle systems. Spring type hose clamps are engineered to provide the proper amount of tension to maintain a leak & maintenance free joint for the life of the vehicle.

Spring type hose clamps have a special coating applied to the exterior of the clamp that is engineered to resist rust/corrosion, improve durability and increase the life of the hose clamp. If the coating is damaged, rust/corrosion could form resulting in the need to replace the hose clamp.

Many spring type hose clamps within GM utilize a small amount of adhesive placed directly on the hose clamp to secure the clamp to the mating hose for manufacturing purposes. Over time the strength of the adhesive will deteriorate. It is extremely important when a technician is attempting to service a joint or remove the hose clamp, that the clamp is not rotated or repositioned so that it tears and/or damages the hose. In this case, the hose and clamp must both be replaced.

When repairing a vehicle it is very important to observe the condition of both the hose and the spring type hose clamp as well as the orientation of the clamp to the hose.

If the spring type hose clamp(s) have any of the following conditions on any area of the clamp, replace the clamp(s) immediately.

- Rust/Corrosion
- Cracks
- Physical damage
- Leakage attributed to the retention of the clamp

Removing The Spring Type Hose Clamp

While keeping the hose stationary, use BO-38185 Hose Clamp Pliers or GE-47622 Hose Clamp Pliers and release the spring type hose clamp tension while attempting to separate the hose clamp from the hose.

- If the spring type hose clamp will not easily separate from the hose and/or the clamp tears or damages the hose, both the hose and hose clamp must be replaced
- If the spring type hose clamp is easily removed from the hose, the clamp can be reused provided that the clamp does not have any of the conditions as noted above.

If The Spring Type Hose Clamp Is Being Reused

It is extremely important that the spring type hose clamp is orientated to the hose in the exact same position as it was installed during vehicle assembly so that the hose clamp is not damaged or the hose clamp does not contact or damage any adjacent components. Do not use any type of adhesive on the hose clamp prior to installation.

When Reusing The Spring Type Hose Clamp and Replacing The Hose

- The inside and outside hose diameter must be identical between the new hose and the existing hose to guarantee proper hose clamp tension and joint integrity.
- Always place the existing spring type hose clamp in the same orientation as it was positioned prior to separating the joint. The new hose might have a marking on the hose indicating the correct position of a hose clamp, which should re-confirm the correct hose clamp position. The hose clamp should not contact any adjacent components after installation.

When Reusing The Spring Type Hose Clamp with an Existing Hose

Always place the existing spring type hose clamp in the same orientation as it was positioned prior to separating the joint. The existing hose might have an indentation or compression mark on the hose from where the hose clamp was installed previously. The hose clamp should identically overlay this position. The existing hose might also have a marking on the hose indicating the correct position of the hose clamp, which should re-confirm the correct hose clamp position. The hose clamp should not contact any adjacent components after installation.

If The Spring Type Hose Clamp Is Being Replaced

If the hose clamp needs to be replaced, always replace the hose as part of the service repair. It is extremely important that a new spring type hose clamp is orientated to the hose in the exact same position as it was installed during vehicle assembly so that the hose clamp is not damaged or the hose clamp does not contact or damage any adjacent components. Do not use any type of adhesive on the hose clamp prior to installation.

When Replacing The Spring Type Hose Clamp and Replacing The Hose

- The inside and outside hose diameter must be identical between the new hose and the existing hose to guarantee proper hose clamp tension and joint integrity.
- Always place the new spring type hose clamp in the same orientation as it was positioned prior to separating the joint. The new hose might have a marking on the hose indicating the correct position of a hose clamp, which should re-confirm the correct hose clamp position. The hose clamp should not contact any adjacent components after installation.

When Replacing The Spring Type Hose Clamp with an Existing Hose

Always place the new spring type hose clamp in the same orientation as it was positioned prior to separating the joint. The existing hose might have an indentation or compression mark on the hose from where a hose clamp was installed previously. The hose clamp should identically overlay this position. The existing hose might also have a marking on the hose indicating the correct position of the hose clamp, which should re-confirm the correct hose clamp position. The hose clamp should not contact any adjacent components after installation.

DRIVE MOTOR BATTERY COOLING SYSTEM DRAINING AND FILLING

Special Tools

- **GE-26568** Coolant and Battery Tester
- **GE-46143-2** Cooling System Adapter
- **GE-47716** Vac-N-Fill Coolant Refill Tool
- **EL-52016-1A** Battery Pack Coolant Passage Test Adapter

- EL-52016 - 2A Coolant Pressure Tester Adapter Plug

Equivalent regional tools: [Special Tools](#)

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

WARNING: Do not use a service jack in locations other than those specified to lift this vehicle. Lifting the vehicle with a jack in those other locations could cause the vehicle to slip off the jack and roll; this could cause injury or death.

WARNING: Do NOT attempt to repair a Lithium Ion Hybrid/EV Battery Pack when an internal coolant leak is evident. The Hybrid/EV Battery Pack must always be replaced as an assembly. Failure to replace a coolant contaminated Hybrid/EV Battery Pack may result in fire, which can cause severe injury or death.

WARNING: To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

Draining Procedure

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Remove the radiator surge tank cap.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)

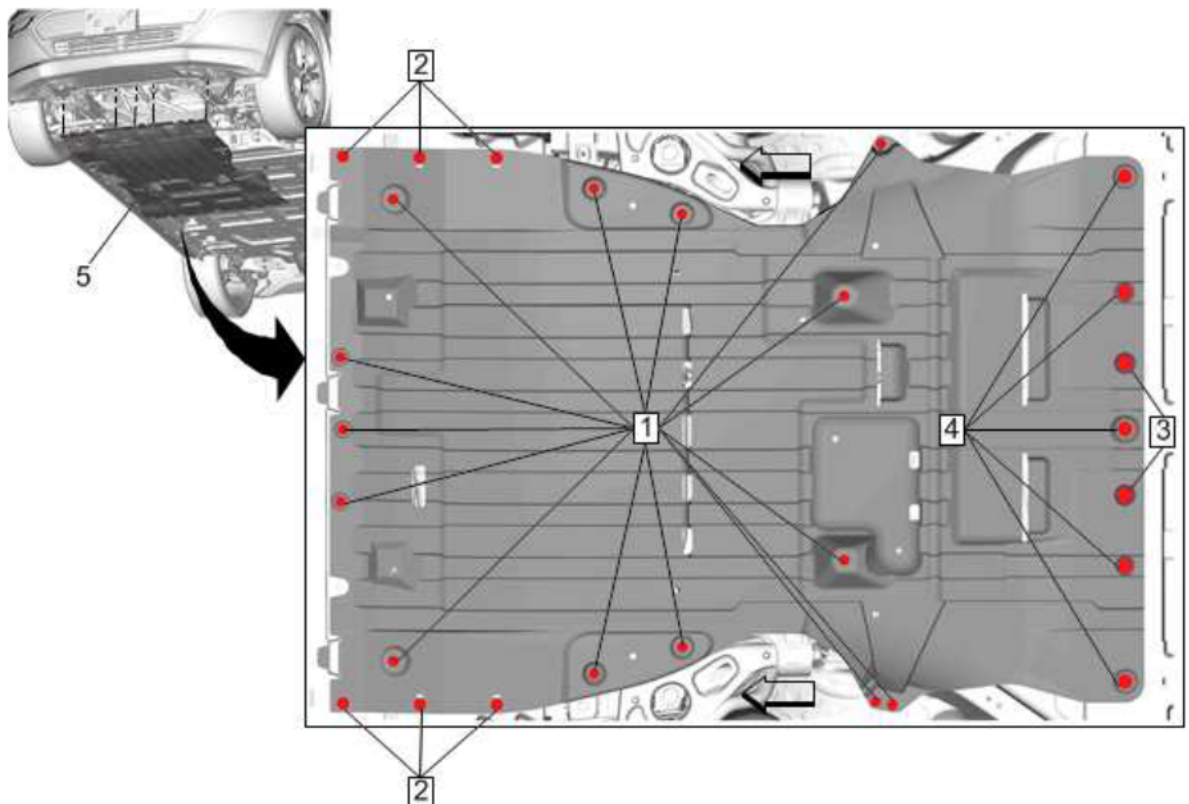


Fig. 9: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

4. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
5. Place a drain pan under the vehicle.

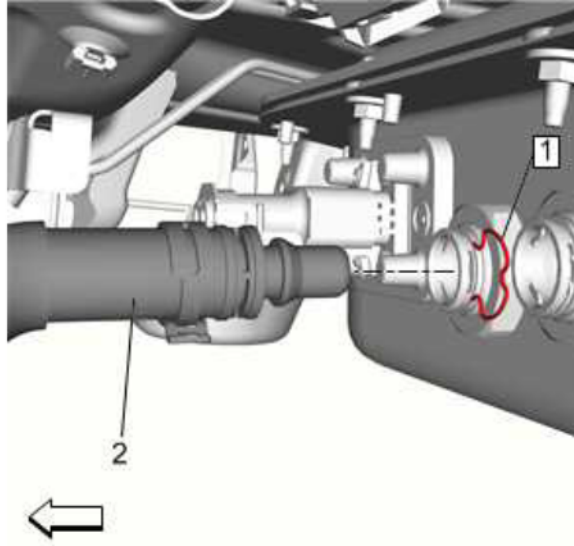


Fig. 10: Battery Vent Hose And Clip

Courtesy of GENERAL MOTORS COMPANY

6. Remove Clip (1)
7. Remove Battery Vent Hose (2)

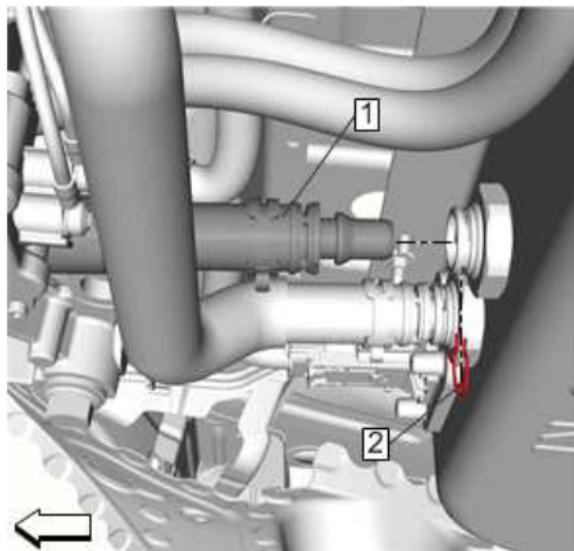


Fig. 11: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (1st Design Battery Pack)

Courtesy of GENERAL MOTORS COMPANY

8. If equipped with the 1st design of battery pack having female inlet and female outlet port, remove the clip (2) and the drive motor battery coolant cooler outlet hose (1) from the RESS.

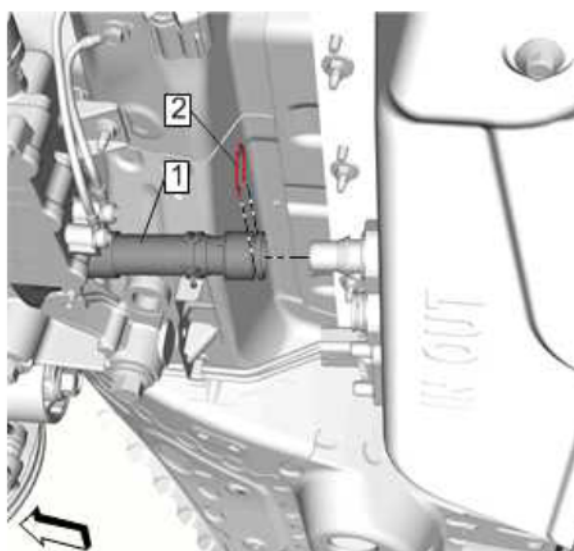


Fig. 12: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (2nd Design Battery Pack)

Courtesy of GENERAL MOTORS COMPANY

9. If equipped with the 2nd design of battery pack having female inlet and male outlet port, remove the clip (2) and the drive motor battery coolant cooler outlet hose (1) from the RESS.
10. Remove the coolant from the drive motor battery cells.
11. Inspect the coolant.

Drive Motor Battery Cell Coolant Removal

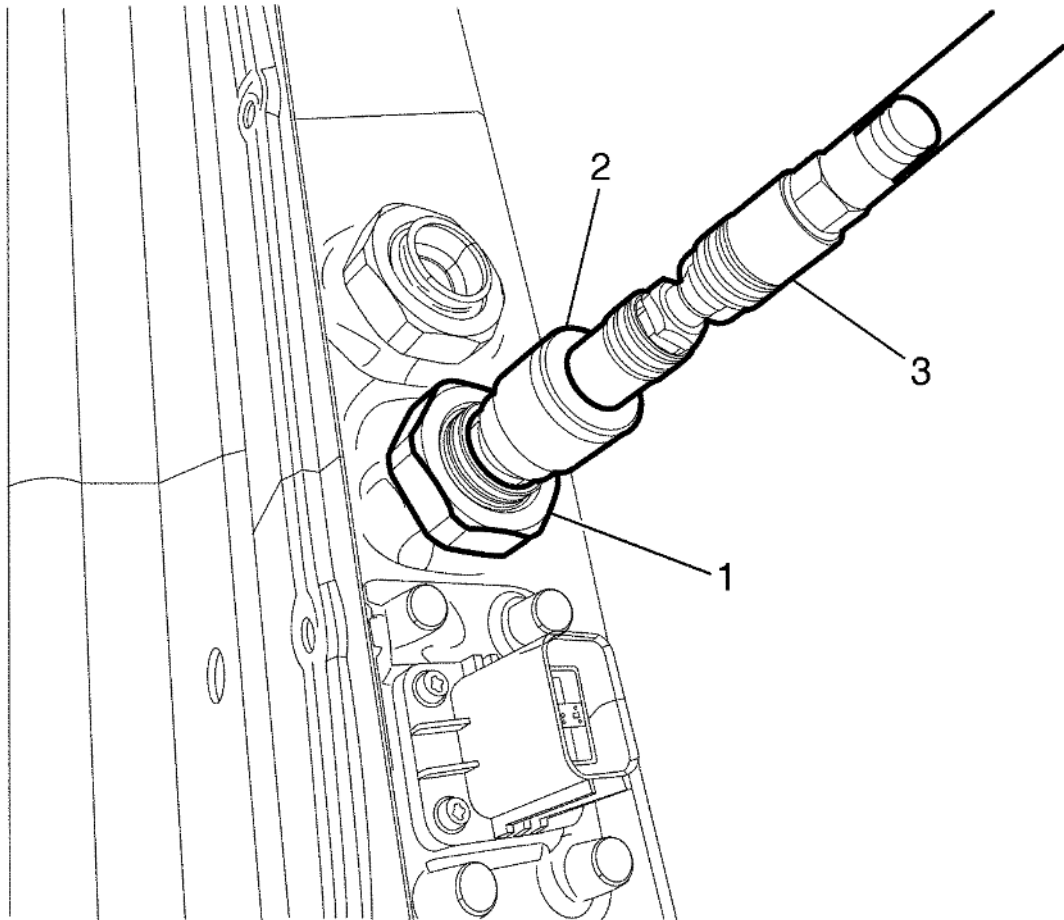


Fig. 13: Battery Pack Coolant Passage Test Adapter, Vac-N-Fill Vacuum Hose And Drive Motor Battery Coolant Inlet

Courtesy of GENERAL MOTORS COMPANY

1. Attach the **EL-52016-1A** Battery Pack Coolant Passage Test Adapter (2) to the drive motor battery coolant Inlet (1).
2. Attach the Vac-N-Fill Vacuum Hose (3) **GE-47716** Vac-N-Fill Coolant Refill Tool to the **EL-52016-1A** Battery Pack Coolant Passage Test Adapter (2).

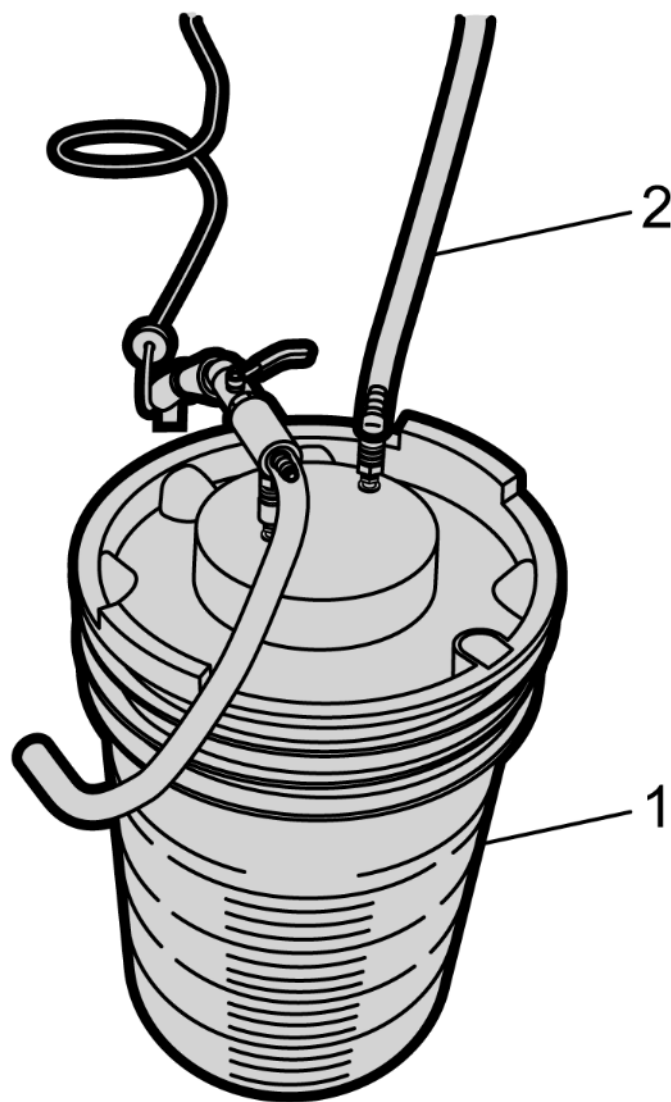


Fig. 14: Vac-N-Fill Vacuum Hose And Tank
Courtesy of GENERAL MOTORS COMPANY

3. Attach the Vac-N-Fill Vacuum Hose (2) to the Vac-N-Fill Vacuum Tank (1) **GE-47716** Vac-N-Fill Coolant Refill Tool.

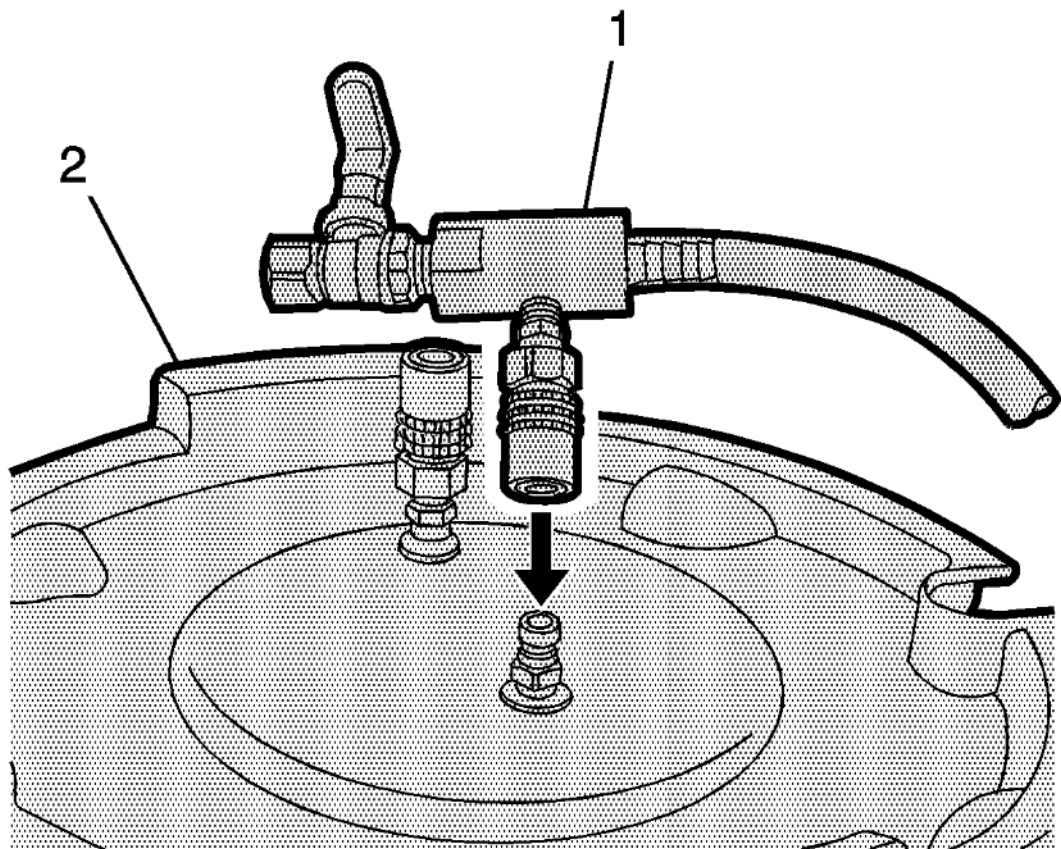


Fig. 15: Vacuum Tank & Venturi Assembly
Courtesy of GENERAL MOTORS COMPANY

4. Attach the venturi assembly (1) to the vacuum tank (2).

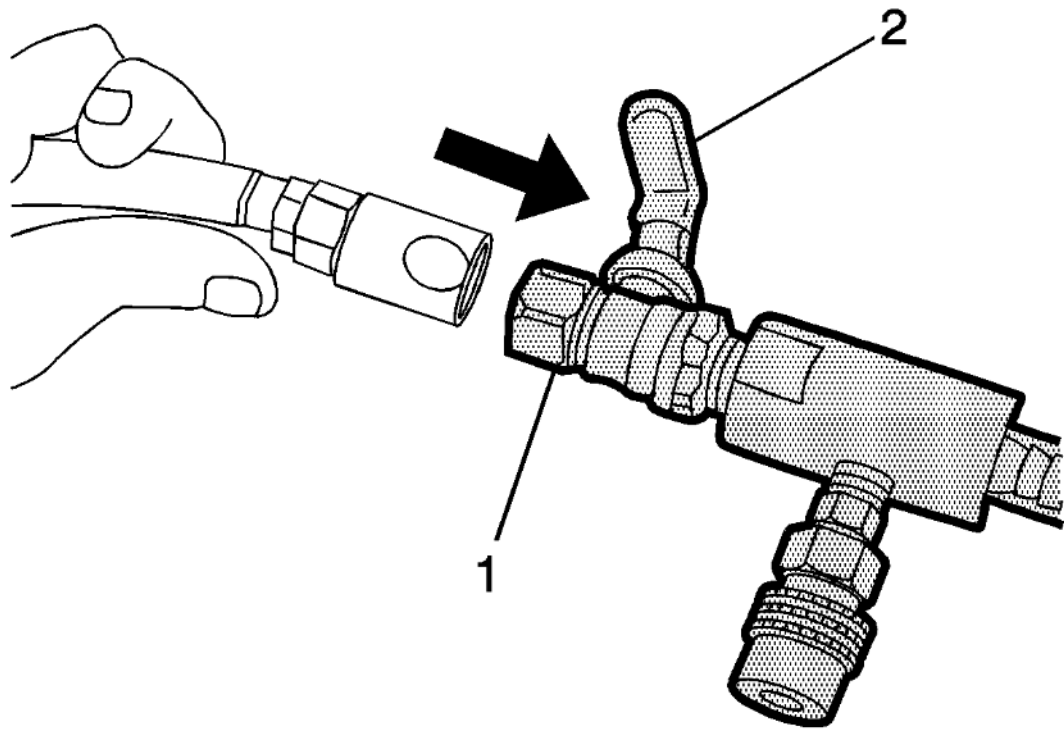


Fig. 16: Venturi Assembly & Valve
Courtesy of GENERAL MOTORS COMPANY

5. Attach a shop air hose to the venturi assembly (1).
6. Ensure the valve (2) on the venturi assembly is closed.
7. Ensure the drain valve located on the bottom of the vacuum tank is closed.

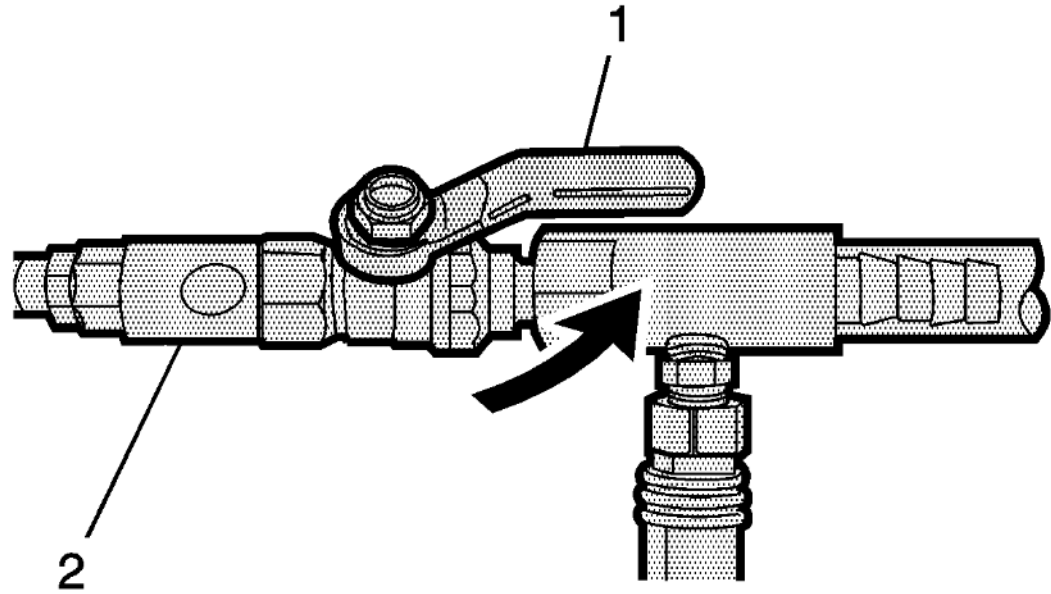


Fig. 17: Valve & Venturi Assembly

Courtesy of GENERAL MOTORS COMPANY

8. Open the valve (1) on the venturi assembly (2). The vacuum gauge will begin to rise and a hissing noise will be present.

Coolant will be drawn from the drive motor battery through the vacuum hose and into the vacuum tank.

Continue to draw coolant from the drive motor battery until there is a continuous mist through the vacuum hose.
9. Install the **EL52016-2A** Battery Pack Coolant Passage Test Adapter, shipping cap or equivalent into the drive motor battery coolant outlet fitting and allow vacuum to build in the drive motor battery for 15-20 seconds.
10. With a vacuum drawn on the drive motor battery cooling system, remove the **EL52016-2A** Battery Pack Coolant Passage Test Adapter, shipping cap or equivalent and allow air to enter the pack to extract additional coolant from the drive motor battery.
11. Repeat steps 7 and 8 until coolant stops draining from the drive motor battery.
12. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.

Vac-N-Fill Procedure

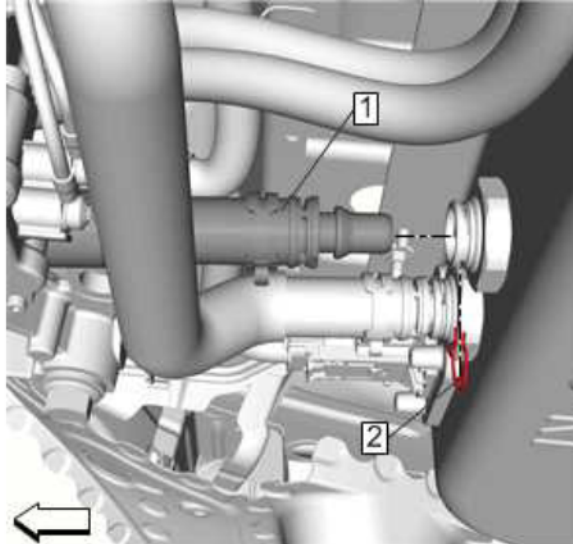


Fig. 18: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (1st Design Battery Pack)
 Courtesy of GENERAL MOTORS COMPANY

NOTE: When installing the inlet or outlet hose, be careful not to confuse the inlet port and outlet port.

1. If equipped with the 1st design of battery pack having female inlet and female outlet port, install the clip (2) and the drive motor battery coolant cooler outlet hose (1) to the RESS.

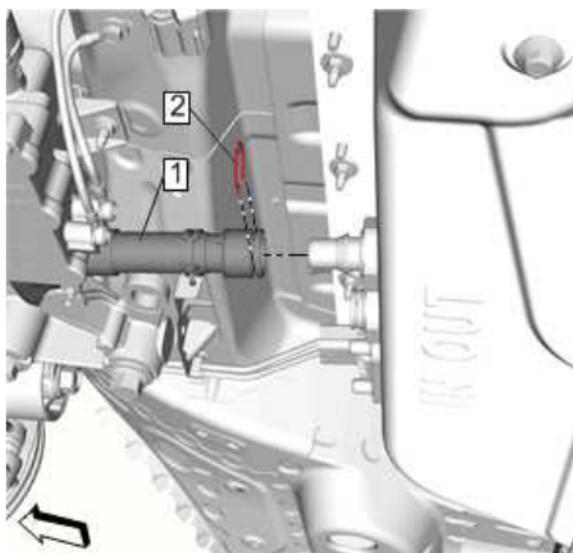


Fig. 19: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (2nd Design Battery Pack)
 Courtesy of GENERAL MOTORS COMPANY

2. If equipped with the 2nd design of battery pack having female inlet and male outlet port, install the clip (2) and the drive motor battery coolant cooler outlet hose (1) to the RESS.

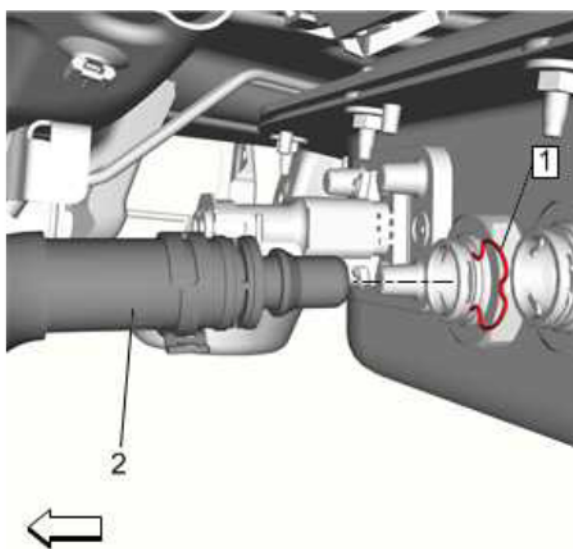


Fig. 20: Battery Vent Hose And Clip
Courtesy of GENERAL MOTORS COMPANY

3. Install Battery Vent Hose (2)
4. Install Clip (1)

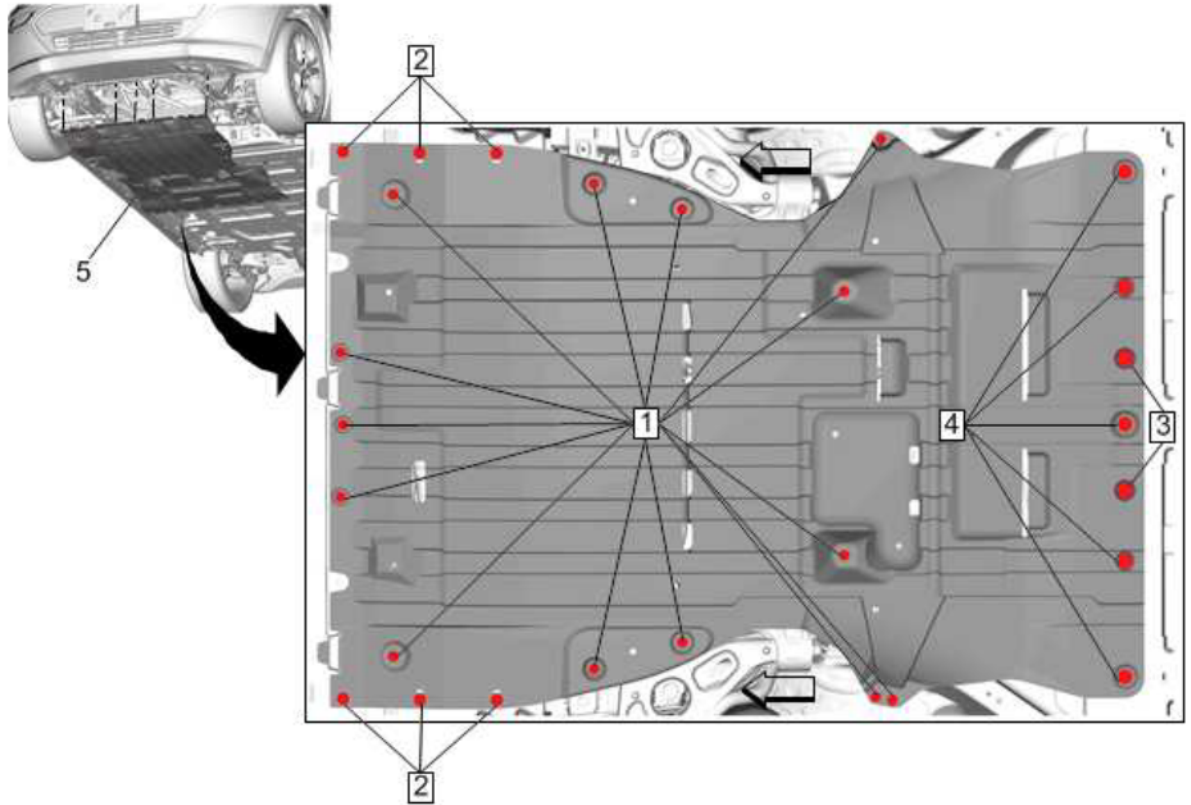


Fig. 21: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

5. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
6. Lower the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
7. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

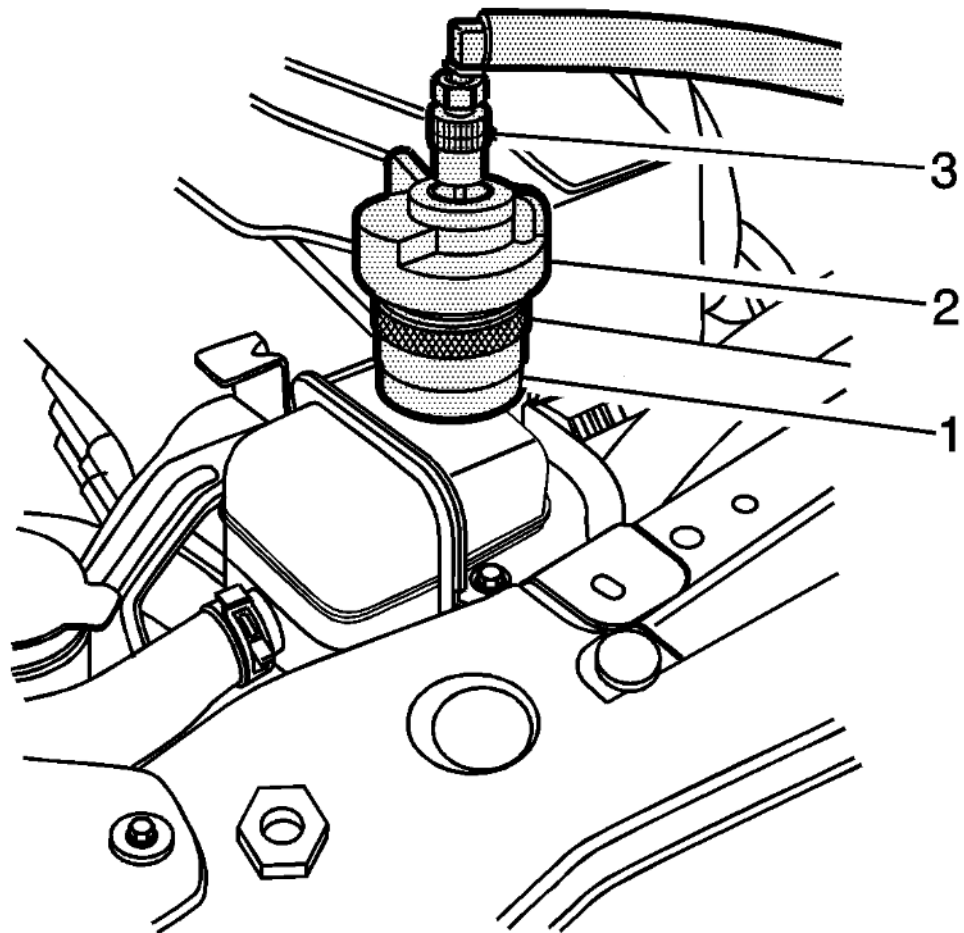


Fig. 22: Adapter, Vacuum Gauge Assembly And Vac-N-Fill Cap

Courtesy of GENERAL MOTORS COMPANY

NOTE: To prevent boiling of the coolant/water mixture in the vehicles cooling system, do not apply vacuum to a cooling system above 49°C (120°F). The tool will not operate properly when the coolant is boiling.

8. Install **GE-46143-2** adapter (1).
9. Attach the Vac-N-Fill cap (2) to **GE-46143-2** adapter (1).
10. Attach the vacuum gauge assembly (3) to the Vac-N-Fill cap (2).

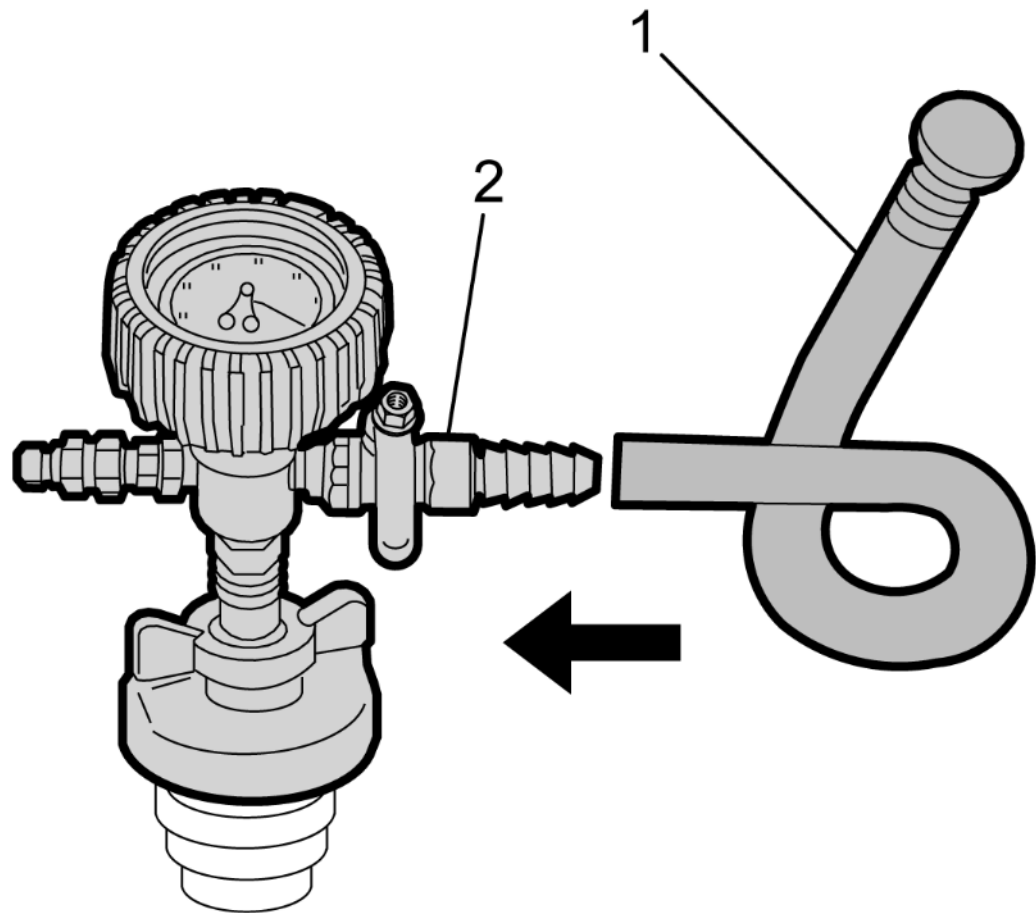


Fig. 23: Vacuum Gauge Assembly & Fill Hose
Courtesy of GENERAL MOTORS COMPANY

11. Attach the fill hose (1) to the barb fitting on the vacuum gauge assembly.

Ensure that the valve is closed.

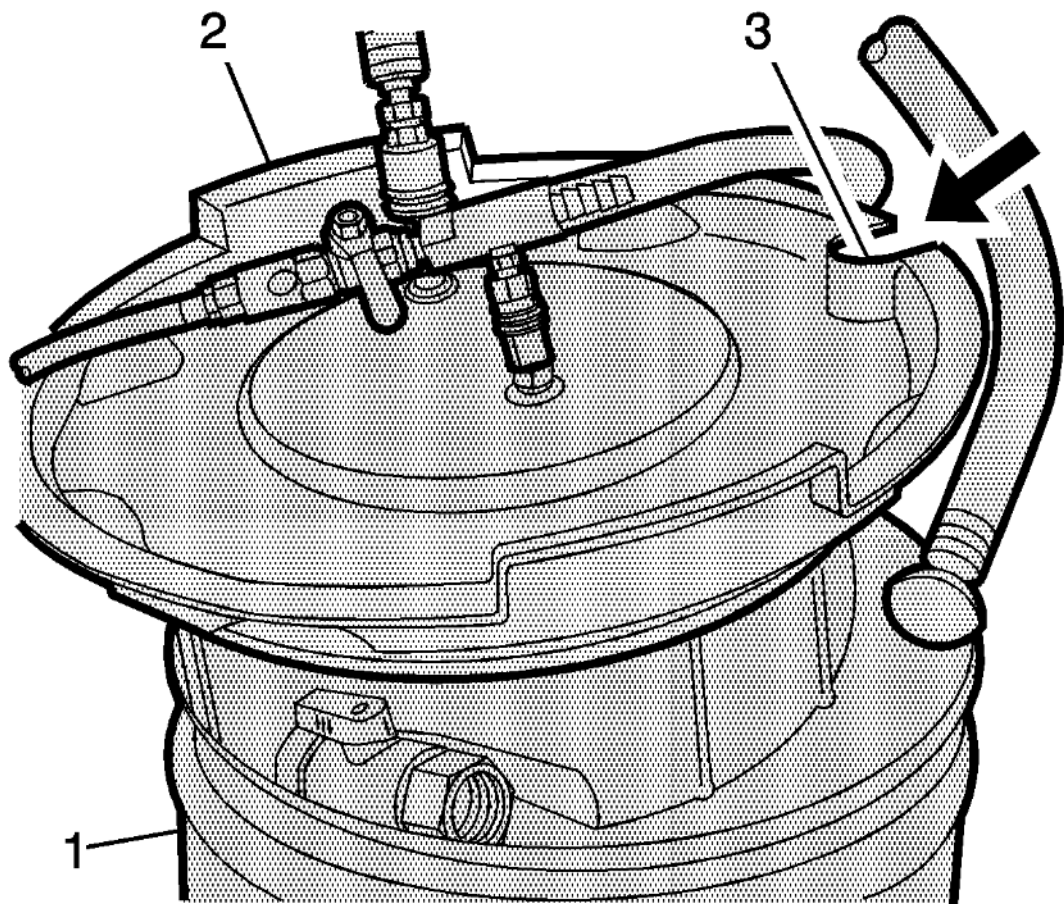


Fig. 24: Graduated Reservoir, Vacuum Tank & Cut-Out Area
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use a Pre-mixed DEXCOOLÂ® (50/50 mixture of DEXCOOLÂ® and deionized water). Always use more coolant than necessary. This will eliminate air from being drawn into the cooling system.

12. Pour the coolant mixture into the graduated reservoir (1).
13. Place the fill hose in the graduated reservoir (1).

NOTE: Prior to installing the vacuum tank onto the graduated reservoir, ensure that the drain valve located on the bottom of the tank is closed.

14. Install the vacuum tank (2) on the graduated reservoir with the fill hose routed through the cut-out area (3) in the vacuum tank.

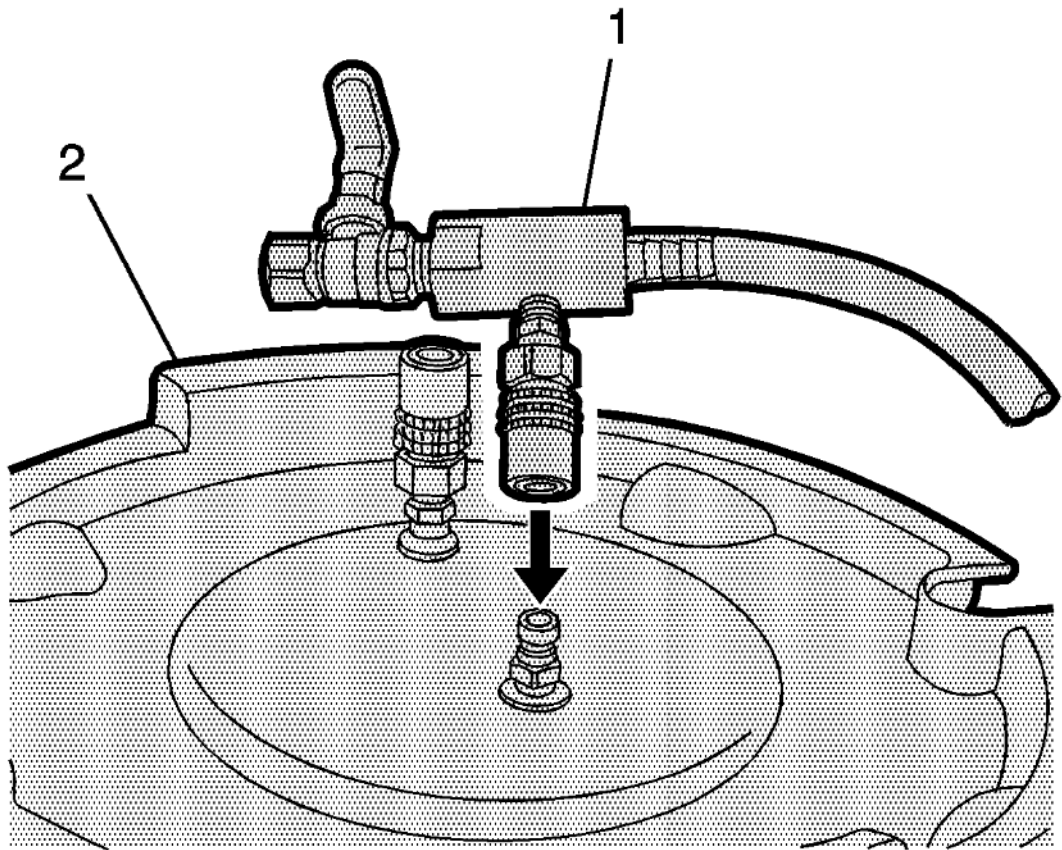


Fig. 25: Vacuum Tank & Venturi Assembly
Courtesy of GENERAL MOTORS COMPANY

15. Attach the venturi assembly (1) to the vacuum tank (2).

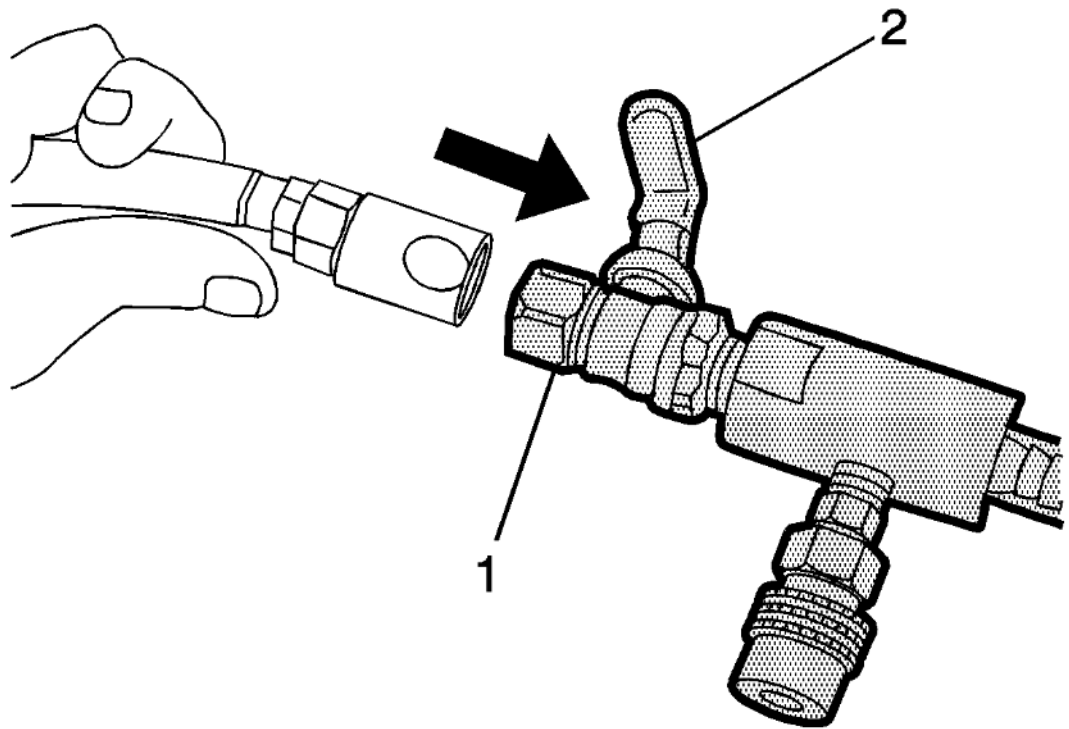


Fig. 26: Venturi Assembly & Valve
Courtesy of GENERAL MOTORS COMPANY

16. Attach a shop air hose to the venturi assembly (1).

Ensure the valve (2) on the venturi assembly is closed.

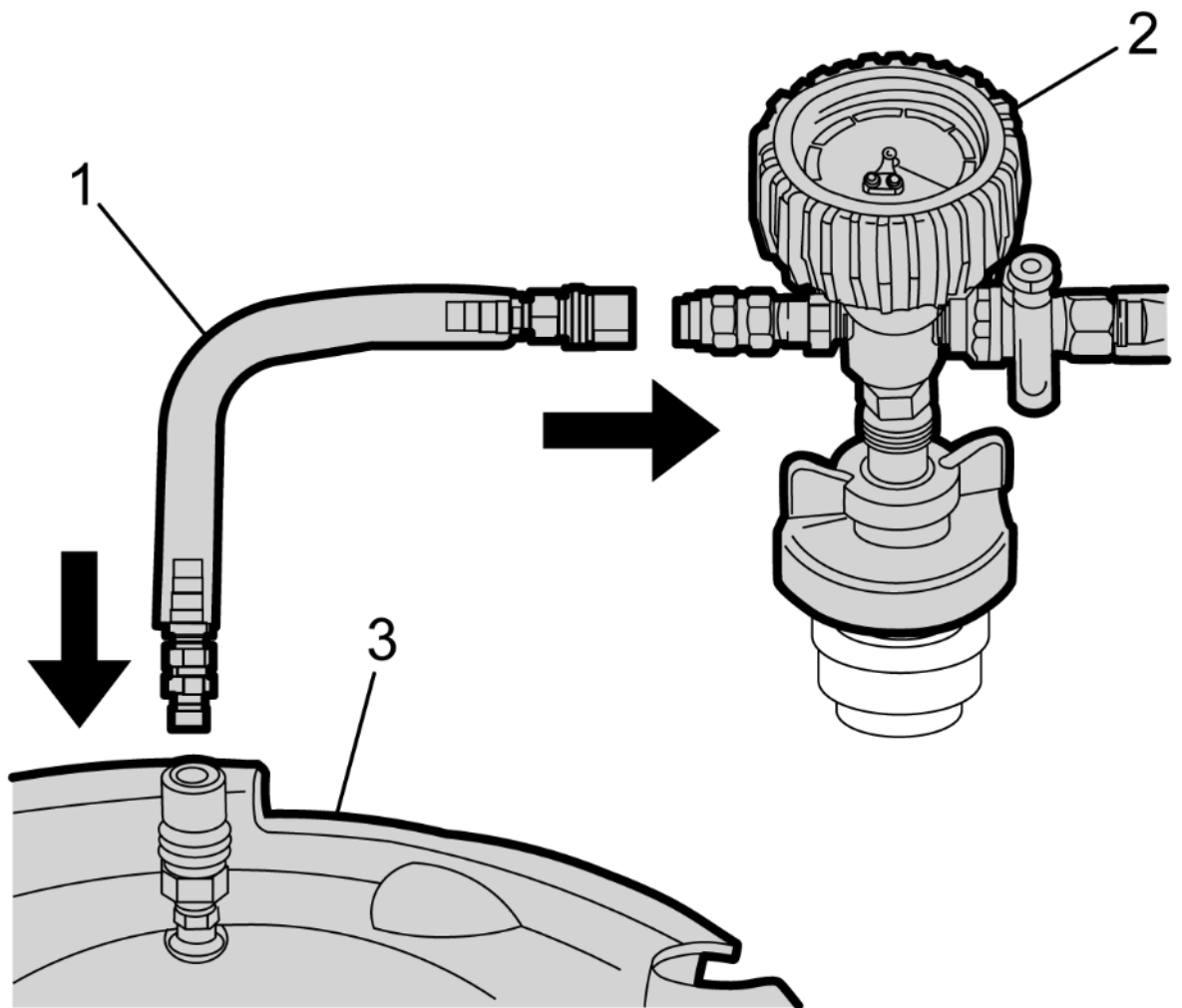


Fig. 27: Vacuum Hose, Gauge Assembly & Tank
Courtesy of GENERAL MOTORS COMPANY

17. Attach the vacuum hose (1) to the vacuum gauge assembly (2) and the vacuum tank (3).

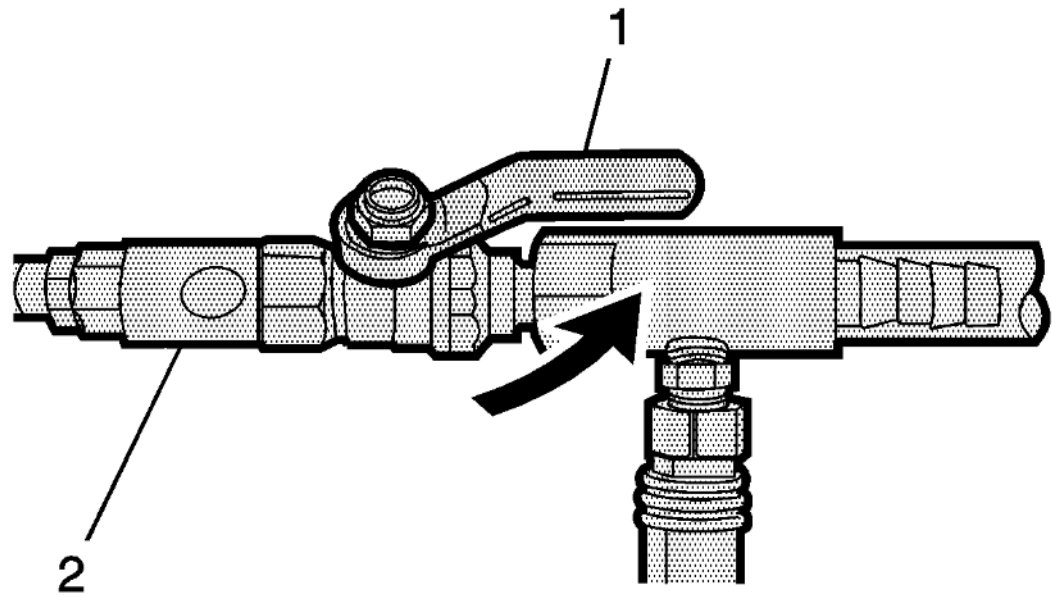


Fig. 28: Valve & Venturi Assembly

Courtesy of GENERAL MOTORS COMPANY

18. Open the valve (1) on the venturi assembly (2). The vacuum gauge will begin to rise and a hissing noise will be present.

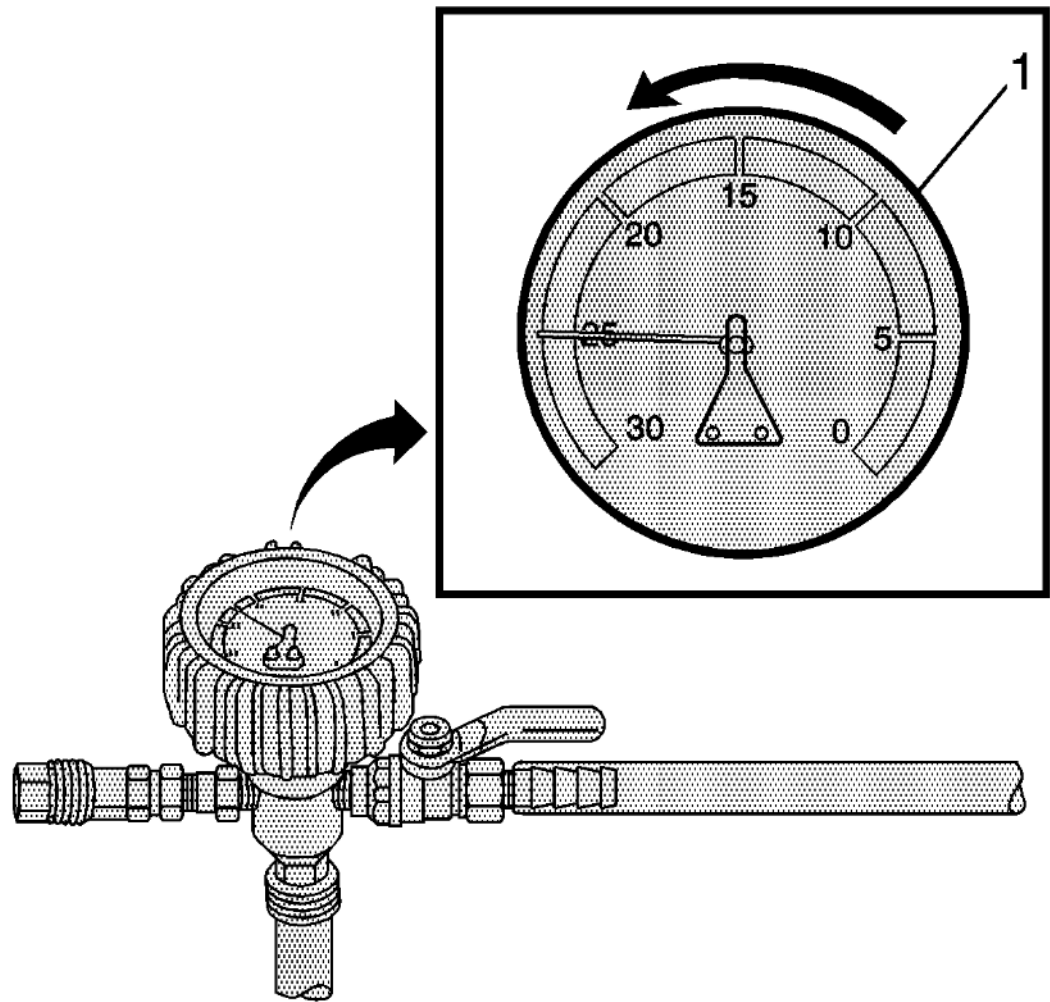


Fig. 29: Vacuum Gauge Needle

Courtesy of GENERAL MOTORS COMPANY

19. Continue to draw vacuum until the needle stops rising (1). This should be 610 - 660 mm Hg (24 - 26 in Hg).
Cooling hoses may start to collapse. This is normal due to vacuum draw.
20. To aid in the fill process, position the graduated reservoir above the coolant fill port.

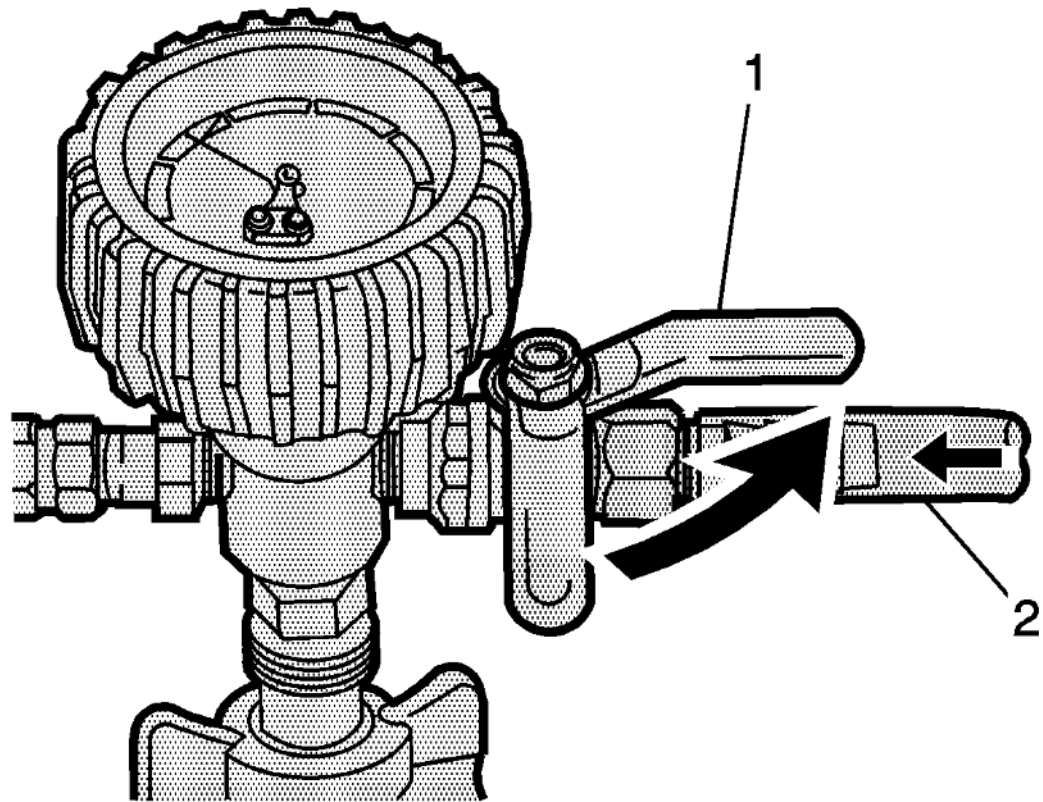


Fig. 30: Vacuum Gauge Assembly & Valve

Courtesy of GENERAL MOTORS COMPANY

21. Slowly open the valve (1) on the vacuum gauge assembly (2). When the coolant reaches the top of the fill hose, close the valve. This will eliminate air from the fill hose.
22. Close the valve on the venturi assembly.
23. If there is a suspected leak in the cooling system, allow the system to stabilize under vacuum and monitor for vacuum loss.

If vacuum loss is observed, refer to [Hybrid Cooling System Loss of Coolant \(Drive Motor Battery Cooling System\)](#)[Hybrid Cooling System Loss of Coolant \(Drive Motor Generator Power Inverter Module Cooling System\)](#).

24. Open the valve on the vacuum gauge assembly. The vacuum gauge will drop as coolant is drawn into the system.

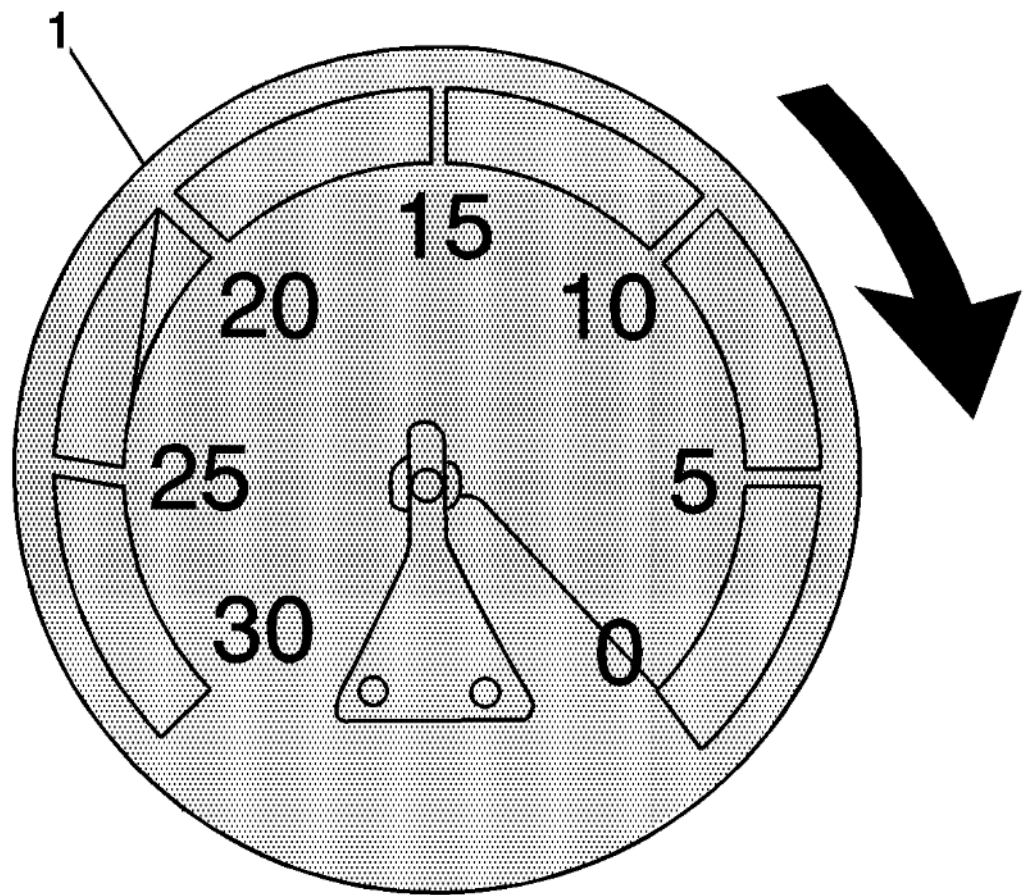


Fig. 31: Vacuum Gauge

Courtesy of GENERAL MOTORS COMPANY

25. Once the vacuum gauge (1) reaches zero, close the valve on the vacuum gauge assembly and repeat steps 15 - 21.
26. Ensure that the vehicle is in service mode. Refer to [**Power Mode Description and Operation**](#)
27. With the GDS scan tool, activate the hybrid/EV battery pack coolant pump for 5 minutes while maintaining 381 mm (15 in Hg) vacuum throughout the process.
28. Detach the Vac-N-Fill cap from the **GE-46143-2** adapter.
29. Remove **GE-46143-2** adapter from the surge tank fill neck.

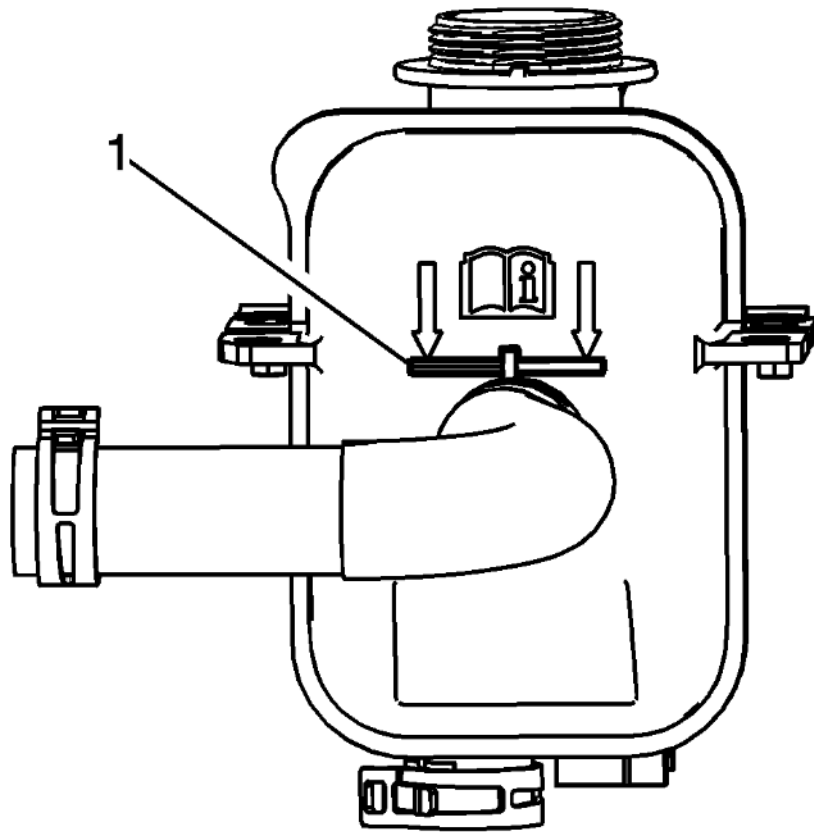


Fig. 32: Adjusting Surge Tank Coolant Level To Position Just Above Seam
Courtesy of GENERAL MOTORS COMPANY

30. Upon completion of the hybrid/EV battery pack coolant pump bleed procedure, adjust the surge tank coolant level to a position just above the seam (1).
31. Inspect the concentration of the coolant mixture using **GE-26568** tester.

REMOVING EXCESS COOLANT FROM SYSTEM

NOTE: After filling the cooling system, the extraction hose can be used to remove excess coolant to achieve the proper coolant level.

1. Detach the vacuum hose from the vacuum gauge assembly.

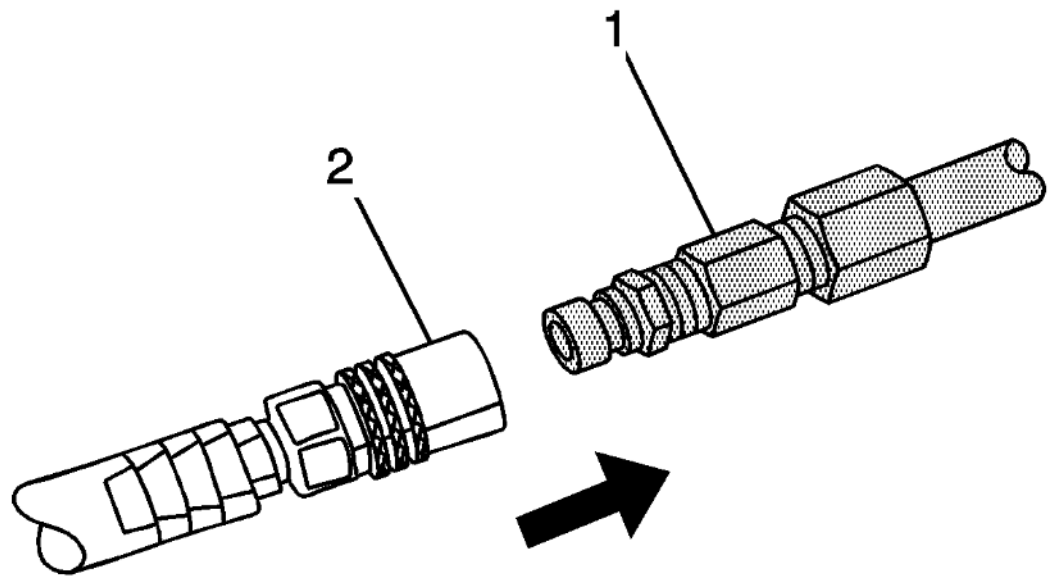


Fig. 33: Vacuum Hose & Extraction Hose
Courtesy of GENERAL MOTORS COMPANY

2. Attach the extraction hose (1) to the vacuum hose (2).

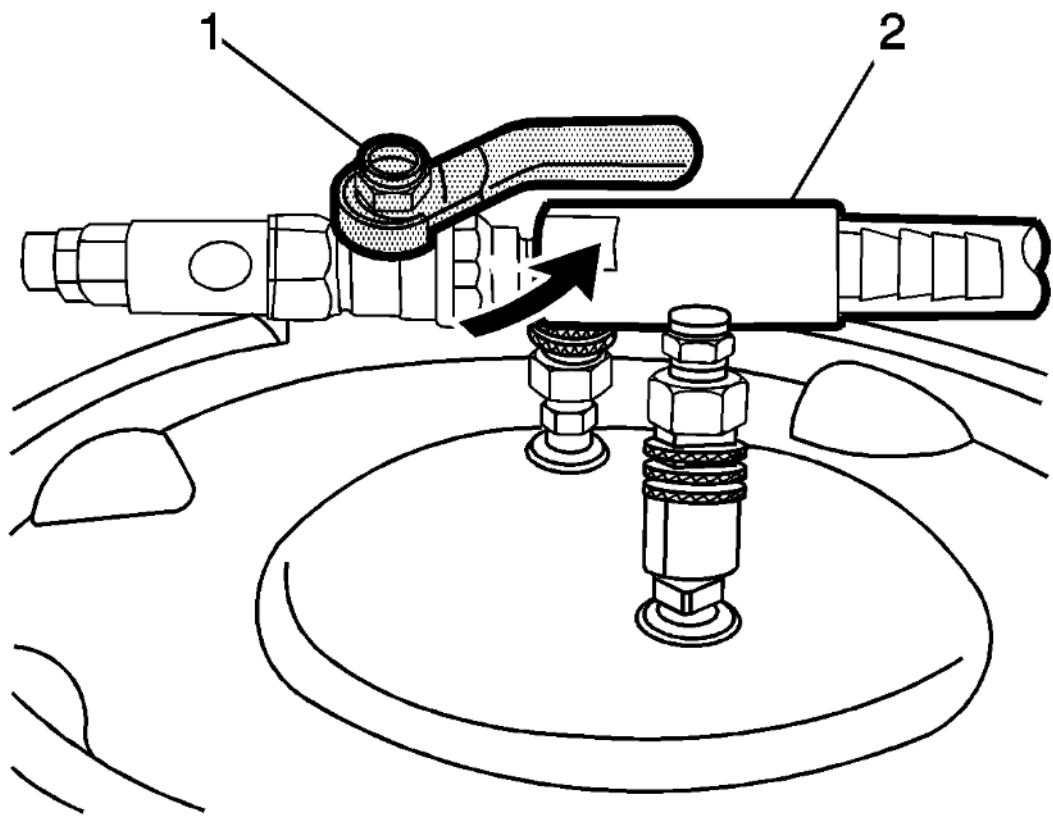


Fig. 34: Venturi Assembly & Valve

Courtesy of GENERAL MOTORS COMPANY

3. Open the valve (1) on the venturi assembly (2) to start a vacuum draw.

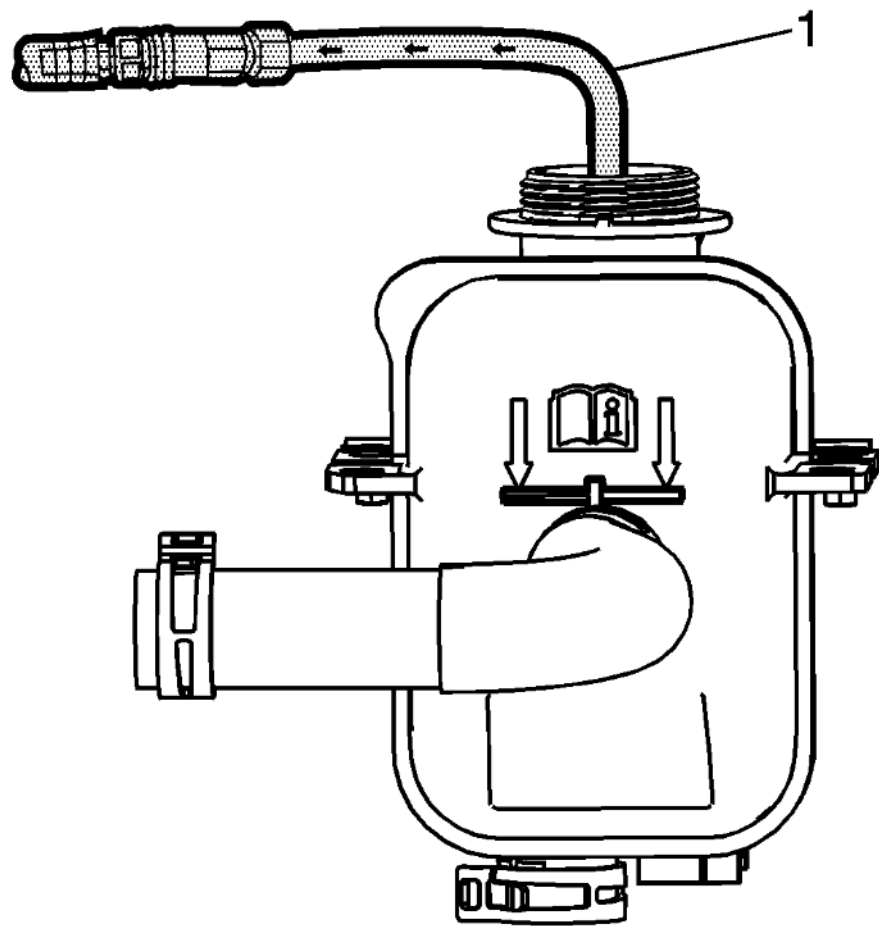


Fig. 35: Extraction Hose

Courtesy of GENERAL MOTORS COMPANY

4. Assemble the extraction hose (1) and insert into the surge tank.

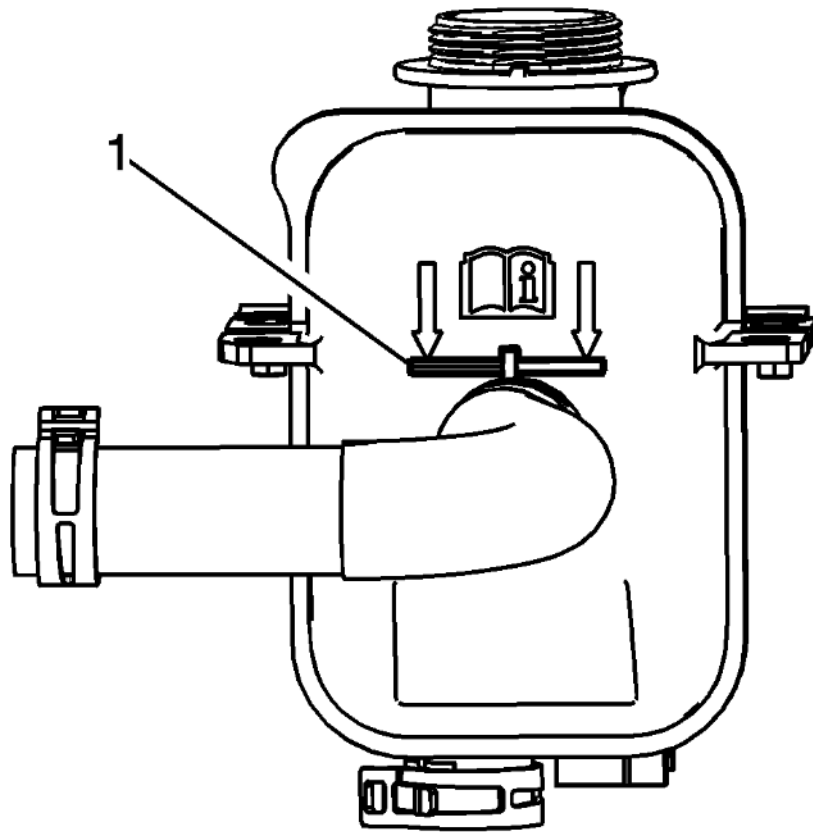


Fig. 36: Adjusting Surge Tank Coolant Level To Position Just Above Seam
 Courtesy of GENERAL MOTORS COMPANY

5. Adjust the surge tank coolant level to a position just above the seam (1).
6. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.

DRIVE MOTOR GENERATOR POWER INVERTER MODULE COOLING SYSTEM DRAINING AND FILLING

Special Tools

- GE-26568 Coolant and Battery Tester
- GE-46143 - 2 Cooling System Adapter
- GE-47716 Vac-N-Fill Coolant Refill Tool

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

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

WARNING: Do not use a service jack in locations other than those specified to lift this vehicle. Lifting the vehicle with a jack in those other locations could cause the vehicle to slip off the jack and roll; this could cause injury or death.

WARNING: To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

Draining Procedure

1. Turn Vehicle Power Off and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Remove the radiator surge tank cap.
3. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
4. Place a drain pan under the vehicle.
5. Remove Front Compartment Air Deflector. Refer to [Front Compartment Air Deflector Replacement](#)

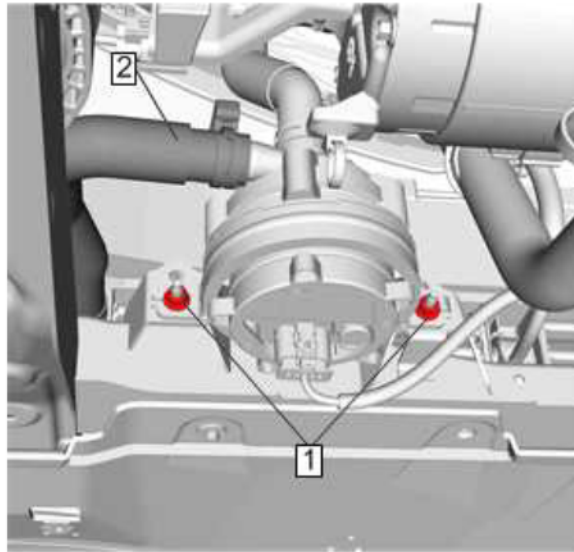


Fig. 37: Drive Motor Battery Coolant Pump Bracket Nuts And Drive Motor Generator Control Module Radiator Inlet Hose

Courtesy of GENERAL MOTORS COMPANY

6. Remove Drive Motor Battery Coolant Pump Bracket Nuts (1) (Qty: 2)
7. Lower the drive motor battery coolant pump to secure the space to drain the coolant.
8. To drain the coolant, remove the drive motor generator control module radiator inlet hose (2) from the drive motor generator control module coolant pump. Refer to [Drive Motor Generator Control Module Radiator Inlet Hose Replacement \(Pump To Radiator\)](#)

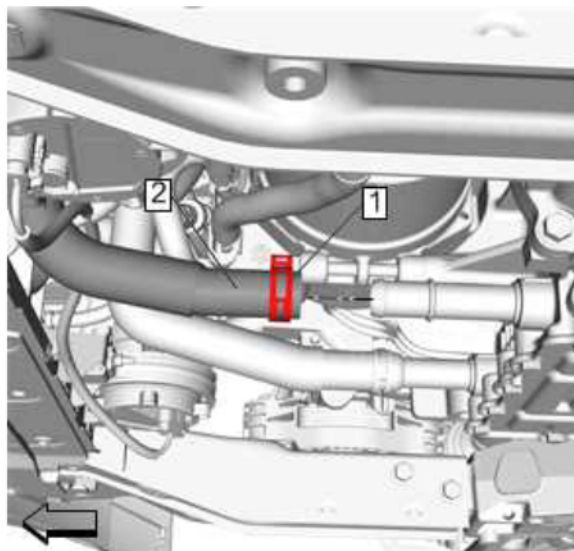


Fig. 38: Generator Control Module Coolant Tank Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

9. To drain the coolant, remove the generator control module coolant tank hose (2) from the drive motor. Refer to [Generator Control Module Coolant Tank Hose Replacement \(DU To Surge Tank\)](#)
10. Inspect the coolant.

Vac-N-Fill Procedure

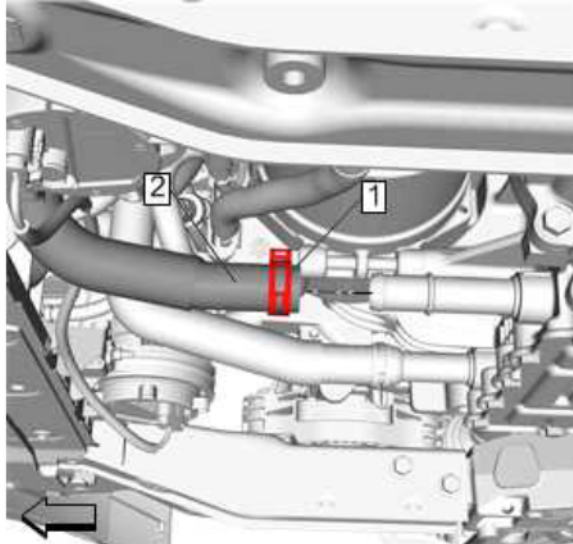


Fig. 39: Generator Control Module Coolant Tank Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

1. Install the generator control module coolant tank hose (2) to the drive motor. Refer to [Generator Control Module Coolant Tank Hose Replacement \(DU To Surge Tank\)](#).

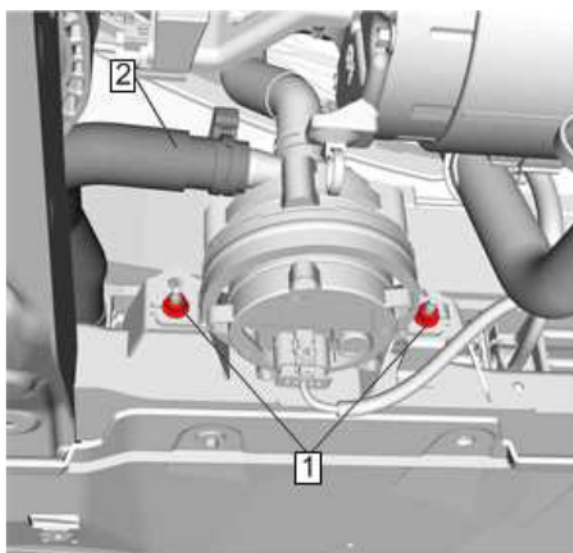


Fig. 40: Drive Motor Battery Coolant Pump Bracket Nuts And Drive Motor Generator Control Module Radiator Inlet Hose

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#)

2. Install and tighten Drive Motor Battery Coolant Pump Bracket Nuts (1) (Qty: 2) to 9 N.m (80 lb in)
3. Install the drive motor generator control module radiator inlet hose (2) to the drive motor generator control module coolant pump. Refer to [Drive Motor Generator Control Module Radiator Inlet Hose Replacement \(Pump To Radiator\)](#)
4. Install Front Compartment Air Deflector. Refer to [Front Compartment Air Deflector Replacement](#)
5. Turn Vehicle Power Off and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

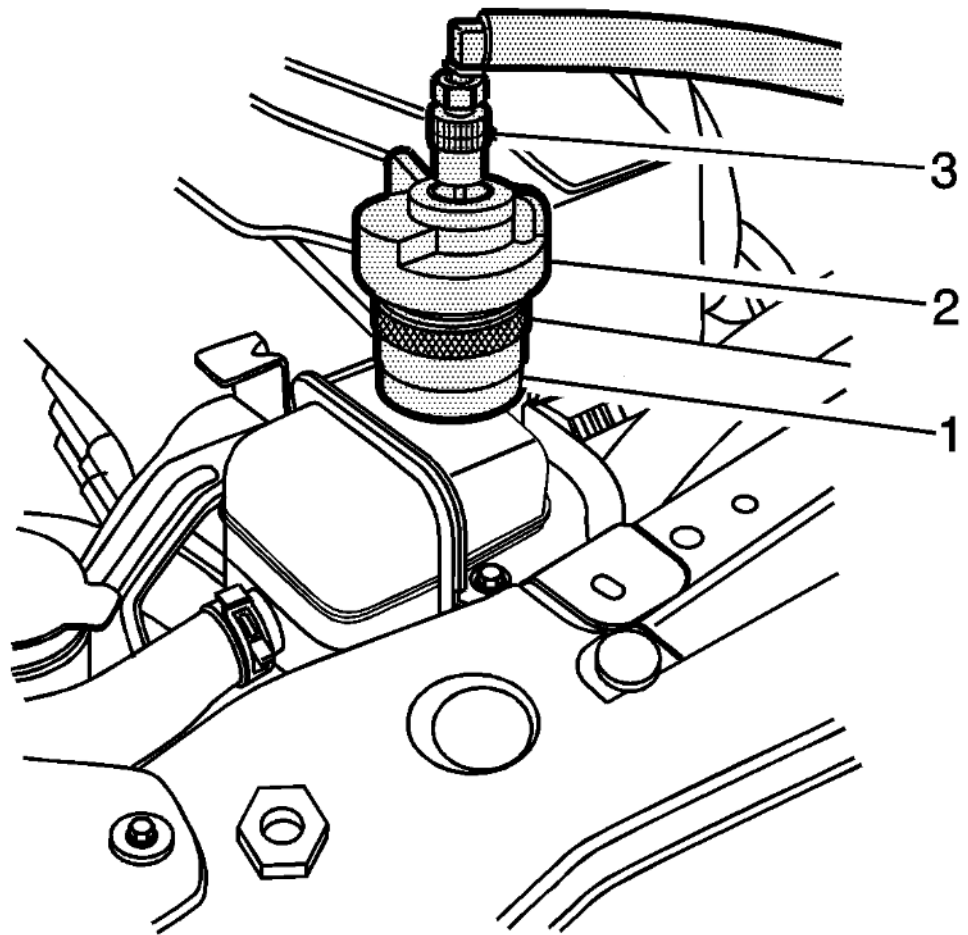


Fig. 41: Adapter, Vacuum Gauge Assembly And Vac-N-Fill Cap
Courtesy of GENERAL MOTORS COMPANY

NOTE: To prevent boiling of the coolant/water mixture in the vehicles cooling system, do not apply vacuum to a cooling system above 49°C (120°F). The tool will not operate properly when the coolant is boiling.

6. Install **GE-46143-2** adapter (1).
7. Attach the Van-N-Fill cap (2) to **GE-46143-2** adapter (1).
8. Attach the vacuum gauge assembly (3) to the Vac-N-Fill cap (2).

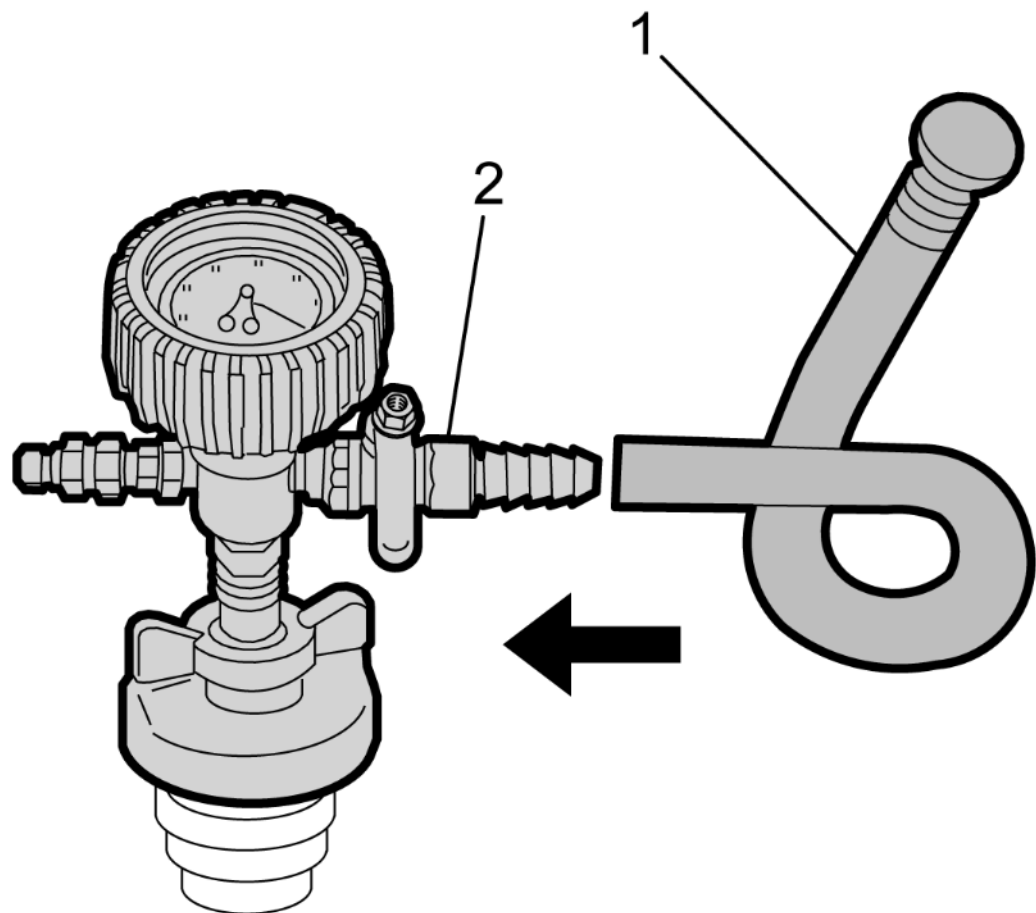


Fig. 42: Vacuum Gauge Assembly & Fill Hose
Courtesy of GENERAL MOTORS COMPANY

9. Attach the fill hose (1) to the barb fitting on the vacuum gauge assembly.

Ensure that the valve is closed.

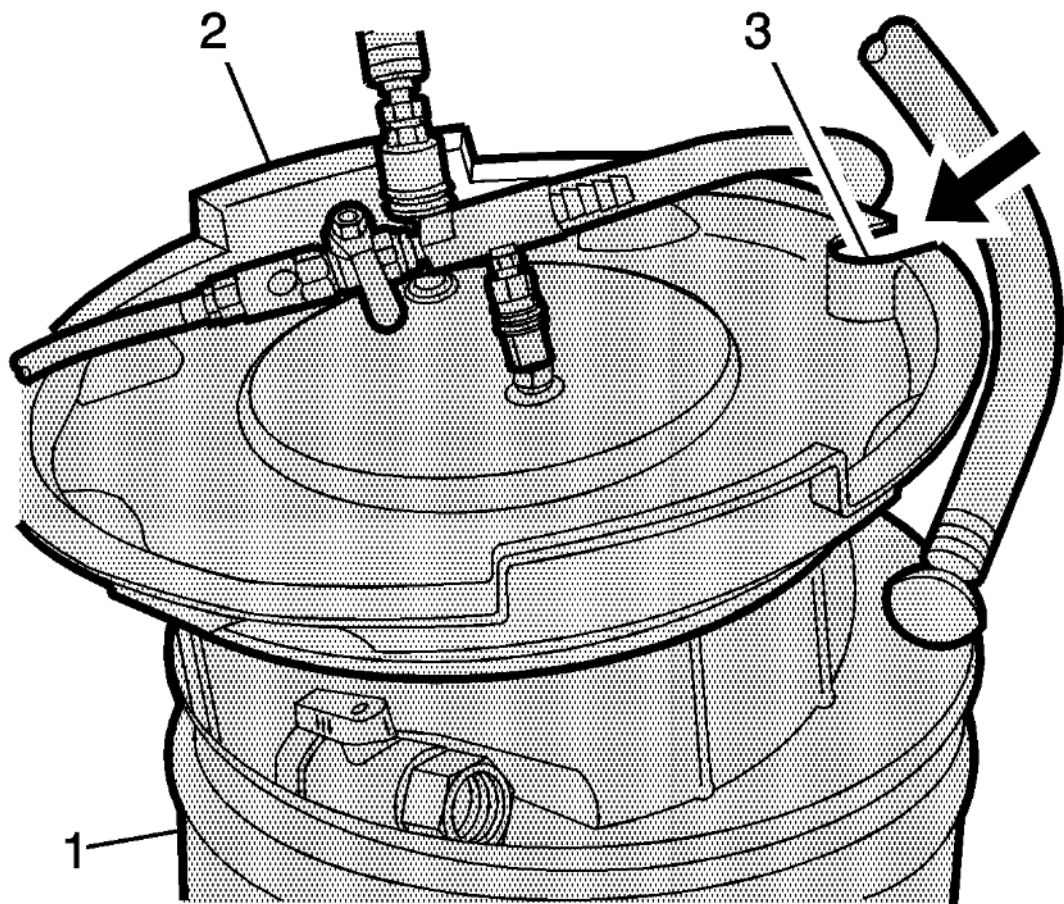


Fig. 43: Graduated Reservoir, Vacuum Tank & Cut-Out Area

Courtesy of GENERAL MOTORS COMPANY

NOTE: Use a Pre-mixed DEXCOOLÂ® (50/50 mixture of DEXCOOLÂ® and deionized water). Always use more coolant than necessary. This will eliminate air from being drawn into the cooling system.

10. Pour the coolant mixture into the graduated reservoir (1).
11. Place the fill hose in the graduated reservoir (1).

NOTE: Prior to installing the vacuum tank onto the graduated reservoir, ensure that the drain valve located on the bottom of the tank is closed.

12. Install the vacuum tank (2) on the graduated reservoir with the fill hose routed through the cut-out area (3) in the vacuum tank.

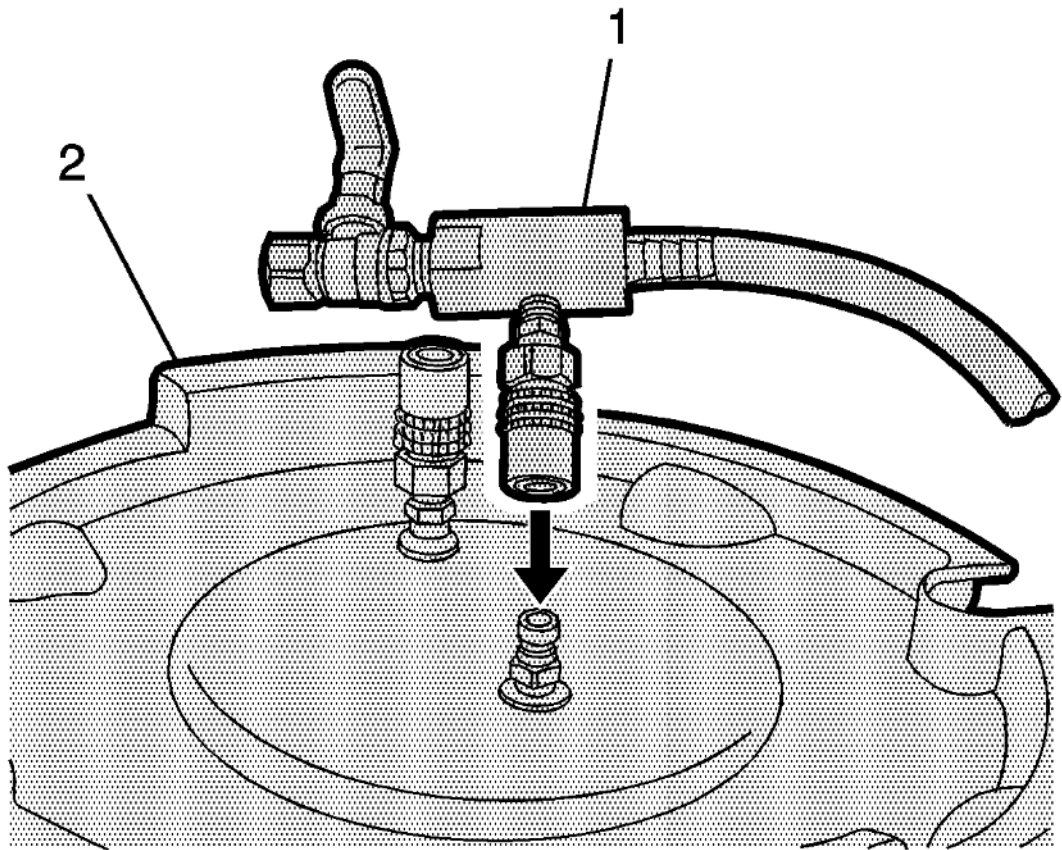


Fig. 44: Vacuum Tank & Venturi Assembly
Courtesy of GENERAL MOTORS COMPANY

13. Attach the venturi assembly (1) to the vacuum tank (2).

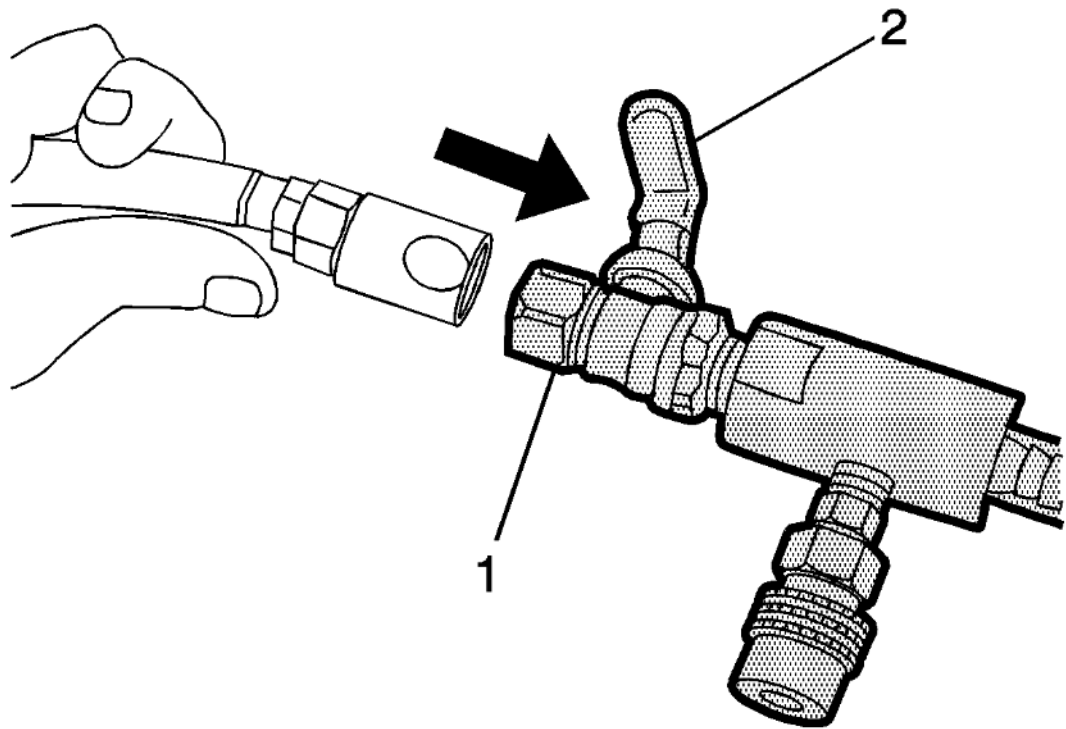


Fig. 45: Venturi Assembly & Valve
Courtesy of GENERAL MOTORS COMPANY

14. Attach a shop air hose to the venturi assembly (1).

Ensure the valve (2) on the venturi assembly is closed.

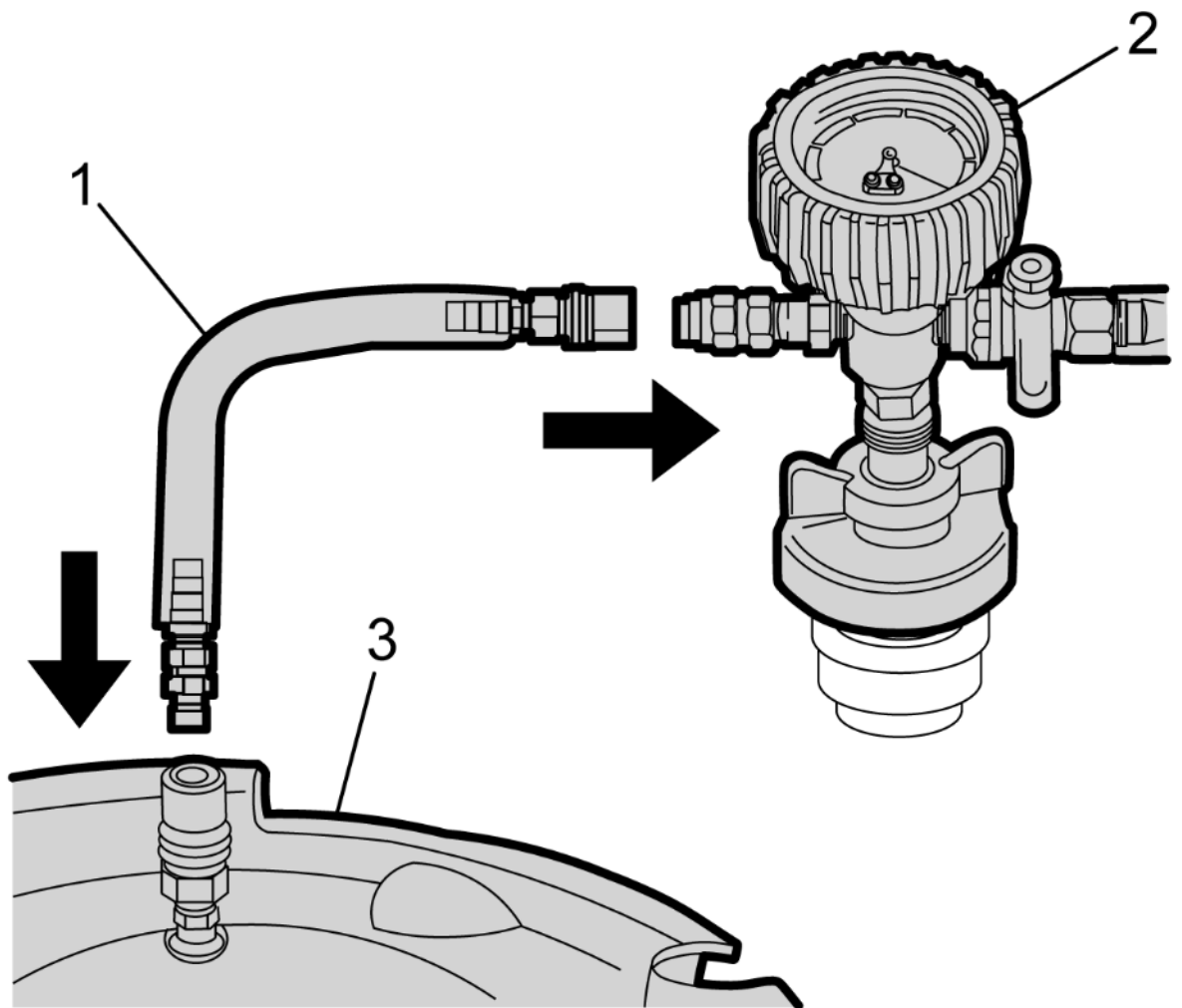


Fig. 46: Vacuum Hose, Gauge Assembly & Tank
Courtesy of GENERAL MOTORS COMPANY

15. Attach the vacuum hose (1) to the vacuum gauge assembly (2) and the vacuum tank (3).

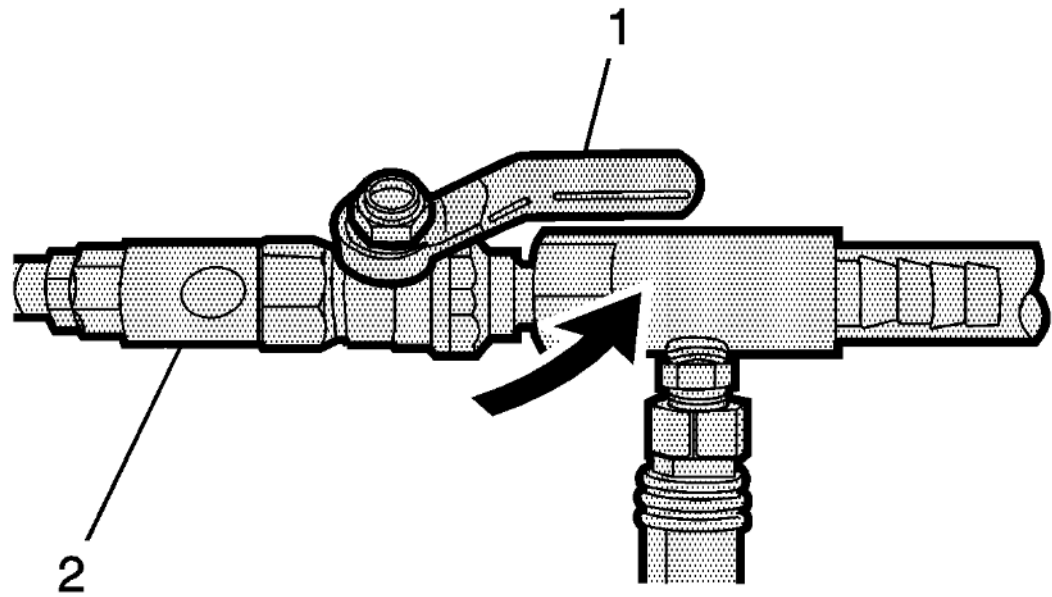


Fig. 47: Valve & Venturi Assembly

Courtesy of GENERAL MOTORS COMPANY

16. Open the valve (1) on the venturi assembly (2). The vacuum gauge will begin to rise and a hissing noise will be present.

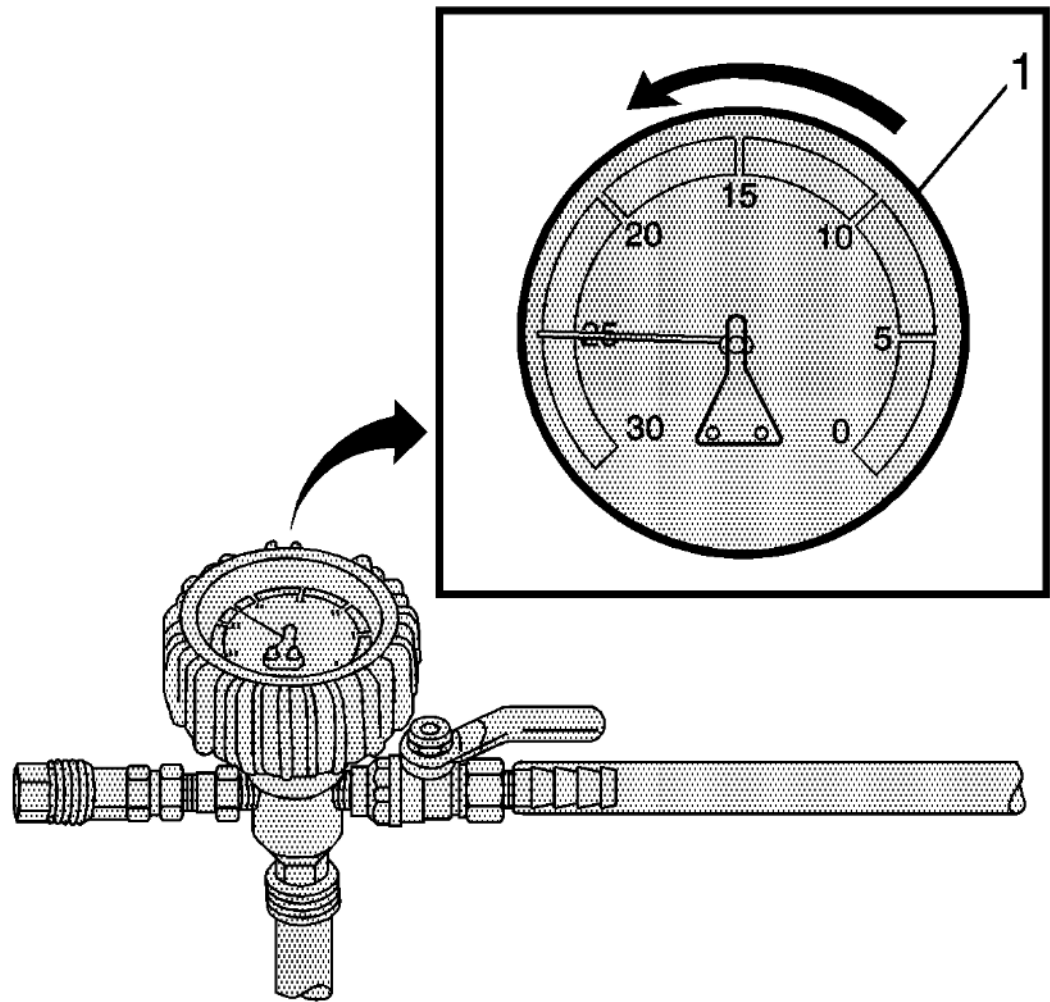


Fig. 48: Vacuum Gauge Needle

Courtesy of GENERAL MOTORS COMPANY

17. Continue to draw vacuum until the needle stops rising (1). This should be 610 - 660 mm Hg (24 - 26 in Hg).
Cooling hoses may start to collapse. This is normal due to vacuum draw.
18. To aid in the fill process, position the graduated reservoir above the coolant fill port.

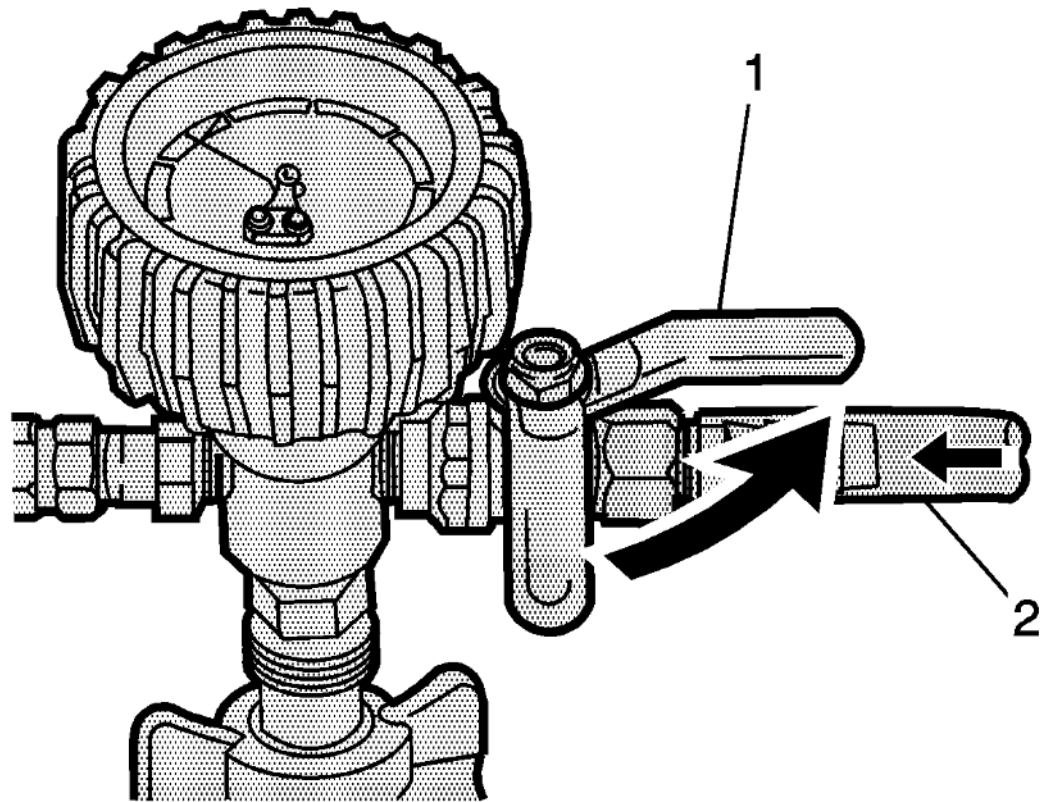


Fig. 49: Vacuum Gauge Assembly & Valve

Courtesy of GENERAL MOTORS COMPANY

19. Slowly open the valve (1) on the vacuum gauge assembly (2). When the coolant reaches the top of the fill hose, close the valve. This will eliminate air from the fill hose.
20. Close the valve on the venturi assembly.
21. If there is a suspected leak in the cooling system, allow the system to stabilize under vacuum and monitor for vacuum loss.

If vacuum loss is observed, refer to [Hybrid Cooling System Loss of Coolant \(Drive Motor Battery Cooling System\)](#)[Hybrid Cooling System Loss of Coolant \(Drive Motor Generator Power Inverter Module Cooling System\)](#).

22. Open the valve on the vacuum gauge assembly. The vacuum gauge will drop as coolant is drawn into the system.

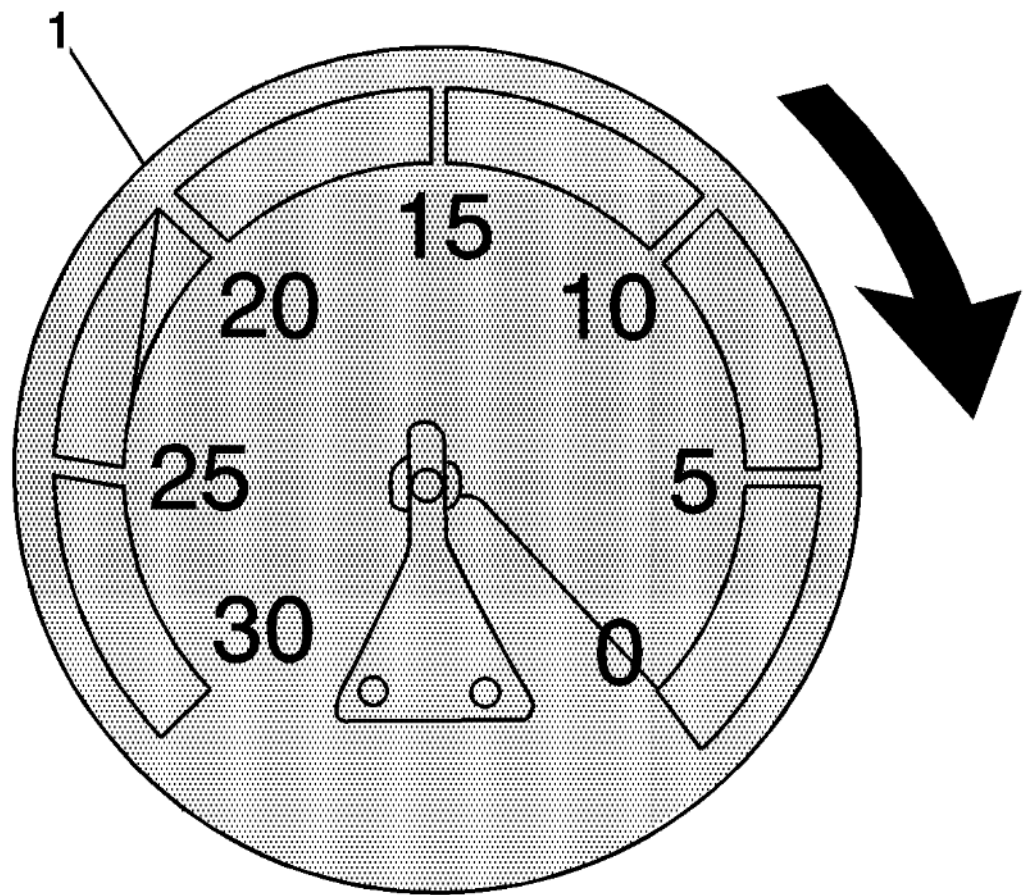


Fig. 50: Vacuum Gauge

Courtesy of GENERAL MOTORS COMPANY

23. Once the vacuum gauge (1) reaches zero, close the valve on the vacuum gauge assembly and repeat steps 15 - 21 one time.
24. Place vehicle in Service Mode. With the GDS scan tool, activate the drive motor generator control module coolant pump for 5 minutes while maintaining 381 mm (15 in Hg) vacuum throughout the process.
25. Detach the Vac-N-Fill cap from the **GE-46143-2** adapter.
26. Remove **GE-46143-2** adapter from the surge tank fill neck.

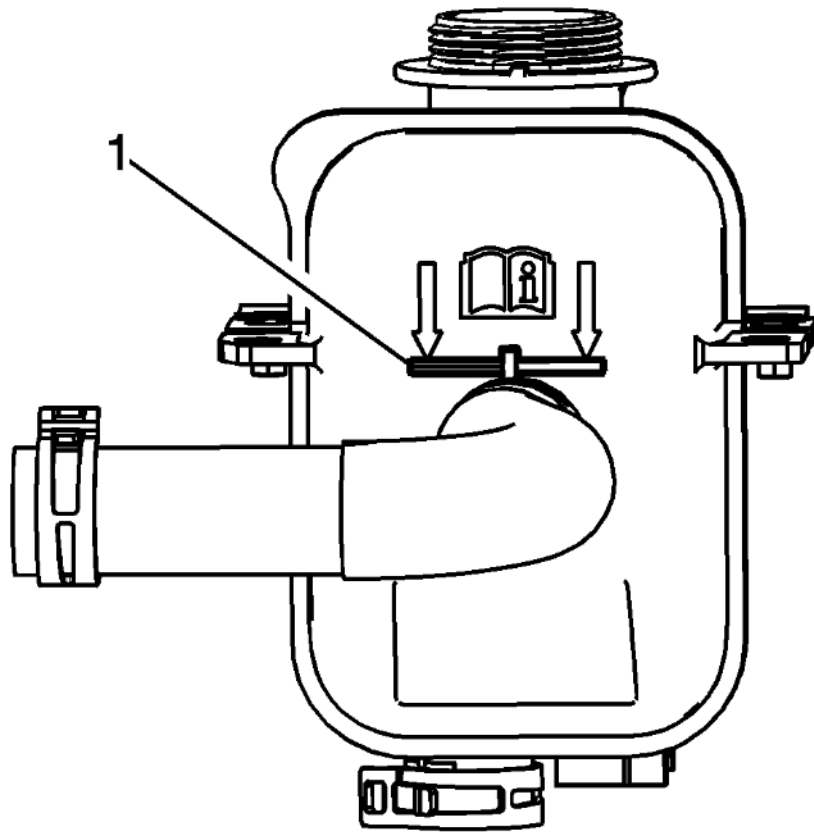


Fig. 51: Adjusting Surge Tank Coolant Level To Position Just Above Seam
Courtesy of GENERAL MOTORS COMPANY

27. Adjust the surge tank coolant level to a position just above the seam (1).
28. Inspect the concentration of the coolant mixture using **GE-26568** tester.

REMOVING EXCESS COOLANT FROM SYSTEM

NOTE: After filling the cooling system, the extraction hose can be used to remove excess coolant to achieve the proper coolant level.

1. Detach the vacuum hose from the vacuum gauge assembly.

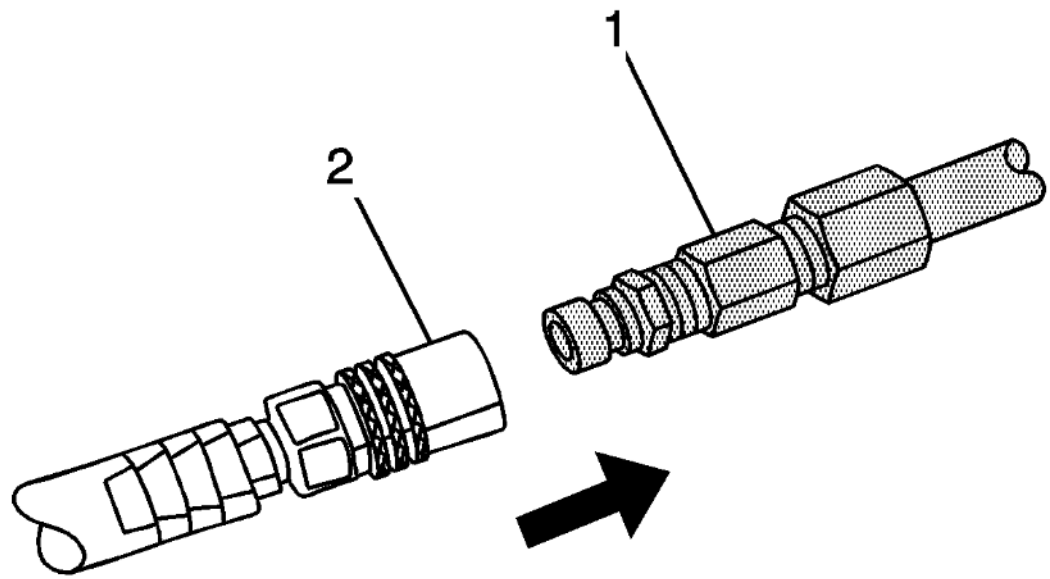


Fig. 52: Vacuum Hose & Extraction Hose
Courtesy of GENERAL MOTORS COMPANY

2. Attach the extraction hose (1) to the vacuum hose (2).

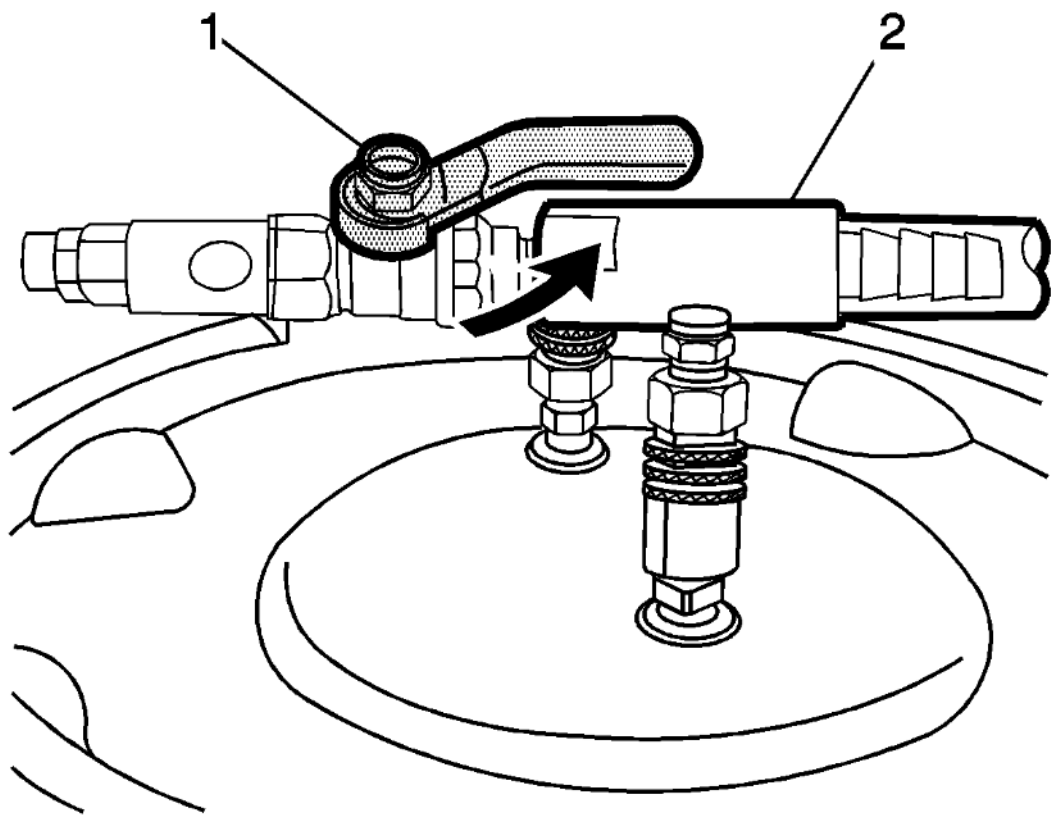


Fig. 53: Venturi Assembly & Valve

Courtesy of GENERAL MOTORS COMPANY

3. Open the valve (1) on the venturi assembly (2) to start a vacuum draw.

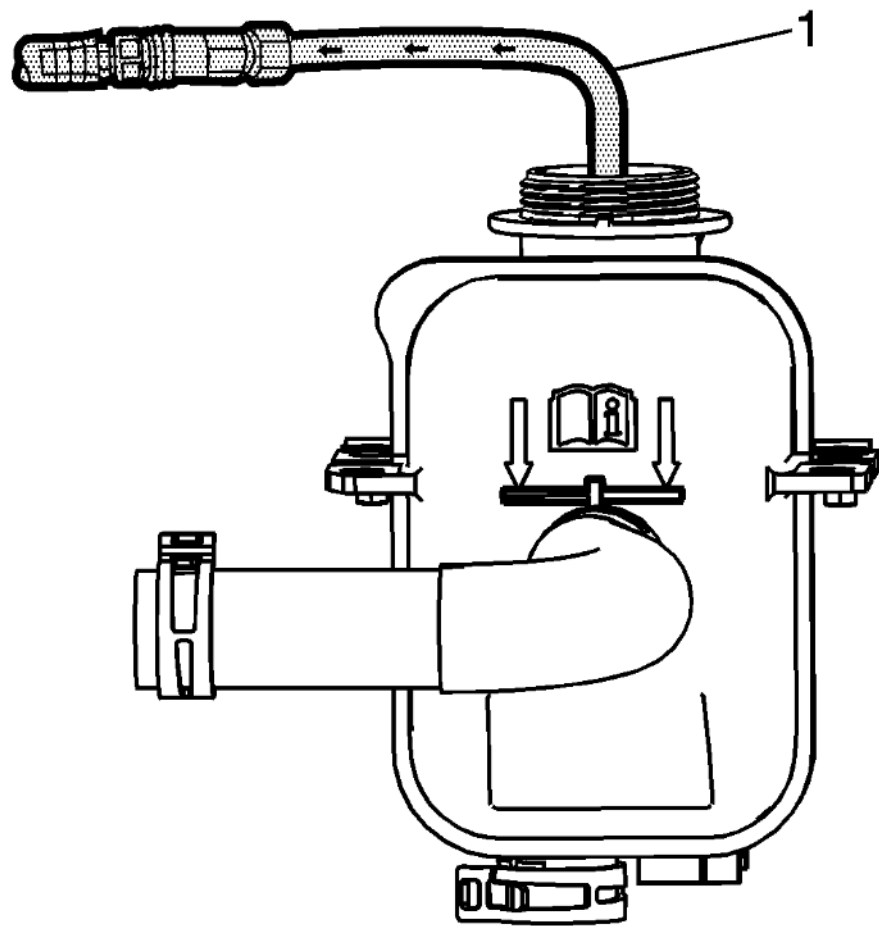


Fig. 54: Extraction Hose

Courtesy of GENERAL MOTORS COMPANY

4. Assemble the extraction hose (1) and insert into the surge tank.

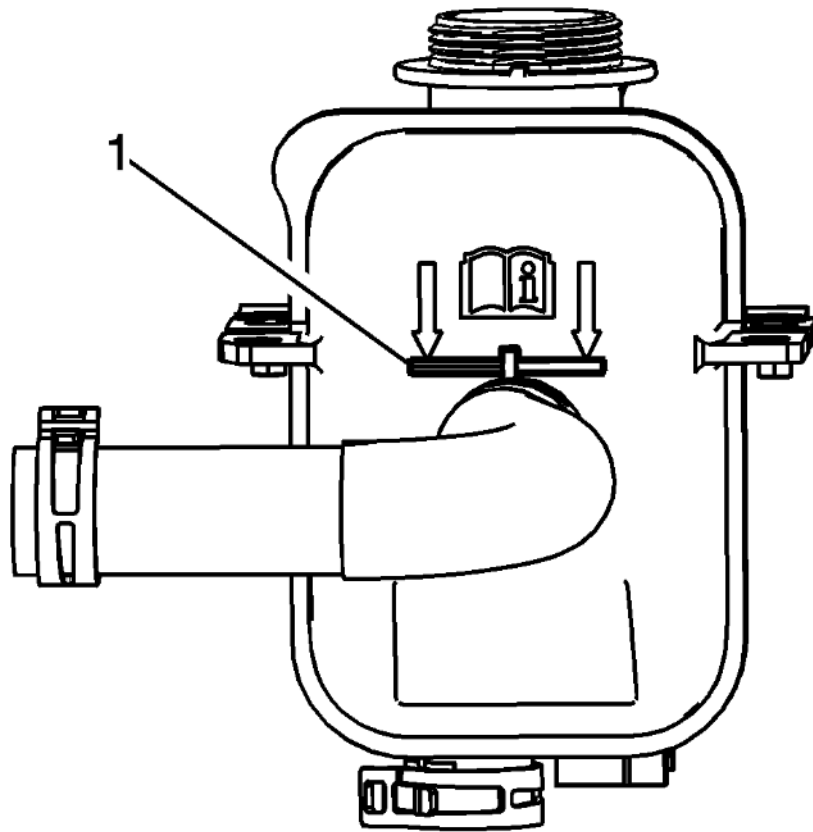


Fig. 55: Adjusting Surge Tank Coolant Level To Position Just Above Seam
Courtesy of GENERAL MOTORS COMPANY

5. Adjust the surge tank coolant level to a position just above the seam (1).
6. The vacuum tank has a drain valve on the bottom of the tank. Open the valve to drain coolant from the vacuum tank into a suitable container for disposal.

ELECTRIC DIFFERENTIAL DRIVE MOTOR POWER INVERTER MODULE COOLING HOSE REPLACEMENT (APM TO OBCM)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

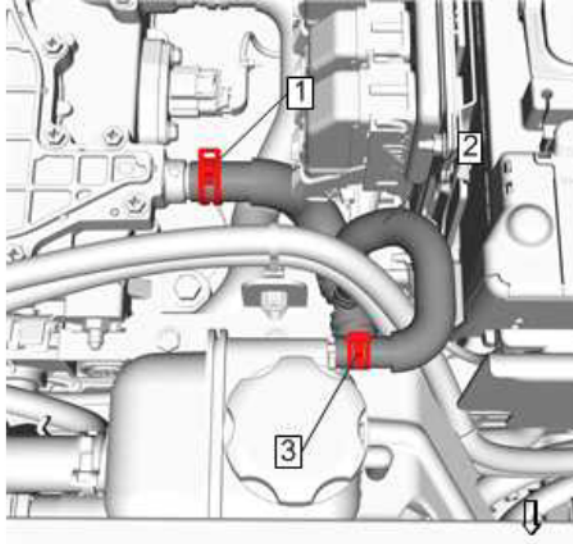


Fig. 56: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamps
Courtesy of GENERAL MOTORS COMPANY

3. Disengage Clamps (1, 3) (Qty: 2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Remove the electric differential drive motor power inverter module cooling hose (2).

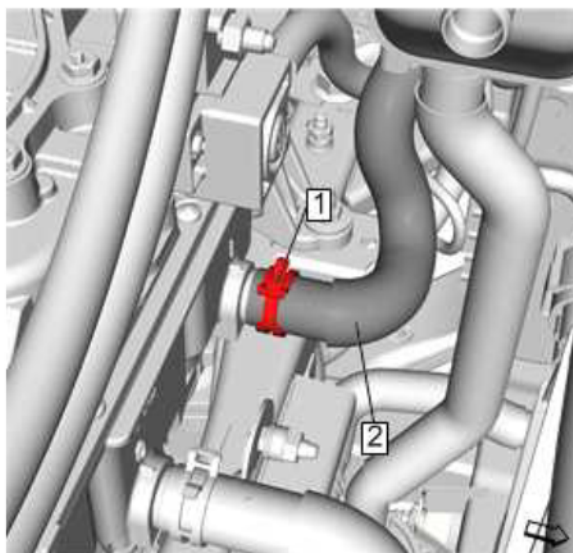
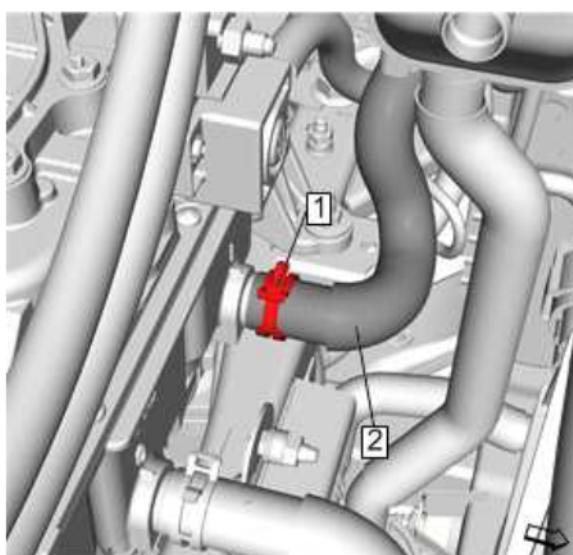


Fig. 57: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

5. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
6. Remove the electric differential drive motor power inverter module cooling hose (2).

Installation Procedure



1. Install the electric differential drive motor power inverter module cooling hose (2).
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

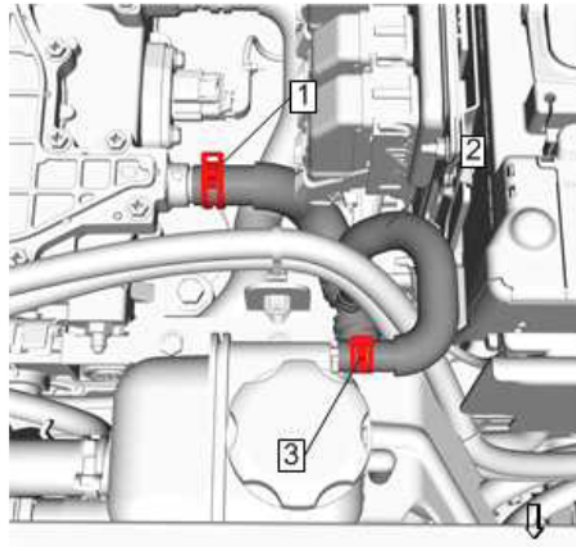


Fig. 59: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamps
Courtesy of GENERAL MOTORS COMPANY

3. Install the electric differential drive motor power inverter module cooling hose (2).
4. Engage Clamps (1, 3) (Qty: 2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
6. Check the cooling system for leaks.

DRIVE MOTOR BATTERY COOLANT LEVEL SENSOR REPLACEMENT

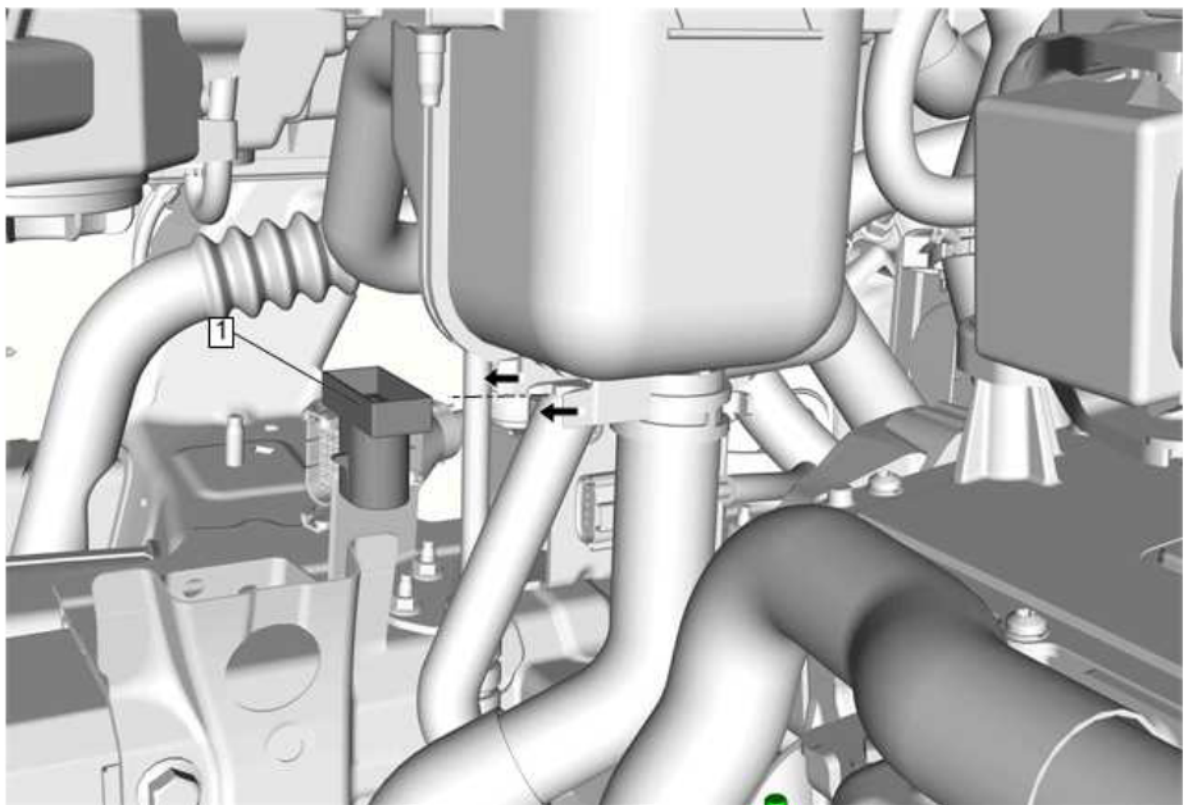


Fig. 60: Drive Motor Battery Coolant Level Sensor
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name	cardiagn.com

Callout	Component Name
Preliminary Procedures	
Disconnect the electrical connector from the coolant level sensor.	
1	Drive Motor Battery Coolant Level Sensor

RADIATOR REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)
3. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#).
4. Recover the refrigerant. Refer to [Refrigerant Recovery and Recharging](#)

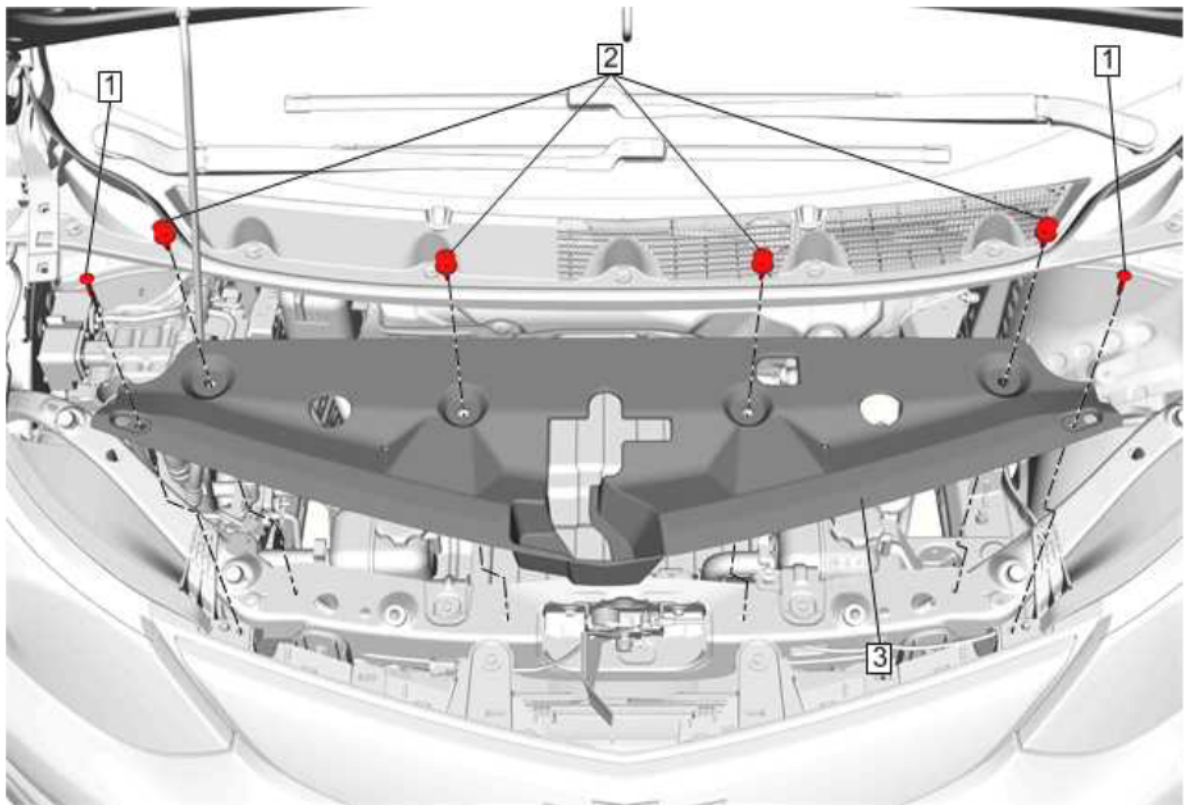


Fig. 61: Front Compartment Front Sight Shield
 Courtesy of GENERAL MOTORS COMPANY

5. Remove Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

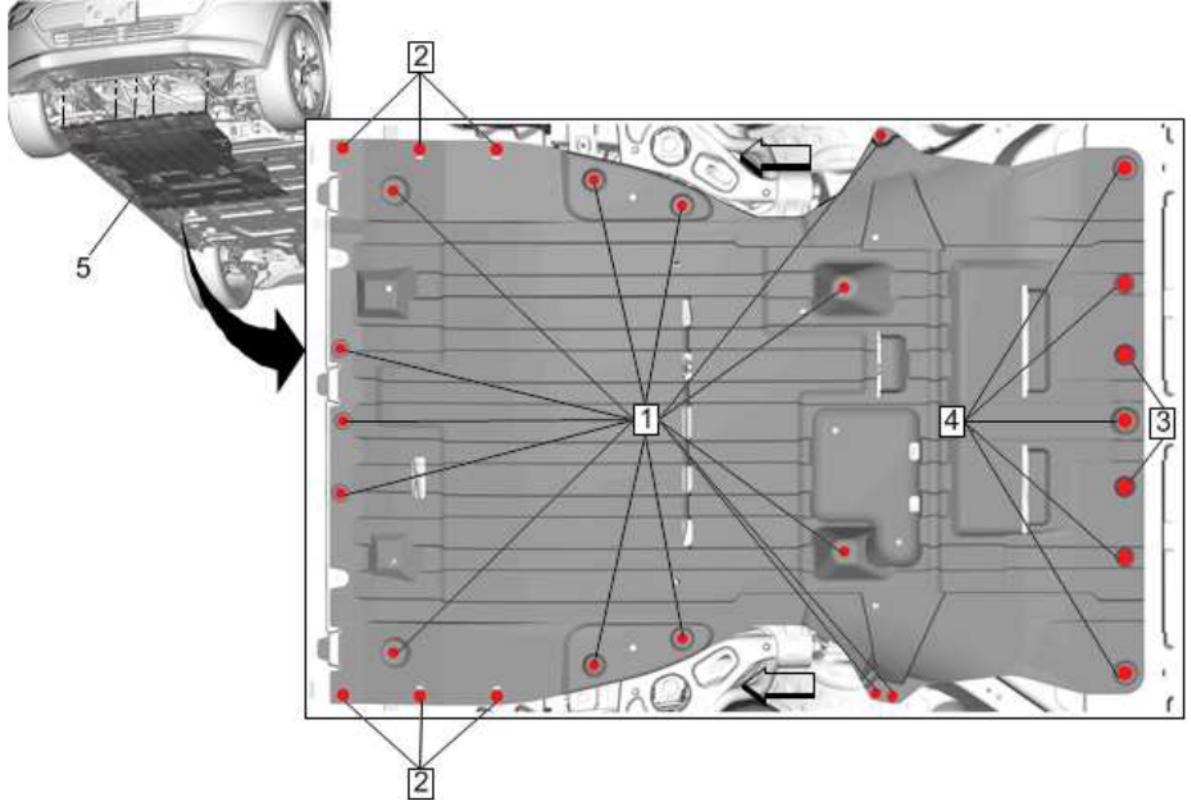


Fig. 62: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

6. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

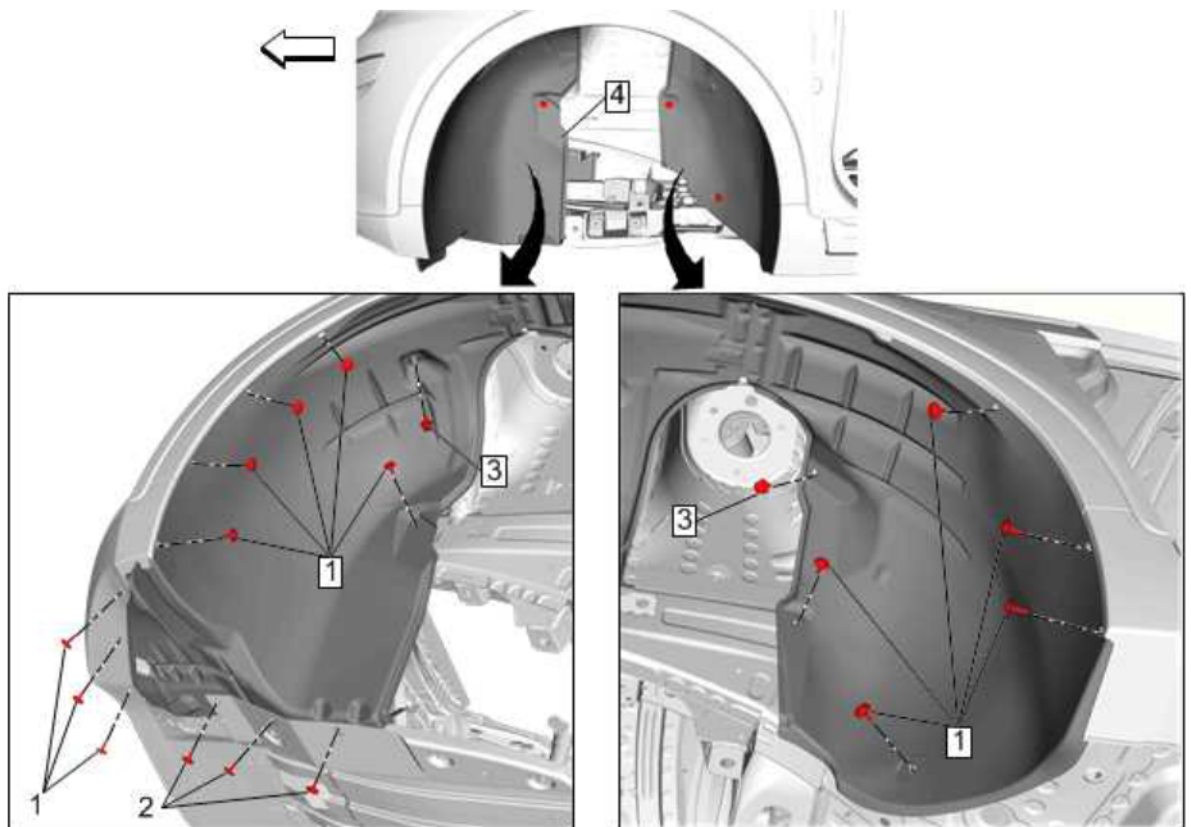


Fig. 63: Front Wheelhouse Liner

Courtesy of GENERAL MOTORS COMPANY

7. Remove Front Wheelhouse Liner (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)
8. Remove the front bumper fascia. Refer to [Front Bumper Fascia Replacement \(North America\)](#) [Front Bumper Fascia Replacement \(Europe, Korea\)](#)

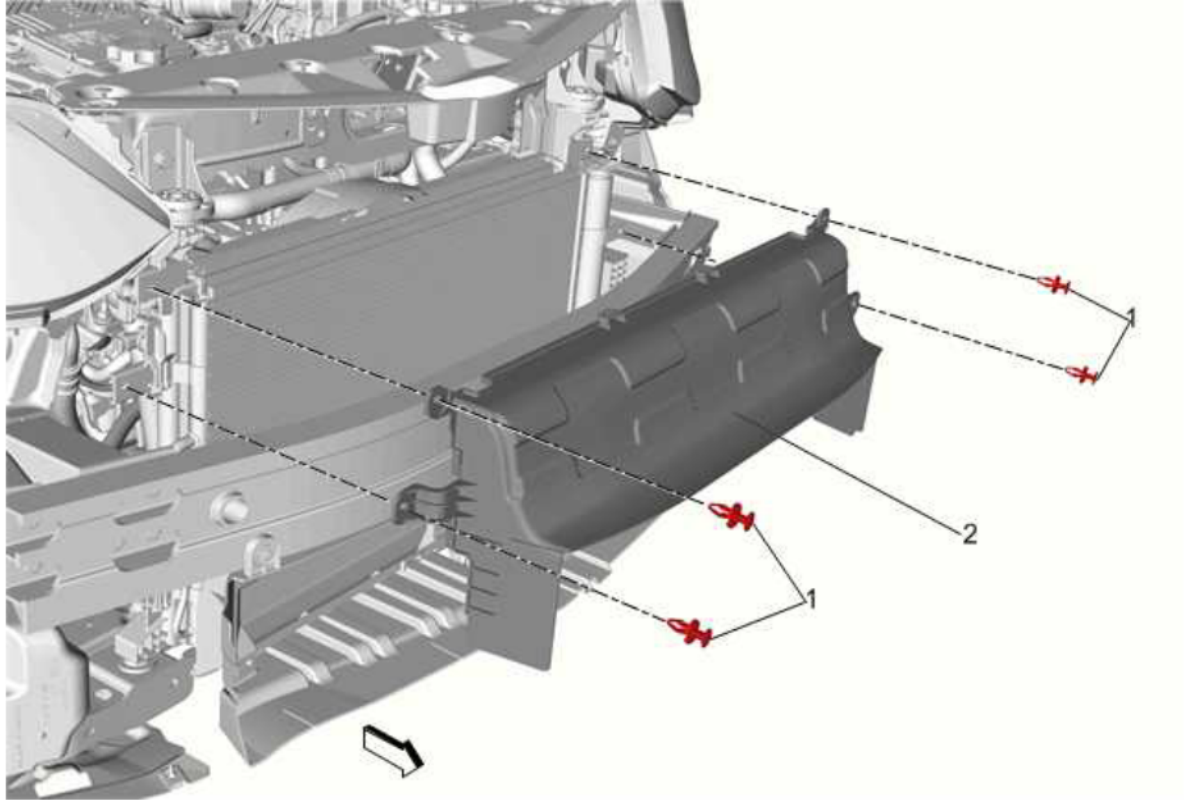


Fig. 64: Radiator Air Upper Baffle And Deflector

Courtesy of GENERAL MOTORS COMPANY

9. Remove Radiator Air Upper Baffle and Deflector (2). Refer to [Radiator Air Upper Baffle and Deflector Replacement](#)

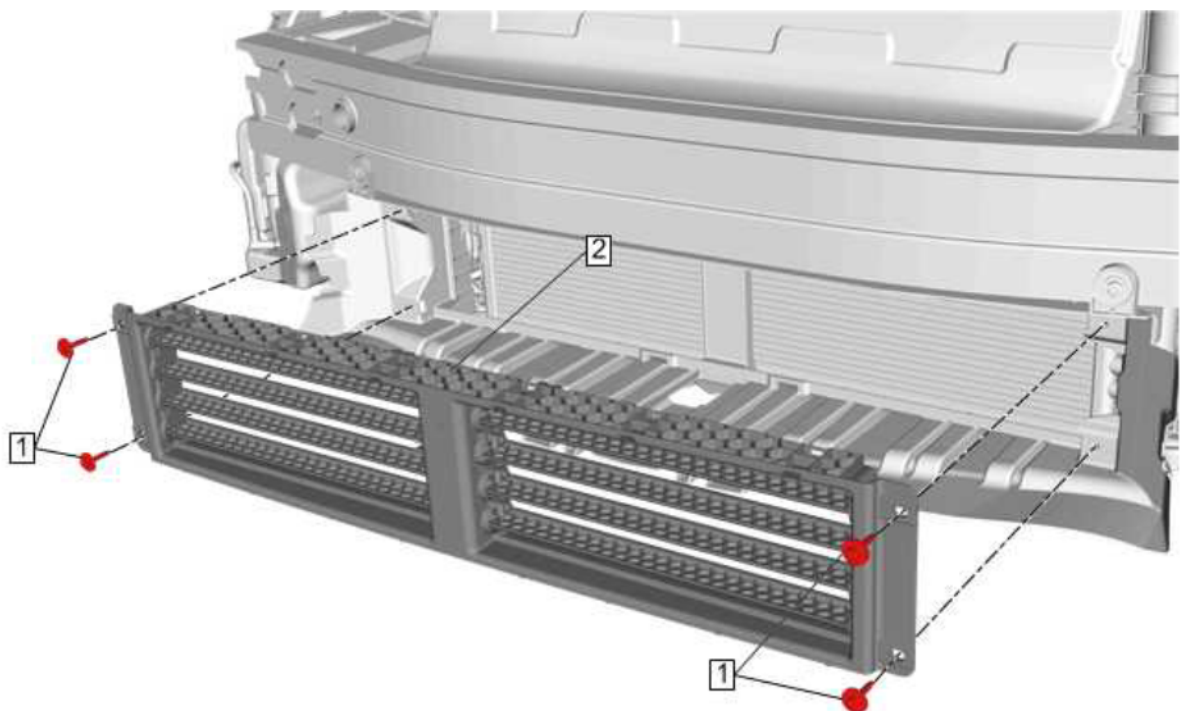


Fig. 65: Front Bumper Shutter

Courtesy of GENERAL MOTORS COMPANY

10. Remove Front Bumper Shutter (2). Refer to [Front Bumper Shutter Replacement](#)

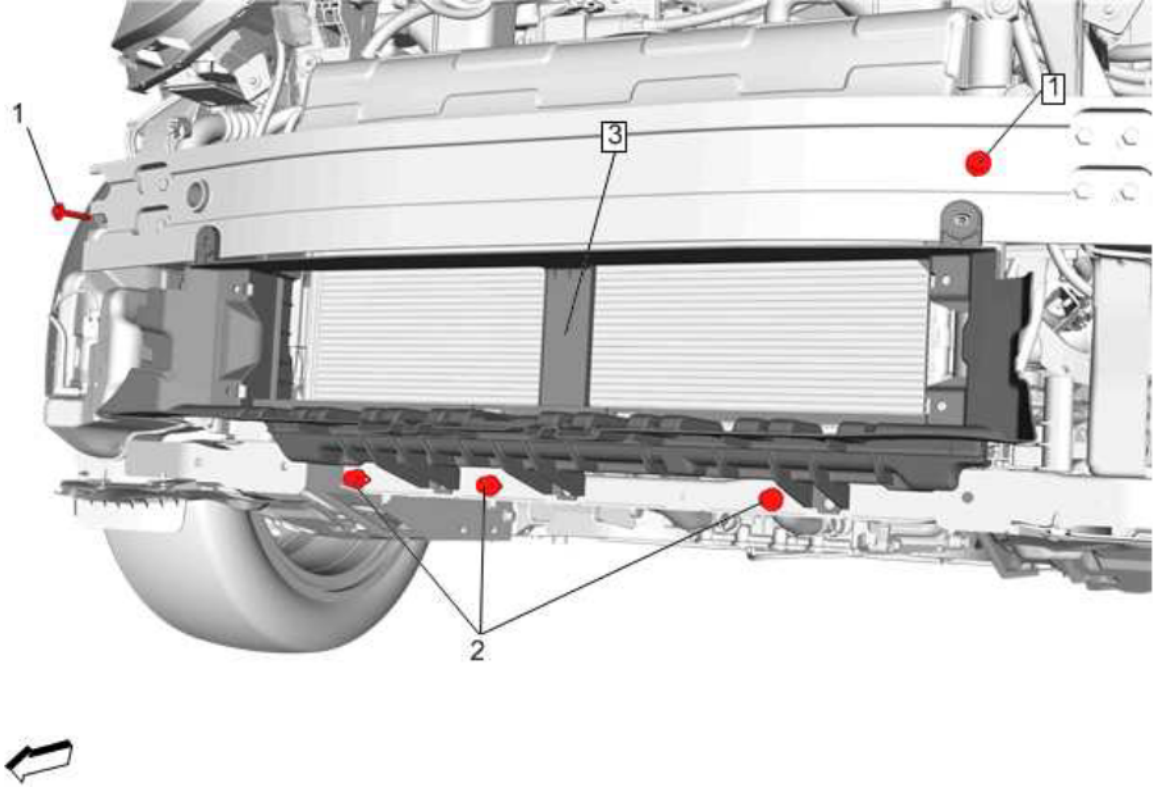


Fig. 66: Radiator Air Lower Baffle and Deflector Assembly

Courtesy of GENERAL MOTORS COMPANY

11. Remove Radiator Air Lower Baffle and Deflector Assembly (3). Refer to [Radiator Air Lower Baffle and Deflector Replacement](#)

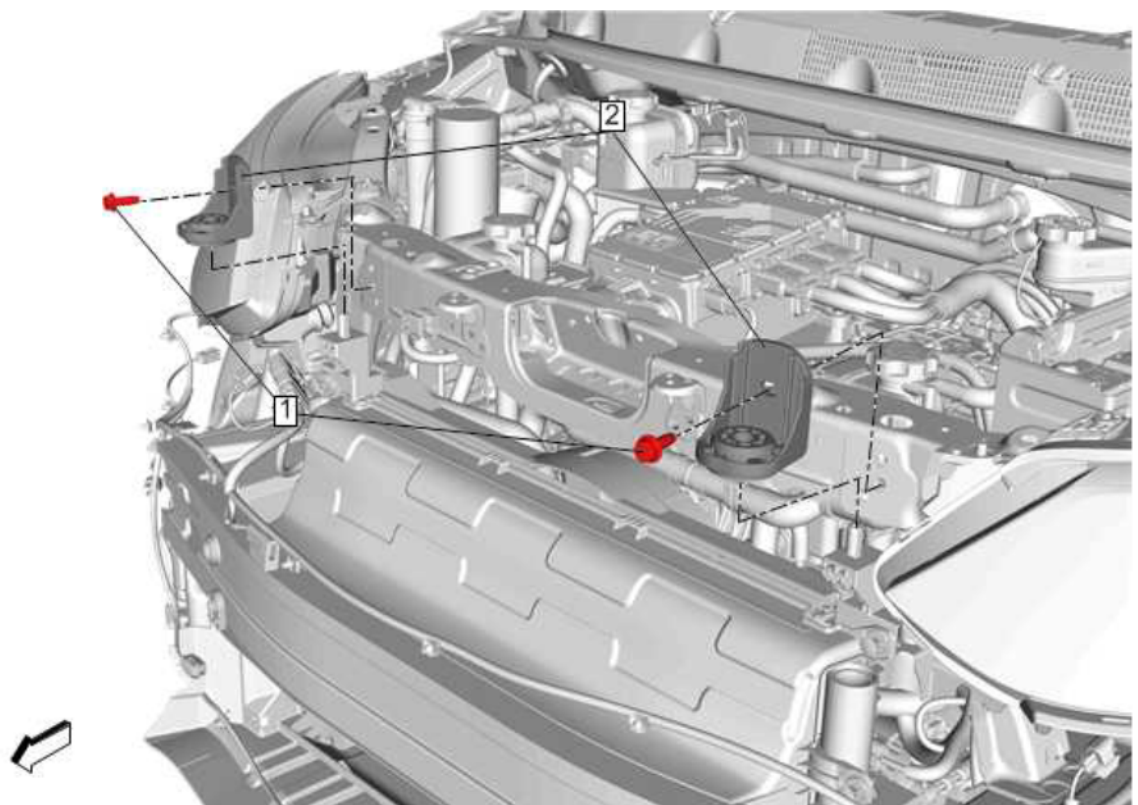


Fig. 67: Radiator Upper Brackets

Courtesy of GENERAL MOTORS COMPANY

12. Remove Radiator Upper Brackets (2) (Qty: 3). Refer to [Radiator Upper Bracket Replacement](#)

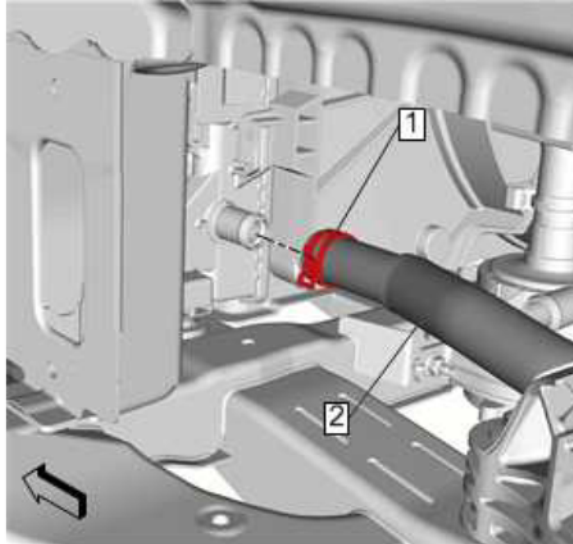


Fig. 68: Drive Motor Generator Control Module Radiator Inlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

13. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
14. Remove Drive Motor Generator Control Module Radiator Inlet Hose (2)

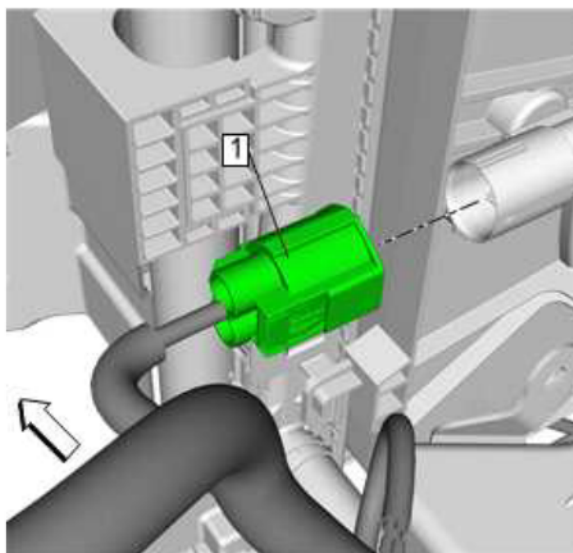


Fig. 69: Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

15. Disconnect Electrical Connector (1)

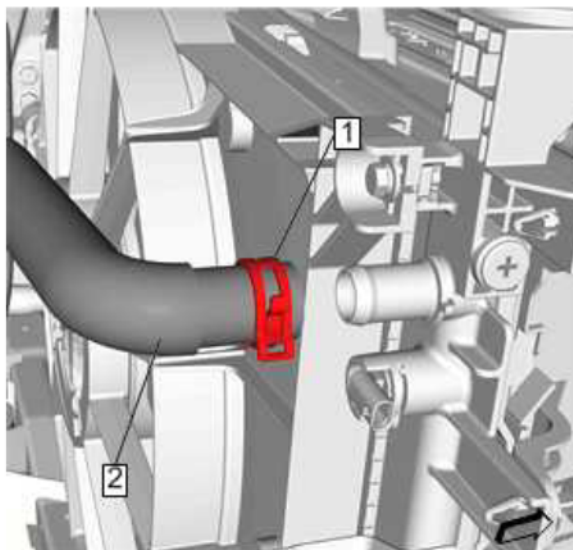


Fig. 70: Drive Motor Generator Control Module Radiator Outlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

16. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
17. Remove Drive Motor Generator Control Module Radiator Outlet Hose (2)

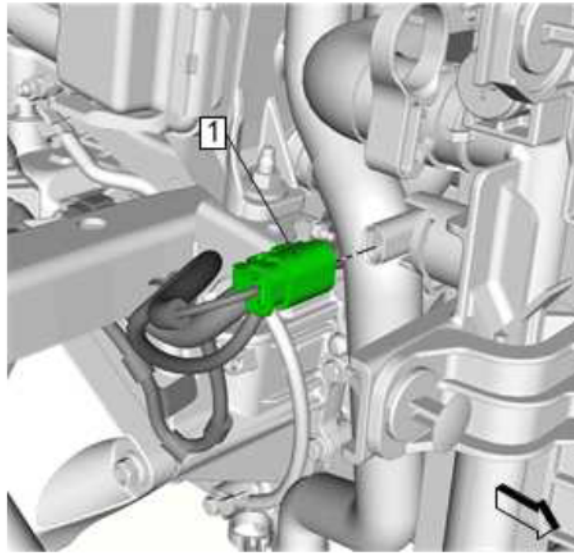


Fig. 71: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

18. Disconnect Electrical Connector (1)

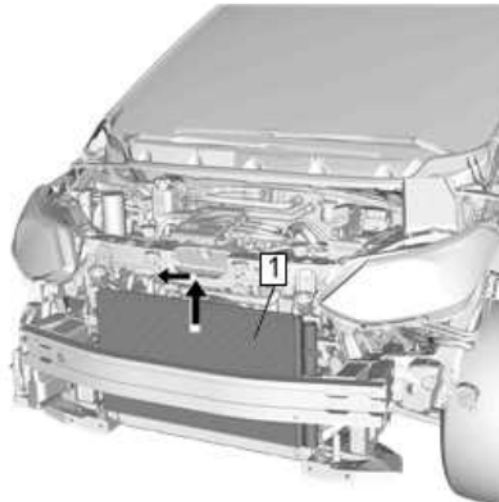
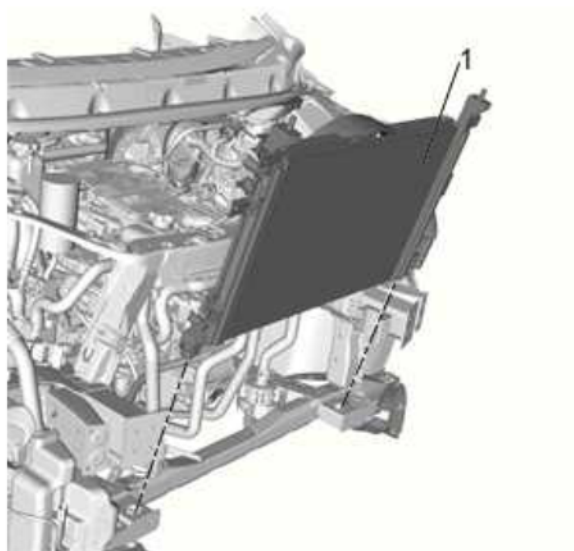


Fig. 72: Air Conditioning Condenser

Courtesy of GENERAL MOTORS COMPANY

19. Remove Air Conditioning Condenser (1). Refer to [Air Conditioning Condenser Replacement](#)



20. Remove Radiator Assembly (1)

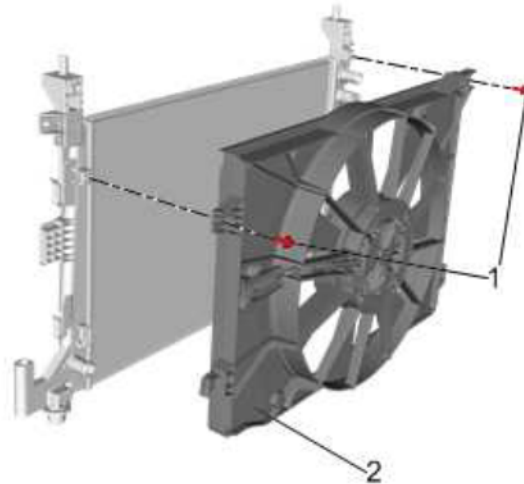


Fig. 74: Cooling Fan And Bolts
Courtesy of GENERAL MOTORS COMPANY

21. Remove the 2 cooling fan bolts (1).
22. Remove Cooling Fan (2)
23. Transfer components as necessary including rubber mounts.

Installation Procedure

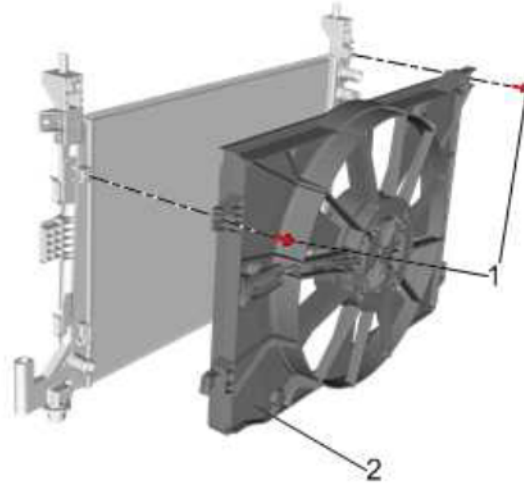


Fig. 75: Cooling Fan And Bolts
Courtesy of GENERAL MOTORS COMPANY

1. Install Cooling Fan (2)

CAUTION: Refer to **Fastener Caution** .

2. Install the 2 cooling fan bolts (1) and tighten to 5 N.m (44 lb in)

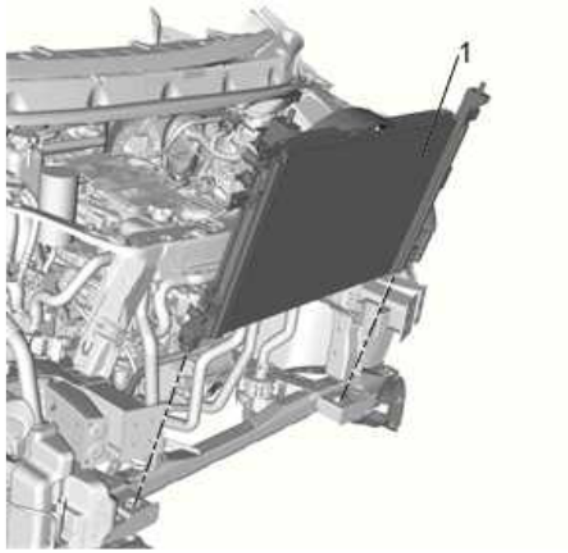


Fig. 76: Radiator Assembly

Courtesy of GENERAL MOTORS COMPANY

3. Install Radiator Assembly (1)

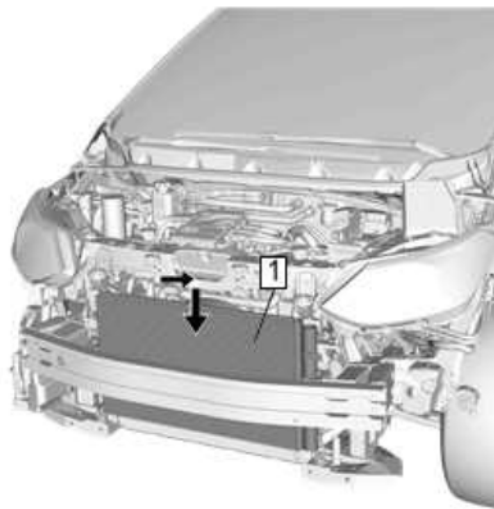


Fig. 77: Air Conditioning Condenser

Courtesy of GENERAL MOTORS COMPANY

4. Install Air Conditioning Condenser (1). Refer to [Air Conditioning Condenser Replacement](#)

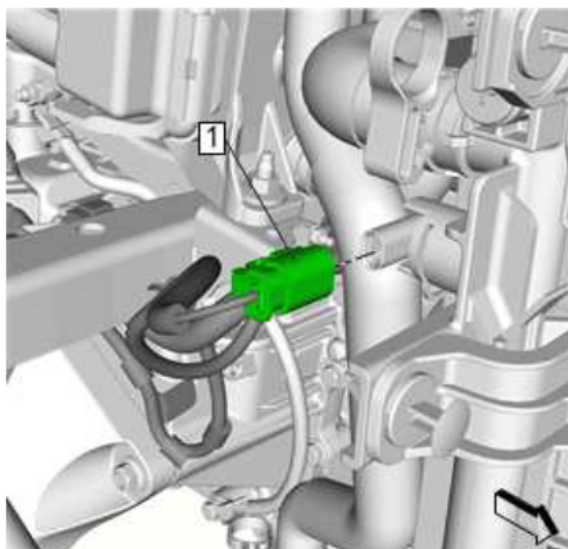


Fig. 78: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

5. Connect Electrical Connector (1)

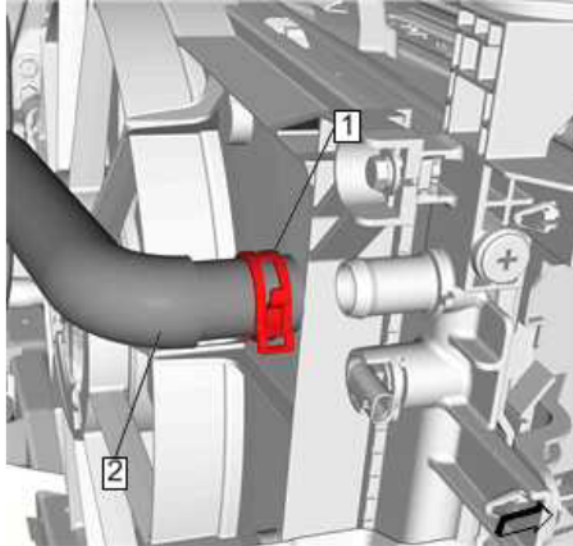


Fig. 79: Drive Motor Generator Control Module Radiator Outlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

6. Install Drive Motor Generator Control Module Radiator Outlet Hose (2)
7. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

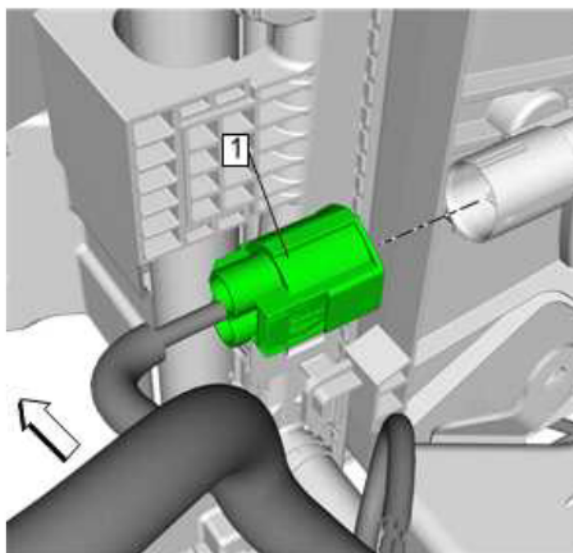


Fig. 80: Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

8. Connect Electrical Connector (1)

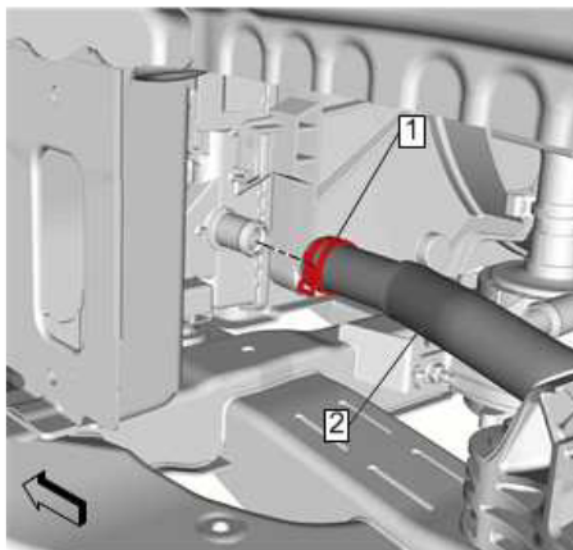


Fig. 81: Drive Motor Generator Control Module Radiator Inlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

9. Install Remove Drive Motor Generator Control Module Radiator Inlet Hose (2)
10. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

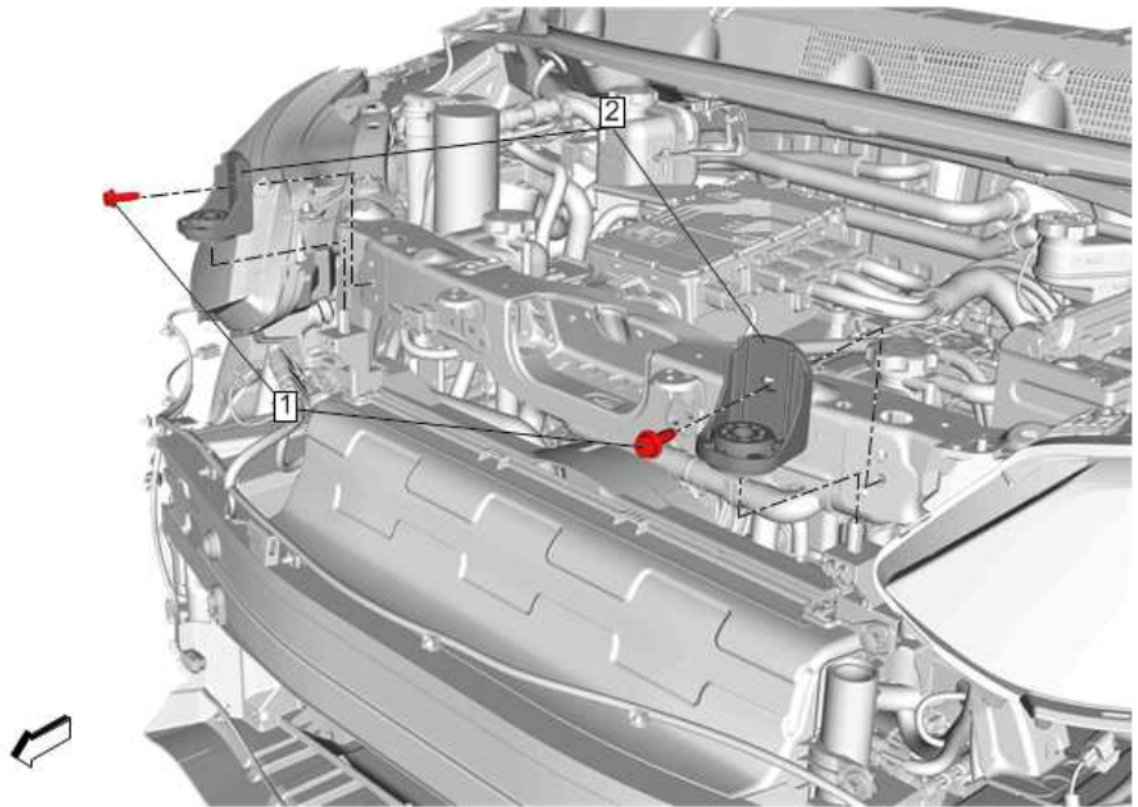


Fig. 82: Radiator Upper Brackets

Courtesy of GENERAL MOTORS COMPANY

11. Install Radiator Upper Brackets (2) (Qty: 3). Refer to [Radiator Upper Bracket Replacement](#)

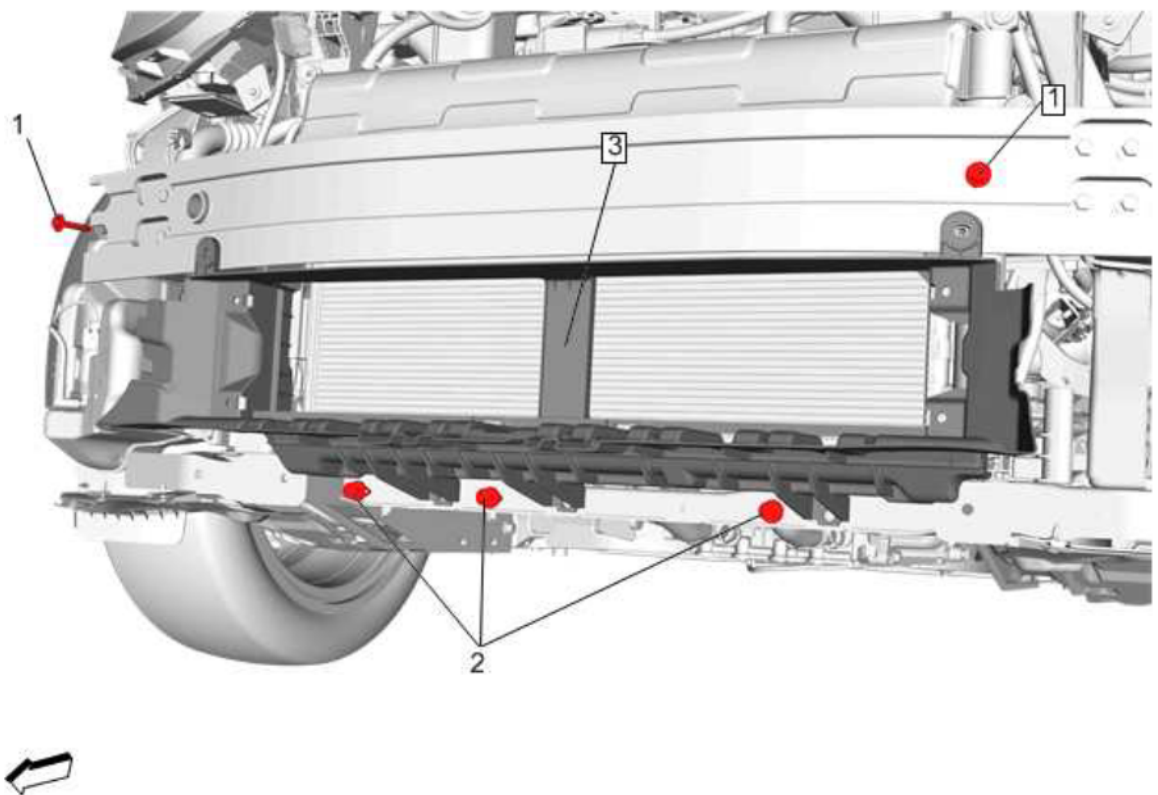


Fig. 83: Radiator Air Lower Baffle and Deflector Assembly

Courtesy of GENERAL MOTORS COMPANY

12. Install Radiator Air Lower Baffle and Deflector Assembly (3). Refer to [Radiator Air Lower Baffle and Deflector Replacement](#)

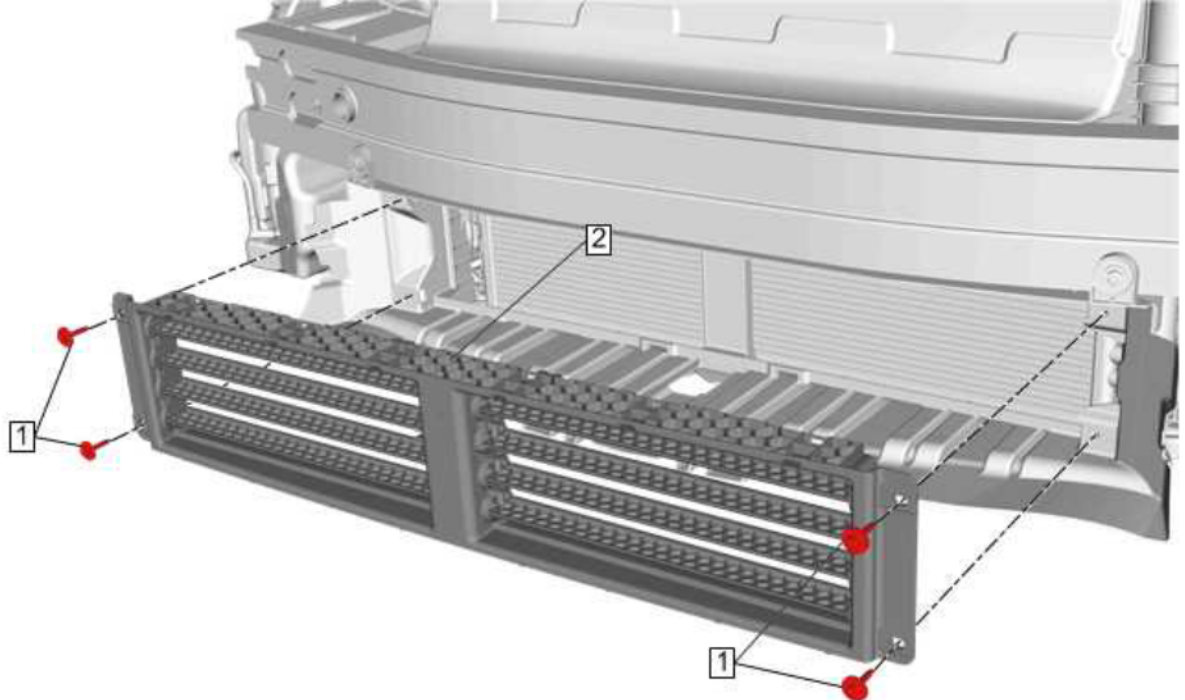


Fig. 84: Front Bumper Shutter

Courtesy of GENERAL MOTORS COMPANY

13. Install Front Bumper Shutter (2). Refer to [Front Bumper Shutter Replacement](#)

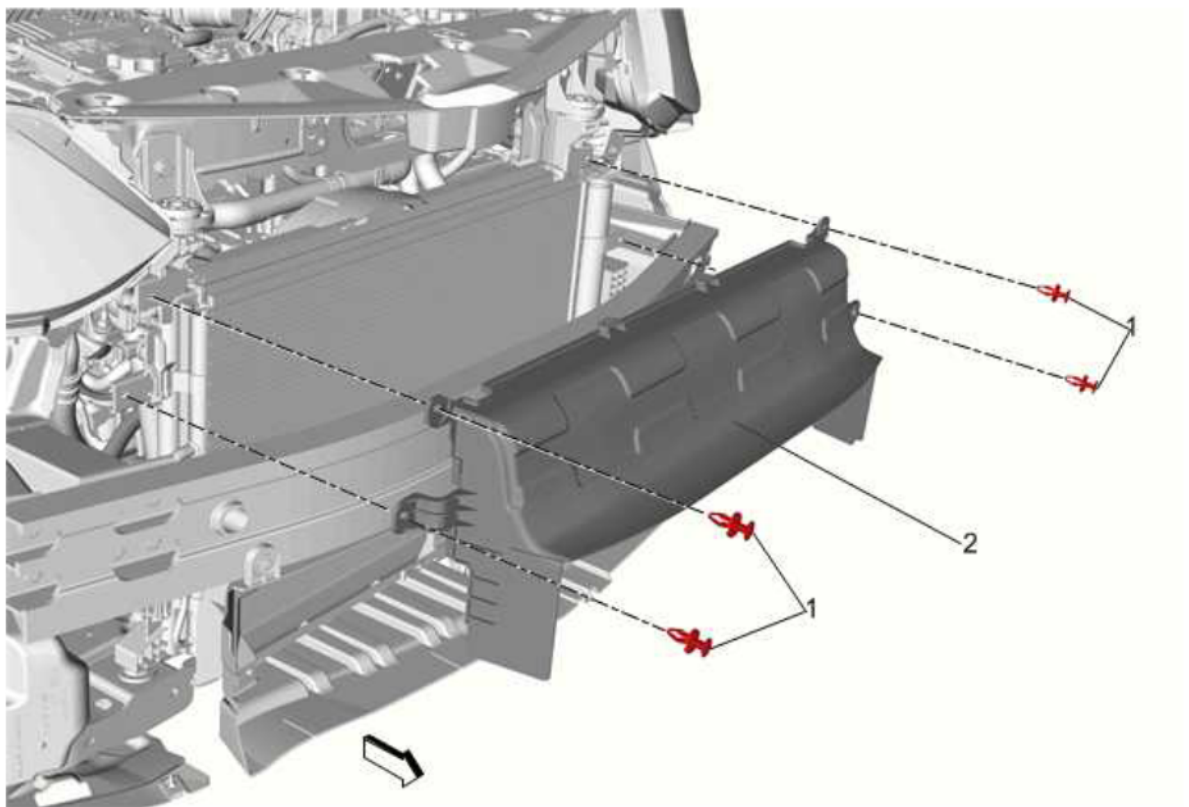


Fig. 85: Radiator Air Upper Baffle And Deflector

Courtesy of GENERAL MOTORS COMPANY

14. Install Radiator Air Upper Baffle and Deflector (2). Refer to [Radiator Air Upper Baffle and Deflector Replacement](#)
15. Install the front bumper fascia. Refer to [Front Bumper Fascia Replacement \(North America\)](#) [Front Bumper Fascia Replacement \(Europe, Korea\)](#)

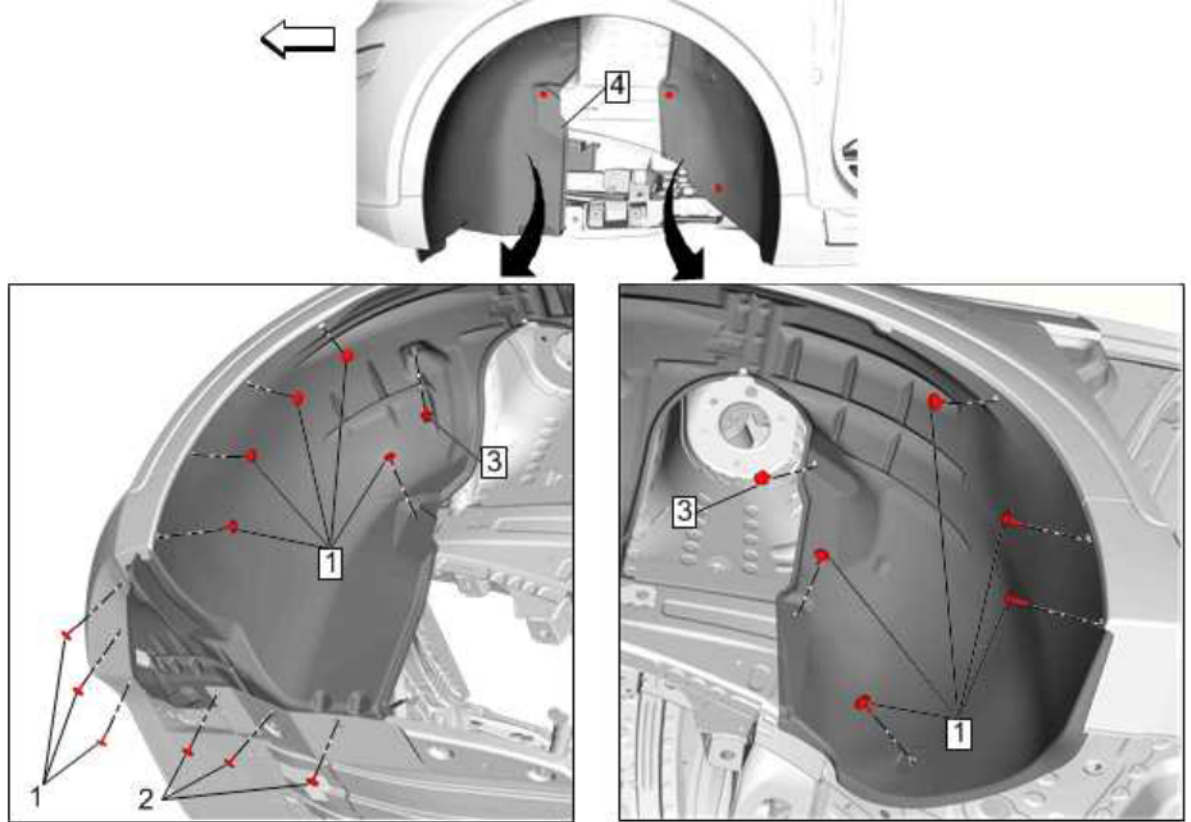


Fig. 86: Front Wheelhouse Liner

Courtesy of GENERAL MOTORS COMPANY

16. Install Front Wheelhouse Liner (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)

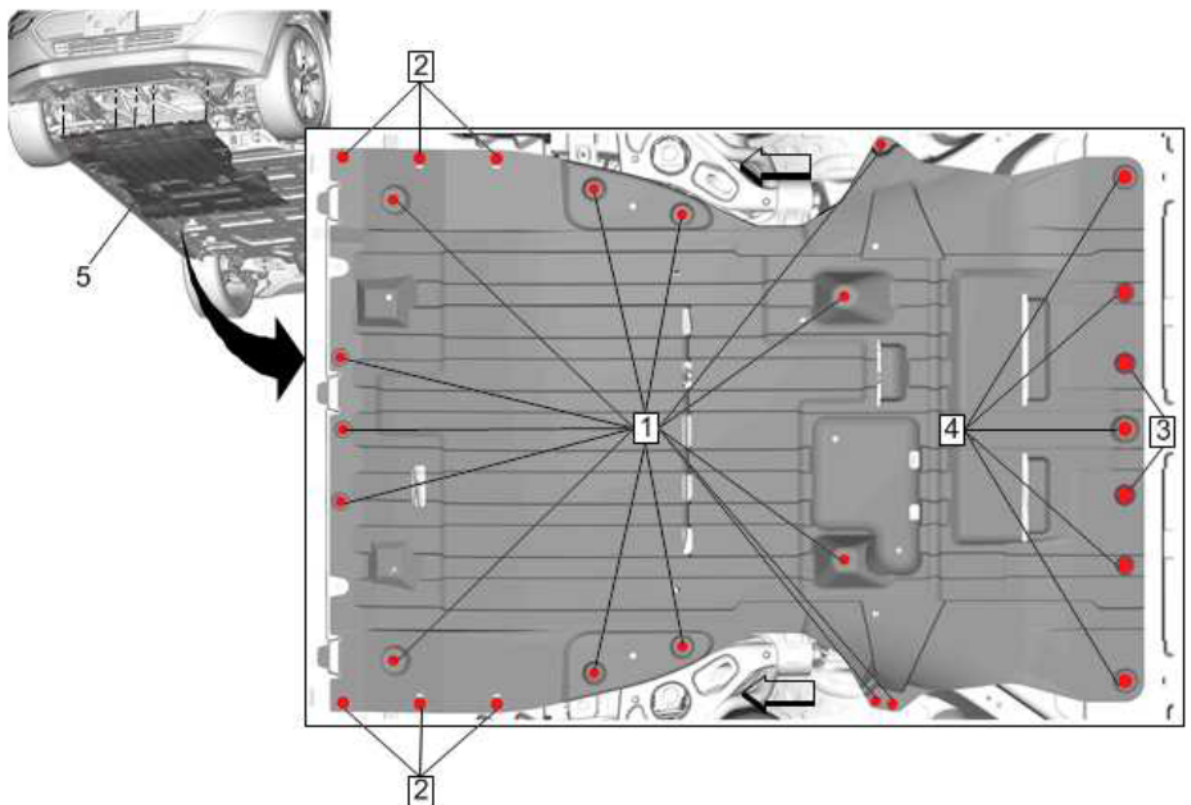


Fig. 87: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

17. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

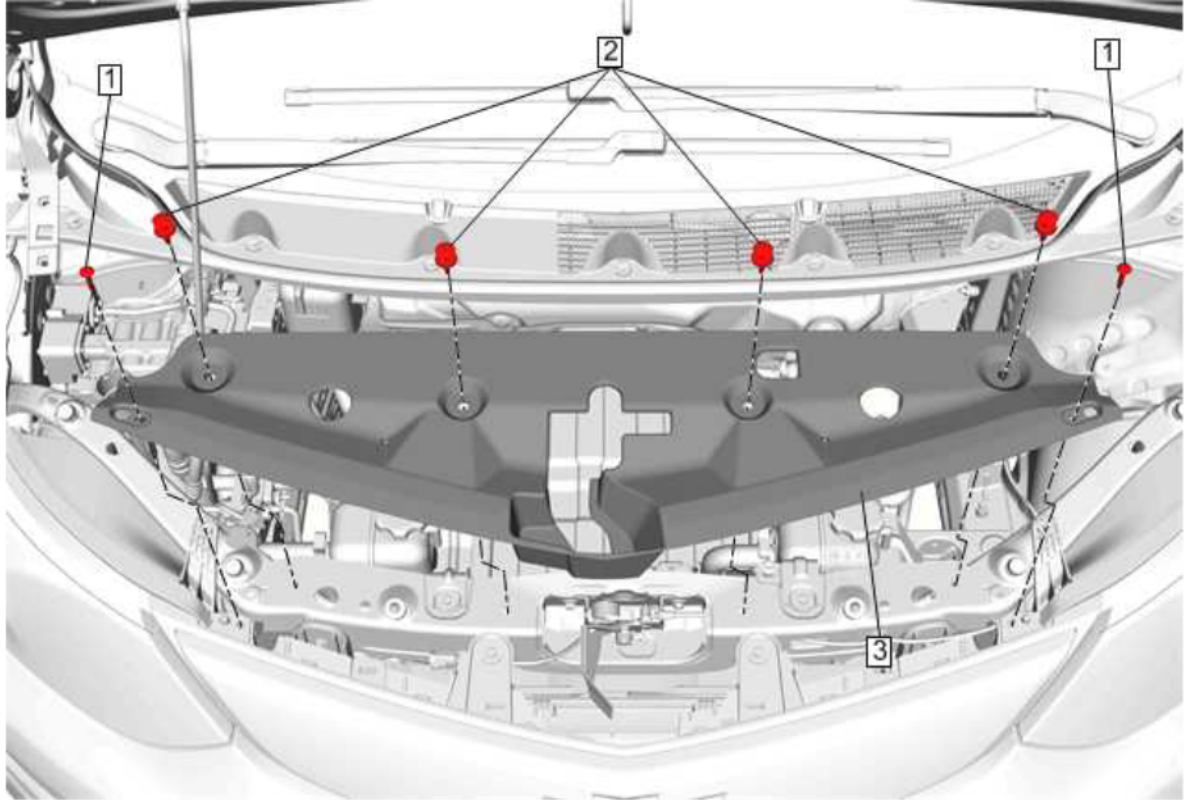


Fig. 88: Front Compartment Front Sight Shield

Courtesy of GENERAL MOTORS COMPANY

18. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)
19. Recharge the refrigerant. Refer to [Refrigerant Recovery and Recharging](#)
20. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#).
21. Check the cooling system for leaks.
22. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

GENERATOR CONTROL MODULE COOLANT TANK HOSE REPLACEMENT (DU TO SURGE TANK)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

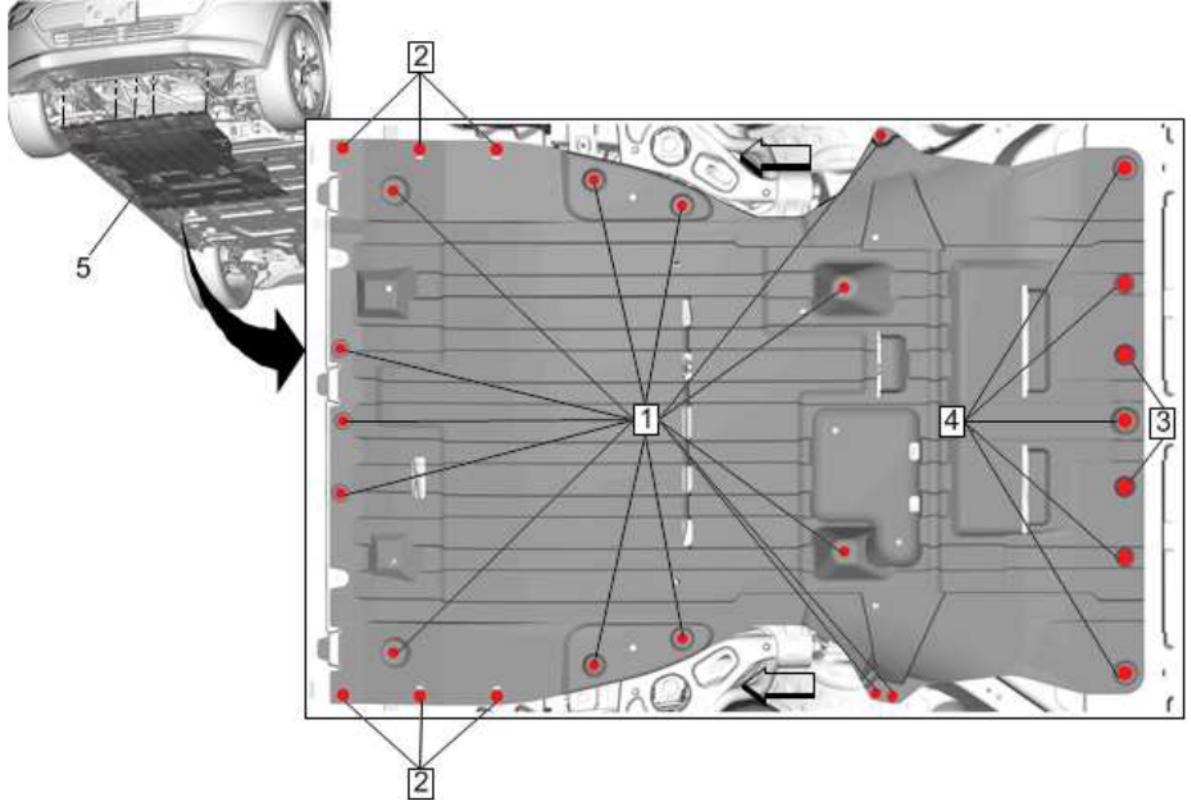


Fig. 89: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

2. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
3. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

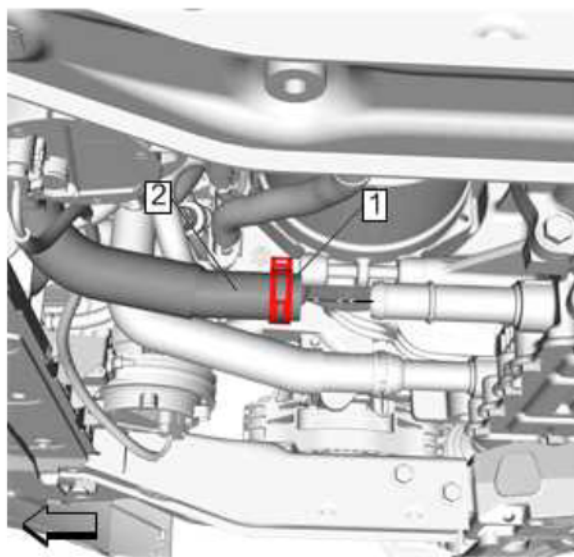


Fig. 90: Generator Control Module Coolant Tank Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove Generator Control Module Coolant Tank Hose (2)

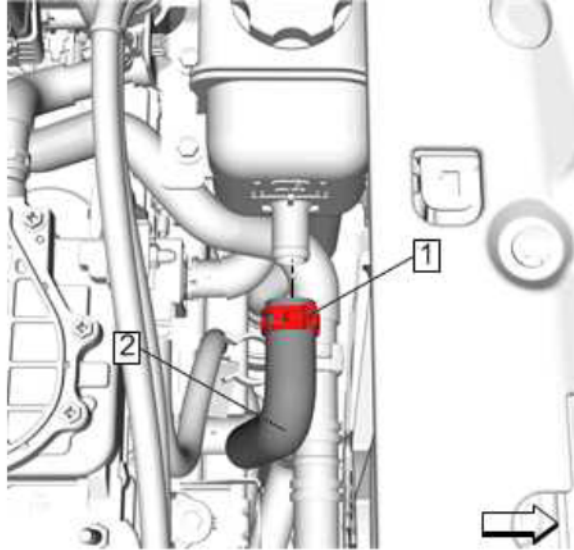


Fig. 91: Generator Control Module Coolant Tank Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

6. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Generator Control Module Coolant Tank Hose (2)

Installation Procedure

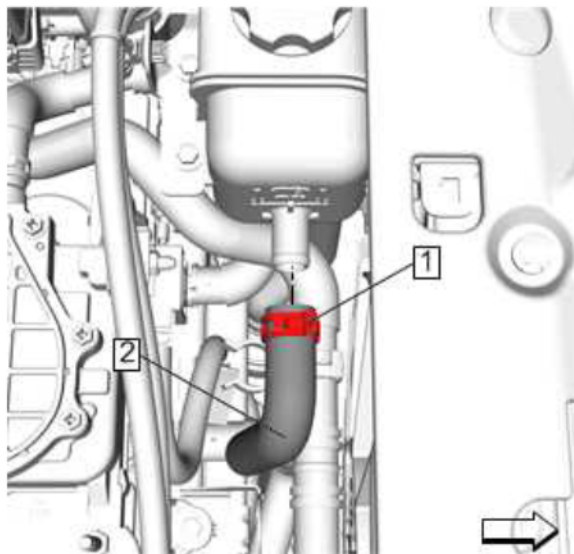


Fig. 92: Generator Control Module Coolant Tank Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

1. Install Generator Control Module Coolant Tank Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

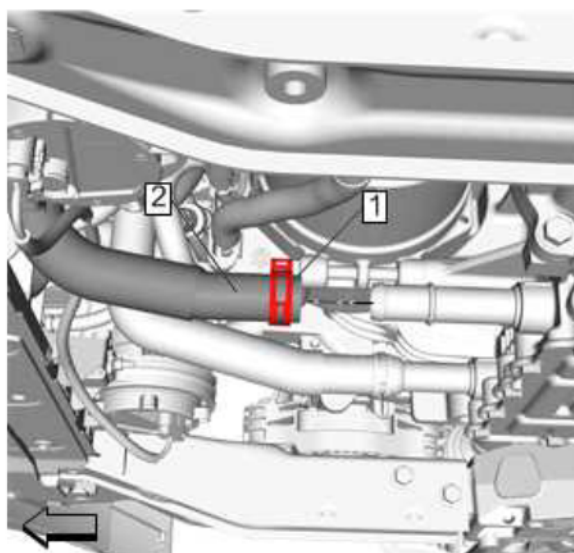


Fig. 93: Generator Control Module Coolant Tank Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

3. Install Generator Control Module Coolant Tank Hose (2)
4. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

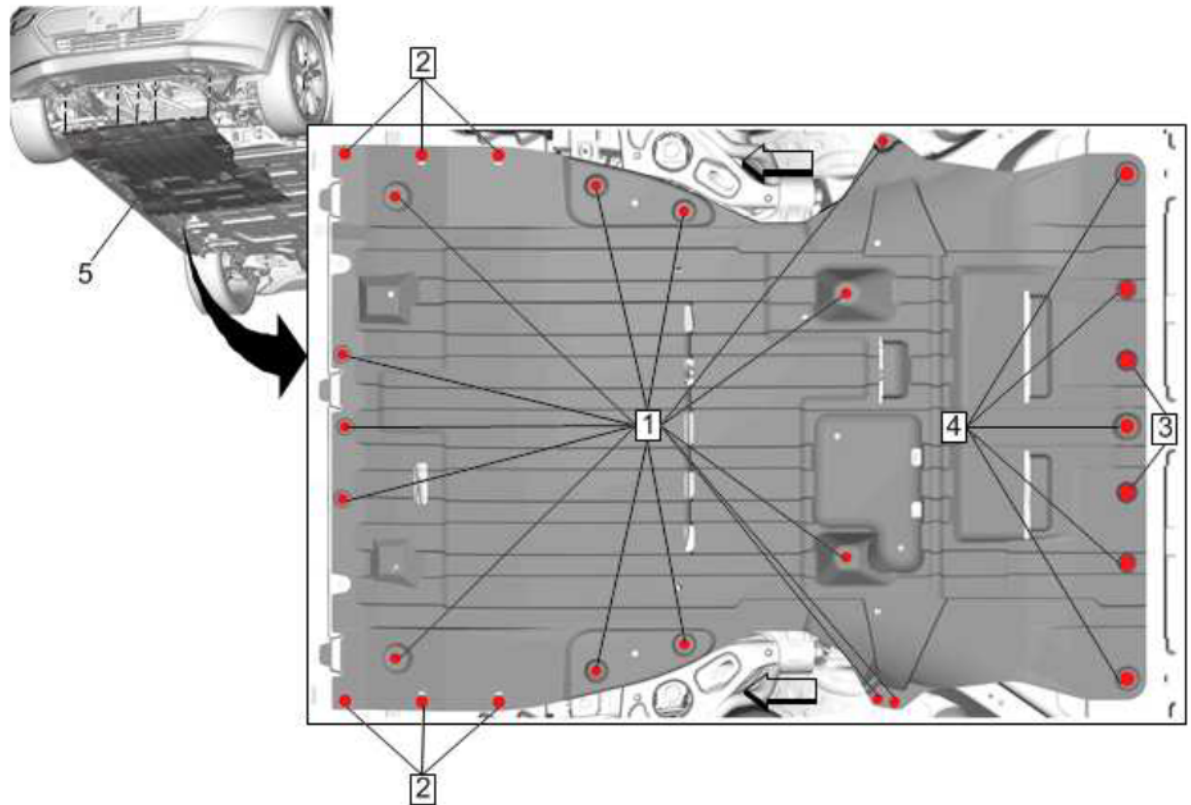


Fig. 94: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

5. Install Front Compartment Air Deflector (3). Refer to [Front Compartment Air Deflector Replacement](#)
6. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
7. Check the cooling system for leaks.

RADIATOR SURGE TANK REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

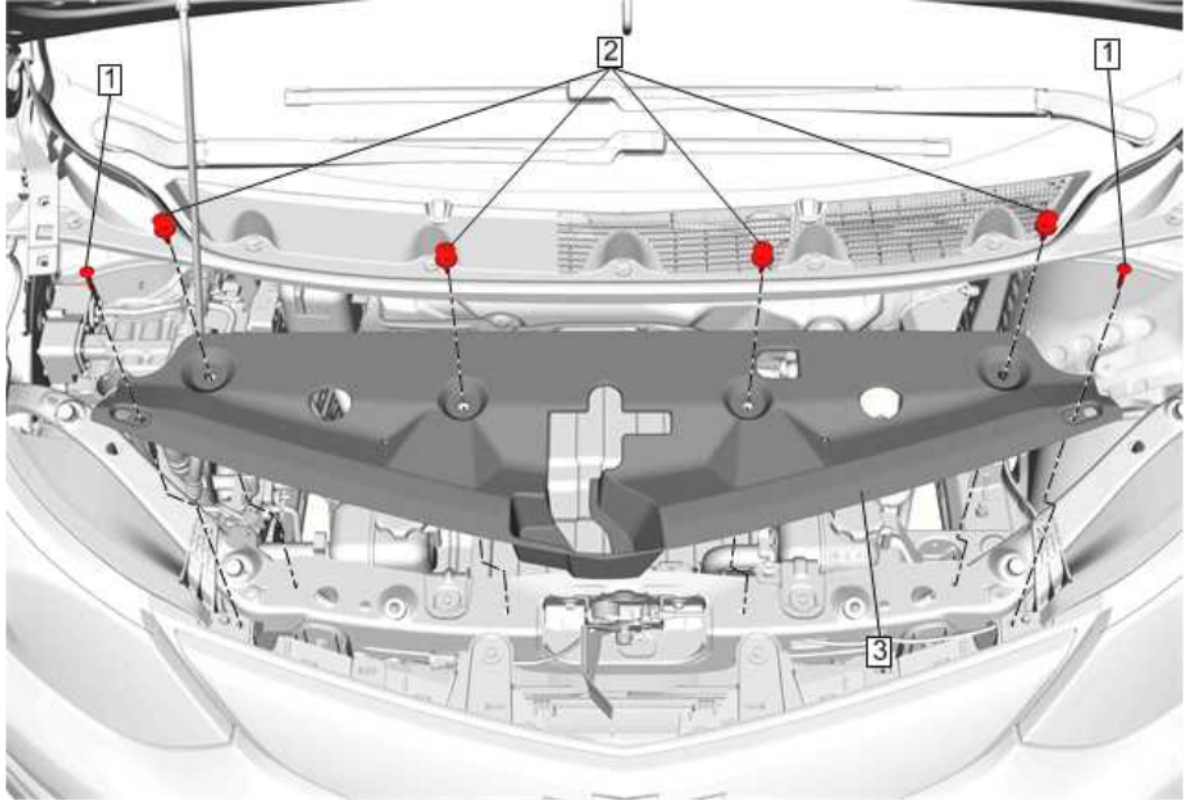


Fig. 95: Front Compartment Front Sight Shield

Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Front Sight Shield (3). Refer to [**Front Compartment Front Sight Shield Replacement**](#)

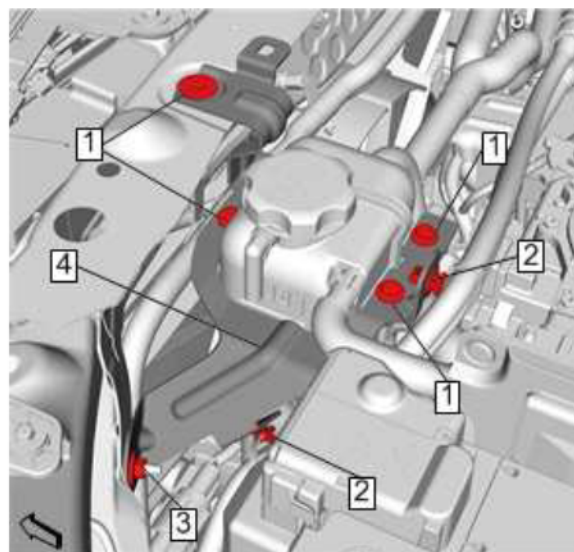


Fig. 96: Radiator Surge Tank Support Bracket And Fasteners (Left Front Side)

Courtesy of GENERAL MOTORS COMPANY

4. Remove the left front side of radiator surge tank support bracket (4). Refer to [**Radiator Surge Tank Support Bracket Replacement \(Radiator\)**](#)

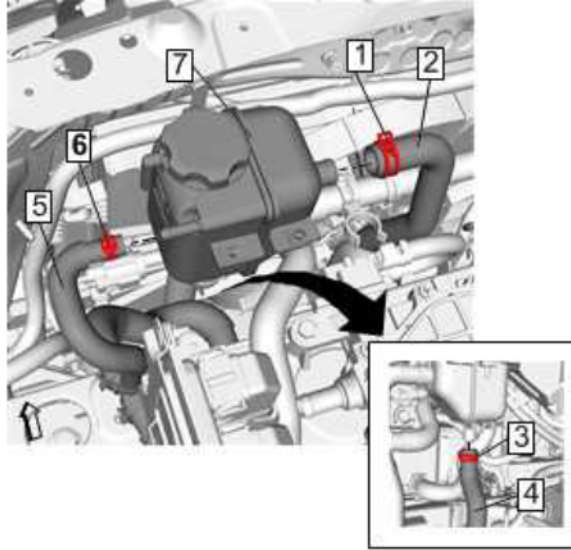


Fig. 97: Radiator Surge Tank And Connecting Components

Courtesy of GENERAL MOTORS COMPANY

5. Disengage Clamp (6). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
6. Remove the electric differential drive motor power inverter module cooling hose (5).
7. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
8. Remove Drive Motor Power Inverter Module Cooling Inlet Hose (2)
9. Disengage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
10. Remove Drive Motor Generator Control Module Coolant Pump Hose (4)
11. Remove Radiator Surge Tank (7)

Installation Procedure

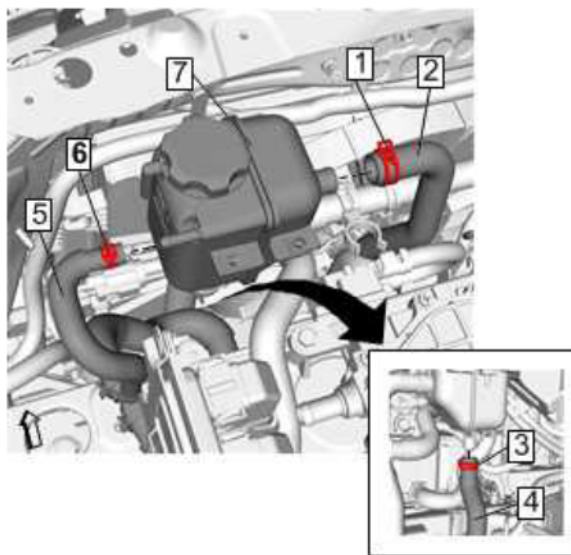


Fig. 98: Radiator Surge Tank And Connecting Components

Courtesy of GENERAL MOTORS COMPANY

1. Install Radiator Surge Tank (7)
2. Install Drive Motor Generator Control Module Coolant Pump Hose (4)
3. Engage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Install Drive Motor Power Inverter Module Cooling Inlet Hose (2)
5. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
6. Install the electric differential drive motor power inverter module cooling hose (5).
7. Engage Clamp (6). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

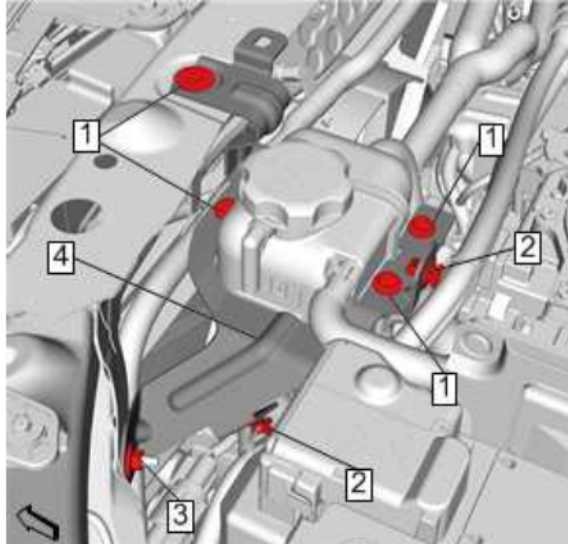


Fig. 99: Radiator Surge Tank Support Bracket And Fasteners (Left Front Side)
Courtesy of GENERAL MOTORS COMPANY

8. Install the left front side of radiator surge tank support bracket (4). Refer to [Radiator Surge Tank Support Bracket Replacement \(Radiator\)](#)

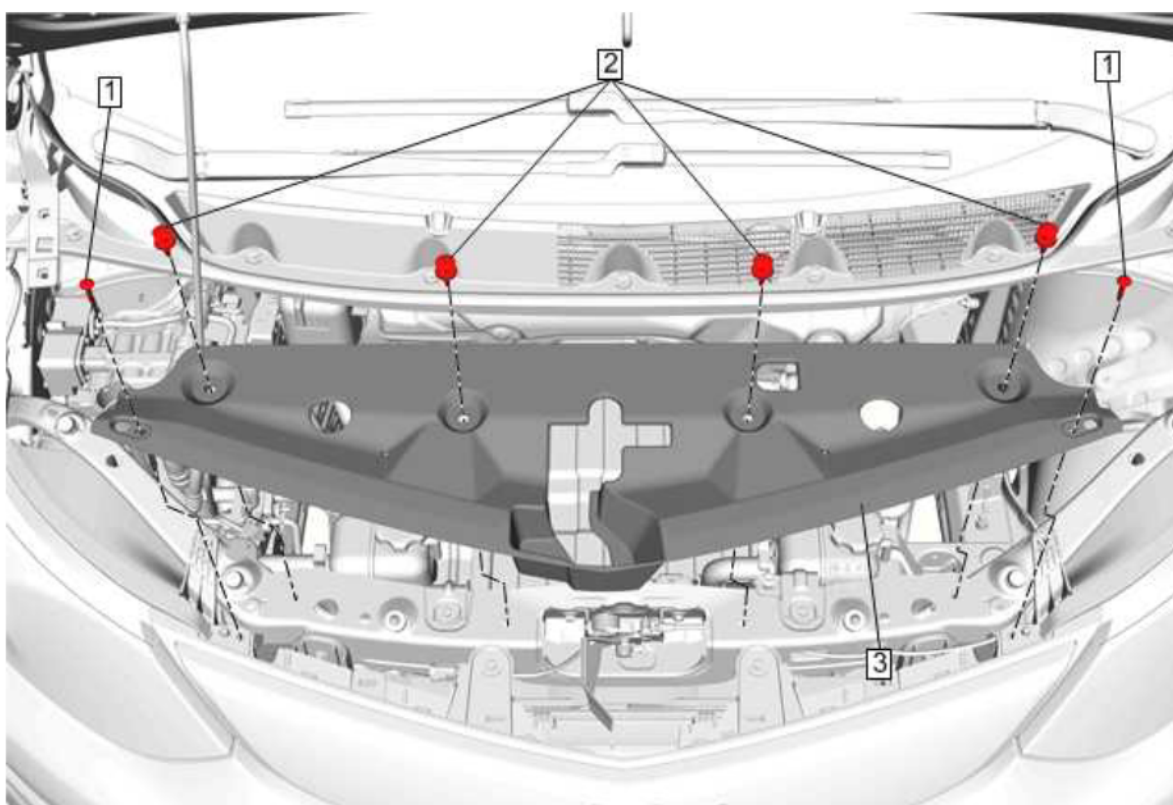


Fig. 100: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

9. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)
10. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
11. Check the cooling system for leaks.

RADIATOR SURGE TANK SUPPORT BRACKET REPLACEMENT (RADIATOR)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any

cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

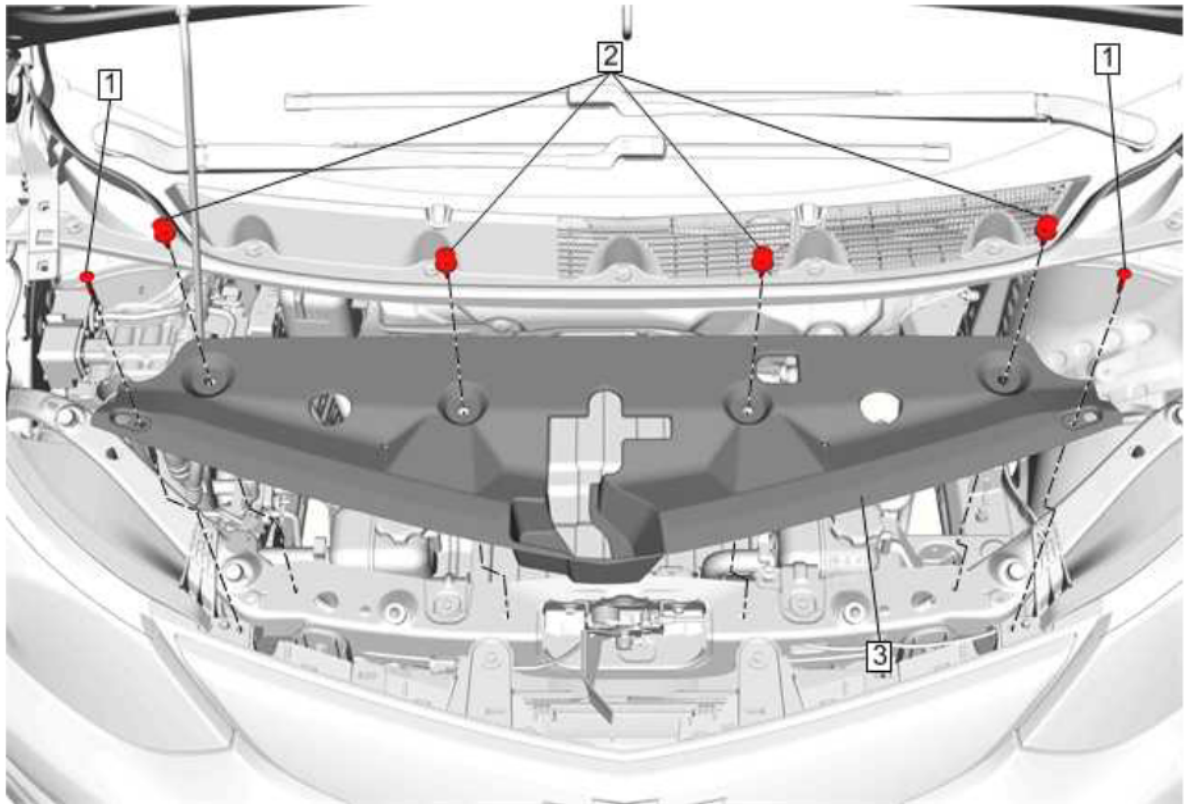


Fig. 101: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

1. Remove Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

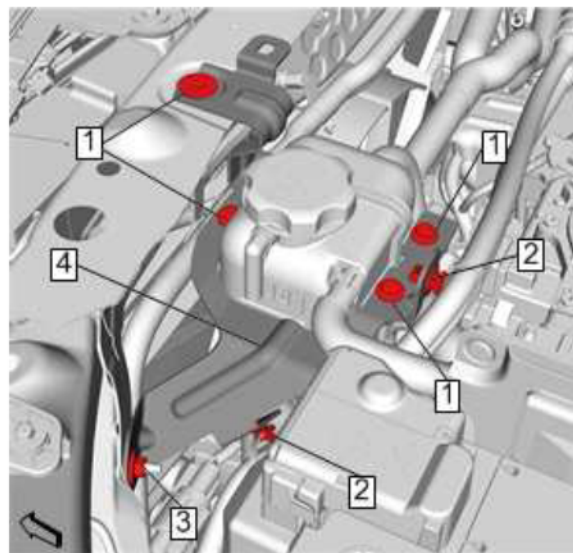


Fig. 102: Radiator Surge Tank Support Bracket And Fasteners (Left Front Side)
Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not remove any coolant hoses from the surge tanks.

2. Remove the 4 radiator surge tank support bracket bolts. (1)
3. Remove the radiator surge tank support bracket nut. (3)
4. {If equipped} Remove Retainers (2) (Qty: 2)
5. Remove the radiator surge tank support bracket. (4)

Installation Procedure

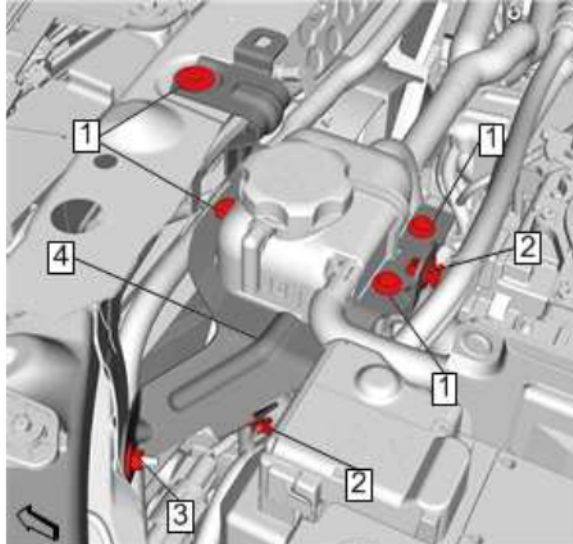


Fig. 103: Radiator Surge Tank Support Bracket And Fasteners (Left Front Side)
 Courtesy of GENERAL MOTORS COMPANY

1. Install the radiator surge tank support bracket. (4)

CAUTION: Refer to [Fastener Caution](#)

2. Install the radiator surge tank support bracket nut (3) and tighten to 9 N.m (80 lb in)
3. Install the 4 radiator surge tank support bracket bolts (1) and tighten to 9 N.m (80 lb in)
4. {If equipped} Install Retainers (2) (Qty: 2)

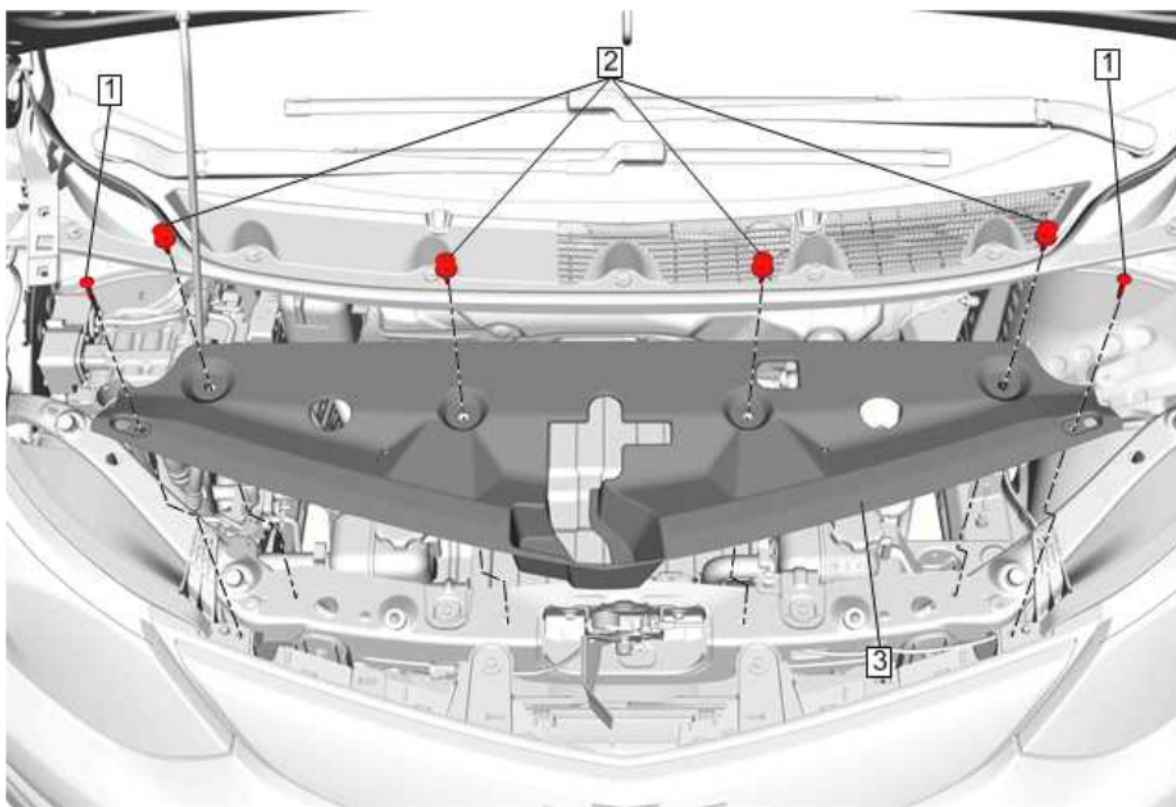


Fig. 104: Front Compartment Front Sight Shield
 Courtesy of GENERAL MOTORS COMPANY

5. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

RADIATOR SURGE TANK SUPPORT BRACKET REPLACEMENT (HEATER)

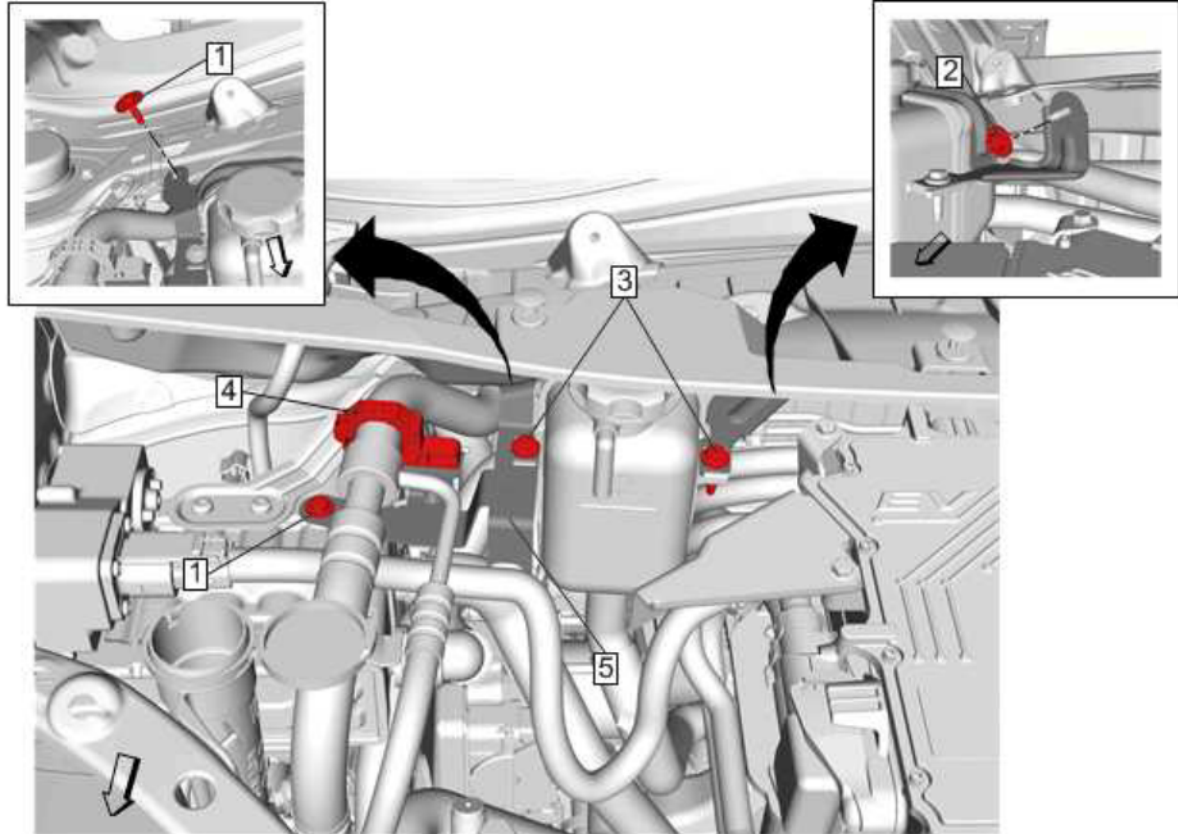


Fig. 105: Radiator Surge Tank Support Bracket (Heater)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.	
1	Radiator Surge Tank Support Bracket Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . 9 N.m (80 lb in)
2	Radiator Surge Tank Support Bracket Nut 9 N.m (80 lb in)
3	Radiator Surge Tank Bolt (Qty: 2) 4.5 N.m (40 lb in)
4	Retainer
5	Heater Surge Tank Bracket Procedure Unclip the high voltage heater harness from the bracket.

RADIATOR SURGE TANK SUPPORT BRACKET REPLACEMENT (RESS)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

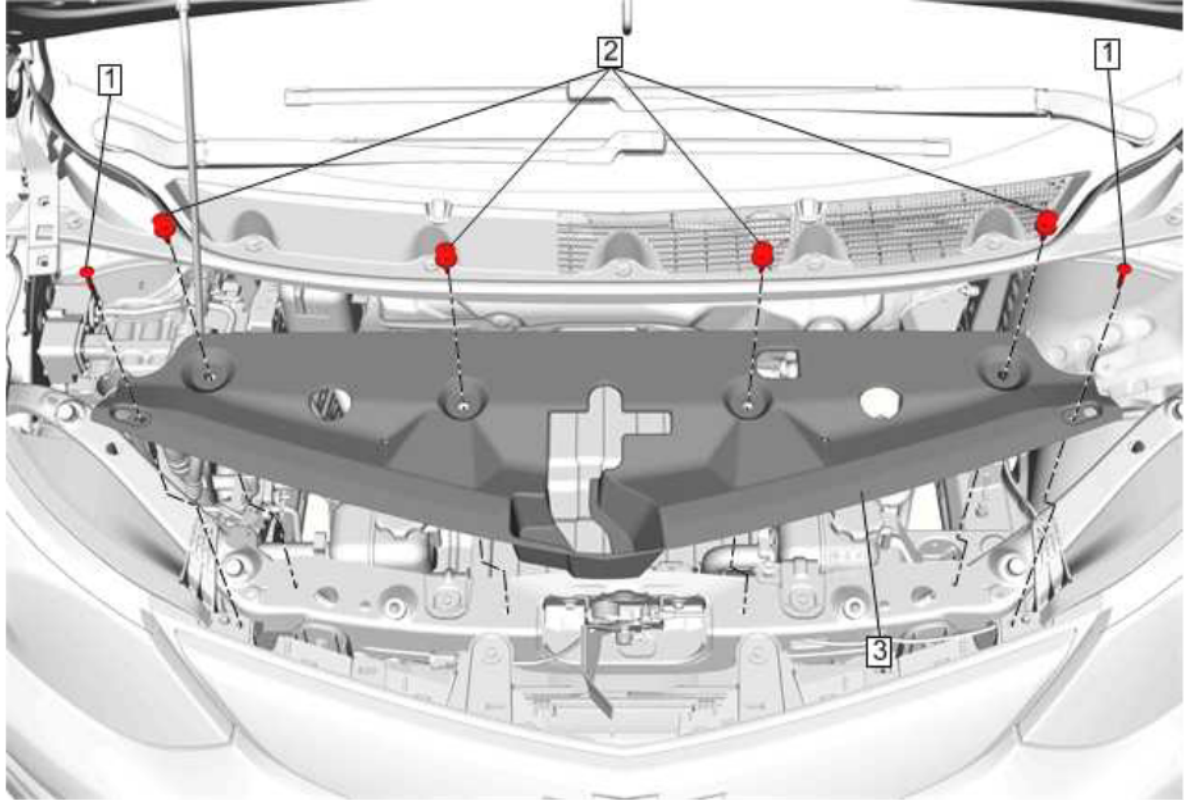


Fig. 106: Front Compartment Front Sight Shield
 Courtesy of GENERAL MOTORS COMPANY

1. Remove Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

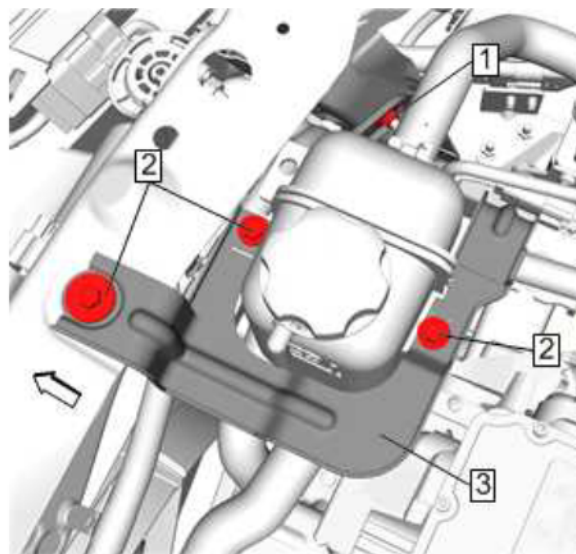


Fig. 107: Drive Motor Battery Radiator Surge Tank Bracket, Bolts And Nut
 Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not remove any coolant hoses from the surge tanks.

2. Remove the 3 drive motor battery radiator surge tank bracket bolts (2).
3. Remove the drive motor battery radiator surge tank bracket nut (1).
4. Remove Radiator Surge Tank Bracket (3)

Installation Procedure

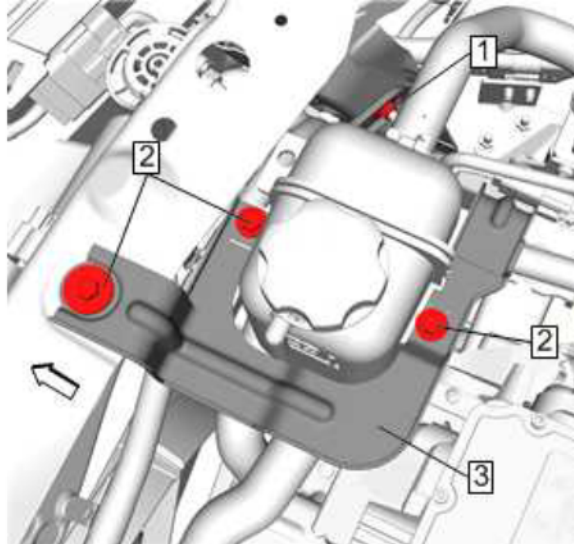


Fig. 108: Drive Motor Battery Radiator Surge Tank Bracket, Bolts And Nut
Courtesy of GENERAL MOTORS COMPANY

1. Install Radiator Surge Tank Bracket (3)

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

2. Install the drive motor battery radiator surge tank bracket nut (1) and tighten to 9 N.m (80 lb in)
3. Install the 3 drive motor battery radiator surge tank bracket bolts (2) and tighten to 9 N.m (80 lb in)

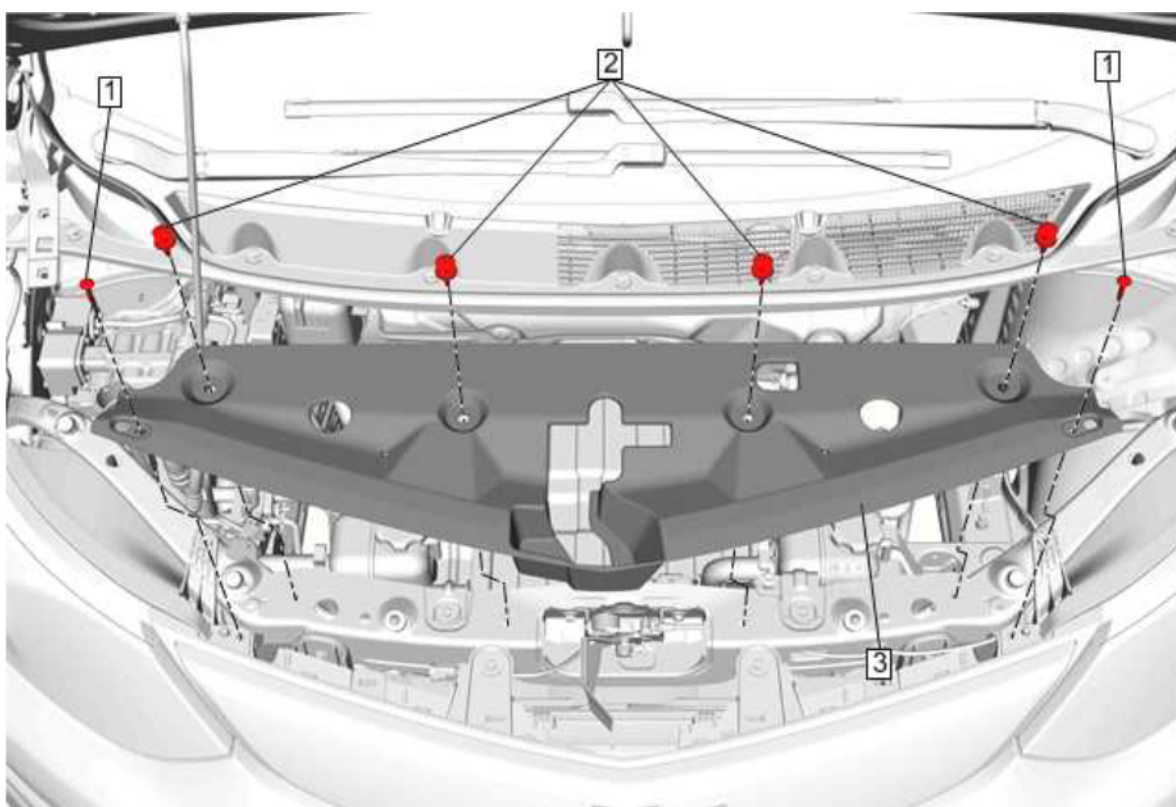


Fig. 109: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

4. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

COOLING FAN AND SHROUD REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any

cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

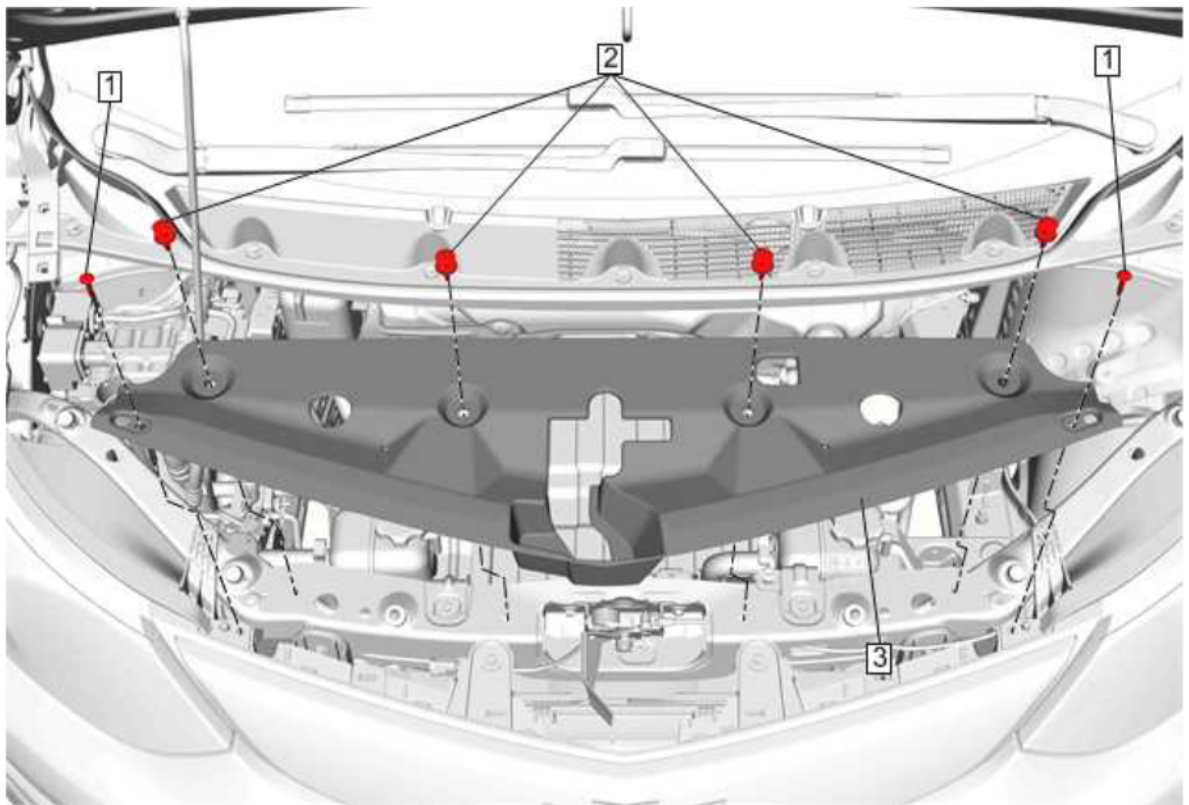


Fig. 110: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

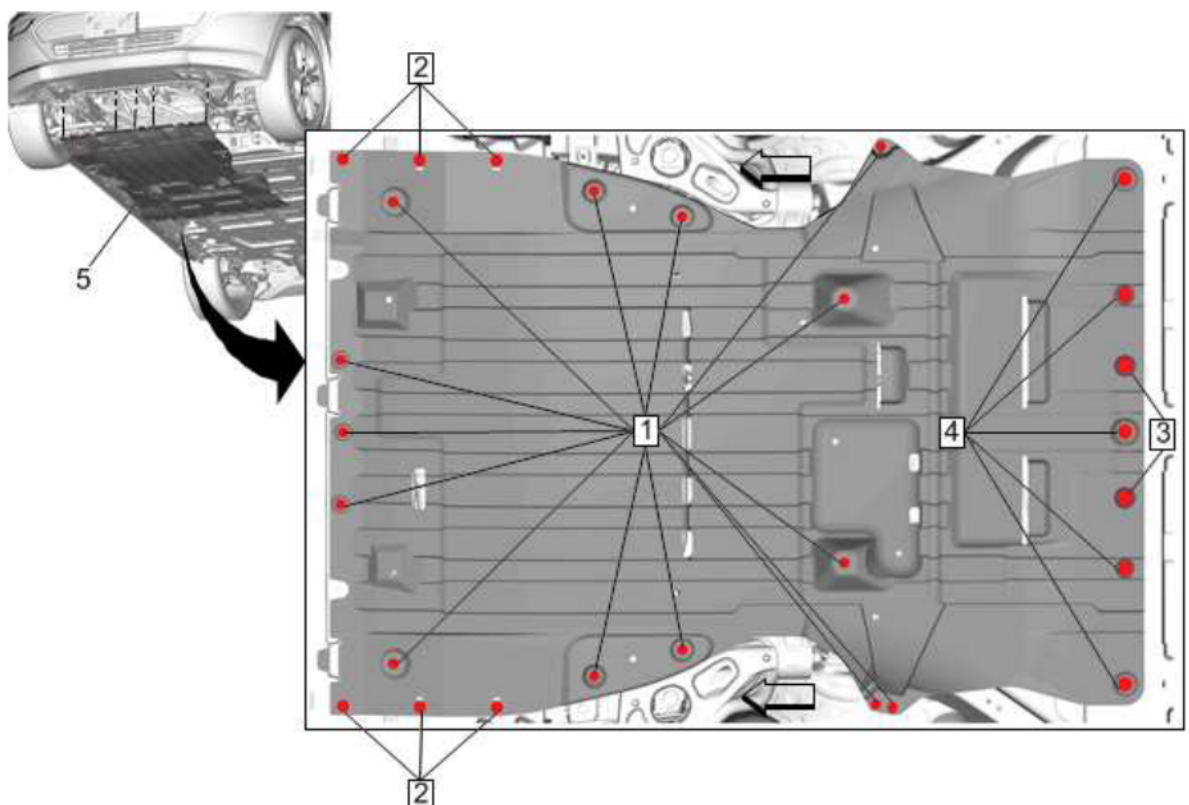


Fig. 111: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

4. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

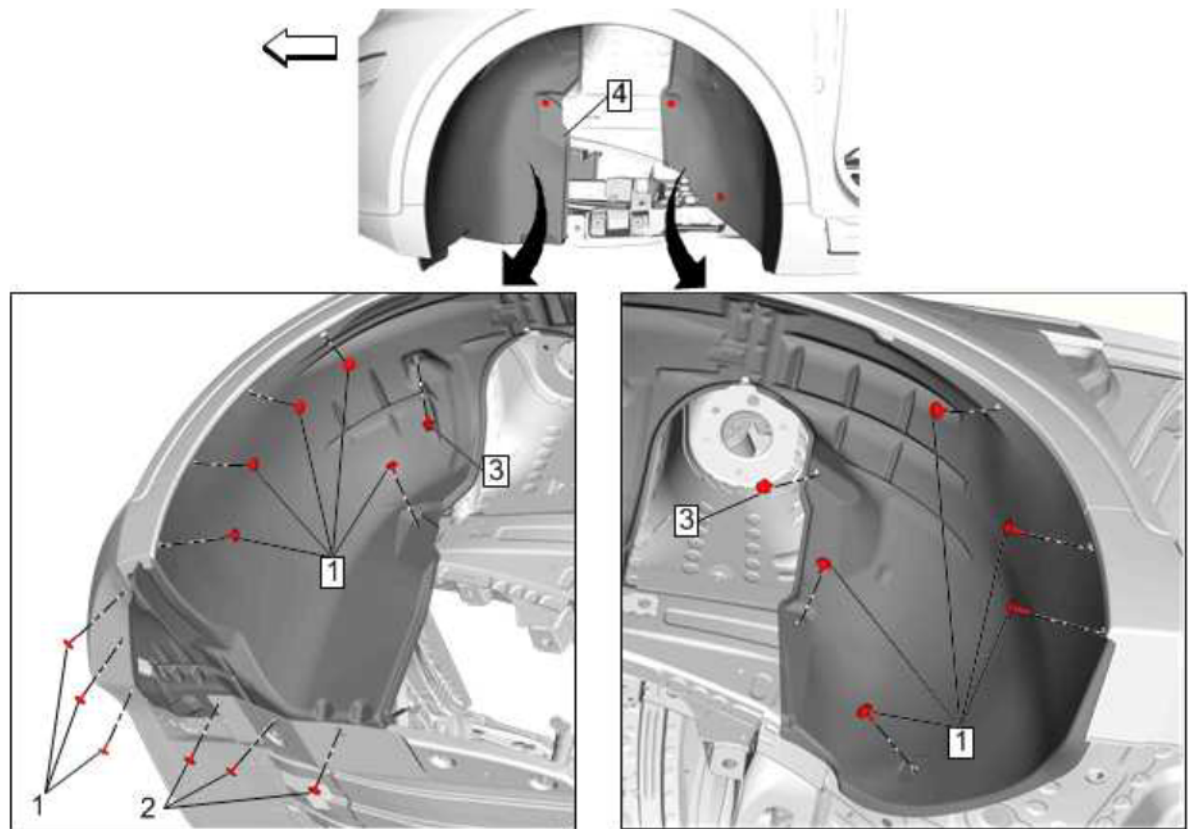


Fig. 112: Front Wheelhouse Liner

Courtesy of GENERAL MOTORS COMPANY

5. Remove Front Wheelhouse Liner (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)

6. Remove the front bumper fascia. Refer to [Front Bumper Fascia Replacement \(North America\)](#) [Front Bumper Fascia Replacement \(Europe, Korea\)](#)

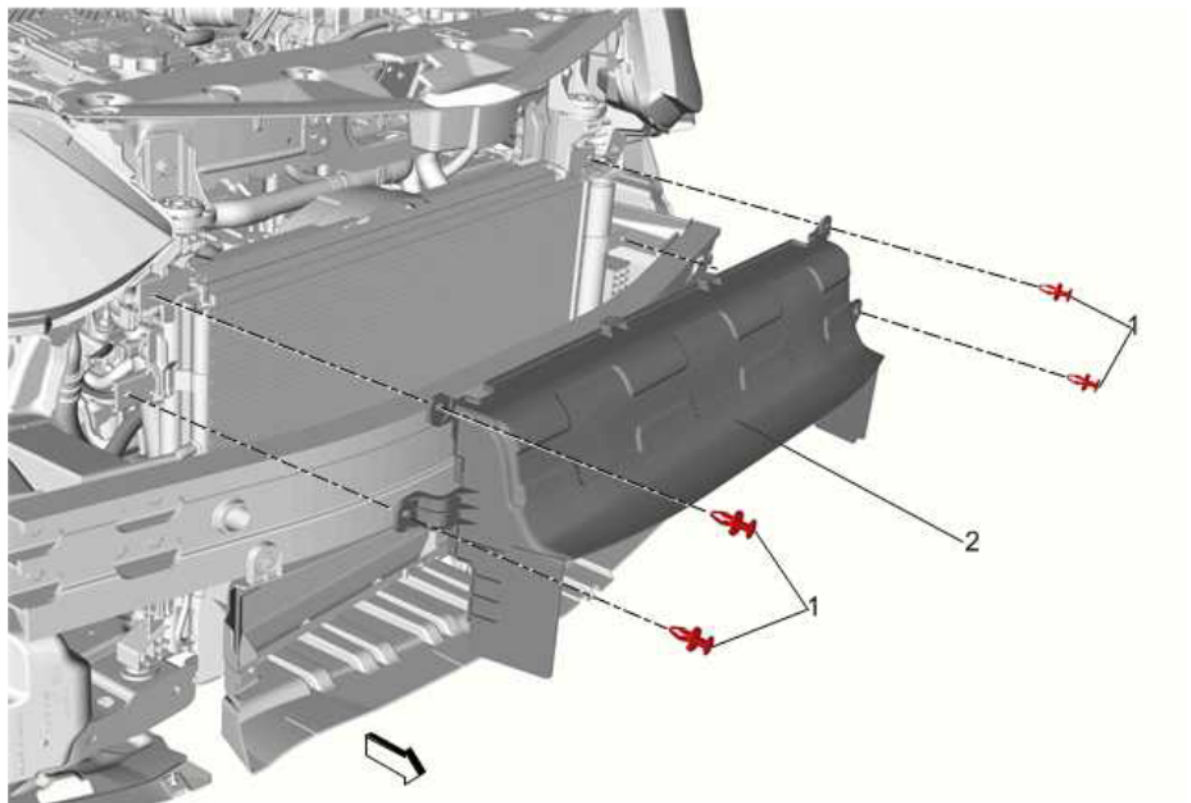


Fig. 113: Radiator Air Upper Baffle And Deflector

Courtesy of GENERAL MOTORS COMPANY

7. Remove Radiator Air Upper Baffle and Deflector (2). Refer to [Radiator Air Upper Baffle and Deflector Replacement](#)

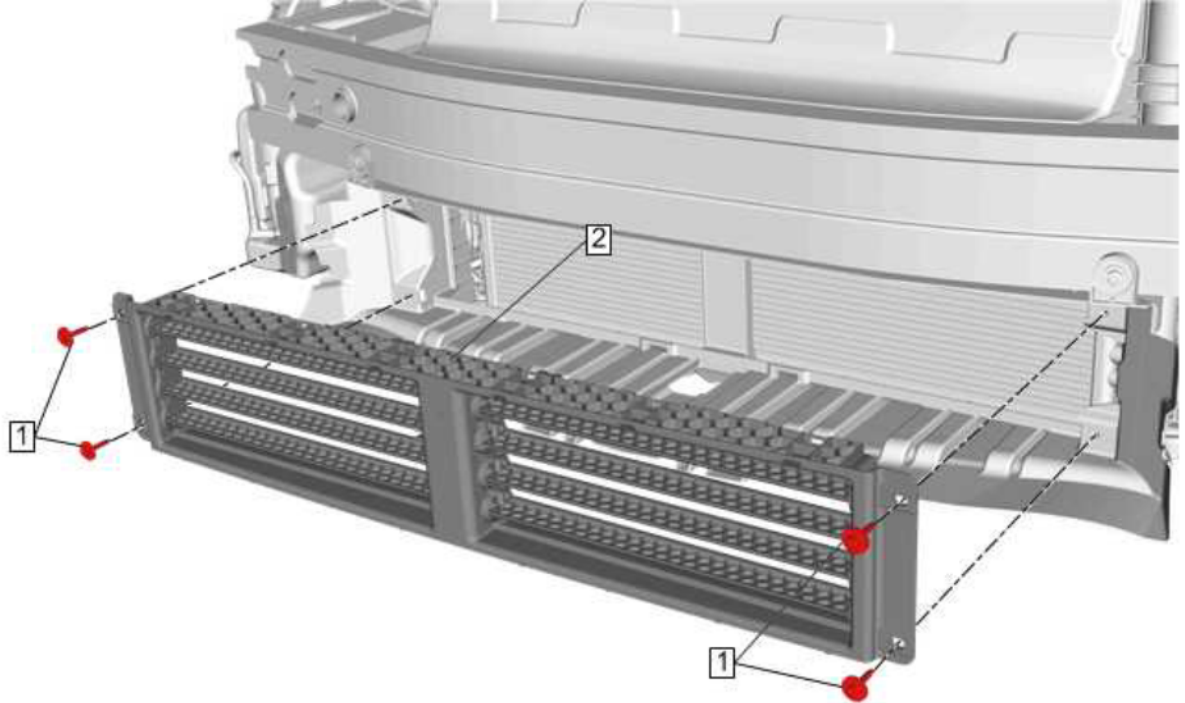


Fig. 114: Front Bumper Shutter

Courtesy of GENERAL MOTORS COMPANY

8. Remove Front Bumper Shutter (2). Refer to [Front Bumper Shutter Replacement](#)

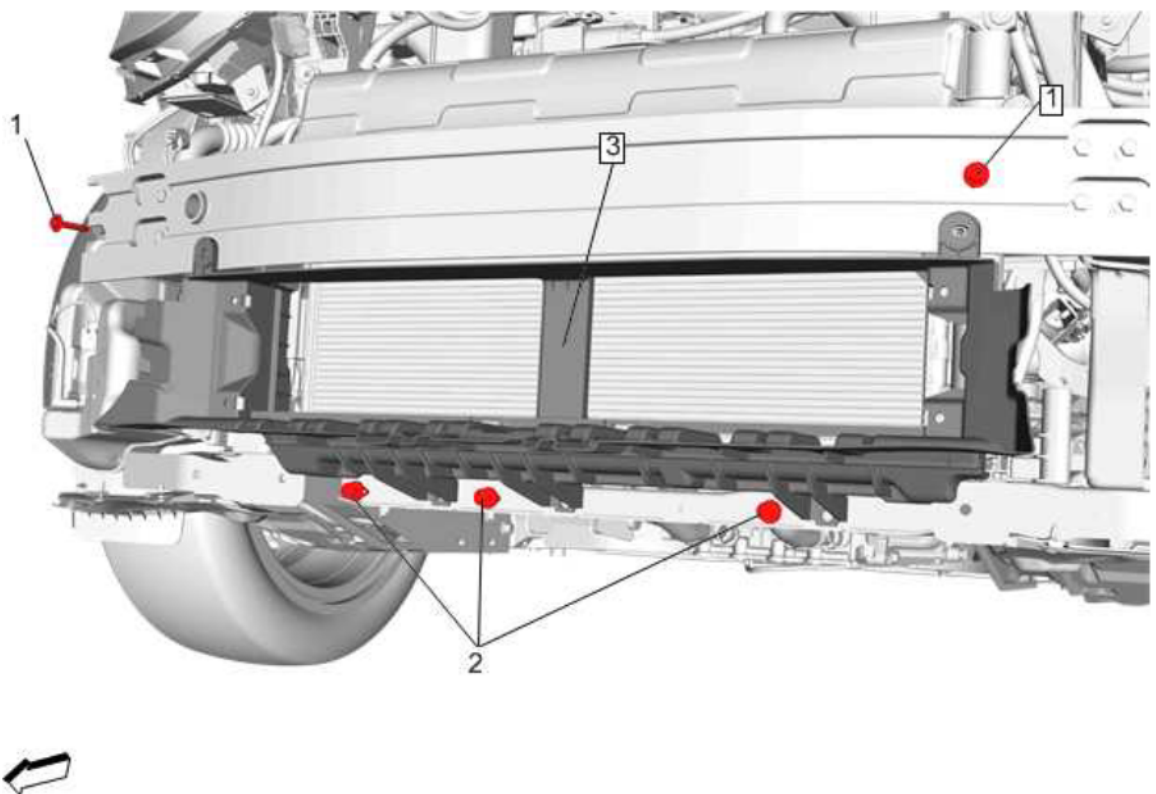


Fig. 115: Radiator Air Lower Baffle and Deflector Assembly

Courtesy of GENERAL MOTORS COMPANY

9. Remove Radiator Air Lower Baffle and Deflector Assembly (3). Refer to [Radiator Air Lower Baffle and Deflector Replacement](#)

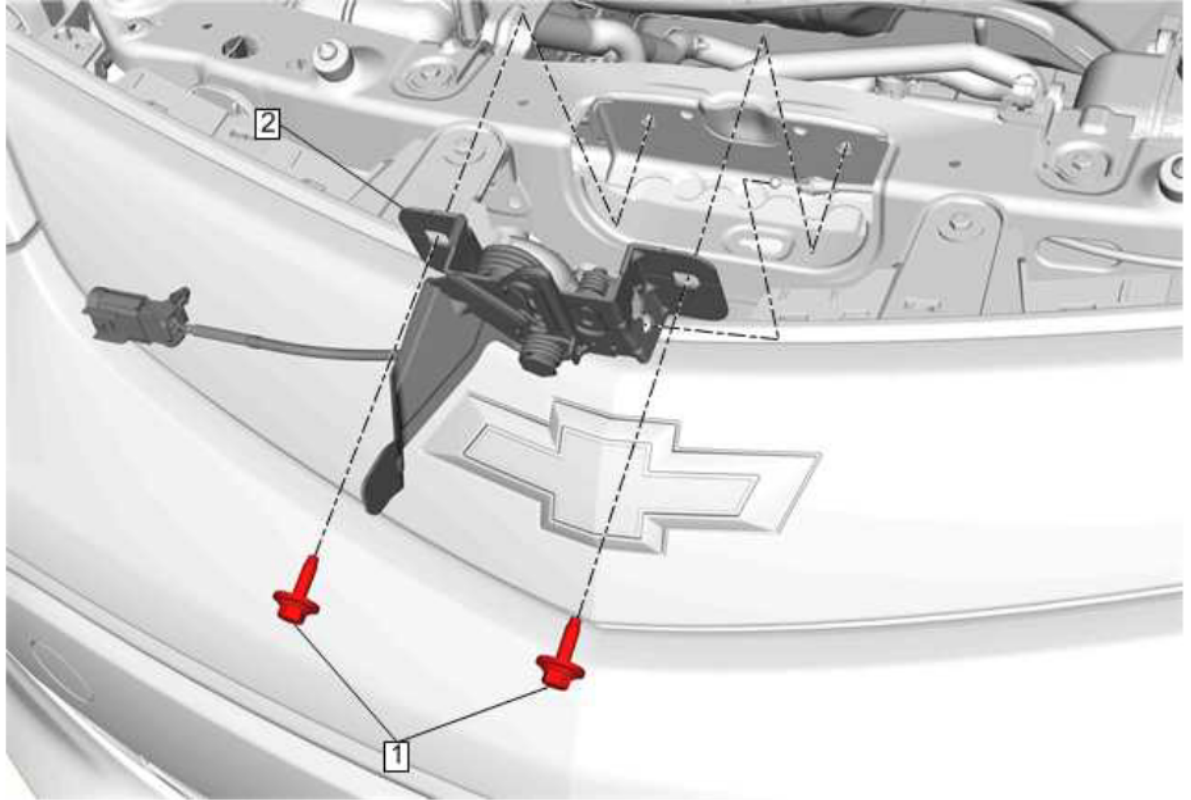


Fig. 116: Hood Primary and Secondary Latch
 Courtesy of GENERAL MOTORS COMPANY

10. Reposition the hood primary and secondary latch (2). Refer to [Hood Primary and Secondary Latch Replacement](#)

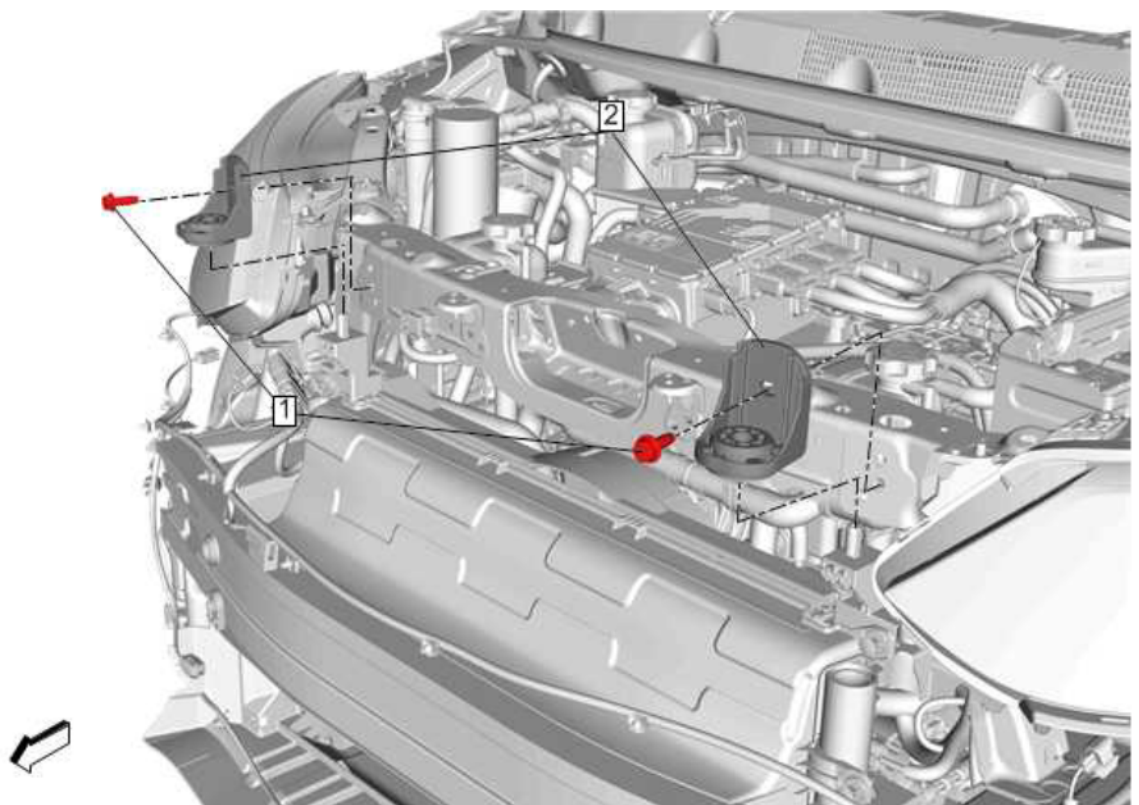


Fig. 117: Radiator Upper Brackets
 Courtesy of GENERAL MOTORS COMPANY

11. Remove Radiator Upper Brackets (2) (Qty: 2). Refer to [Radiator Upper Bracket Replacement](#)

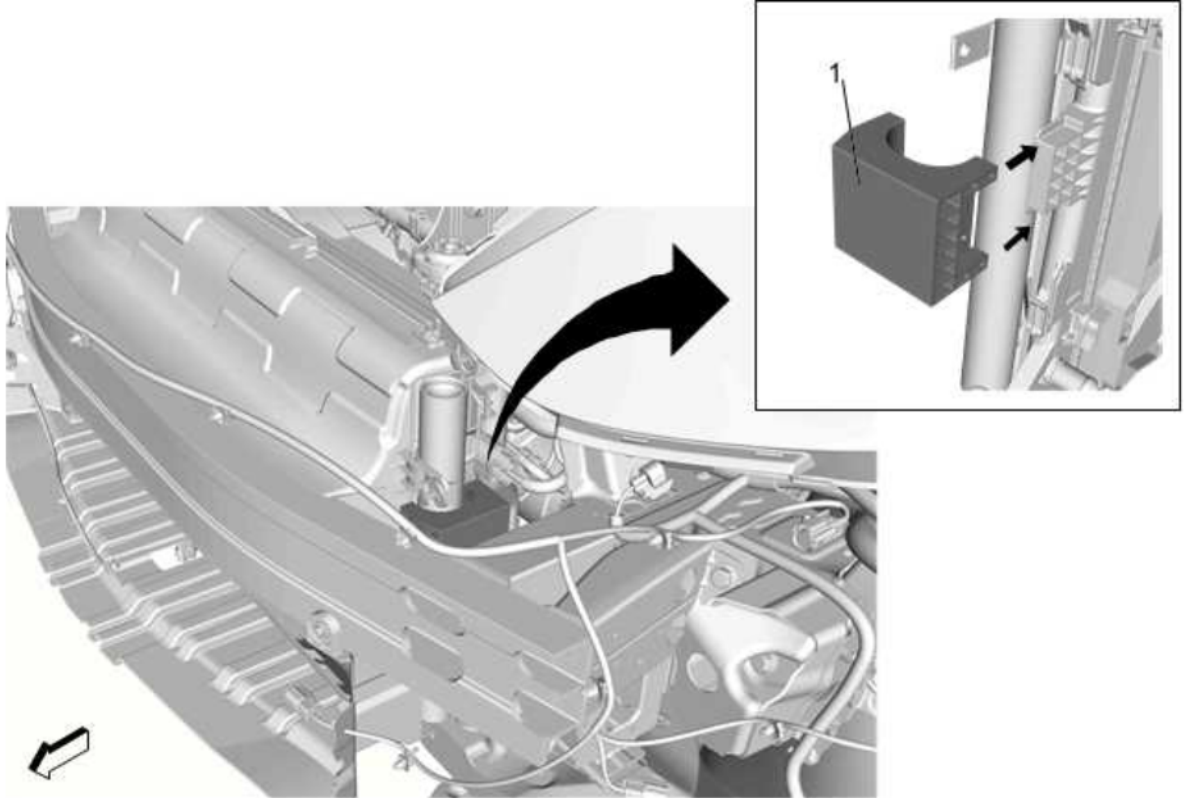


Fig. 118: Radiator Protector

Courtesy of GENERAL MOTORS COMPANY

12. Remove the radiator protector (1). Refer to [Radiator Protector Replacement](#)

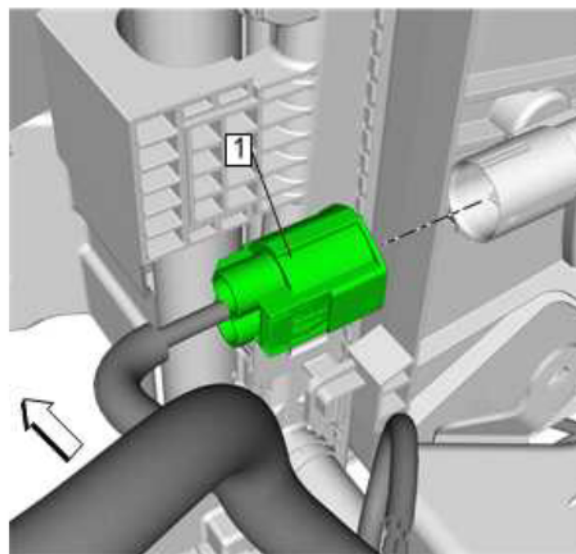


Fig. 119: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

13. Disconnect Electrical Connector (1)

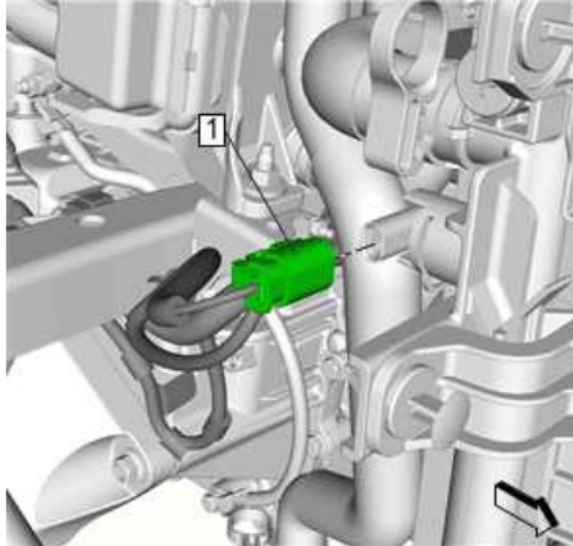


Fig. 120: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

14. Disconnect Electrical Connector (1)

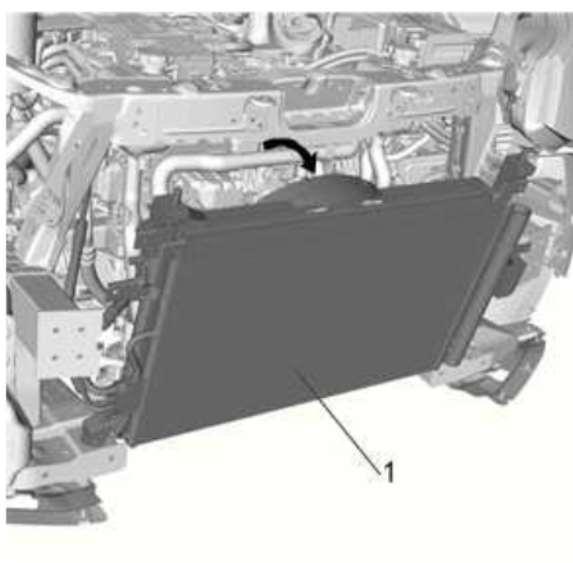


Fig. 121: Radiator Assembly

Courtesy of GENERAL MOTORS COMPANY

15. Pull the radiator assembly (1) with air conditioning condenser hoses forward to get the space.

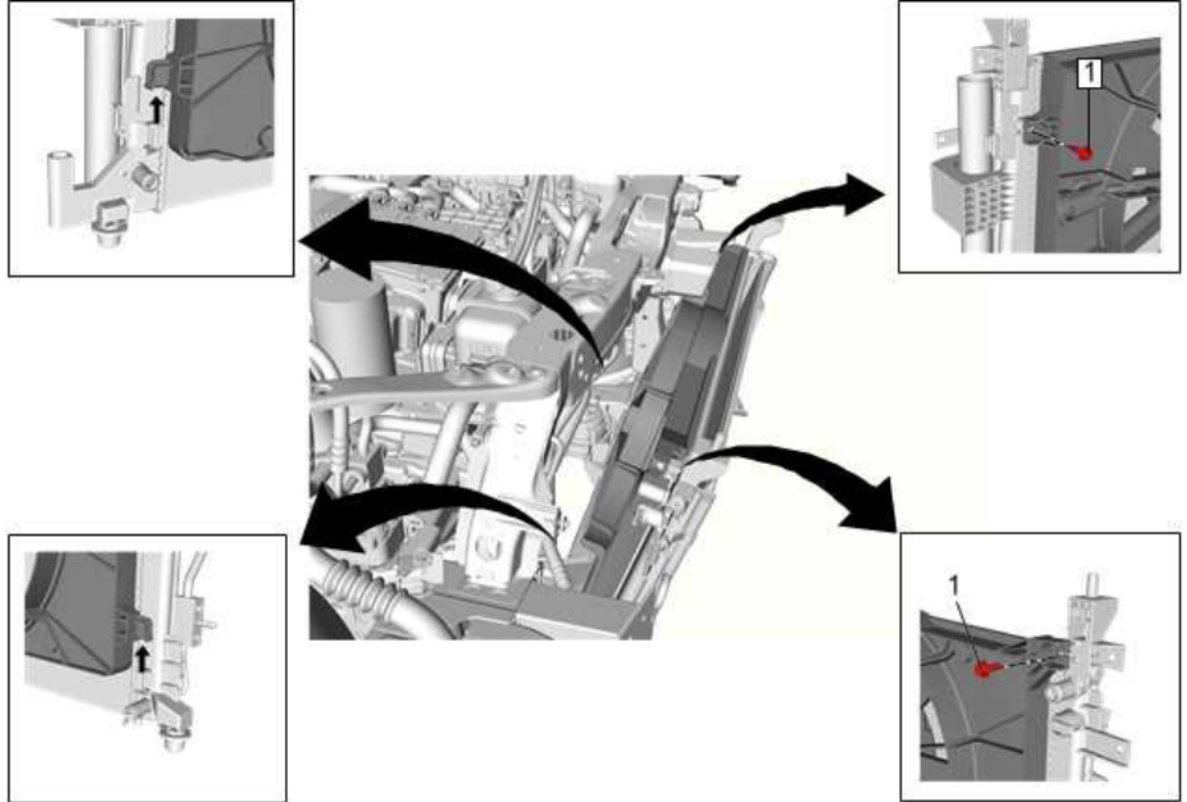


Fig. 122: Cooling Fan Bolts

Courtesy of GENERAL MOTORS COMPANY

16. Remove the 2 cooling fan bolts (1).
17. Pull up the lower cooling fan assembly until it can be put out of the retaining tabs.

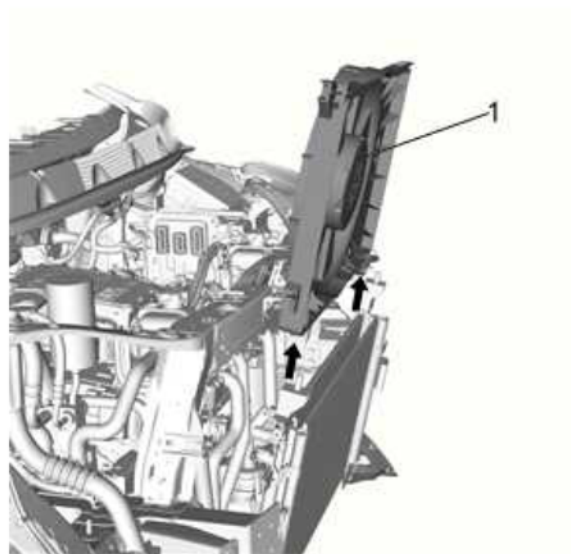


Fig. 123: Cooling Fan

Courtesy of GENERAL MOTORS COMPANY

18. Remove Cooling Fan (1)

Installation Procedure

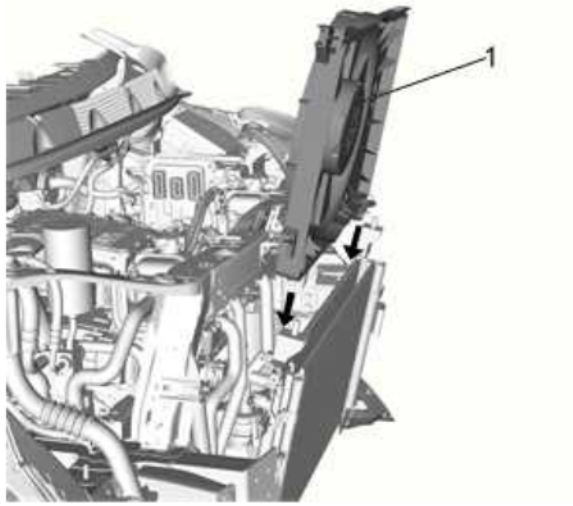


Fig. 124: Cooling Fan

Courtesy of GENERAL MOTORS COMPANY

1. Install Cooling Fan (1)

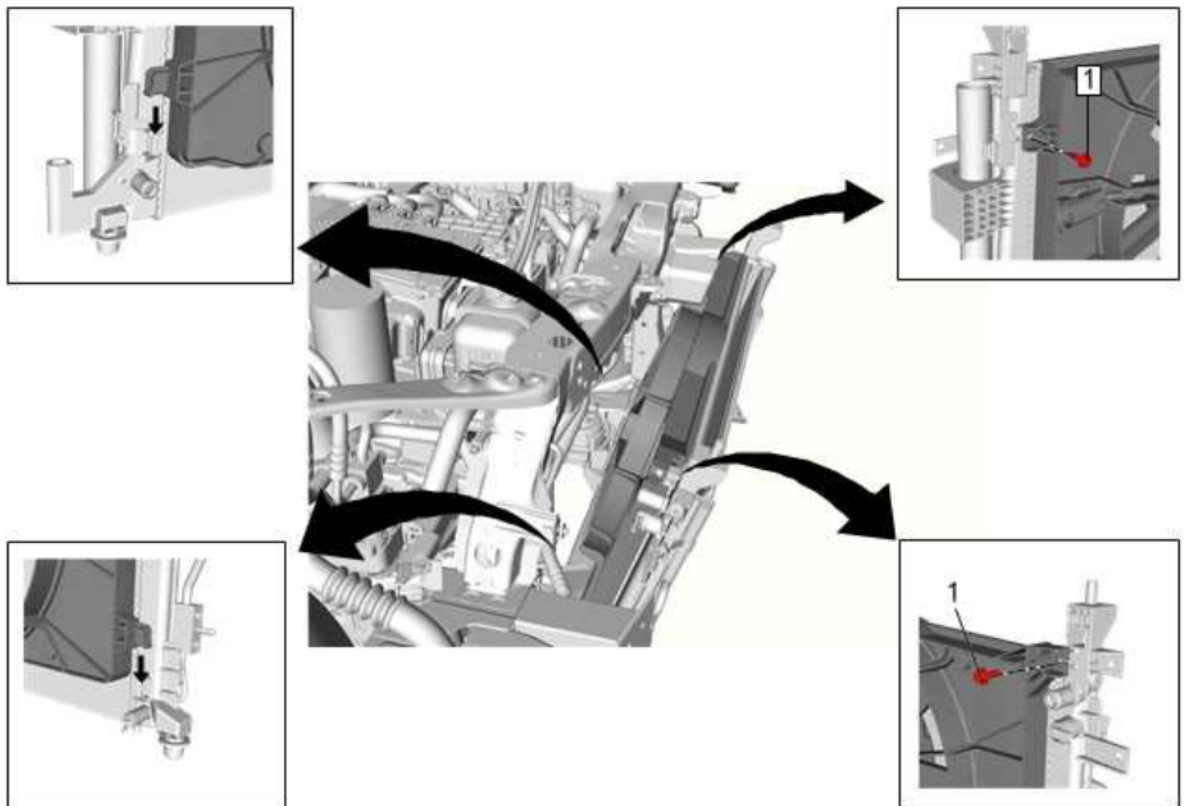


Fig. 125: Cooling Fan Bolts

Courtesy of GENERAL MOTORS COMPANY

2. Install the lower cooling fan assembly into the retaining tabs.

CAUTION: Refer to **Fastener Caution** .

3. Install the 2 cooling fan bolts (1) and tighten to 5 N.m (44 lb in).

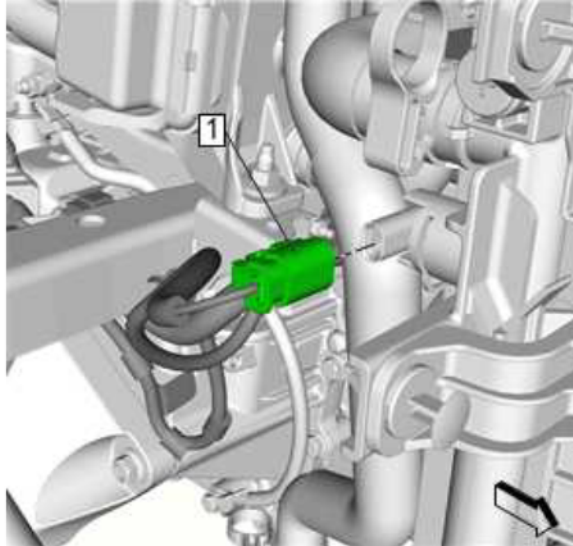


Fig. 126: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

4. Connect Electrical Connector (1)

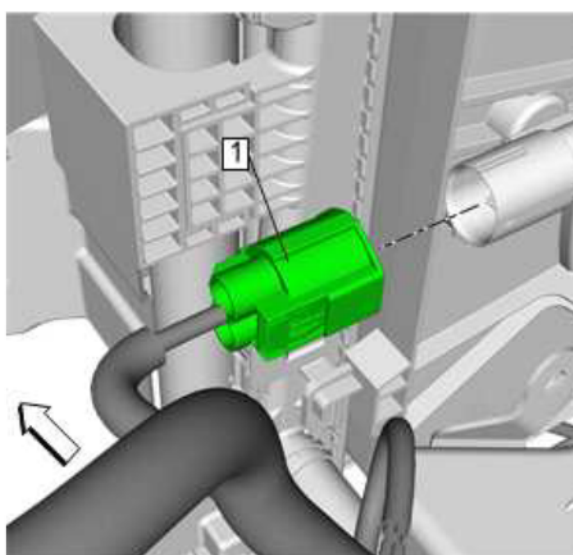


Fig. 127: Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

5. Connect Electrical Connector (1)

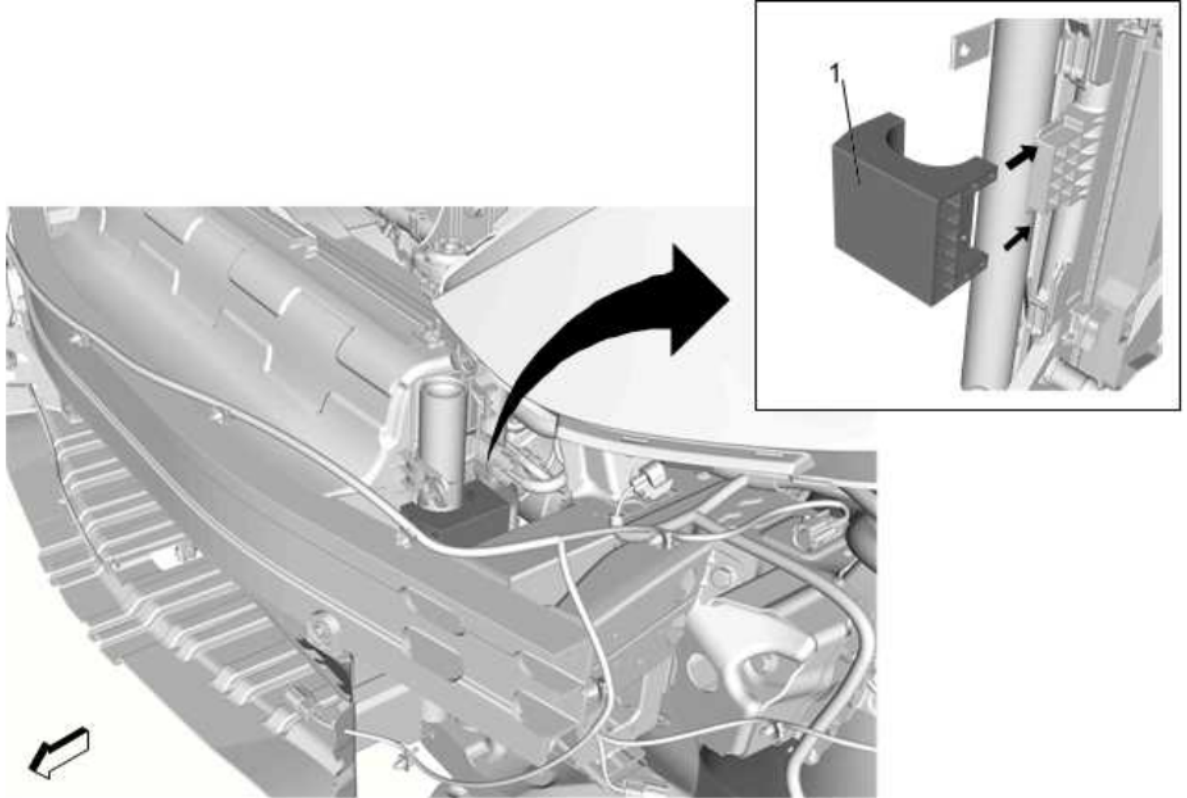


Fig. 128: Radiator Protector

Courtesy of GENERAL MOTORS COMPANY

6. Install the radiator protector (1). Refer to [Radiator Protector Replacement](#)

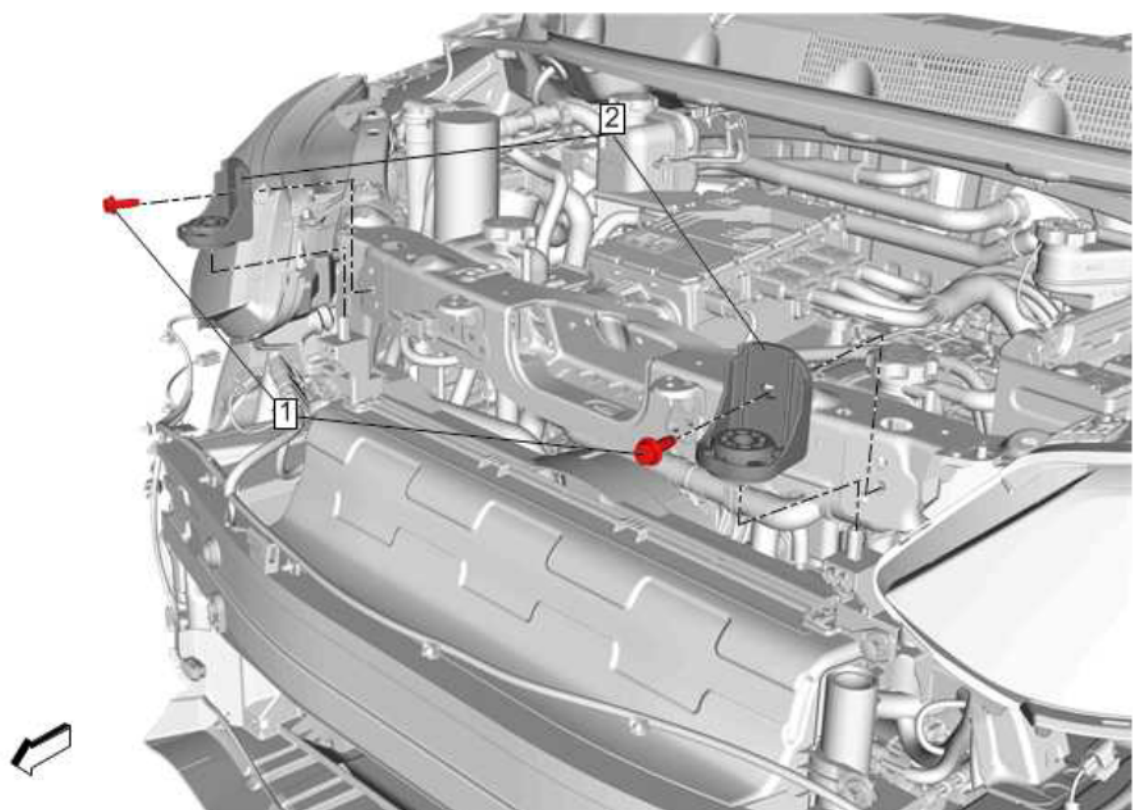


Fig. 129: Radiator Upper Brackets

Courtesy of GENERAL MOTORS COMPANY

7. Install Radiator Upper Brackets (2) (Qty: 2). Refer to [Radiator Upper Bracket Replacement](#)

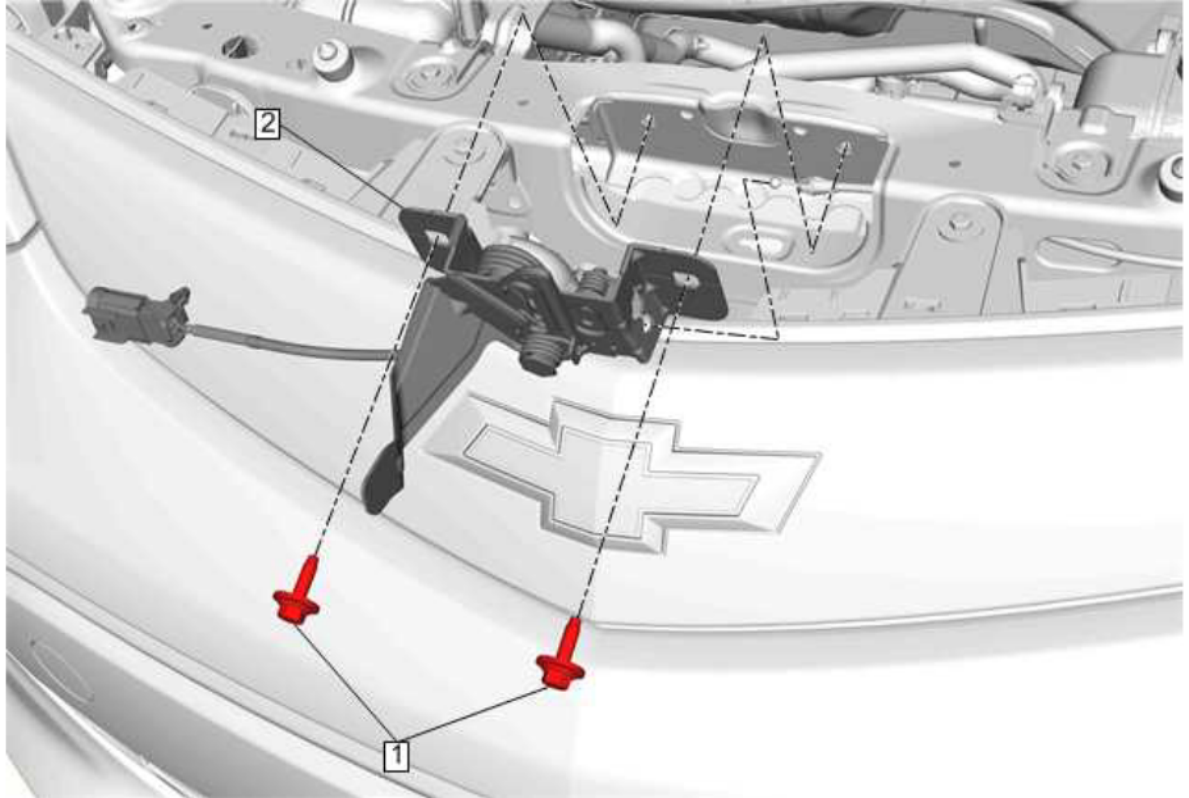


Fig. 130: Hood Primary and Secondary Latch
 Courtesy of GENERAL MOTORS COMPANY

8. Install the hood primary and secondary latch (2). Refer to [Hood Primary and Secondary Latch Replacement](#)

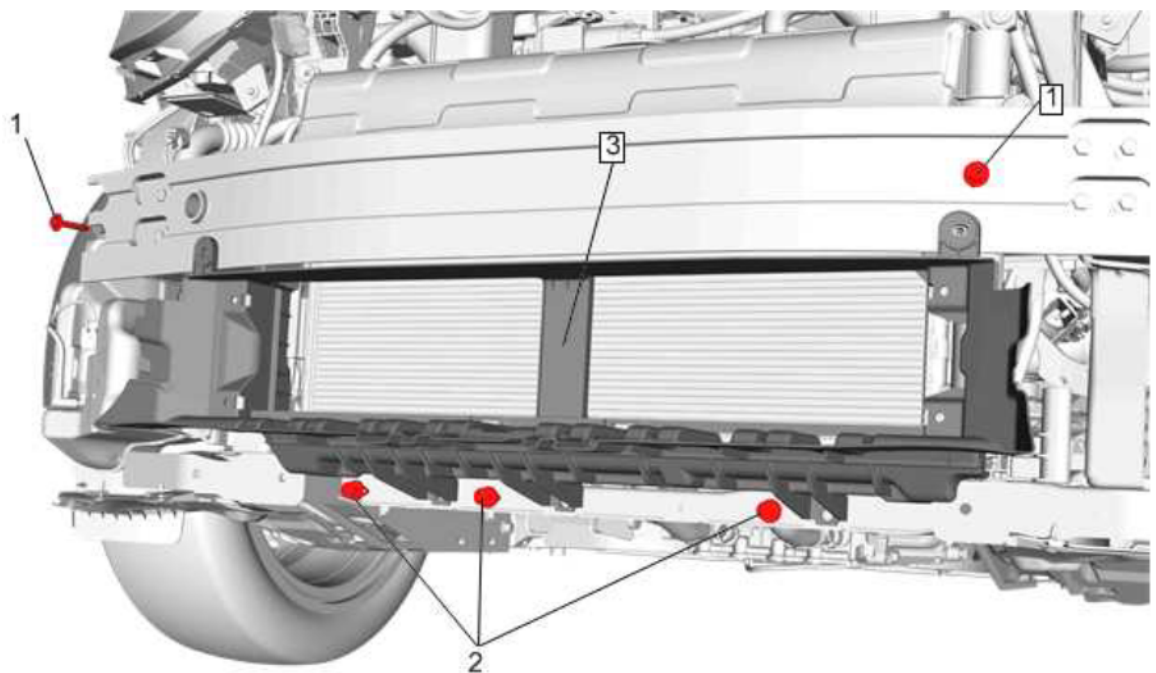


Fig. 131: Radiator Air Lower Baffle and Deflector Assembly
 Courtesy of GENERAL MOTORS COMPANY

9. Install Radiator Air Lower Baffle and Deflector Assembly (3). Refer to [Radiator Air Lower Baffle and Deflector Replacement](#)

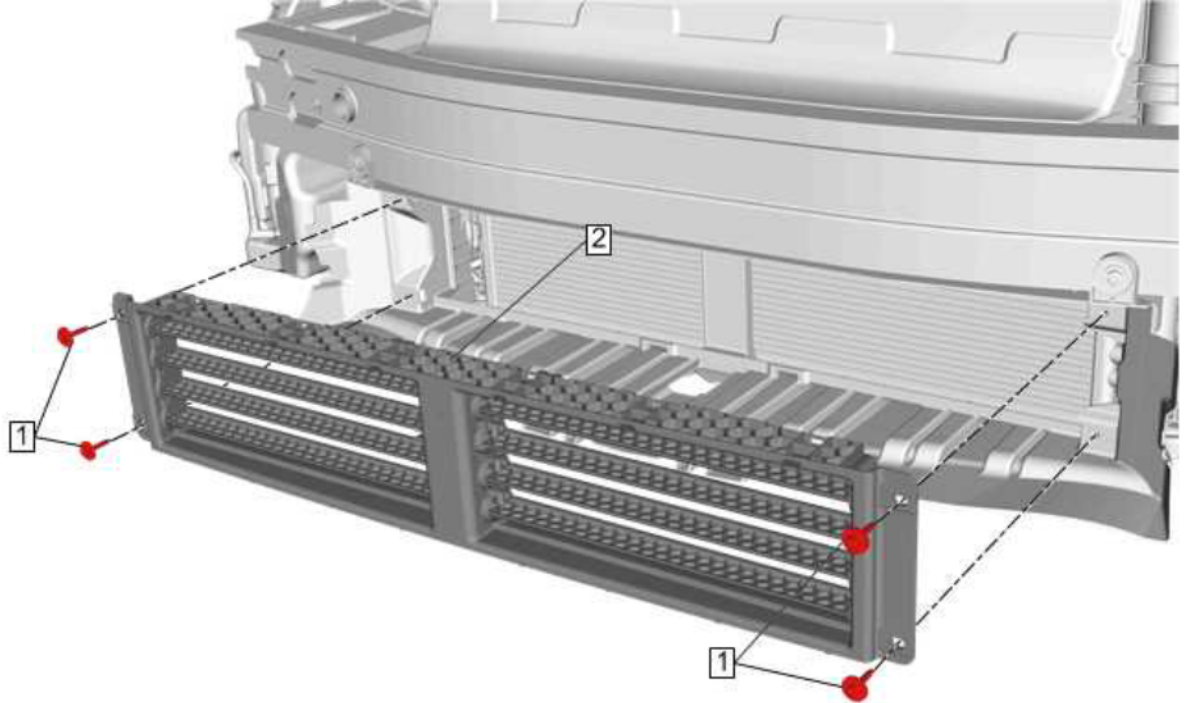


Fig. 132: Front Bumper Shutter

Courtesy of GENERAL MOTORS COMPANY

10. Install Front Bumper Shutter (2). Refer to [Front Bumper Shutter Replacement](#)

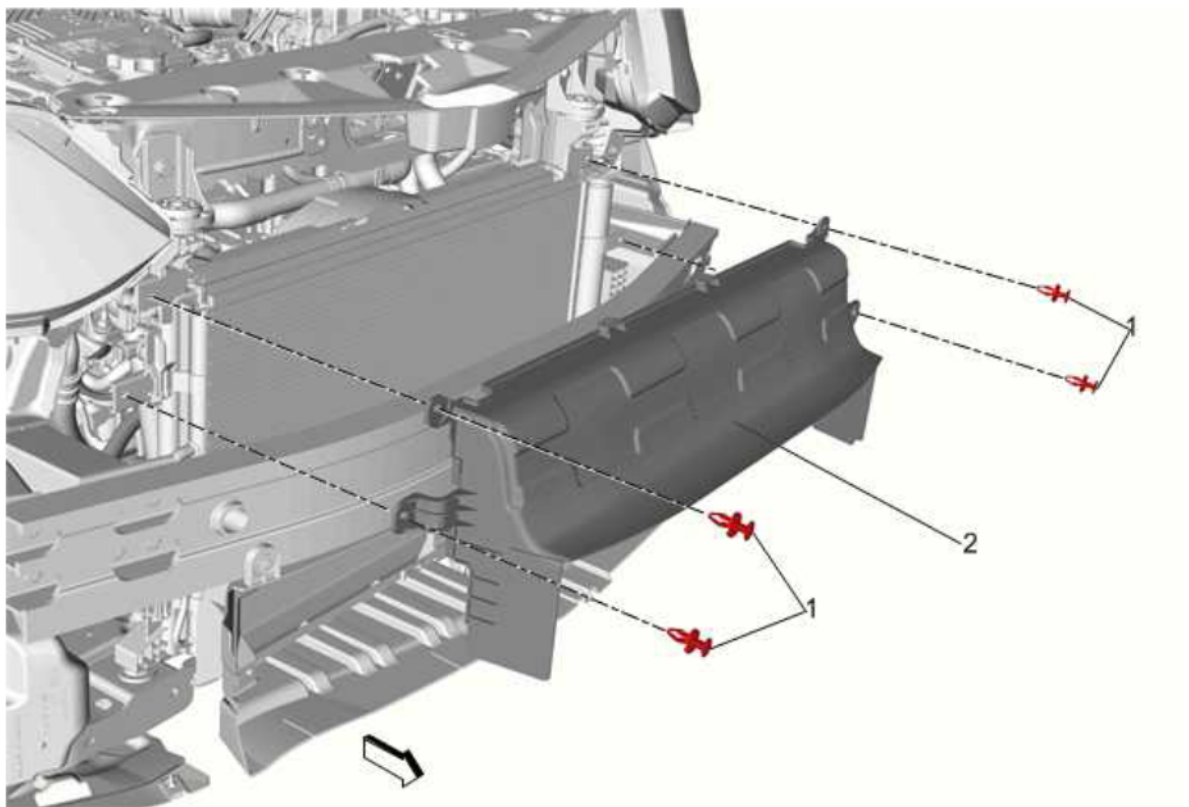


Fig. 133: Radiator Air Upper Baffle And Deflector

Courtesy of GENERAL MOTORS COMPANY

11. Install Radiator Air Upper Baffle and Deflector (2). Refer to [Radiator Air Upper Baffle and Deflector Replacement](#)
12. Install Front Bumper Fascia. Refer to [Front Bumper Fascia Replacement \(North America\)](#) [Front Bumper Fascia Replacement \(Europe, Korea\)](#)

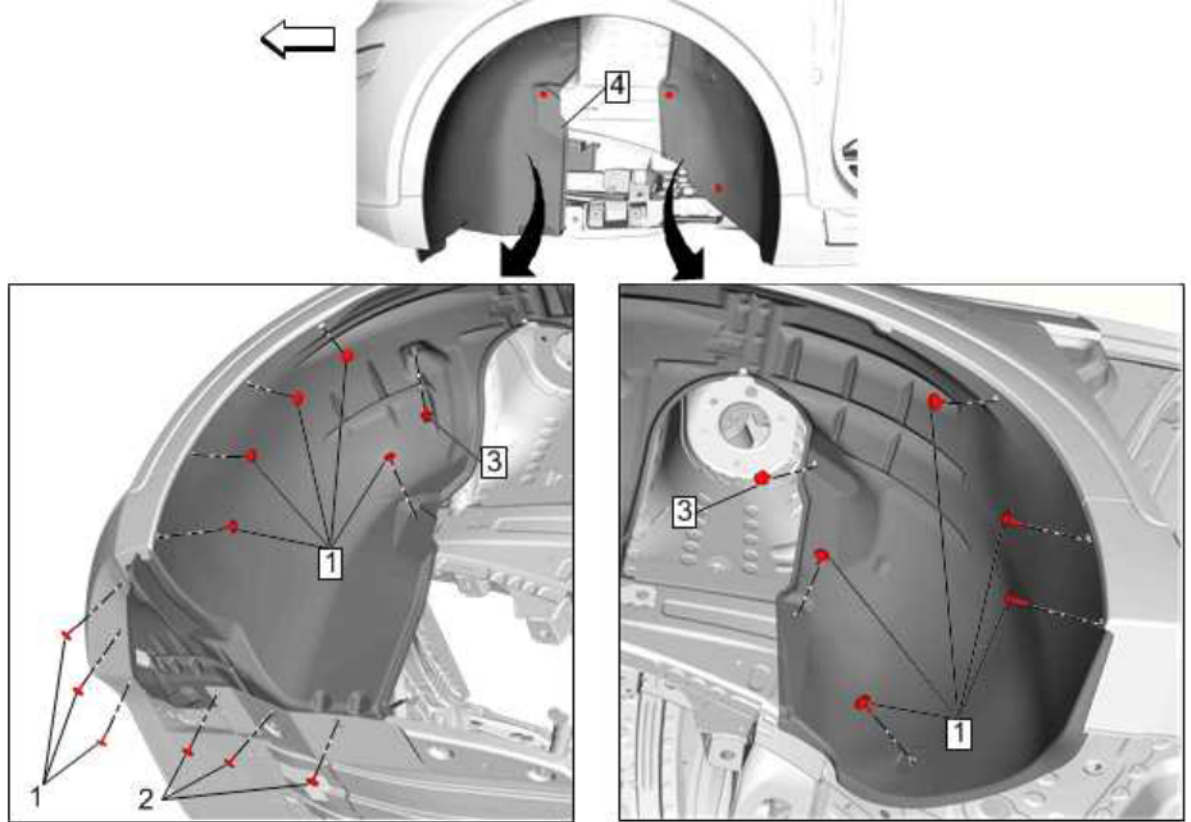


Fig. 134: Front Wheelhouse Liner

Courtesy of GENERAL MOTORS COMPANY

13. Install Front Wheelhouse Liner (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)

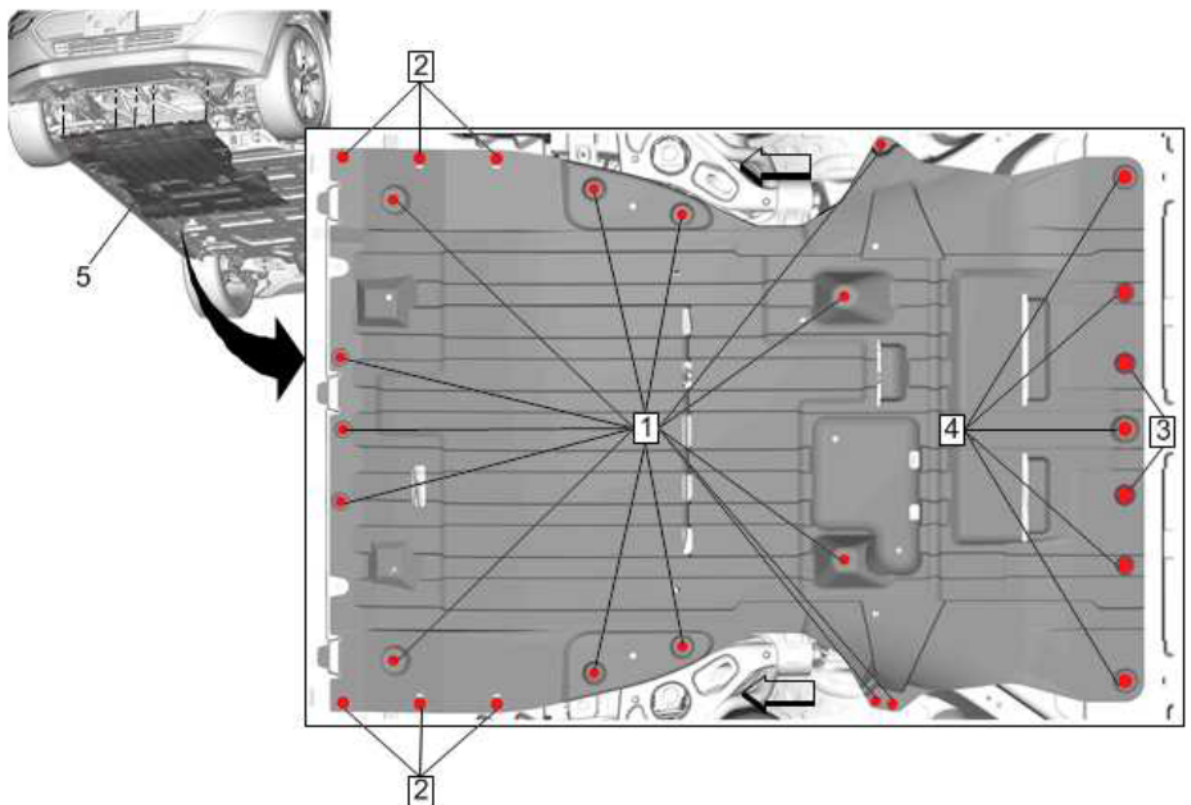


Fig. 135: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

14. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

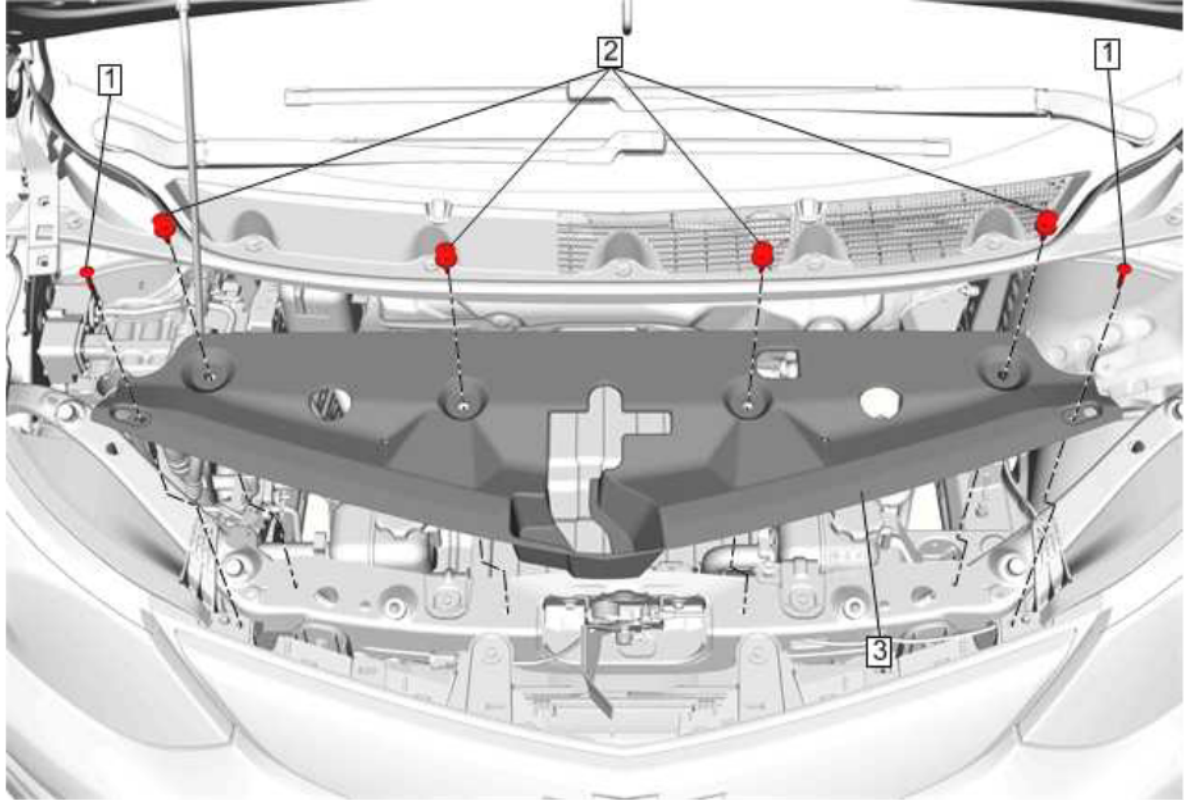


Fig. 136: Front Compartment Front Sight Shield
 Courtesy of GENERAL MOTORS COMPANY

15. Install Front Compartment Front Sight Shield (3). Refer to [**Front Compartment Front Sight Shield Replacement**](#)
16. Connect the battery negative cable. Refer to [**Battery Negative Cable Disconnection and Connection**](#)

ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT - RADIATOR SIDE

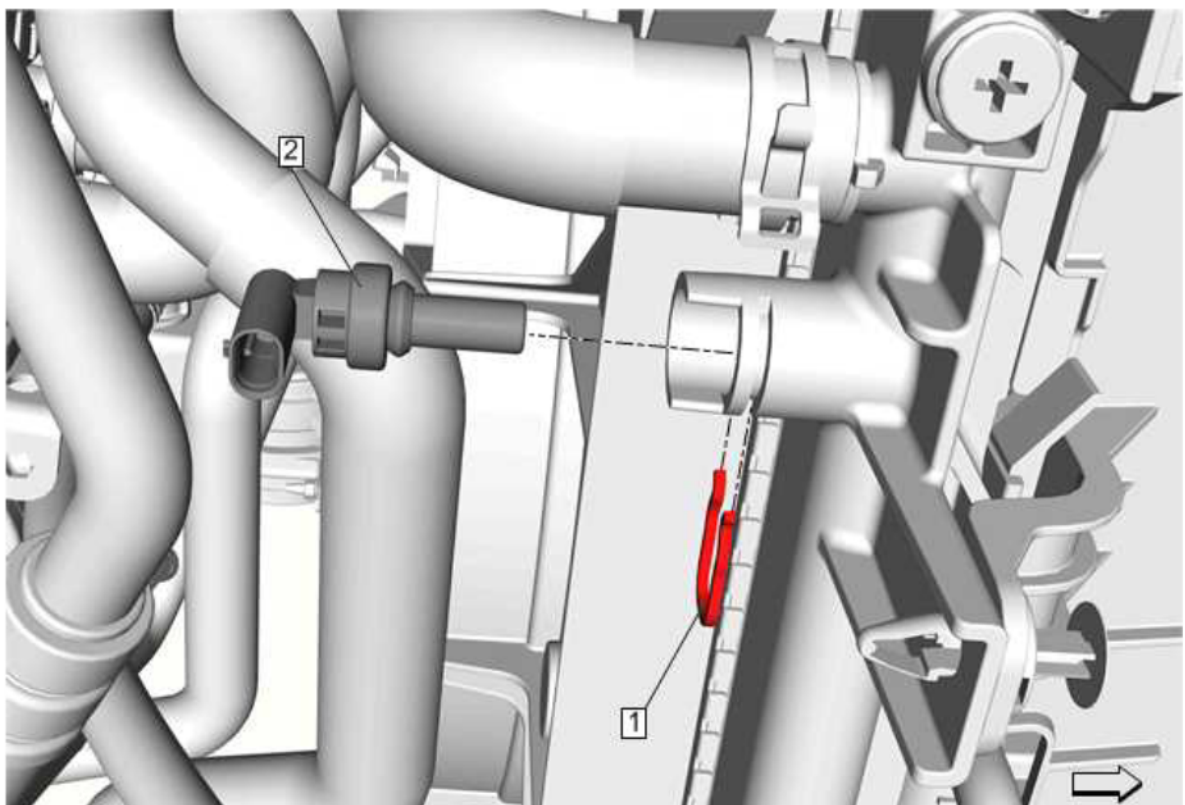


Fig. 137: Engine Coolant Temperature Sensor - Radiator Side
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
	cardiagn.com

Callout	Component Name
Preliminary Procedures	
1. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection 2. Remove the RESS surge tank bracket. Refer to Radiator Surge Tank Support Bracket Replacement (RESS) 3. Disconnect the electrical connector from the engine coolant temperature sensor.	
1	Engine Coolant Temperature Sensor Retainer
2	Engine Coolant Temperature Sensor Procedure After replacement, connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection

RADIATOR DRAIN COCK REPLACEMENT

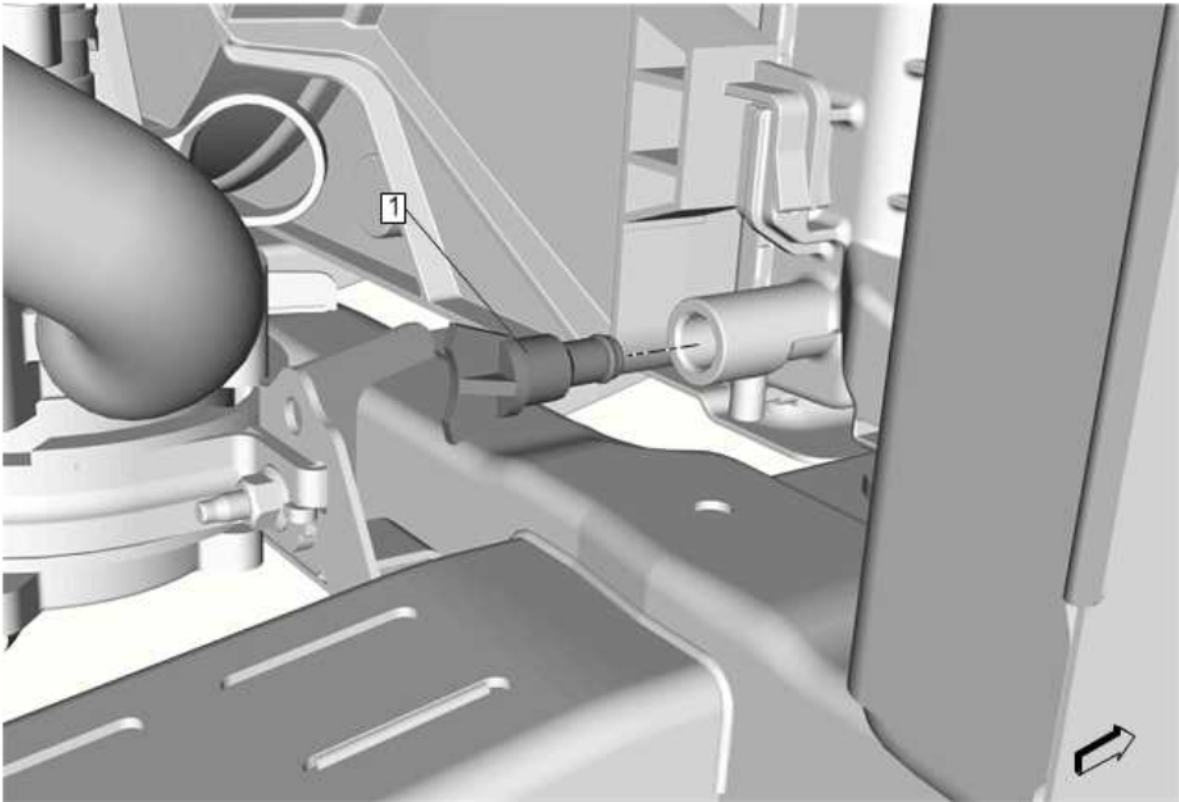


Fig. 138: Radiator Drain Cock
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Do not use a service jack in locations other than those specified to lift this vehicle. Lifting the vehicle with a jack in those other locations could cause the vehicle to slip off the jack and roll; this could cause injury or death.	
Preliminary Procedures	
1. Remove the right front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement 2. Remove the front compartment air deflector. Refer to Front Compartment Air Deflector Replacement 3. Drain the drive motor cooling system. Refer to Drive Motor Battery Cooling System Draining and Filling	

Callout	Component Name
	Radiator Drain Cock
	CAUTION: Refer to Fastener Caution .
	Procedures
1	1. Reposition the lower portion of the fascia to access the drain port. 2. Attach a rubber hose to the drive motor battery coolant radiator drain port. 3. Place a drain pan under the left side of the drive motor battery coolant radiator. 4. After installation, fill the coolant reservoir to the fill level. Refer to Drive Motor Battery Cooling System Draining and Filling 5. Inspect cooling system for leaks.

RADIATOR LOWER INSULATOR REPLACEMENT

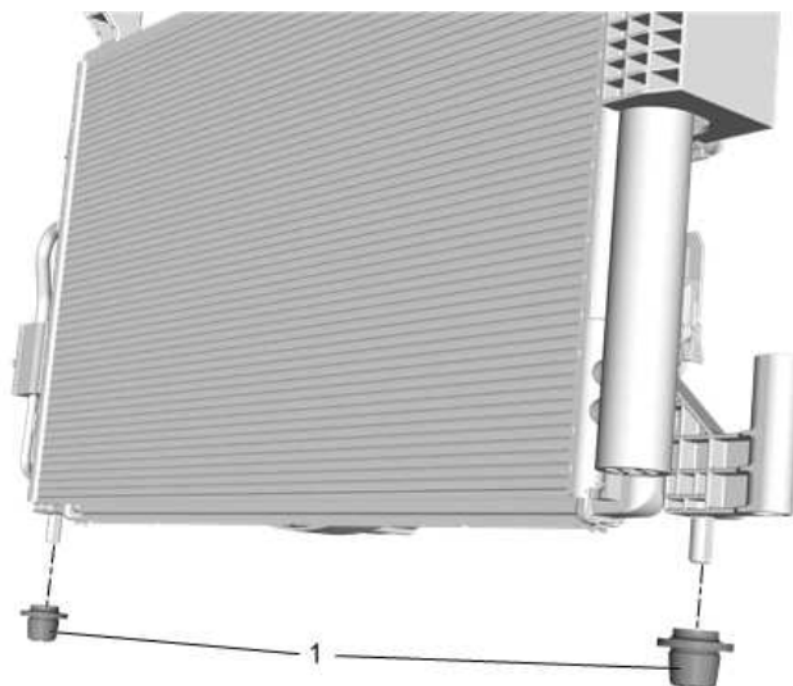


Fig. 139: Radiator Lower Insulator

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures	
1. Remove Front Bumper Fascia. Refer to Front Bumper Fascia Replacement (North America) Front Bumper Fascia Replacement (Europe, Korea) 2. Remove Radiator Upper Bracket. Refer to Radiator Upper Bracket Replacement	
1	Radiator Lower Insulator

RADIATOR UPPER BRACKET REPLACEMENT

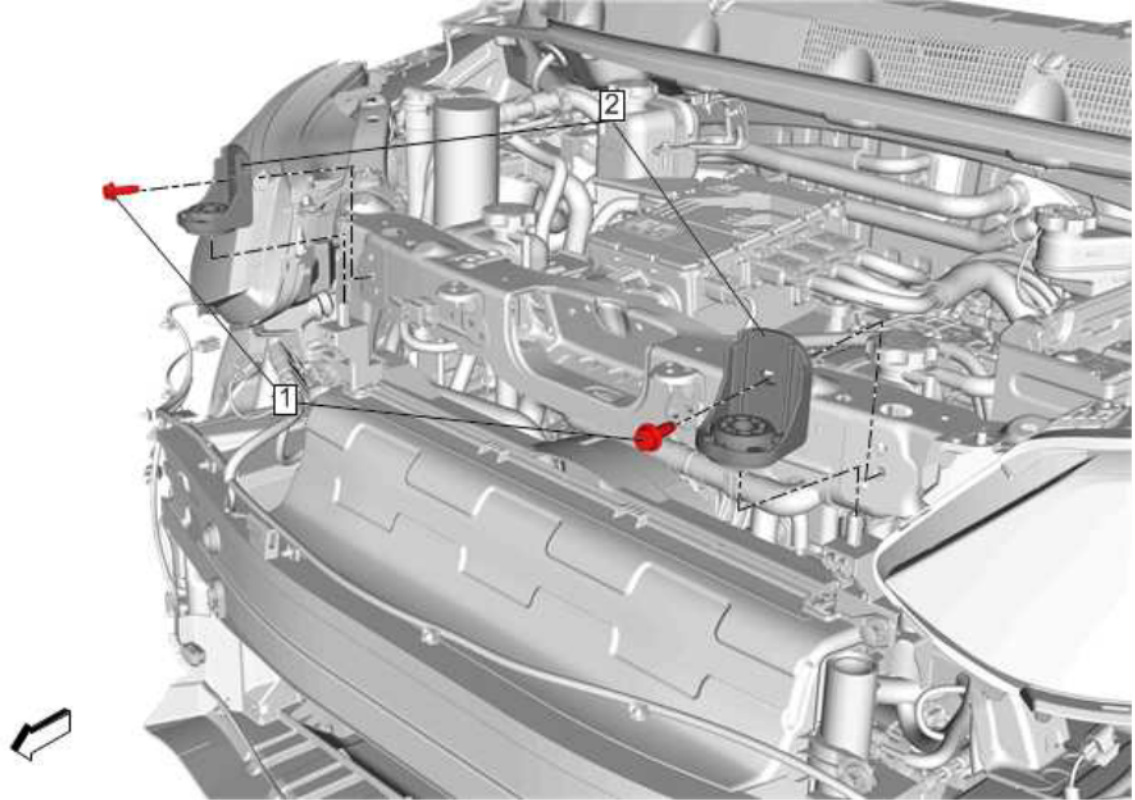


Fig. 140: Radiator Upper Brackets
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove Front Compartment Front Sight Shield. Refer to Front Compartment Front Sight Shield Replacement	
1	Radiator Upper Bracket Fastener (Qty: 2) CAUTION: Refer to Fastener Caution 22 N.m (16 lb ft)
2	Radiator Upper Bracket

RADIATOR VENT VALVE REPLACEMENT

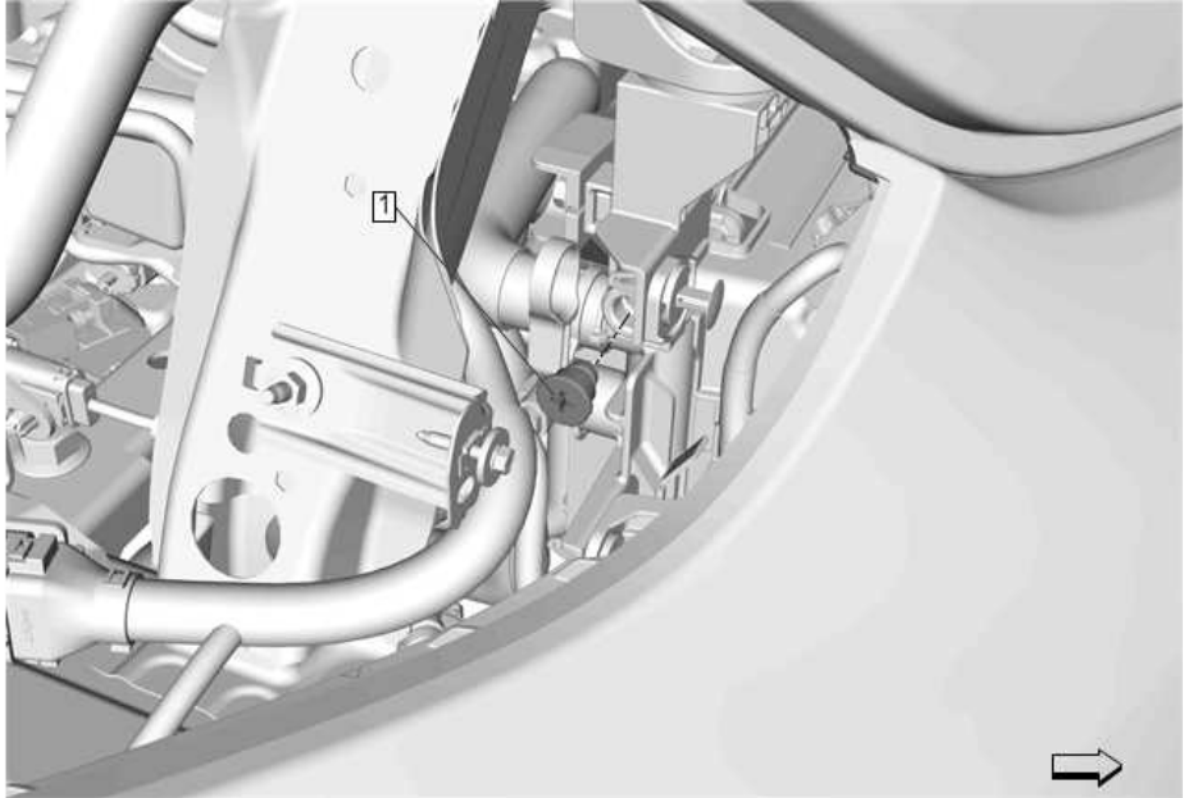


Fig. 141: Radiator Vent Valve
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove Front Bumper Fascia. Refer to Front Bumper Fascia Replacement (North America) Front Bumper Fascia Replacement (Europe, Korea)	
1	Radiator Vent Valve CAUTION: Refer to Fastener Caution 1.9 N.m (17 lb in)

RADIATOR PROTECTOR REPLACEMENT

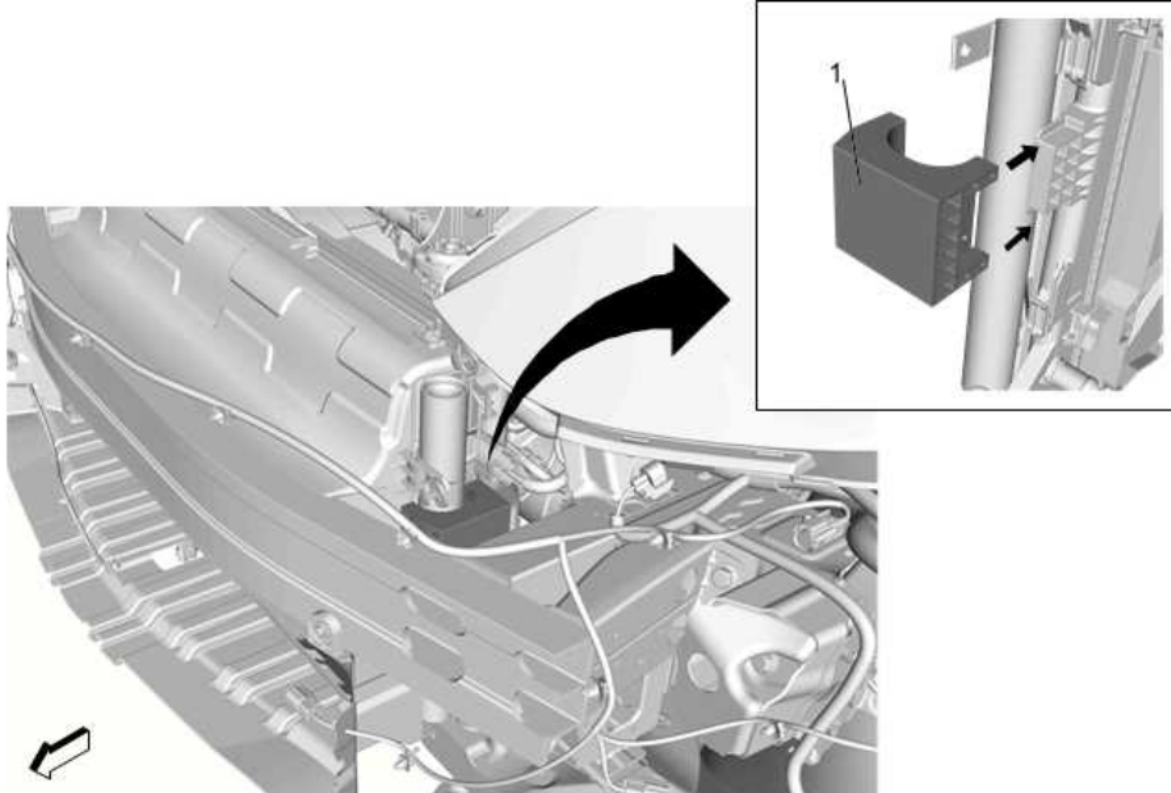


Fig. 142: Radiator Protector

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove Front Bumper Fascia. Refer to Front Bumper Fascia Replacement (North America) Front Bumper Fascia Replacement (Europe, Korea)	
1	Radiator Protector Procedure Using a flat bladed tool, work the protector off of the radiator towards the drivers side of the vehicle. Reposition the radiator as necessary.

DRIVE MOTOR GENERATOR CONTROL MODULE COOLANT PUMP HOSE REPLACEMENT (SURGE TANK TO PUMP)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
3. Remove Front Compartment Front Sight Shield. Refer to [Front Compartment Front Sight Shield Replacement](#)

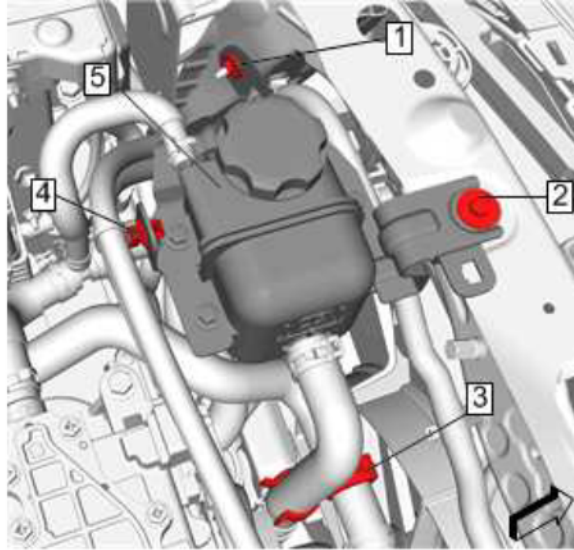


Fig. 143: Radiator Surge Tank Assembly And Fasteners

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not remove any coolant hoses from the surge tanks.

4. Remove Radiator Surge Tank Bracket Bolt (2)
5. Remove Radiator Surge Tank Bracket Nut (1)
6. {If equipped} Remove Retainers (3, 4)
7. To gain access to the second radiator inlet hose clamp, lay the radiator surge tank assembly (5) aside.

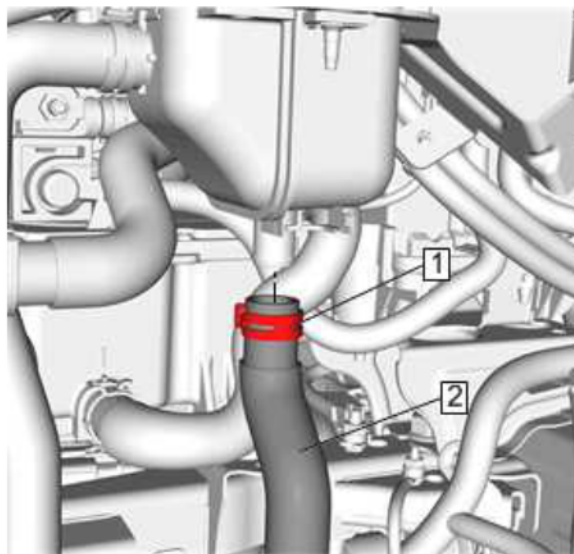


Fig. 144: Drive Motor Generator Control Module Coolant Pump Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

8. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
9. Remove Drive Motor Generator Control Module Coolant Pump Hose (2)
10. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
11. Disconnect the pump electrical connector.
12. Remove the pump/hose assembly from the vehicle. Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#)

NOTE: The drain procedure has the technician remove the pump fasteners and one of the hoses. It is better to disconnect the pump electrical, and remove the pump/hose together.

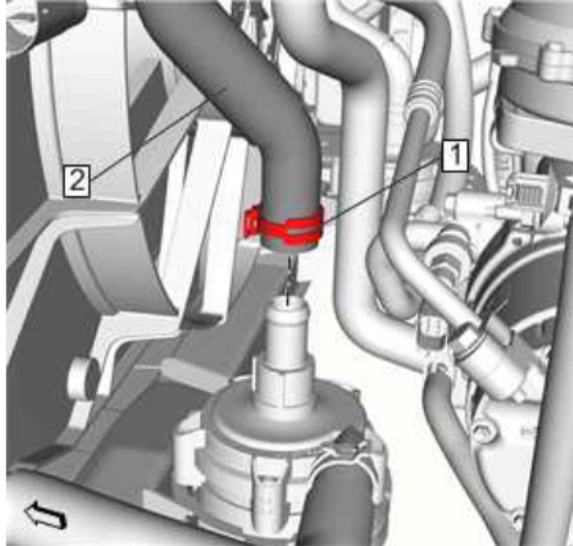


Fig. 145: Drive Motor Generator Control Module Coolant Pump Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

13. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
14. Remove Drive Motor Generator Control Module Coolant Pump Hose (2)

Installation Procedure

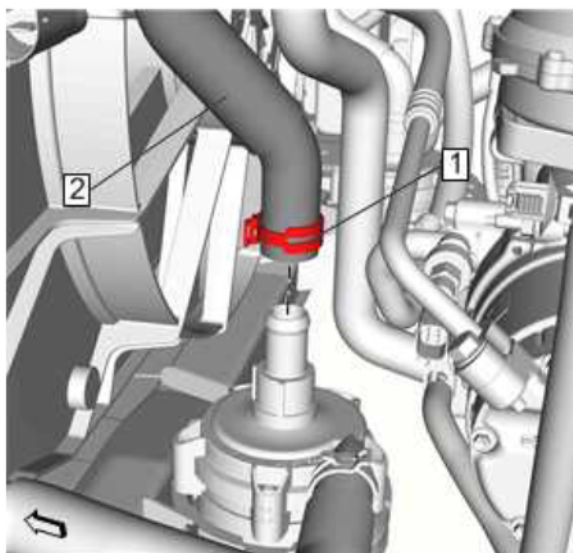


Fig. 146: Drive Motor Generator Control Module Coolant Pump Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Generator Control Module Coolant Pump Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
3. Install the pump/hose assembly to the vehicle. Refer to [Drive Motor Battery Coolant Pump Replacement \(RESS Pump\)](#)[Drive Motor Battery Coolant Pump Replacement \(PE Pump\)](#)
4. Connect the pump electrical connector.

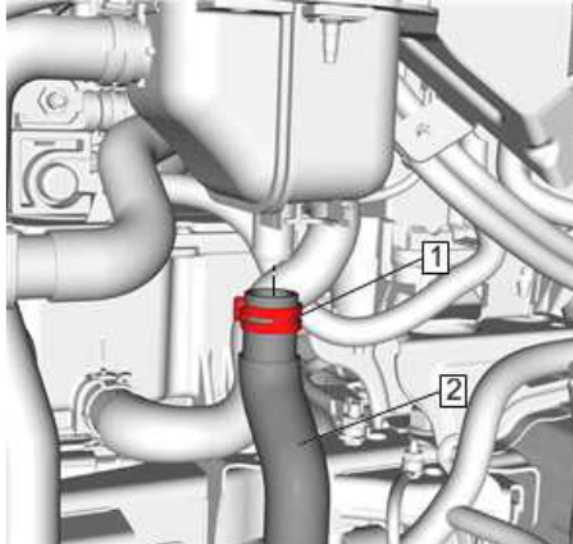


Fig. 147: Drive Motor Generator Control Module Coolant Pump Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

5. Install Drive Motor Generator Control Module Coolant Pump Hose (2)
6. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Install Radiator Surge Tank (5)

CAUTION: Refer to [Fastener Caution](#)

8. Install and tighten Radiator Surge Tank Bracket Nut (1) to 9 N.m (80 lb in)
9. Install and tighten Radiator Surge Tank Bracket Bolt (2) to 9 N.m (80 lb in)
10. {If Equipped} Install Retainers (3, 4)
11. Install Front Compartment Front Sight Shield. Refer to [Front Compartment Front Sight Shield Replacement](#)
12. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
13. Check the cooling system for leaks.

DRIVE MOTOR GENERATOR CONTROL MODULE COOLING OUTLET HOSE REPLACEMENT (SPIM TO APM)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

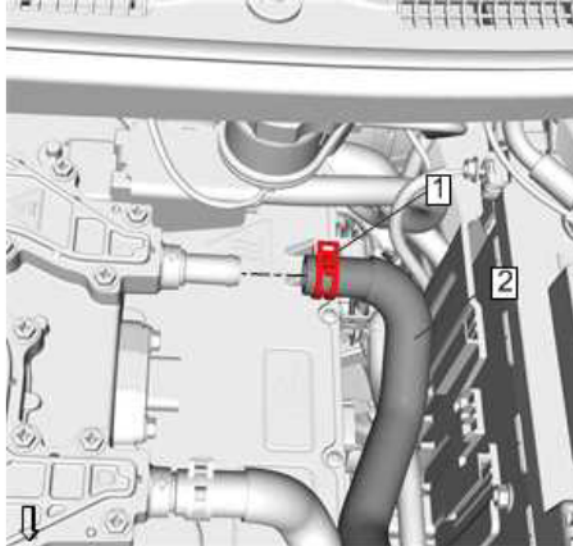


Fig. 148: Drive Motor Generator Control Module Cooling Outlet Hose
Courtesy of GENERAL MOTORS COMPANY

3. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Remove Drive Motor Generator Control Module Cooling Outlet Hose (2)

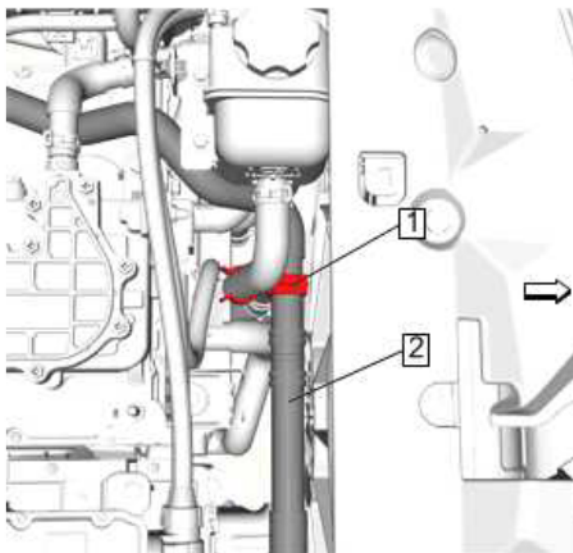


Fig. 149: Drive Motor Generator Control Module Cooling Outlet Hose And Retainer
Courtesy of GENERAL MOTORS COMPANY

5. Remove Retainer (1)
6. Remove Drive Motor Generator Control Module Cooling Outlet Hose (2)
7. Remove the RESS surge tank bracket and reposition the surge tank. Refer to [Radiator Surge Tank Support Bracket Replacement \(RESS\)](#)

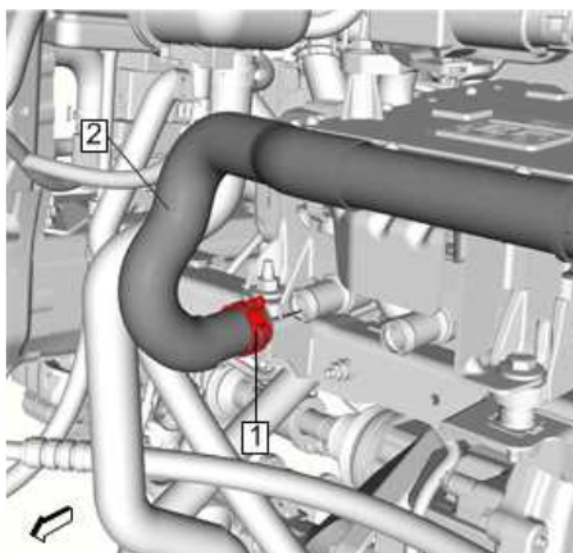


Fig. 150: Drive Motor Generator Control Module Cooling Outlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

8. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
9. Remove Drive Motor Generator Control Module Cooling Outlet Hose (2)

Installation Procedure

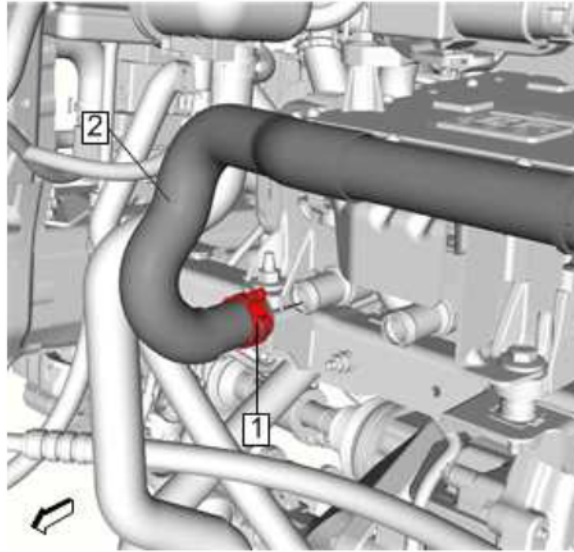


Fig. 151: Drive Motor Generator Control Module Cooling Outlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Generator Control Module Cooling Outlet Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
3. Position the surge tank and install the RESS surge tank bracket. Refer to [Radiator Surge Tank Support Bracket Replacement \(RESS\)](#)

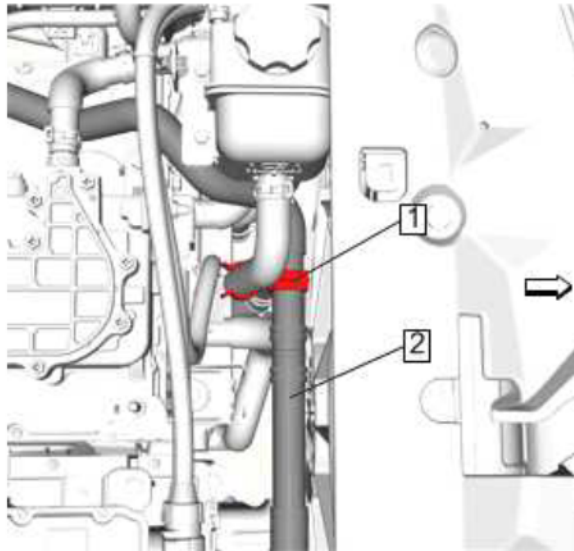


Fig. 152: Drive Motor Generator Control Module Cooling Outlet Hose And Retainer
Courtesy of GENERAL MOTORS COMPANY

4. Install Retainer (1)
5. Install Drive Motor Generator Control Module Cooling Outlet Hose (2)

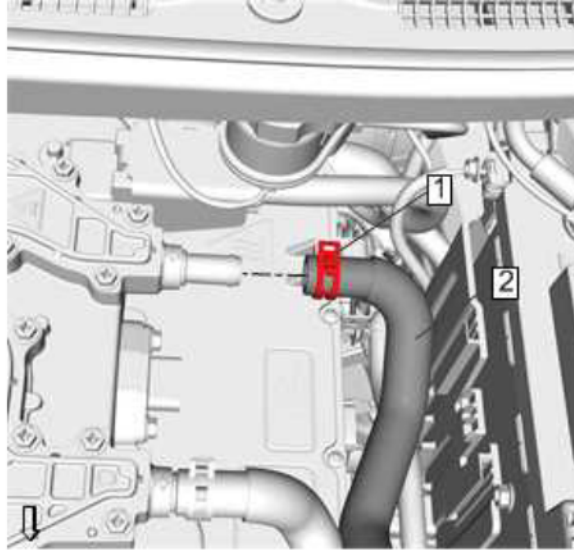


Fig. 153: Drive Motor Generator Control Module Cooling Outlet Hose
 Courtesy of GENERAL MOTORS COMPANY

6. Install Drive Motor Generator Control Module Cooling Outlet Hose (2)
7. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
8. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
9. Check the cooling system for leaks.

DRIVE MOTOR GENERATOR CONTROL MODULE RADIATOR INLET HOSE REPLACEMENT (PUMP TO RADIATOR)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Remove Front Compartment Air Deflector. Refer to [Front Compartment Air Deflector Replacement](#)
3. Remove Front Wheelhouse Liner-Left Side. Refer to [Front Wheelhouse Liner Replacement](#)
4. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

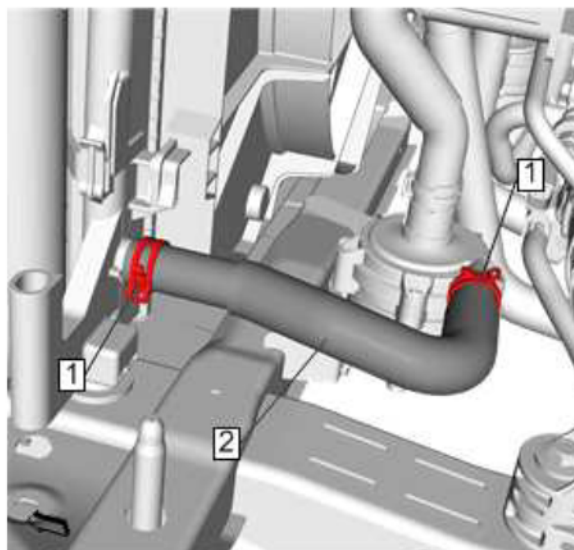


Fig. 154: Drive Motor Generator Control Module Radiator Inlet Hose And Clamps
 Courtesy of GENERAL MOTORS COMPANY

5. Disengage Clamps (1) (Qty: 2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
6. Remove Drive Motor Generator Control Module Radiator Inlet Hose (2)

Installation Procedure

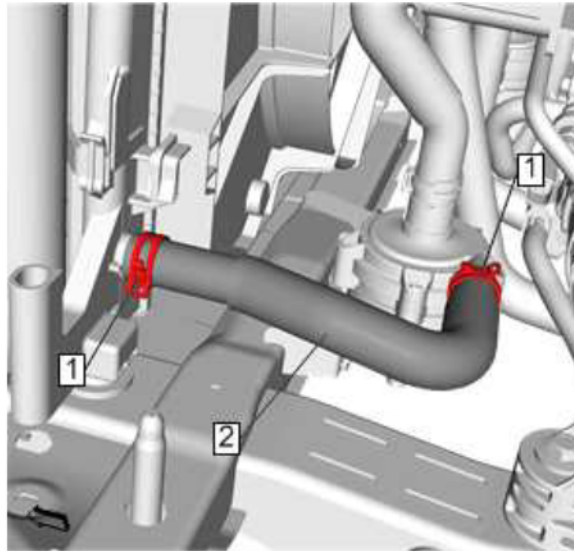


Fig. 155: Drive Motor Generator Control Module Radiator Inlet Hose And Clamps
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Generator Control Module Radiator Inlet Hose (2)
2. Engage Clamps (1) (Qty: 2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
3. Install Front Wheelhouse Liner-Left Side. Refer to [Front Wheelhouse Liner Replacement](#)
4. Install Front Compartment Air Deflector. Refer to [Front Compartment Air Deflector Replacement](#)
5. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
6. Check the cooling system for leaks.

DRIVE MOTOR GENERATOR CONTROL MODULE RADIATOR OUTLET HOSE REPLACEMENT (RADIATOR TO SPIM)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)
3. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
4. Remove Front Compartment Front Sight Shield. Refer to [Front Compartment Front Sight Shield Replacement](#)

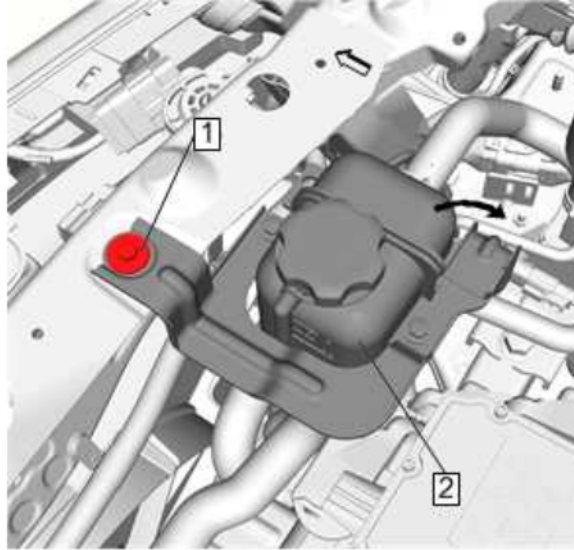


Fig. 156: Drive Motor Battery Radiator Surge Tank And Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

5. Remove Drive Motor Battery Radiator Surge Tank Bracket Bolt (1)
6. Position aside drive motor battery radiator surge tank (2).

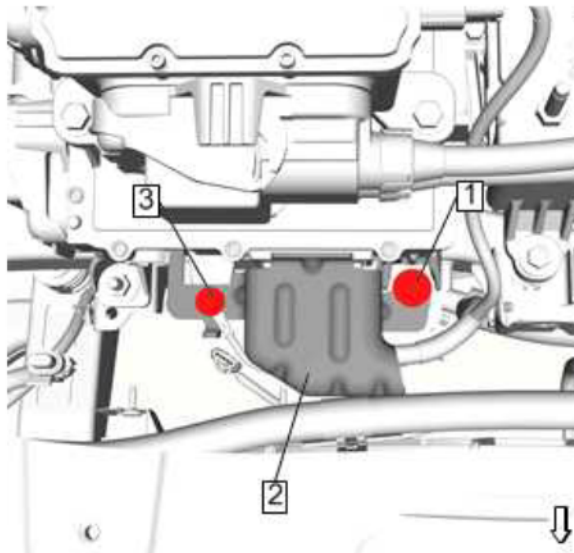
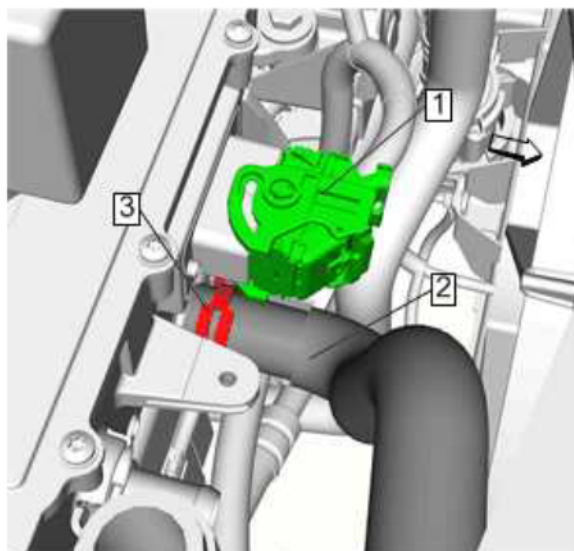


Fig. 157: Drive Motor Power Inverter Module Shield And Bolts
Courtesy of GENERAL MOTORS COMPANY

7. Remove Drive Motor Power Inverter Module Shield Bolt (1)
8. Remove Ground Cable Bolt (3) @ Drive Motor Power Inverter Module
9. Remove Drive Motor Power Inverter Module Shield (2)



Courtesy of GENERAL MOTORS COMPANY

10. Disconnect Electrical Connector (1)
11. Disengage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
12. Remove Drive Motor Generator Control Module Radiator Outlet Hose (2)

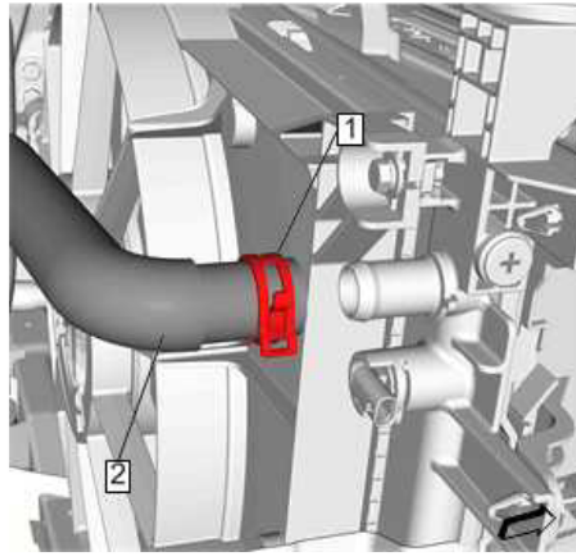


Fig. 159: Drive Motor Generator Control Module Radiator Outlet Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

13. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
14. Remove Drive Motor Generator Control Module Radiator Outlet Hose (2)

Installation Procedure

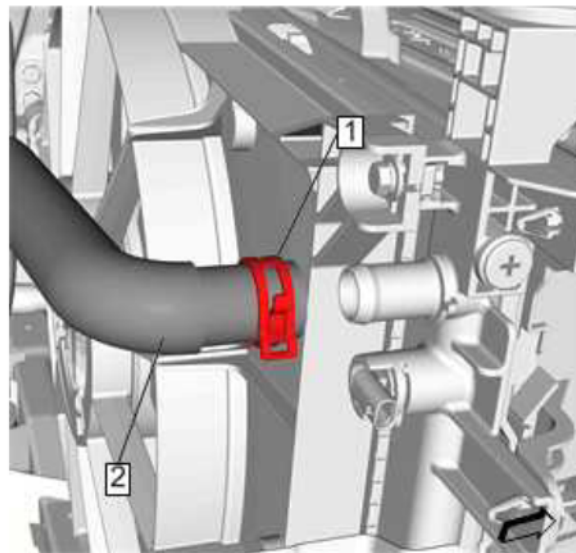


Fig. 160: Drive Motor Generator Control Module Radiator Outlet Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Generator Control Module Radiator Outlet Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

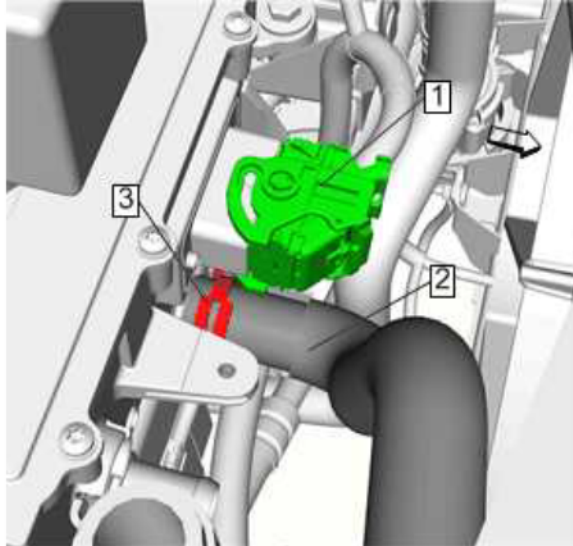


Fig. 161: Drive Motor Generator Control Module Radiator Outlet Hose, Clamp And Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Generator Control Module Radiator Outlet Hose (2)
4. Engage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Connect Electrical Connector (1)

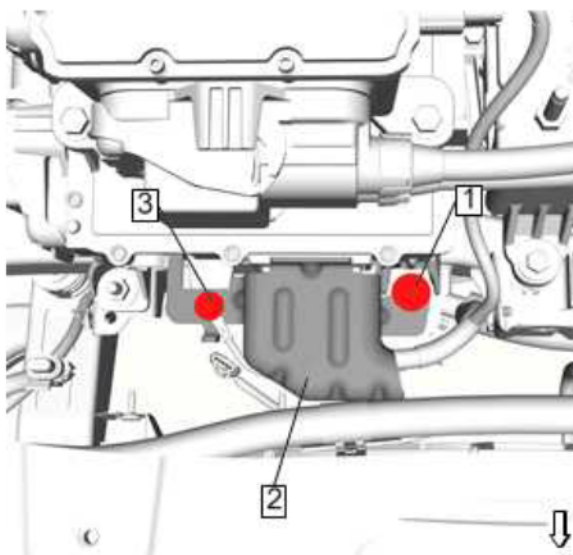


Fig. 162: Drive Motor Power Inverter Module Shield And Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Install Drive Motor Power Inverter Module Shield (2)

CAUTION: Refer to [Fastener Caution](#)

7. Install and tighten Ground Cable Bolt (3) @ Drive Motor Power Inverter Module to 9 N.m (80 lb in)
8. Install and tighten Drive Motor Power Inverter Module Shield Bolt (1) to 25 N.m (18 lb ft)

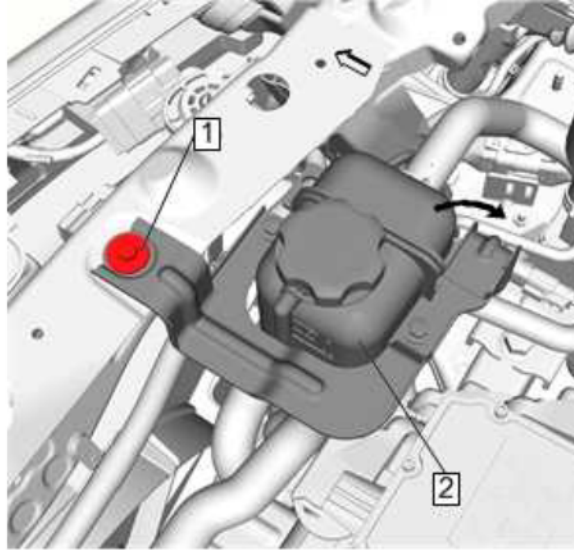


Fig. 163: Drive Motor Battery Radiator Surge Tank And Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Install Drive Motor Battery Radiator Surge Tank (2)
10. Install and tighten Drive Motor Battery Radiator Surge Tank Bracket Bolt (1) to 9 N.m (80 lb in)
11. Install Front Compartment Front Sight Shield. Refer to [Front Compartment Front Sight Shield Replacement](#)
12. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
13. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

RADIATOR AIR LOWER BAFFLE AND DEFLECTOR REPLACEMENT

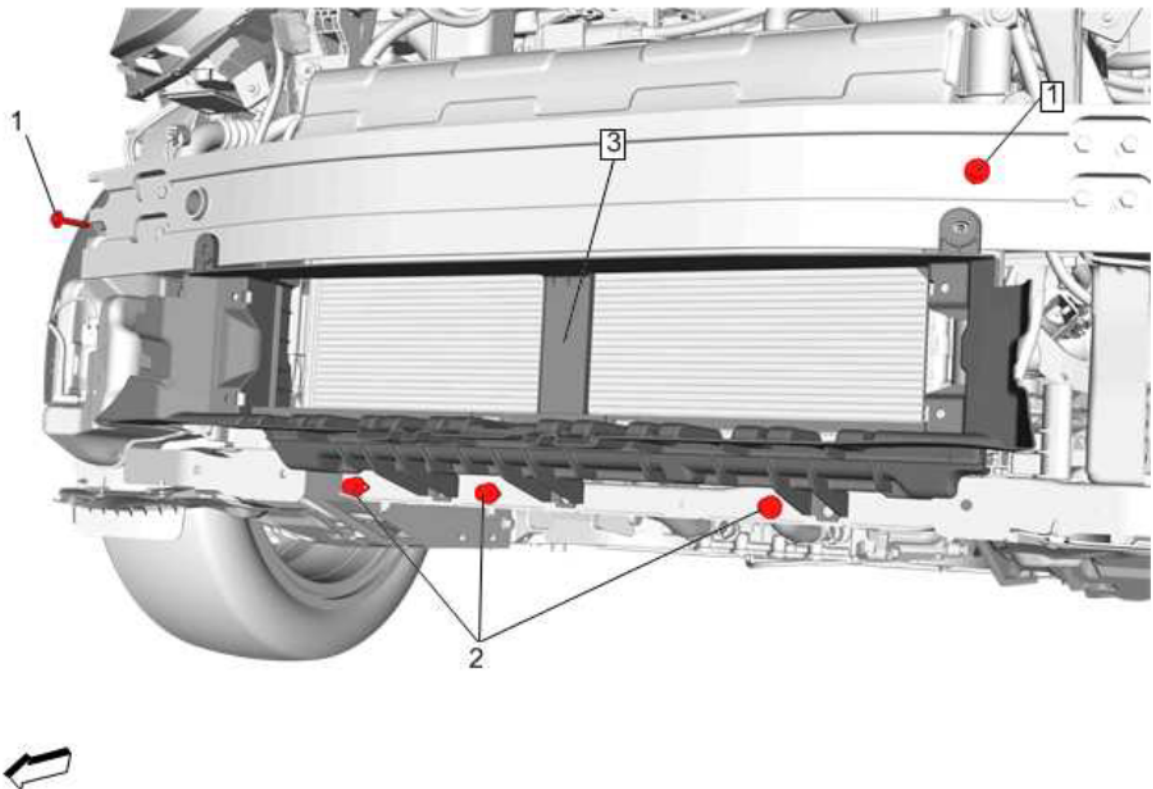


Fig. 164: Radiator Air Lower Baffle and Deflector Assembly
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure	
Remove Front Bumper Shutter. Refer to Front Bumper Shutter Replacement	
cardiagn.com	

Callout	Component Name
1	Radiator Air Lower Baffle Bolt (Qty: 2) CAUTION: Refer to Fastener Caution . 9 N.m (80 lb in)
2	Radiator Air Lower Baffle Retainer (Qty: 3)
3	Radiator Air Lower Baffle and Deflector Assembly Procedure Unclip the electrical harness.

RADIATOR AIR UPPER BAFFLE AND DEFLECTOR REPLACEMENT

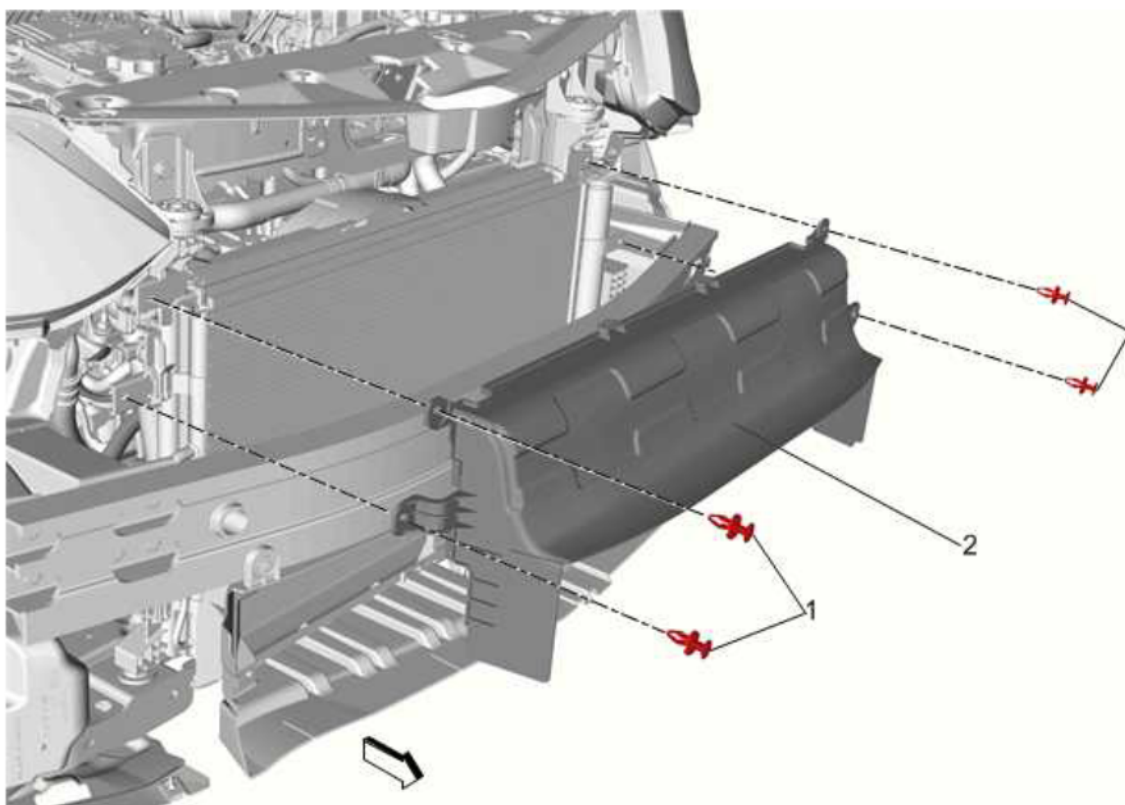


Fig. 165: Radiator Air Upper Baffle And Deflector

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedure Remove Front Bumper Fascia. Refer to Front Bumper Fascia Replacement (North America) Front Bumper Fascia Replacement (Europe, Korea)	
1	Radiator Air Upper Baffle Retainer (Qty: 4)
2	Radiator Air Upper Baffle and Deflector

HIGH VOLTAGE BATTERY HEATER REPLACEMENT

Removal Procedure

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

The High Voltage Disabling procedure includes the following steps:

- Identify how to disable high voltage.
- Identify how to test for the presence of high voltage.

- Identify condition under which high voltage is always present and personal protection equipment (PPE) and proper procedures must be followed.

Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:

- Safety glasses with appropriate side shields when within 15 meters (50 feet) of the vehicle, either indoors or outdoors.
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
 - Visually and functionally inspect the gloves before use.
 - Wear the Insulation gloves with leather protectors at all times when working with the high voltage battery assembly, whether the system is energized or not.

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

1. Disable the high voltage system. Refer to [High Voltage Disabling](#)
2. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
3. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

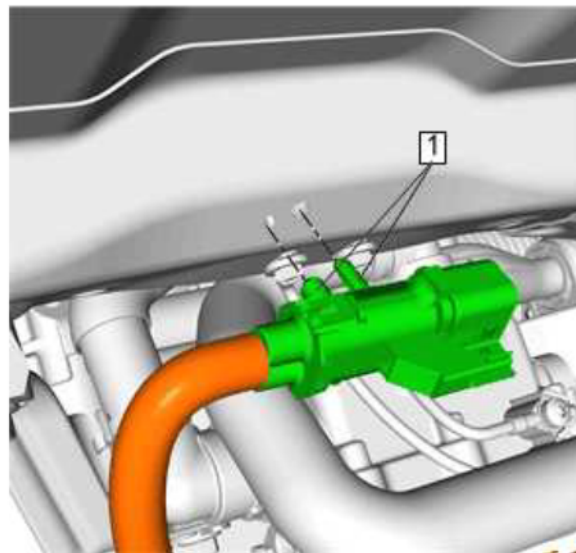


Fig. 166: Retainer

Courtesy of GENERAL MOTORS COMPANY

4. Unclip Retainer (1)

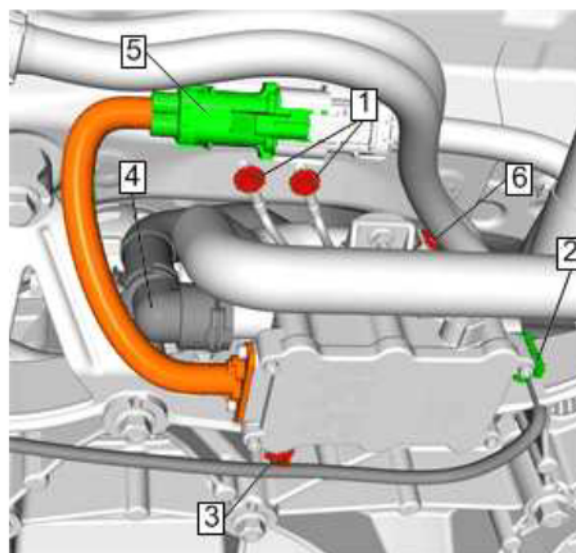


Fig. 167: Drive Motor Battery Coolant Cooler Inlet Hose, Electrical Connectors, Retainers And Bolts
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect Electrical Connectors (2, 5)
6. Remove Retainers (3, 6)
7. Remove Ground Cable Bolts (1) (Qty: 2)
8. Remove Drive Motor Battery Coolant Cooler Inlet Hose (4) @ High Voltage Battery Heater. Refer to [**Drive Motor Battery Coolant Cooler Inlet Hose Replacement \(Pump To RESS Heater\)**](#)

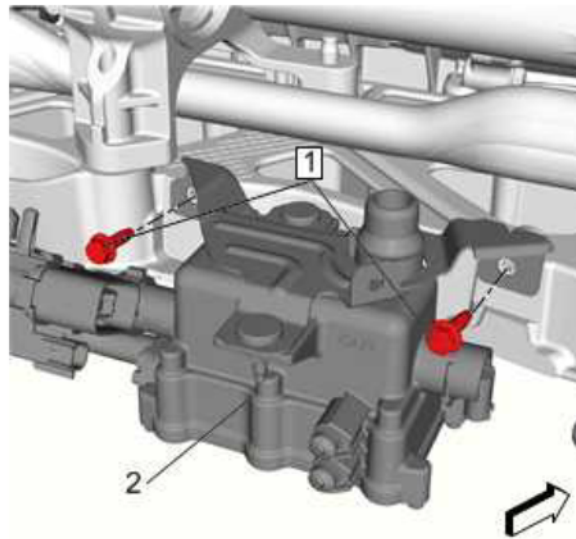


Fig. 168: High Voltage Battery Heater And Bracket Bolts
Courtesy of GENERAL MOTORS COMPANY

9. Remove Heater Bracket Bolts (1) (Qty: 2)
10. Lower the high voltage battery heater (2) to get the space to access to the battery vent hose.
11. Remove Battery Vent Hose @ High Voltage Battery Heater (2). Refer to [**Battery Vent Hose Replacement \(RESS HTR To RESS\)**](#)
12. Remove High Voltage Battery Heater (2)

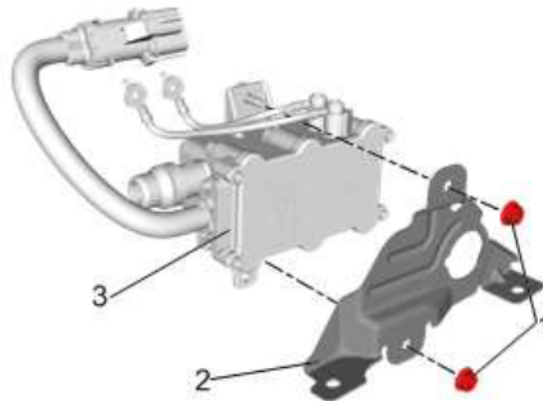


Fig. 169: High Voltage Battery Heater, Bracket And Nuts
Courtesy of GENERAL MOTORS COMPANY

13. Remove the 2 heater bracket nuts (1).
14. Remove Heater Bracket (2) @ High Voltage Battery Heater (3)

Installation Procedure

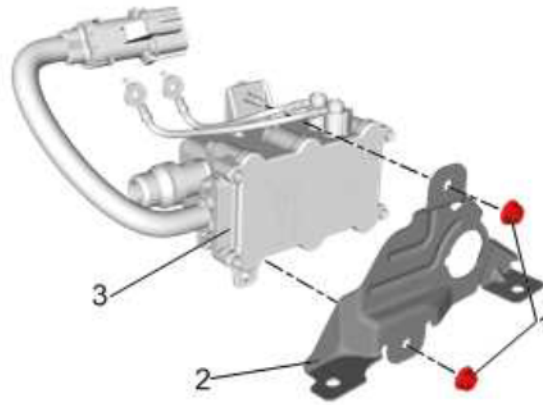


Fig. 170: High Voltage Battery Heater, Bracket And Nuts

Courtesy of GENERAL MOTORS COMPANY

1. Install Heater Bracket (2) @ High Voltage Battery Heater (3)

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

2. Install the 2 heater bracket nuts (1) and tighten to 9 N.m (80 lb in)

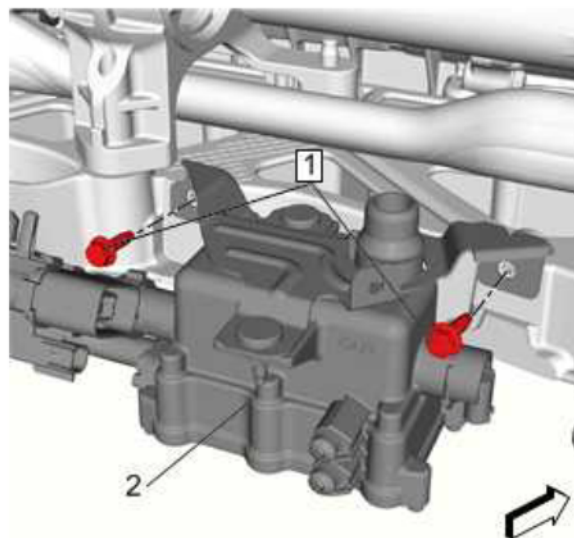


Fig. 171: High Voltage Battery Heater And Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

3. Install High Voltage Battery Heater (2)
4. Install Battery Vent Hose @ High Voltage Battery Heater (2). Refer to [Battery Vent Hose Replacement \(RESS HTR To RESS\)](#)
5. Install and tighten Heater Bracket Bolts (1) (Qty: 2) to 9 N.m (80 lb in)

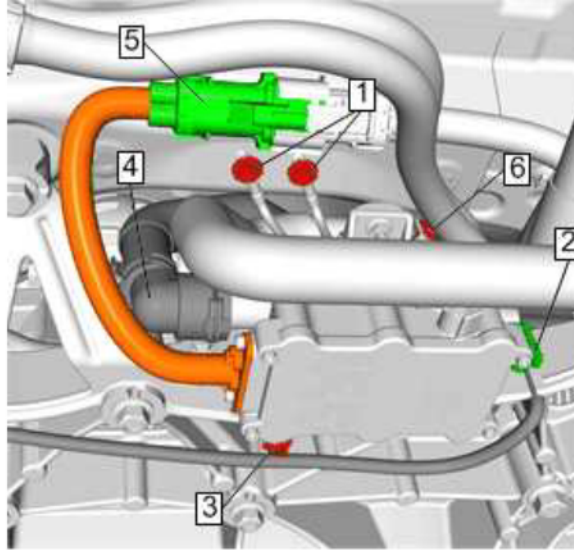


Fig. 172: Drive Motor Battery Coolant Cooler Inlet Hose, Electrical Connectors, Retainers And Bolts
 Courtesy of GENERAL MOTORS COMPANY

6. Install Drive Motor Battery Coolant Cooler Inlet Hose (4) @ High Voltage Battery Heater. Refer to [Drive Motor Battery Coolant Cooler Inlet Hose Replacement \(Pump To RESS Heater\)](#)
7. Install and tighten Ground Cable Bolt (1) (Qty: 2) to 9 N.m (80 lb in)
8. Install Retainers (3, 6)
9. Connect Electrical Connectors (2, 5)

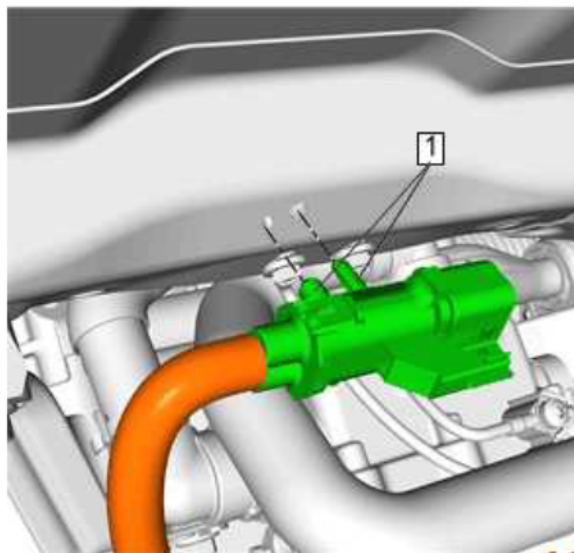


Fig. 173: Retainer
 Courtesy of GENERAL MOTORS COMPANY

10. Install Retainer (1)
11. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
12. Check the cooling system for leaks.
13. Enable the high voltage system. Refer to [High Voltage Enabling](#)

DRIVE MOTOR POWER INVERTER MODULE COOLING INLET HOSE REPLACEMENT (OBCM TO DU)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death. cardiagn.com

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

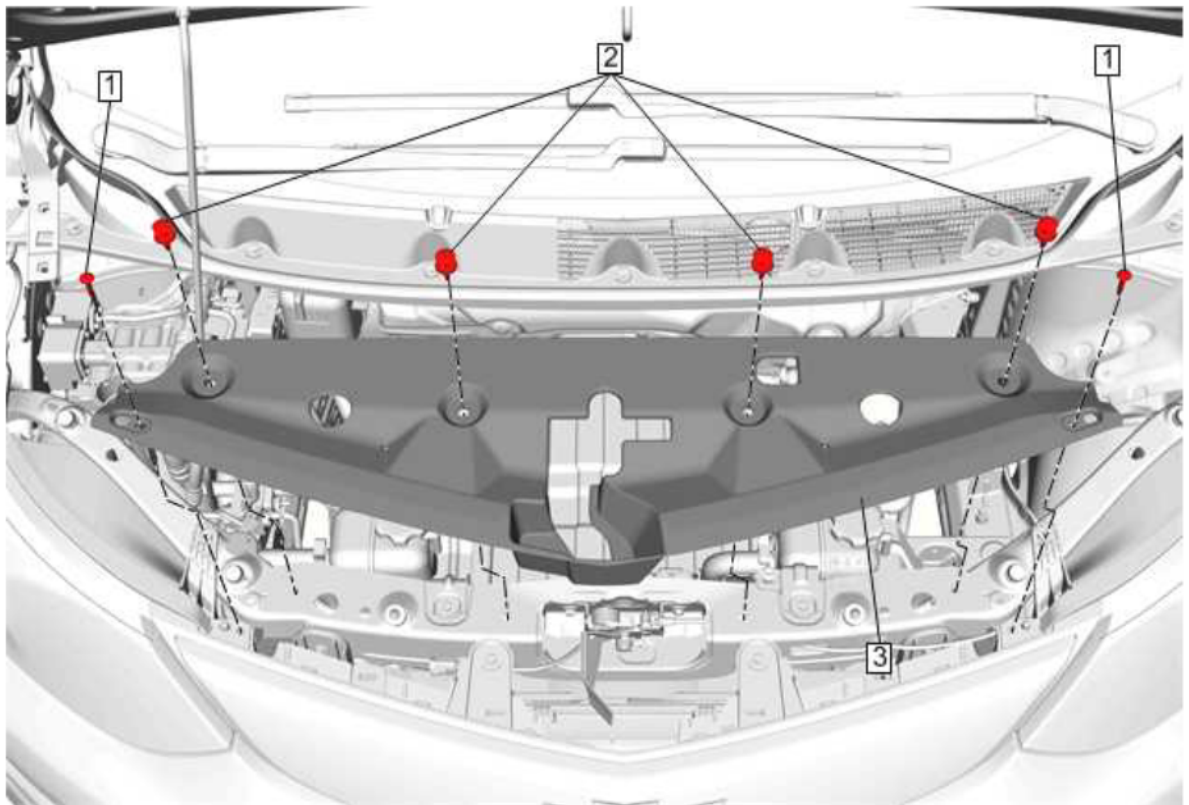


Fig. 174: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)

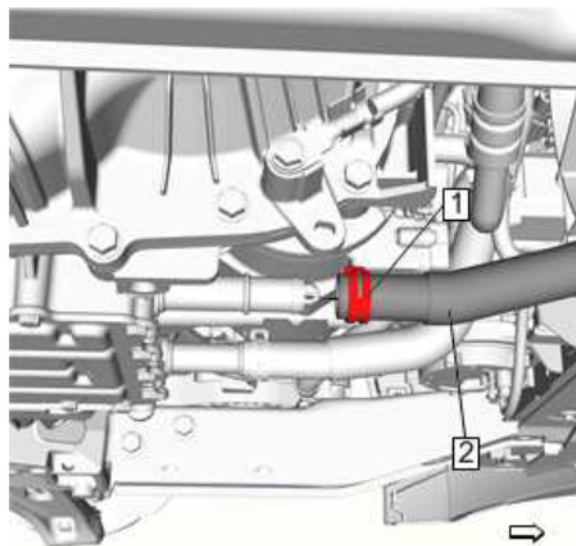


Fig. 175: Drive Motor Power Inverter Module Cooling Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove the drive motor power inverter module cooling inlet hose (2) from the drive unit (DU).

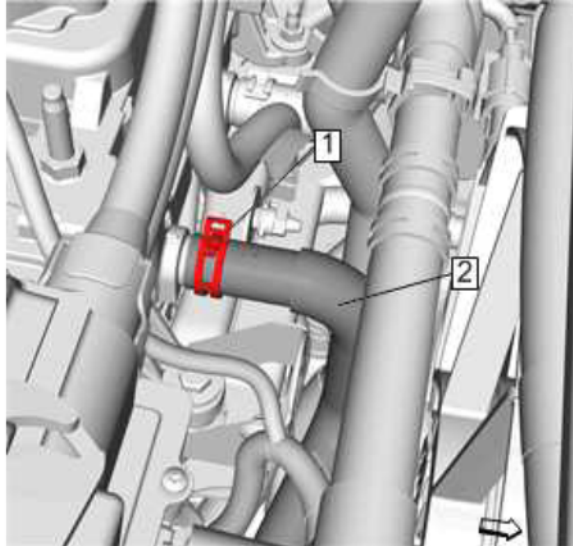


Fig. 176: Drive Motor Power Inverter Module Cooling Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

6. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove the drive motor power inverter module cooling inlet hose (2) from the on board charging module (OBCM).

Installation Procedure

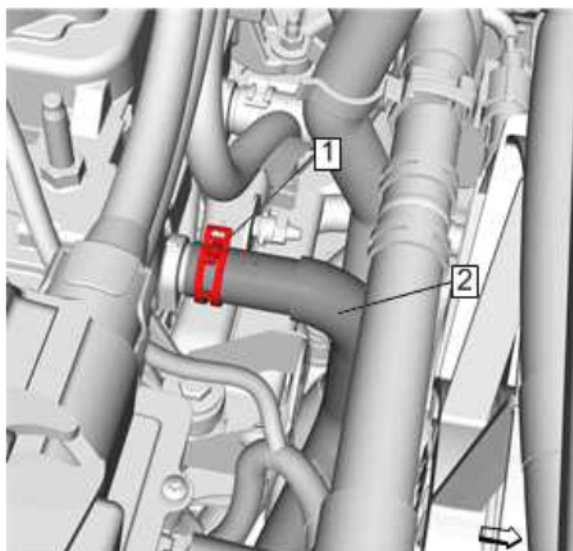


Fig. 177: Drive Motor Power Inverter Module Cooling Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

1. Install the drive motor power inverter module cooling inlet hose (2) to the on board charging module (OBCM).
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

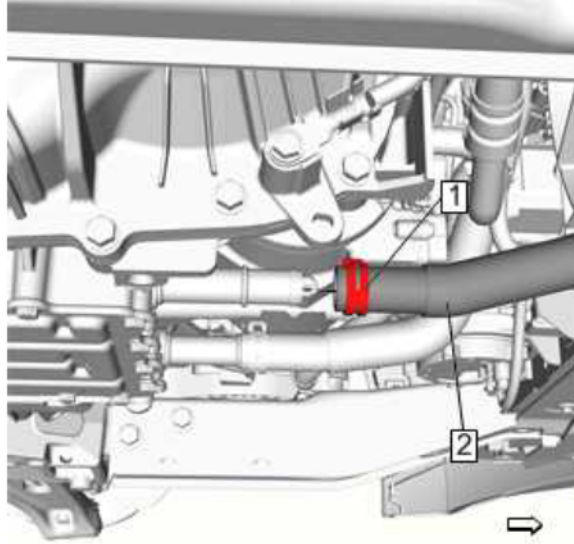


Fig. 178: Drive Motor Power Inverter Module Cooling Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

3. Install the drive motor power inverter module cooling inlet hose (2) to the drive unit (DU).
4. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

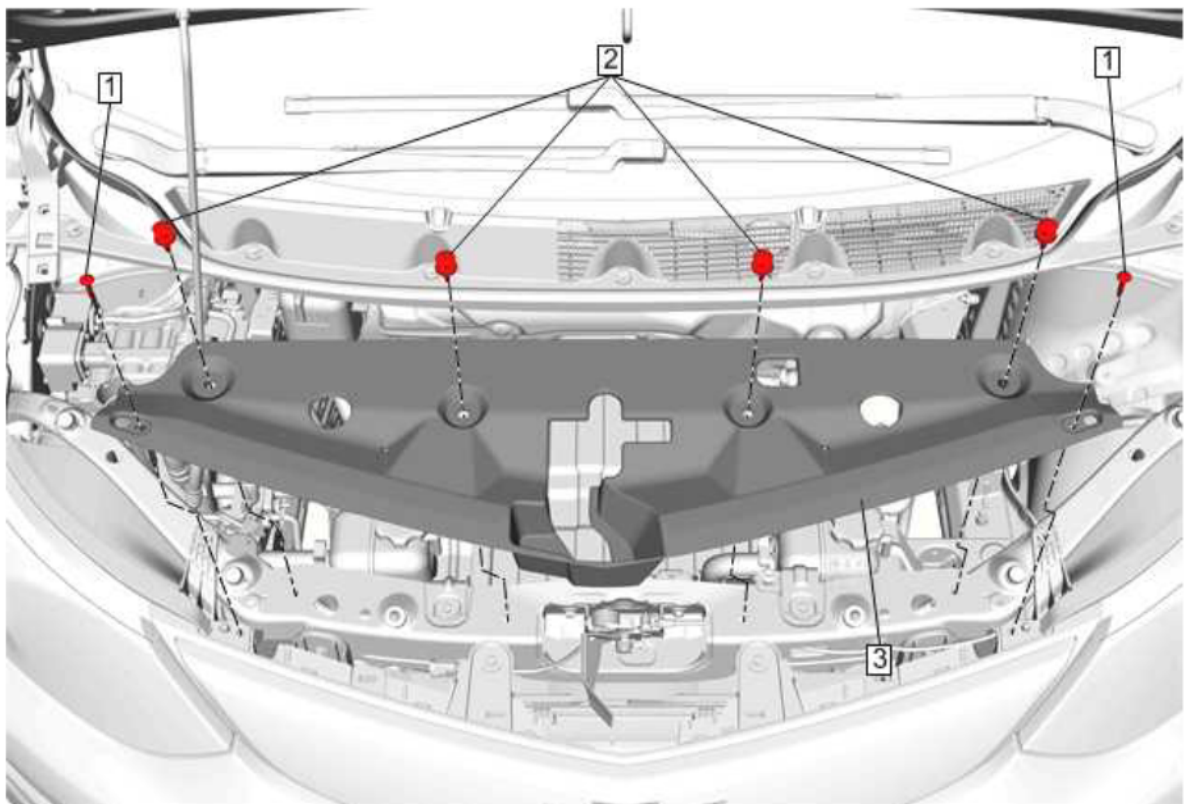


Fig. 179: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

5. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)
6. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
7. Check the cooling system for leaks.

DRIVE MOTOR BATTERY COOLANT COOLER REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any

cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the drive motor battery cooling system draining and filling. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)
3. Remove Air Conditioning Evaporator Hose Assembly @ Drive Motor Battery Coolant Cooler. Refer to [Air Conditioning Evaporator Hose Assembly Replacement](#)

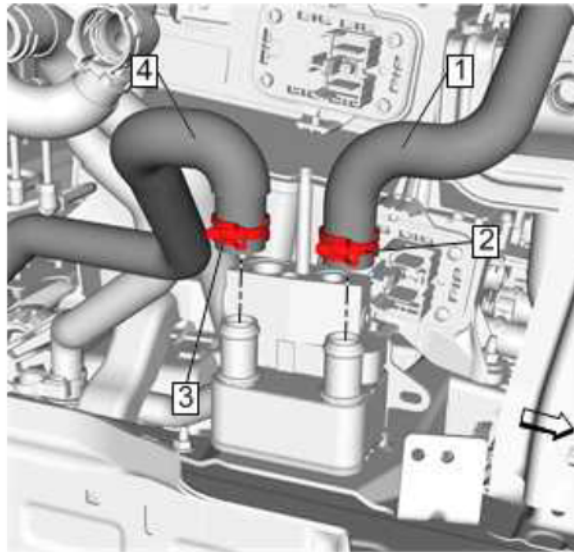


Fig. 180: Drive Motor Battery Coolant Cooler Outlet Hose, Drive Motor Battery Radiator Outlet Hose And Clamps

Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove the drive motor battery radiator outlet hose (1).
6. Disengage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Drive Motor Battery Coolant Cooler Outlet Hose (4)

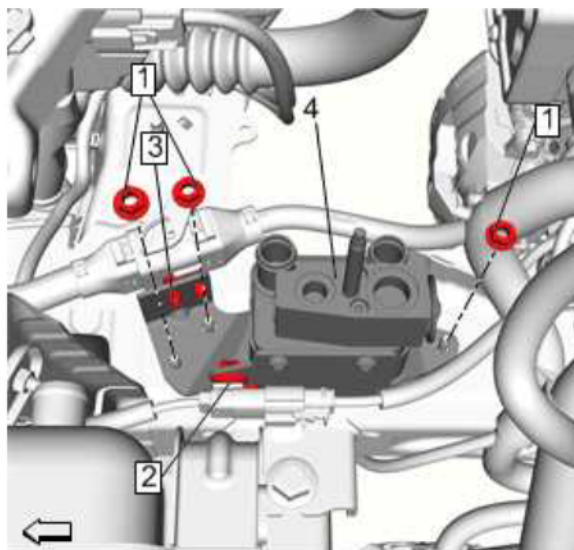


Fig. 181: Drive Motor Battery Coolant Cooler, Bracket Nuts And Retainers

Courtesy of GENERAL MOTORS COMPANY

8. Remove Drive Motor Battery Coolant Cooler Bracket Nuts (1) (Qty: 3)
9. Remove Retainers (2, 3)
10. Remove Drive Motor Battery Coolant Cooler (4)

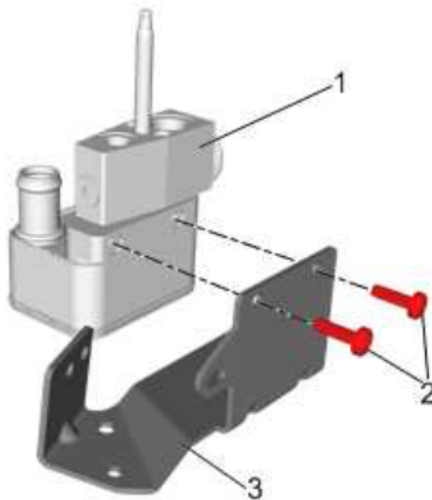


Fig. 182: Drive Motor Battery Coolant Cooler, Bracket And Bolts
 Courtesy of GENERAL MOTORS COMPANY

11. Remove the 2 drive motor battery coolant cooler bracket bolts (2).
12. Remove Drive Motor Battery Coolant Cooler Bracket (3) @ Drive Motor Battery Coolant Cooler (1)

Installation Procedure

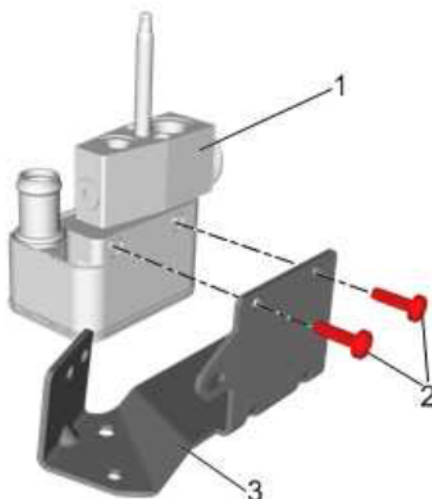


Fig. 183: Drive Motor Battery Coolant Cooler, Bracket And Bolts
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Cooler Bracket (3) @ Drive Motor Battery Coolant Cooler (1)

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

2. Install the 2 drive motor battery coolant cooler bracket bolts (2) and tighten to 9 N.m (80 lb in).

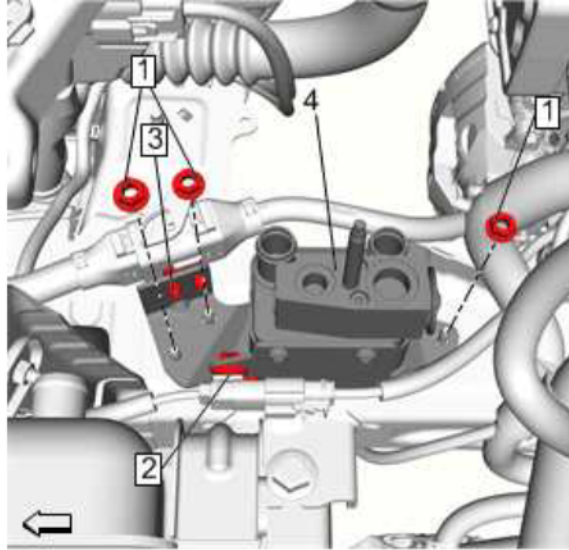


Fig. 184: Drive Motor Battery Coolant Cooler, Bracket Nuts And Retainers
 Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Battery Coolant Cooler (4)
4. Install Retainers (2, 3)
5. Install and tighten Drive Motor Battery Coolant Cooler Bracket Nuts (1) (Qty: 3) to 9 N.m (80 lb in)

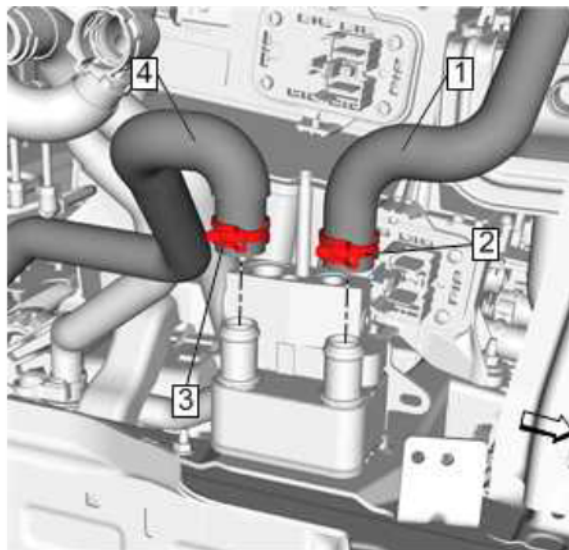


Fig. 185: Drive Motor Battery Coolant Cooler Outlet Hose, Drive Motor Battery Radiator Outlet Hose And Clamps
 Courtesy of GENERAL MOTORS COMPANY

6. Install Drive Motor Battery Coolant Cooler Outlet Hose (4)
7. Engage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
8. Install the drive motor battery radiator outlet hose (1).
9. Engage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
10. Install Air Conditioning Evaporator Hose Assembly @ Drive Motor Battery Coolant Cooler. Refer to [Air Conditioning Evaporator Hose Assembly Replacement](#)
11. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
12. Check the cooling system for leaks.

DRIVE MOTOR BATTERY COOLANT PUMP REPLACEMENT (RESS PUMP)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any

cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

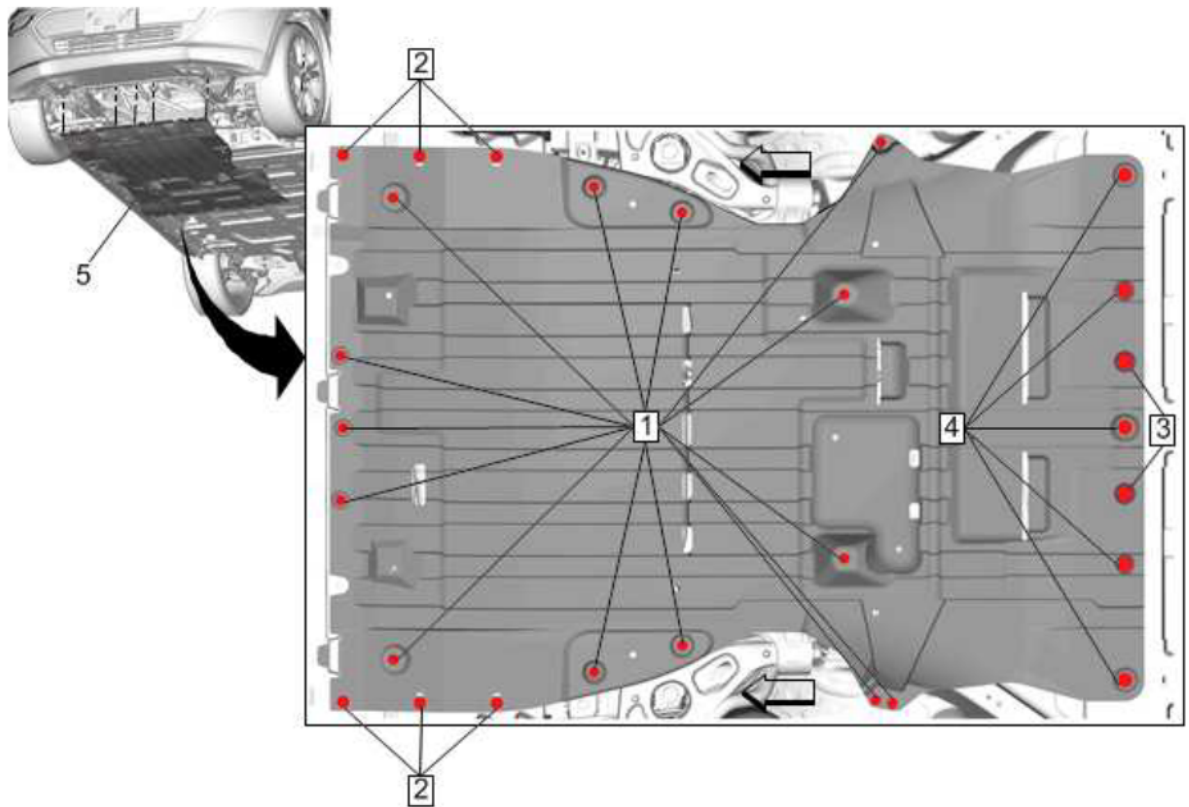


Fig. 186: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
4. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

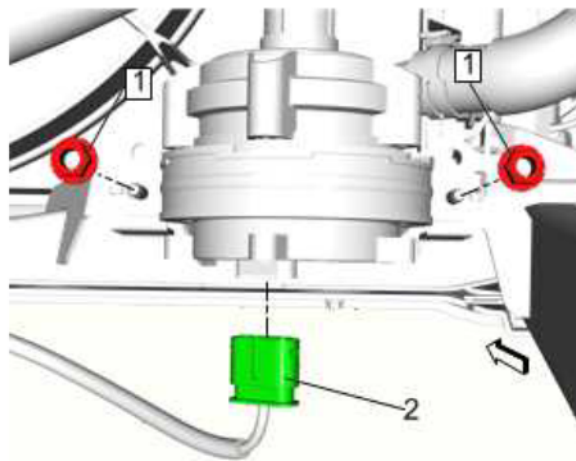


Fig. 187: Drive Motor Battery Coolant Pump Bracket Nuts And Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect Electrical Connector (2)
6. Remove the 2 drive motor battery coolant pump bracket nuts (1).

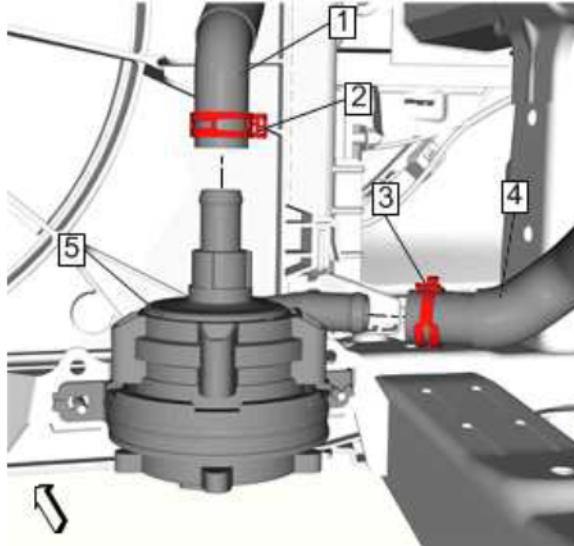


Fig. 188: Drive Motor Battery Coolant Pump And Attaching Components
 Courtesy of GENERAL MOTORS COMPANY

7. Disengage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
8. Remove Drive Motor Battery Coolant Pump Inlet Hose (1) @ Drive Motor Battery Coolant Pump (5)
9. Disengage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
10. Remove Drive Motor Battery Coolant Cooler Inlet Hose (4) @ Drive Motor Battery Coolant Pump (5)
11. Remove Drive Motor Battery Coolant Pump (5)

Installation Procedure

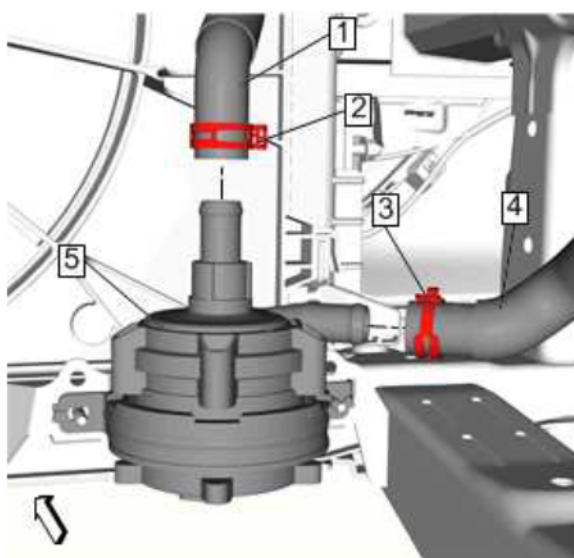


Fig. 189: Drive Motor Battery Coolant Pump And Attaching Components
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Pump (5)
2. Install Drive Motor Battery Coolant Cooler Inlet Hose (4) @ Drive Motor Battery Coolant Pump (5)
3. Engage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Install Drive Motor Battery Coolant Pump Inlet Hose (1) @ Drive Motor Battery Coolant Pump (5)
5. Engage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

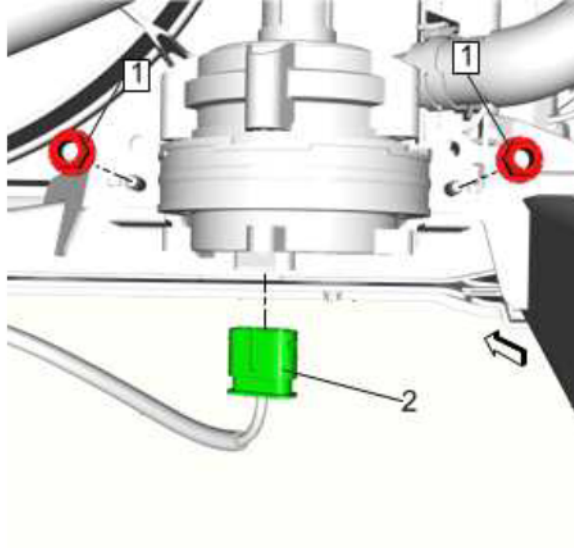


Fig. 190: Drive Motor Battery Coolant Pump Bracket Nuts And Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#)

6. Install the 2 drive motor battery coolant pump bracket nuts (1) and tighten to 9 N.m (80 lb in).
7. Connect Electrical Connector (2)

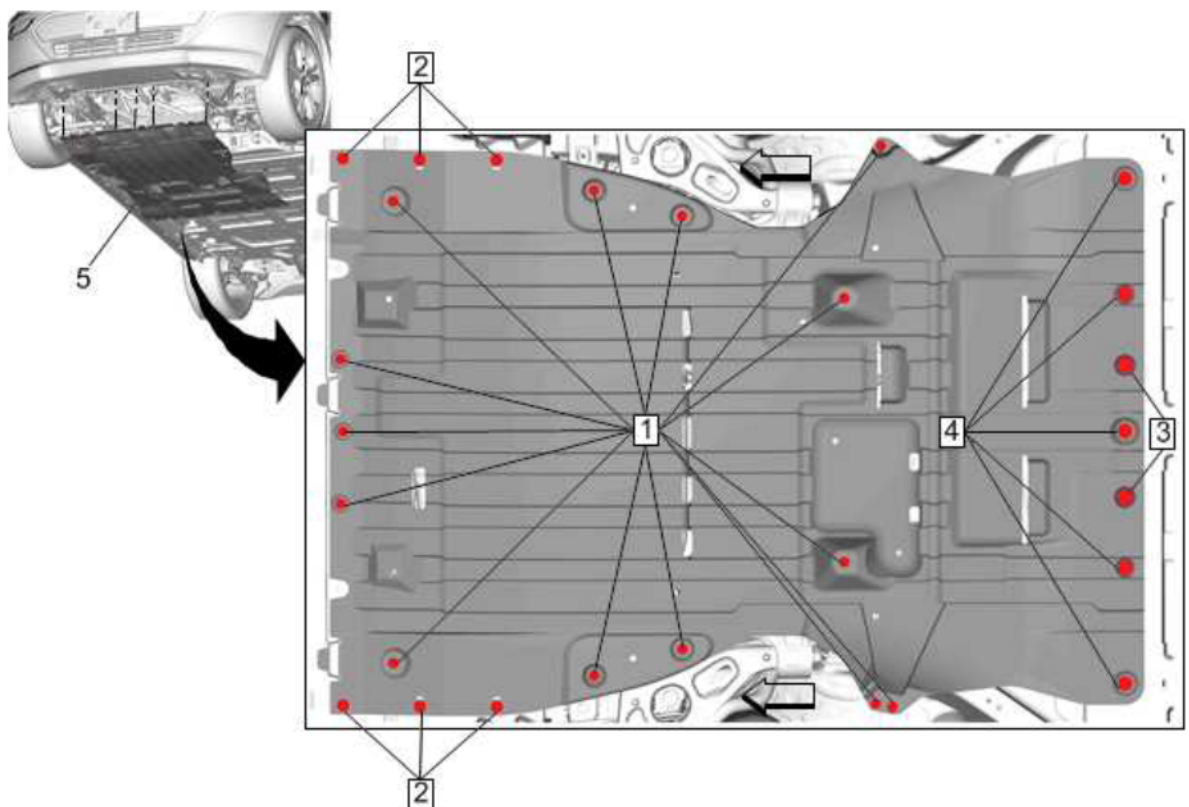


Fig. 191: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

8. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
9. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
10. Check the cooling system for leaks.
11. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

DRIVE MOTOR BATTERY COOLANT PUMP REPLACEMENT (PE PUMP)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults

exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

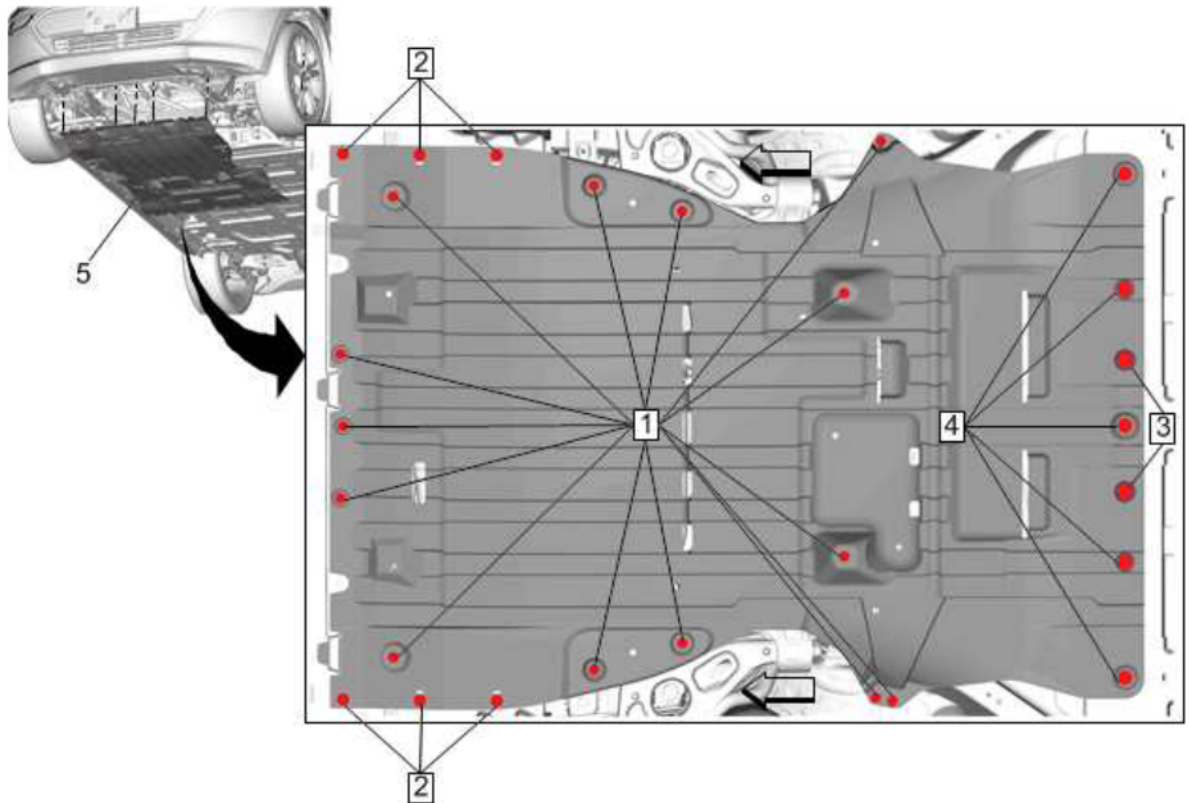


Fig. 192: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

3. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
4. Drain the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)

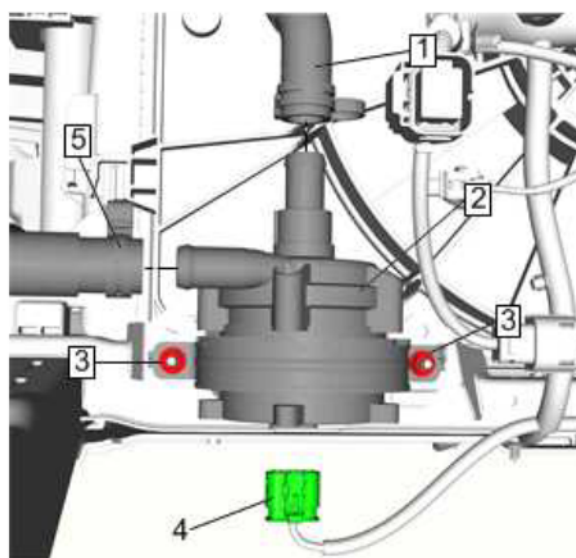


Fig. 193: Drive Motor Battery Coolant Pump And Attaching Components

Courtesy of GENERAL MOTORS COMPANY

5. Disconnect Electrical Connector (4) @ Drive Motor Battery Coolant Pump (2)
6. Disengage Drive Motor Generator Control Module Coolant Pump Hose (1) @ Drive Motor Battery Coolant Pump (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Drive Motor Battery Coolant Pump (2)

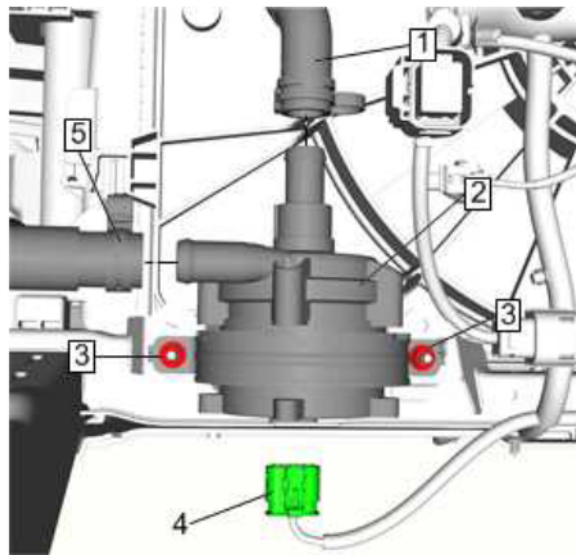


Fig. 194: Drive Motor Battery Coolant Pump And Attaching Components
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Pump (2)
2. Engage Drive Motor Generator Control Module Coolant Pump Hose (1) @ Drive Motor Battery Coolant Pump (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
3. Connect Electrical Connector (4) @ Drive Motor Battery Coolant Pump (2)

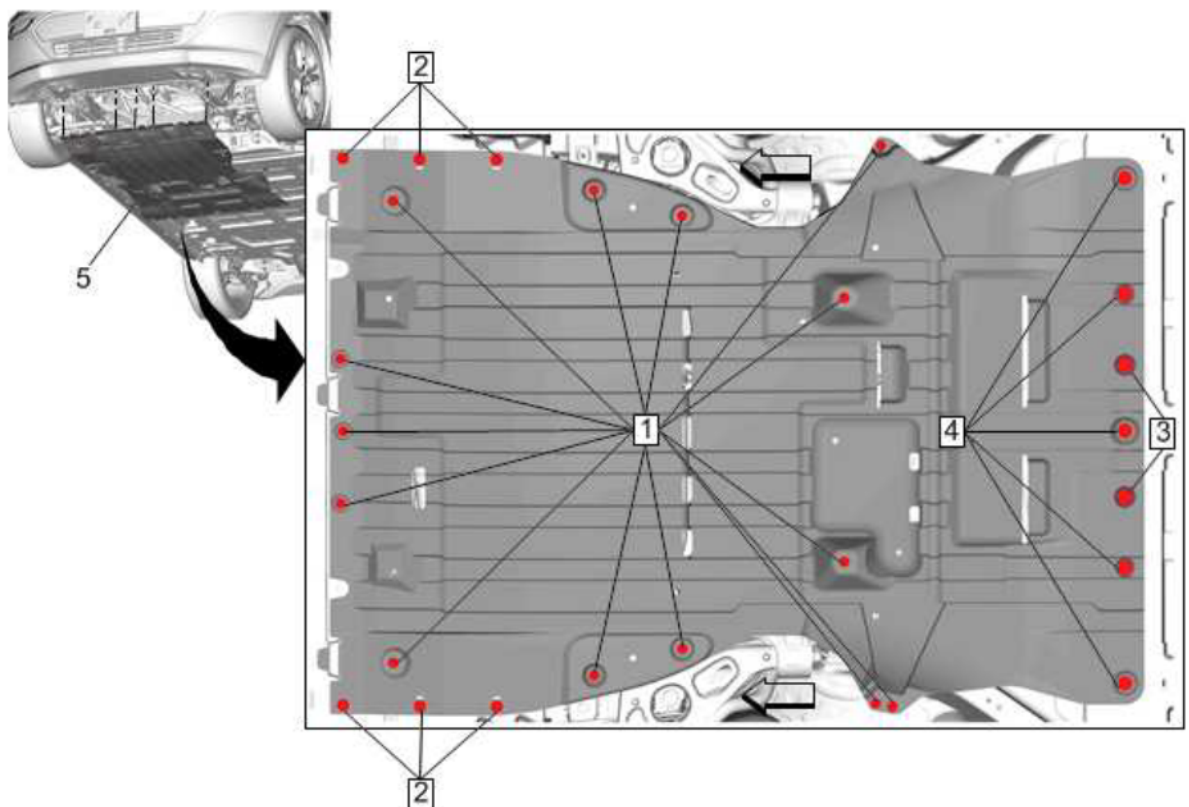


Fig. 195: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

4. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
5. Fill the drive motor generator power inverter module cooling system. Refer to [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
6. Check the cooling system for leaks.
7. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

DRIVE MOTOR BATTERY COOLANT PUMP INLET HOSE REPLACEMENT (SURGE TANK TO PUMP)

cardiagn.com

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

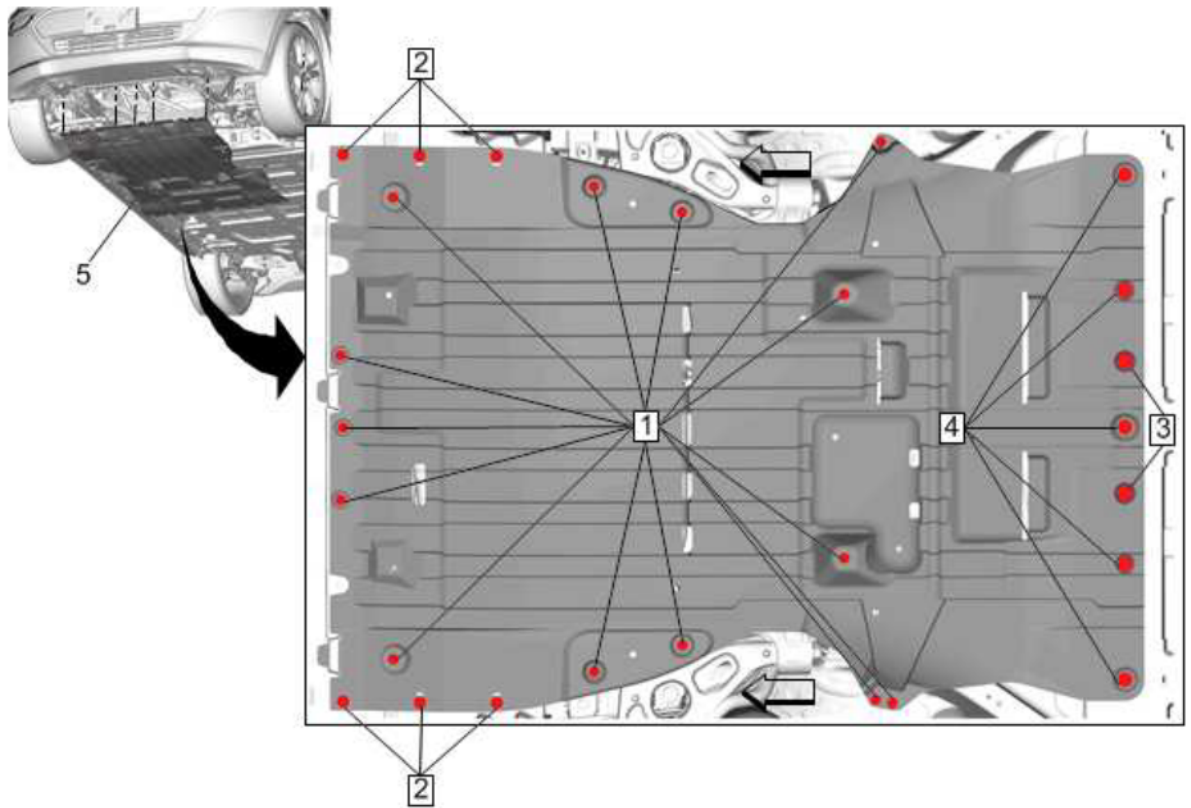


Fig. 196: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

2. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
3. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

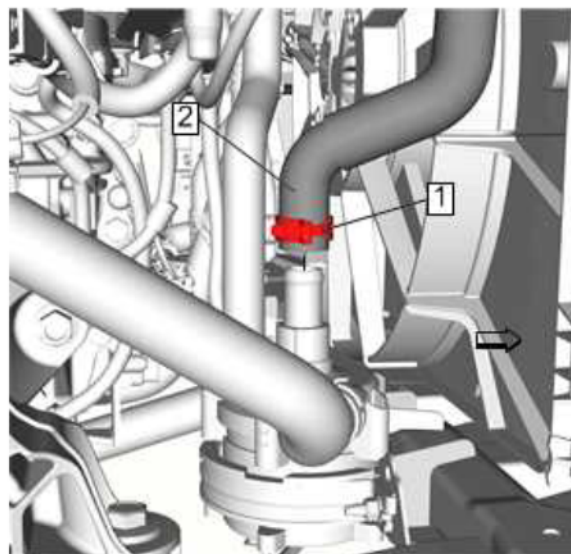


Fig. 197: Drive Motor Battery Coolant Pump Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove Drive Motor Battery Coolant Pump Inlet Hose (2)

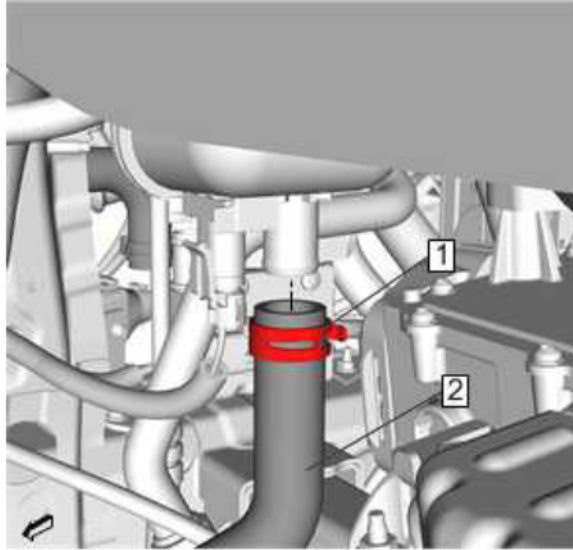


Fig. 198: Drive Motor Battery Coolant Pump Inlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

6. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Drive Motor Battery Coolant Pump Inlet Hose (2)

Installation Procedure

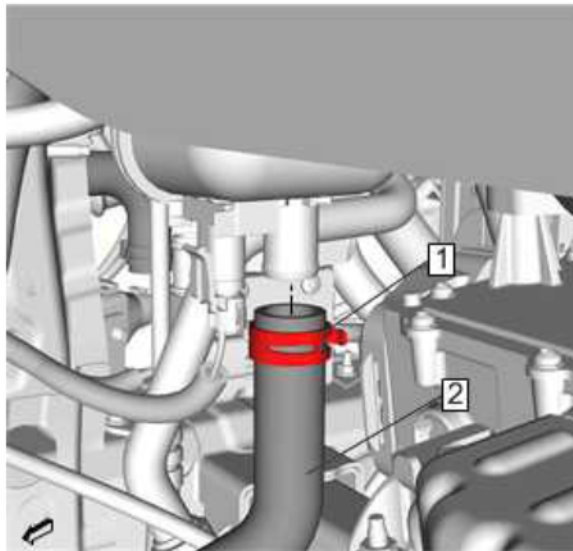


Fig. 199: Drive Motor Battery Coolant Pump Inlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Pump Inlet Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

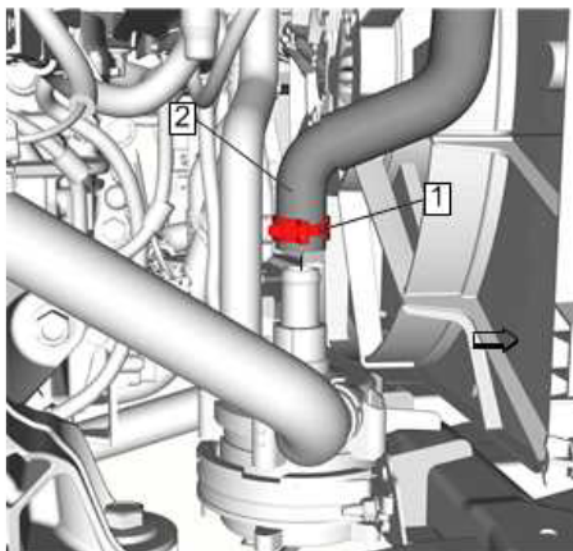


Fig. 200: Drive Motor Battery Coolant Pump Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Battery Coolant Pump Inlet Hose (2)
4. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

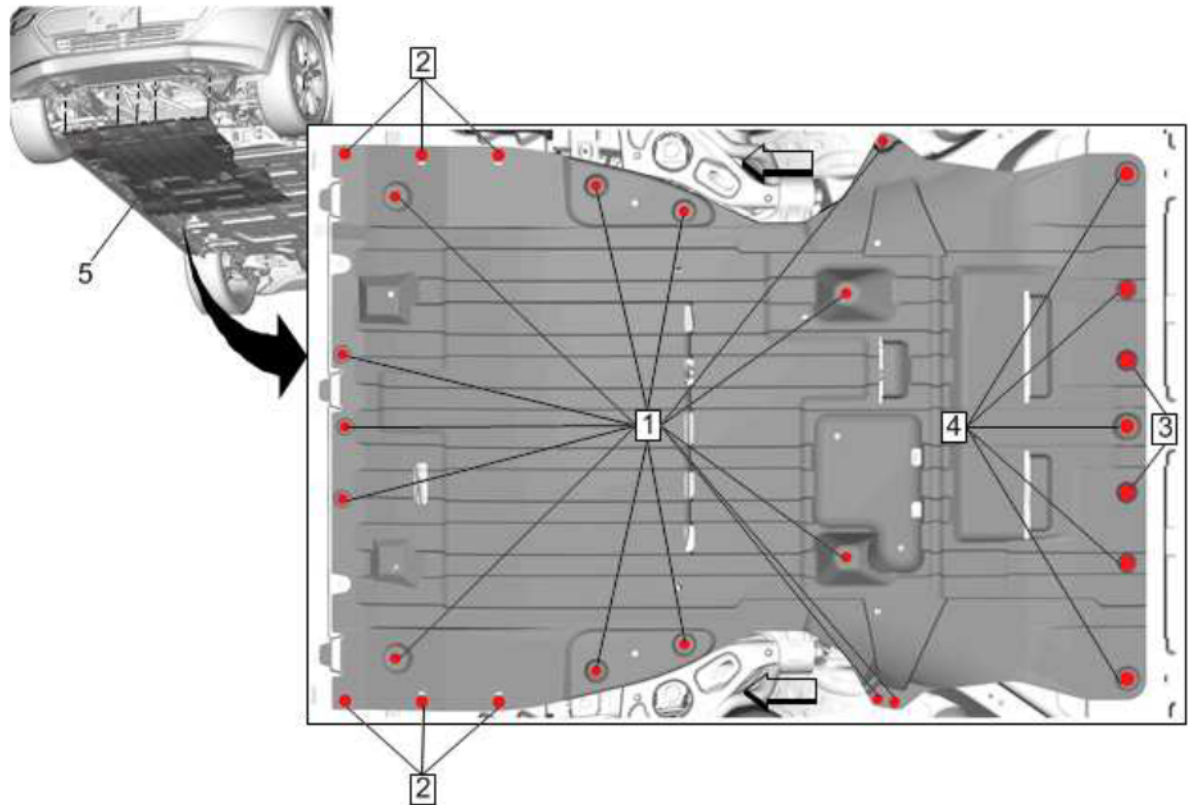


Fig. 201: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

5. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
6. Fill the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)
7. Check the cooling system for leaks.

DRIVE MOTOR BATTERY RADIATOR SURGE TANK REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Disconnect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)
3. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

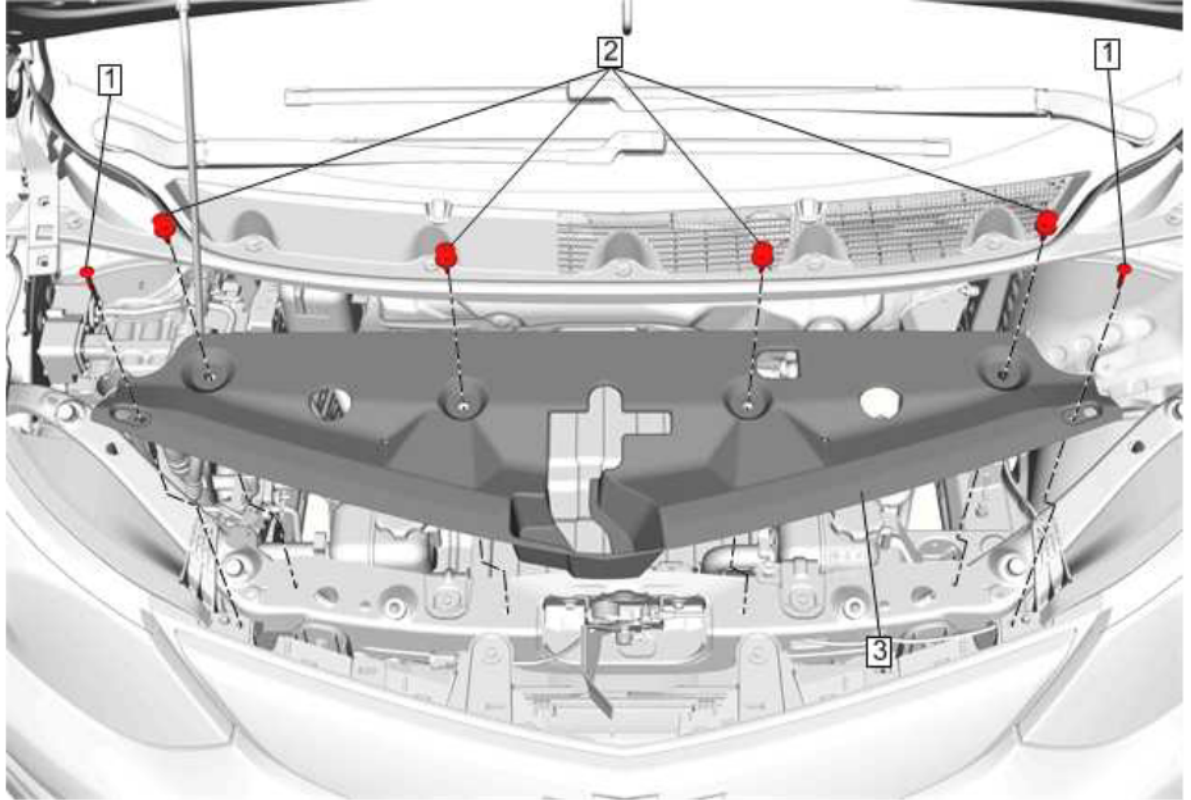


Fig. 202: Front Compartment Front Sight Shield
 Courtesy of GENERAL MOTORS COMPANY

4. Remove Front Compartment Front Sight Shield (3). Refer to [**Front Compartment Front Sight Shield Replacement**](#)

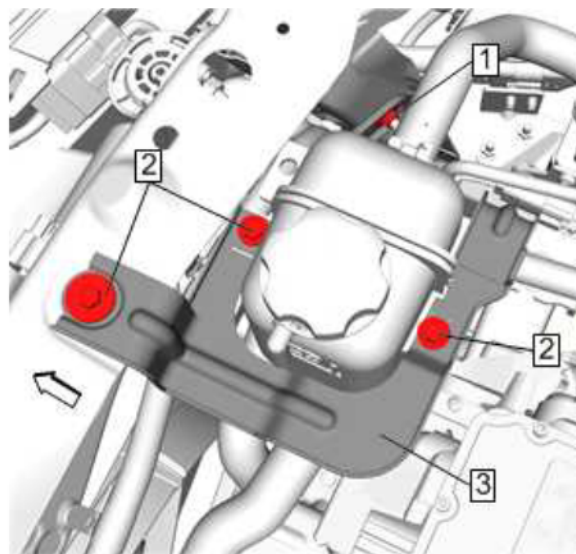


Fig. 203: Drive Motor Battery Radiator Surge Tank Bracket, Bolts And Nut
 Courtesy of GENERAL MOTORS COMPANY

5. Remove Radiator Surge Tank Bracket (3). Refer to [**Radiator Surge Tank Support Bracket Replacement \(RESS\)**](#)

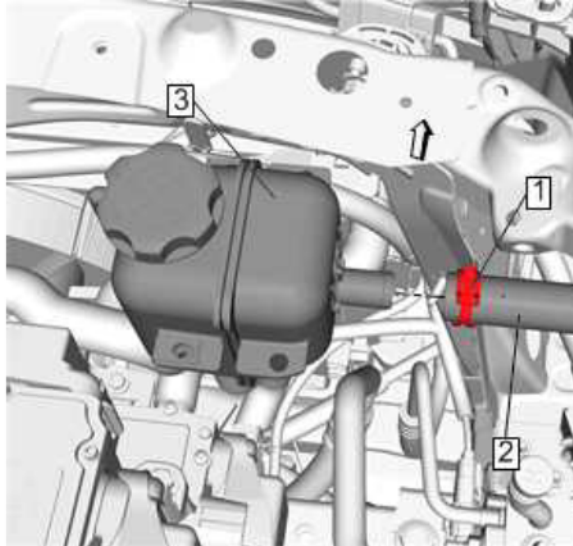


Fig. 204: Drive Motor Battery Radiator Surge Tank, Radiator Outlet Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

6. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Drive Motor Battery Radiator Outlet Hose (2) @ Drive Motor Battery Radiator Surge Tank (3)

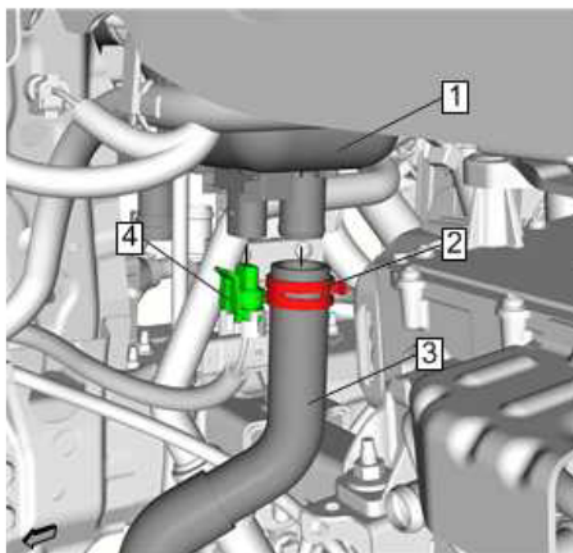


Fig. 205: Drive Motor Battery Radiator Surge Tank, Coolant Pump Inlet Hose, Clamp And Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

8. Disconnect Electrical Connector (4)
9. Disengage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
10. Remove Drive Motor Battery Coolant Pump Inlet Hose (3)
11. Remove Drive Motor Battery Radiator Surge Tank (1)
12. Transfer components as necessary.

Installation Procedure

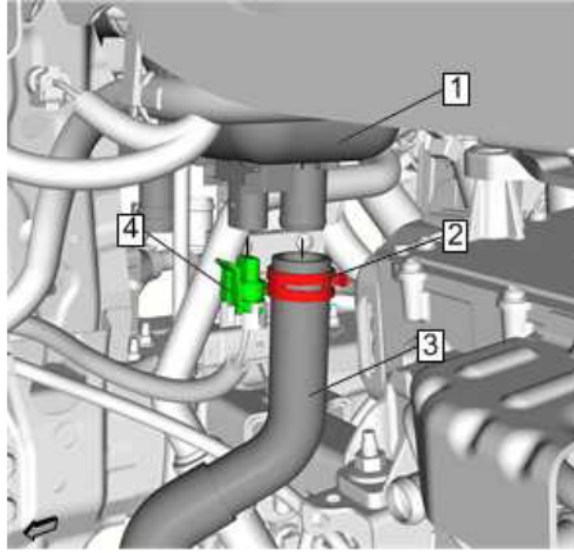


Fig. 206: Drive Motor Battery Radiator Surge Tank, Coolant Pump Inlet Hose, Clamp And Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Radiator Surge Tank (1)
2. Install Drive Motor Battery Coolant Pump Inlet Hose (3)
3. Engage Clamp (2). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Connect Electrical Connector (4)

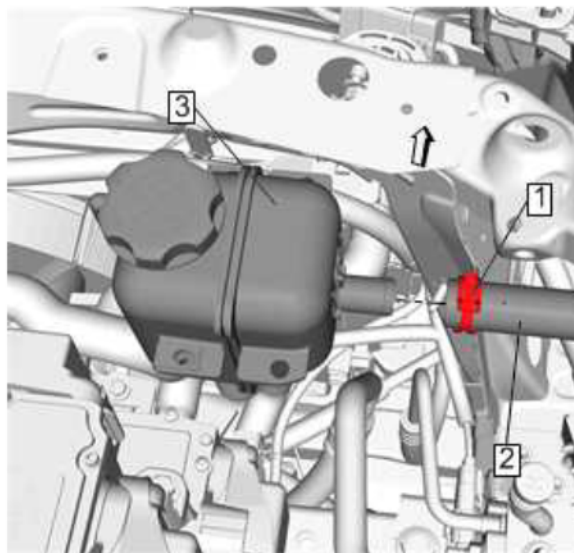


Fig. 207: Drive Motor Battery Radiator Surge Tank, Radiator Outlet Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

5. Install Drive Motor Battery Radiator Outlet Hose (2) @ Drive Motor Battery Radiator Surge Tank (3)
6. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

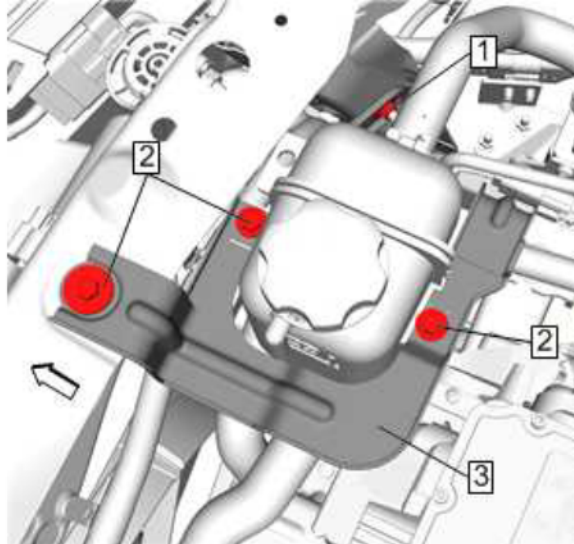


Fig. 208: Drive Motor Battery Radiator Surge Tank Bracket, Bolts And Nut
Courtesy of GENERAL MOTORS COMPANY

7. Install Radiator Surge Tank Bracket (3). Refer to [Radiator Surge Tank Support Bracket Replacement \(RESS\)](#)

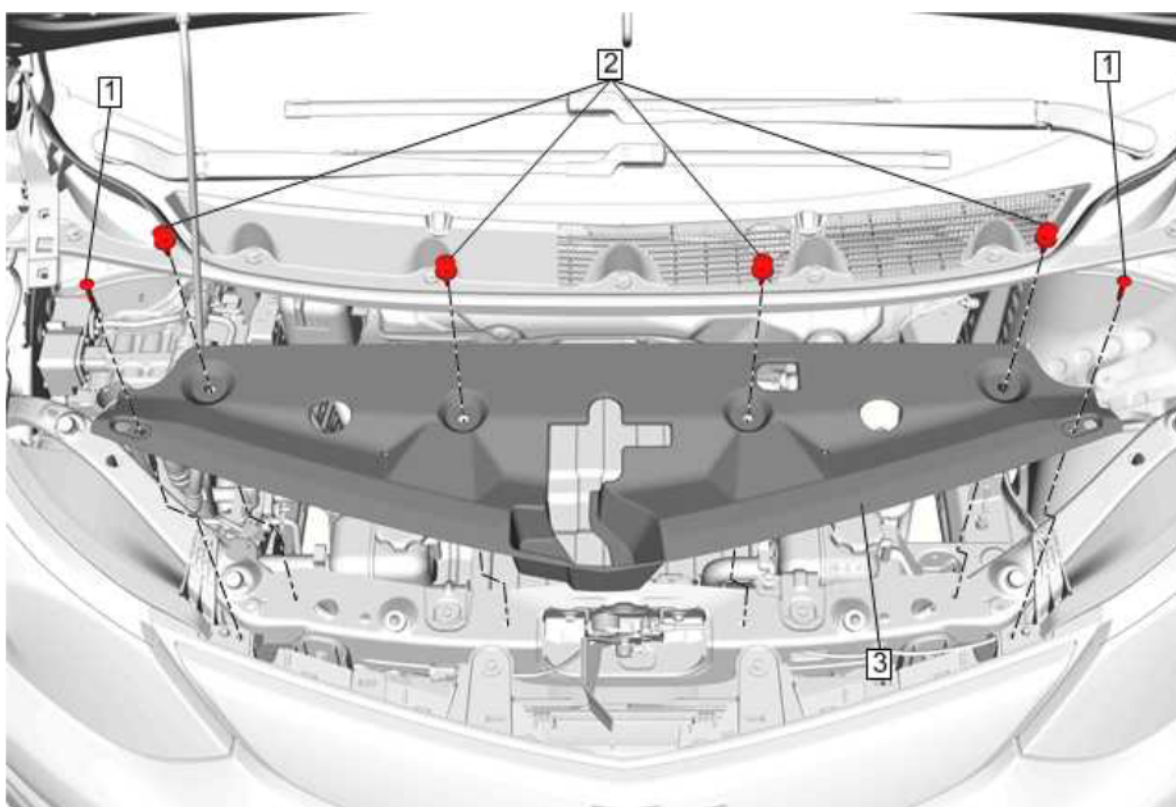


Fig. 209: Front Compartment Front Sight Shield
Courtesy of GENERAL MOTORS COMPANY

8. Install Front Compartment Front Sight Shield (3). Refer to [Front Compartment Front Sight Shield Replacement](#)
9. Fill the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)
10. Check the cooling system for leaks.
11. Connect the battery negative cable. Refer to [Battery Negative Cable Disconnection and Connection](#)

DRIVE MOTOR BATTERY COOLANT COOLER OUTLET HOSE REPLACEMENT (CHILLER TO RESS)

Removal Procedure

WARNING:

Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults

exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

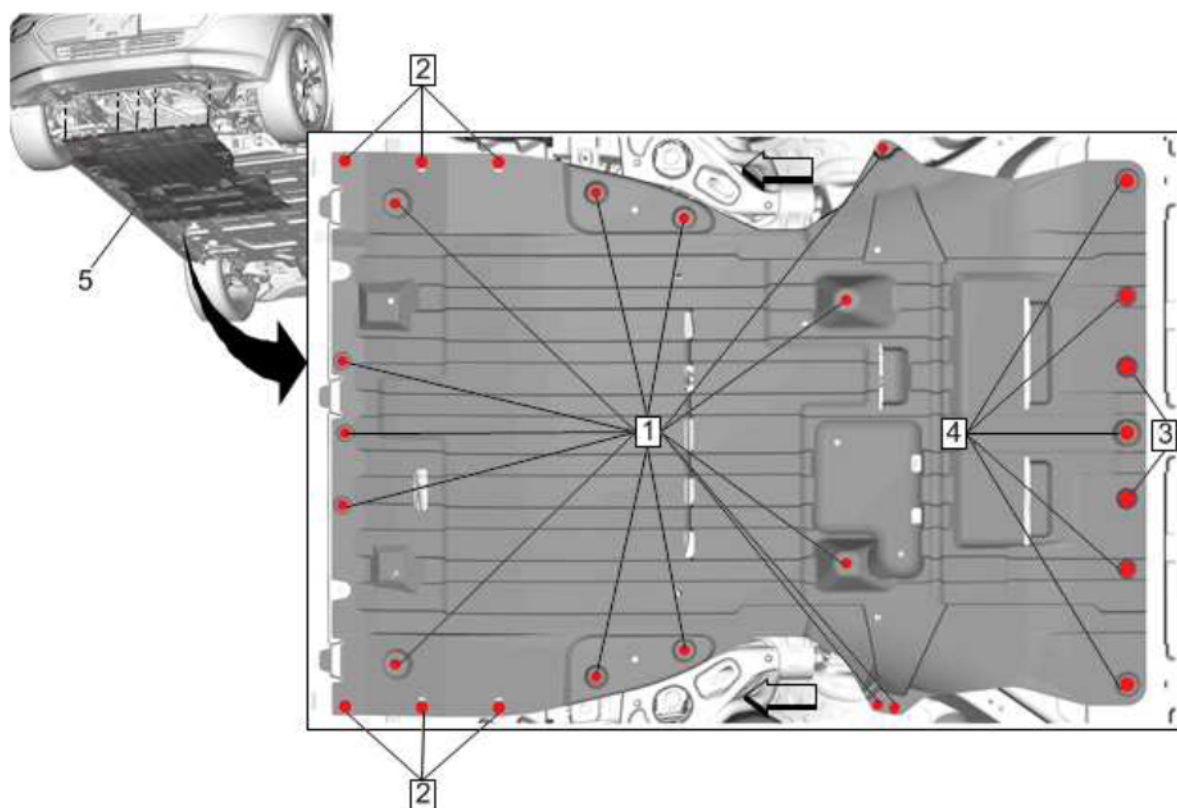


Fig. 210: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

2. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

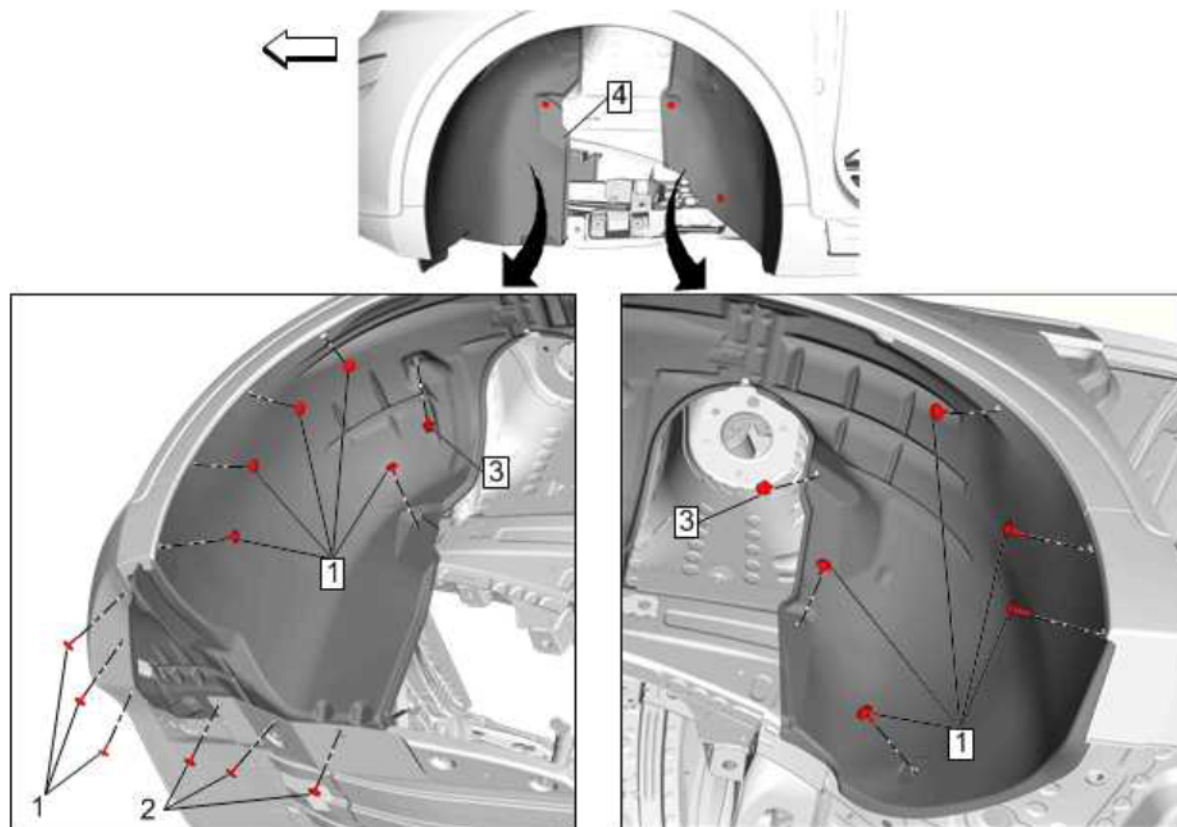


Fig. 211: Front Wheelhouse Liner

Courtesy of GENERAL MOTORS COMPANY

cardiagn.com

3. Remove Front Wheelhouse Liner-Right Side (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)

4. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

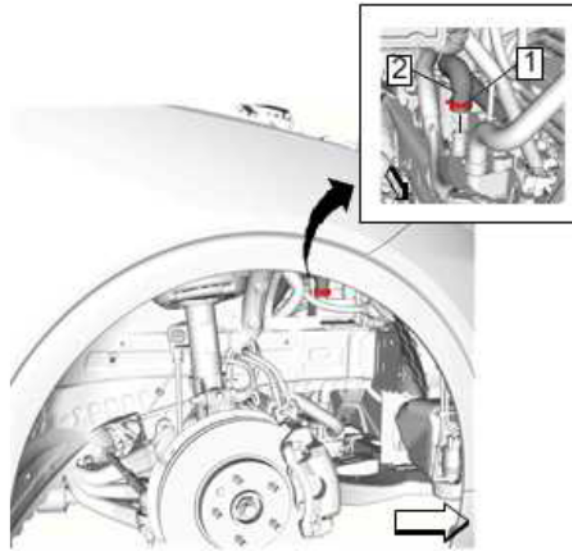


Fig. 212: Drive Motor Battery Coolant Cooler Outlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

5. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
6. Remove Drive Motor Battery Coolant Cooler Outlet Hose (2)

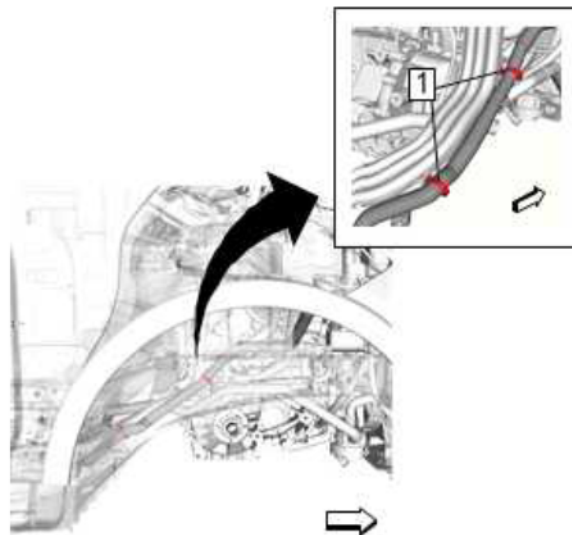


Fig. 213: Retainers
Courtesy of GENERAL MOTORS COMPANY

7. Remove Retainers (1) (Qty: 2)

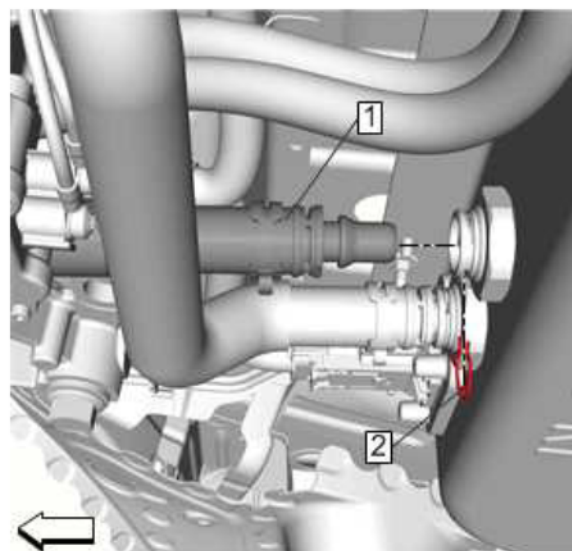


Fig. 214: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (1st Design Battery Pack)
Courtesy of GENERAL MOTORS COMPANY

8. If equipped with the 1st design of battery pack having female inlet and female outlet port, remove the clip (2) and the drive motor battery coolant cooler outlet hose (1) from the RESS.

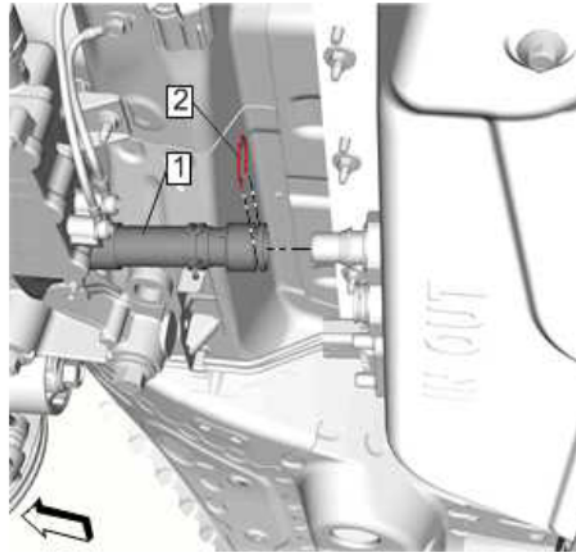


Fig. 215: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (2nd Design Battery Pack)
Courtesy of GENERAL MOTORS COMPANY

9. If equipped with the 2nd design of battery pack having female inlet and male outlet port, remove the clip (2) and the drive motor battery coolant cooler outlet hose (1) from the RESS.

Installation Procedure

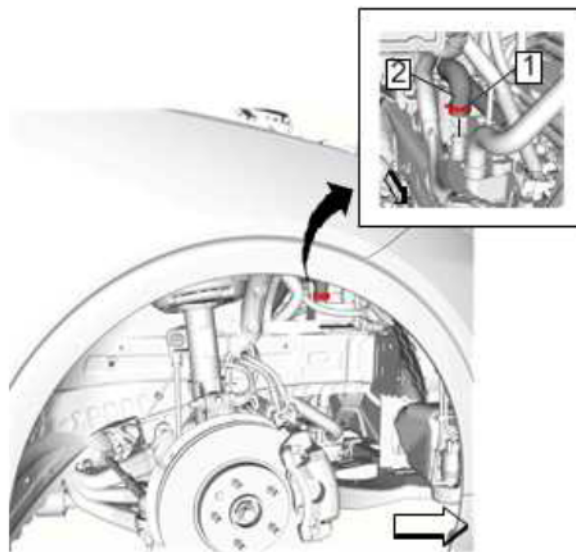


Fig. 216: Drive Motor Battery Coolant Cooler Outlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Cooler Outlet Hose (2)
2. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

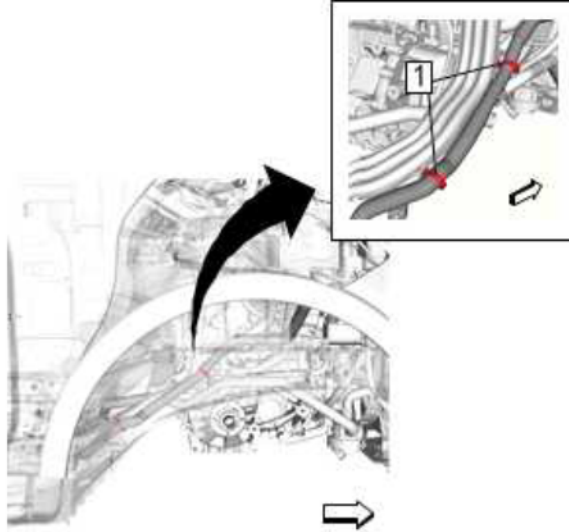


Fig. 217: Retainers

Courtesy of GENERAL MOTORS COMPANY

3. Install Retainers (1) (Qty: 2)

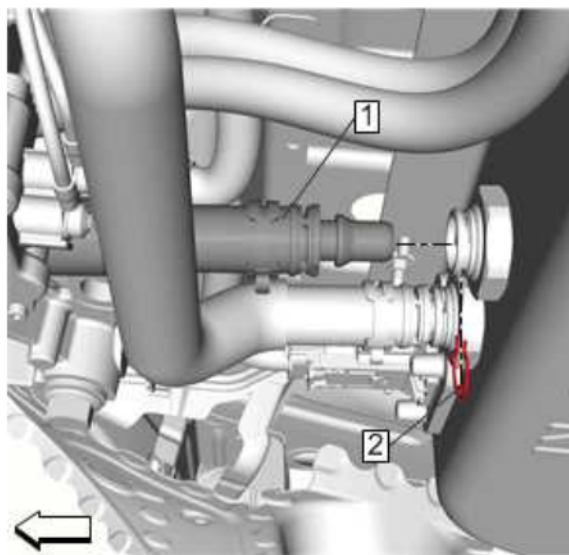


Fig. 218: Drive Motor Battery Coolant Cooler Outlet Hose And Clip (1st Design Battery Pack)

Courtesy of GENERAL MOTORS COMPANY

NOTE: When installing the inlet or outlet hose, be careful not to confuse the inlet port and outlet port.

4. If equipped with the 1st design of battery pack having female inlet and female outlet port, install the clip (2) and the drive motor battery coolant cooler outlet hose (1) to the RESS.

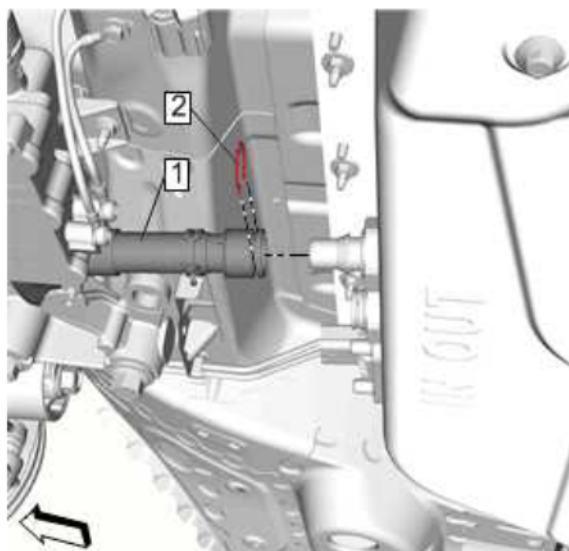


Fig. 219: Drive Motor Battery Cooler Outlet Hose And Clip (2nd Design Battery Pack)
Courtesy of GENERAL MOTORS COMPANY

5. If equipped with the 2nd design of battery pack having female inlet and male outlet port, install the clip (2) and the drive motor battery coolant cooler outlet hose (1) to the RESS.

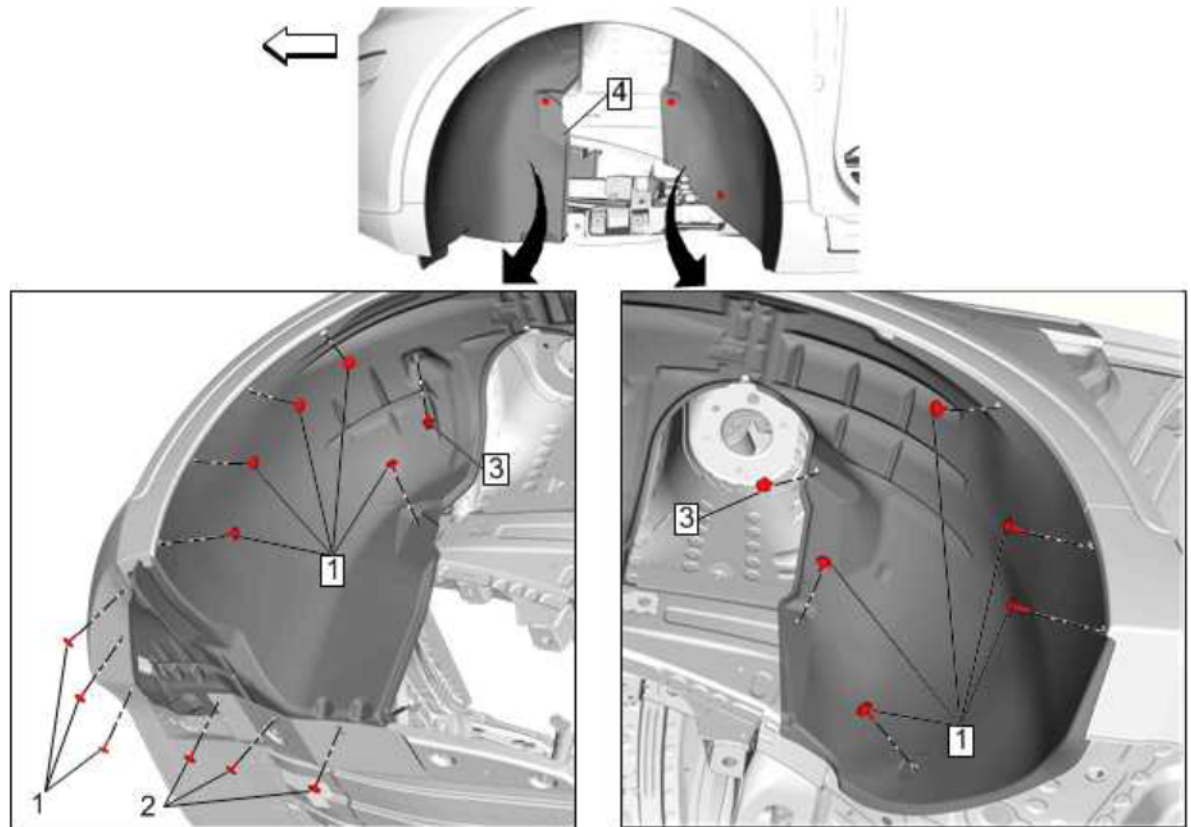


Fig. 220: Front Wheelhouse Liner
Courtesy of GENERAL MOTORS COMPANY

6. Install Front Wheelhouse Liner-Right Side (4) (Qty: 2). Refer to [Front Wheelhouse Liner Replacement](#)

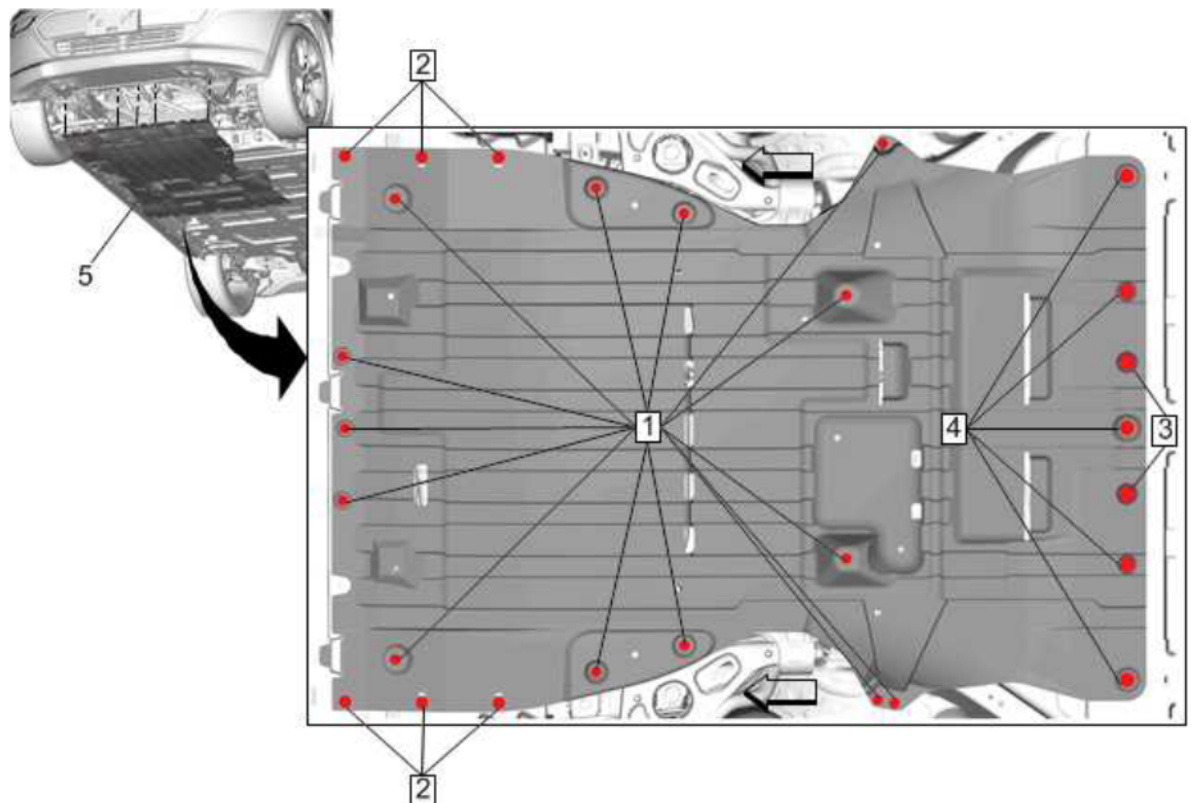


Fig. 221: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

7. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)

8. Fill the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

9. Check the cooling system for leaks.

DRIVE MOTOR BATTERY COOLANT INLET HOSE REPLACEMENT

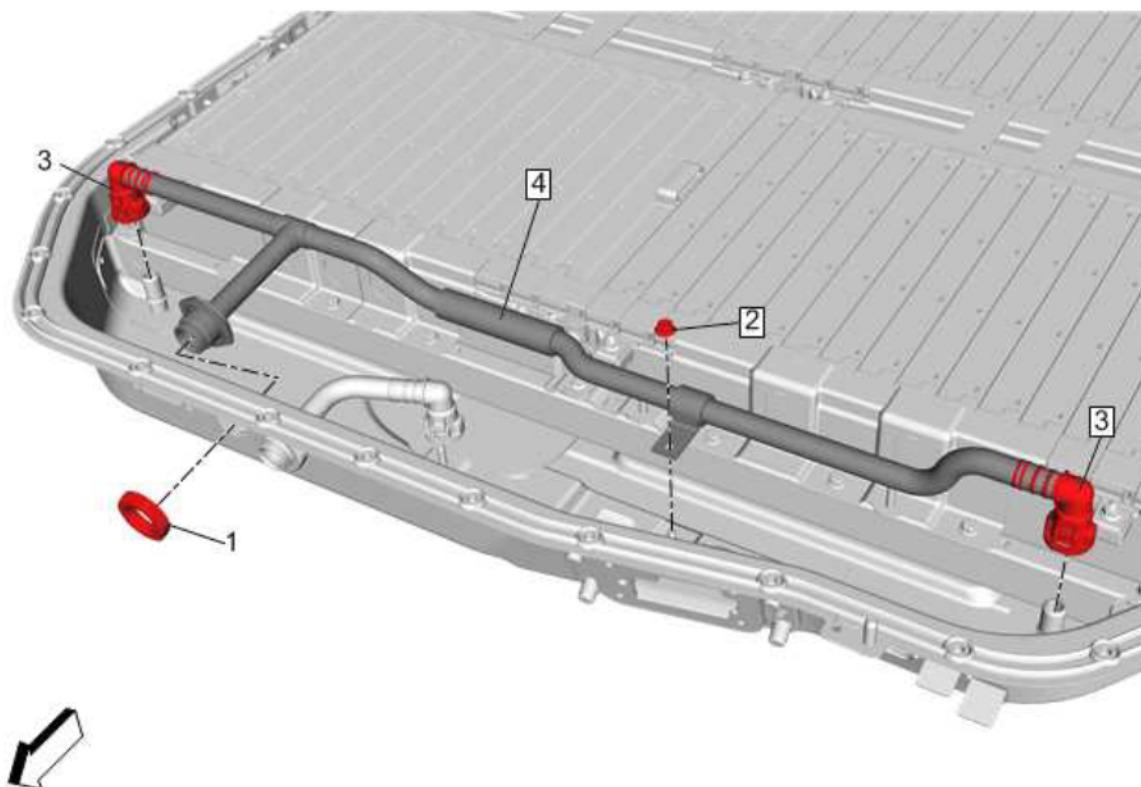


Fig. 222: Drive Motor Battery Coolant Inlet Hose

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING:	
Ensure all High Voltage safety procedures are followed. Failure to follow the procedure exactly as written may result in serious injury or death.	
WARNING:	
Before working on any high voltage system, be sure to wear the following Personal Protection Equipment:	
• Safety glasses with appropriate side shields when within 50 feet of the vehicle, either indoors or outdoors • Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors • Visually and functionally inspect the gloves before use. • Wear the Insulation gloves at all times when working with the high voltage battery assembly, whether the system is energized or not.	
Failure to follow the procedure exactly as written may result in serious injury or death.	
Preliminary Procedure	
1. Remove the high voltage battery disconnect relay. Refer to High Voltage Battery Disconnect Relay Replacement 2. Remove the high voltage connector X4 harness assembly. Refer to High Voltage Connector Replacement (X4)	

Callout	Component Name
1	Drive Motor Battery Coolant Port Nut CAUTION: Refer to Fastener Caution Tighten 40 N.m (30 lb ft) NOTE: Use a suitable tool to hold the backside fastener (inside nut).
2	Drive Motor Battery Coolant Inlet Hose Nut Tighten 5 N.m (44 lb in)
3	Drive Motor Battery Coolant Inlet Hose Quick Connectors (Qty: 2) NOTE: Place rags around the quick connectors. Residual coolant will leak out when quick connectors are disconnected and under no circumstances can coolant leak into the battery tray. CAUTION: The module must be drained of all residual coolant prior to disassembly. Failure to properly drain all residual coolant may cause electronic circuit damage to occur during disassembly.
4	Drive Motor Battery Coolant Inlet Hose Procedure Check the battery pack cooling system for leaks before installing the battery pack to the vehicle. Refer to Hybrid Battery Pack Coolant Passage Leak Test

DRIVE MOTOR BATTERY COOLANT OUTLET HOSE REPLACEMENT

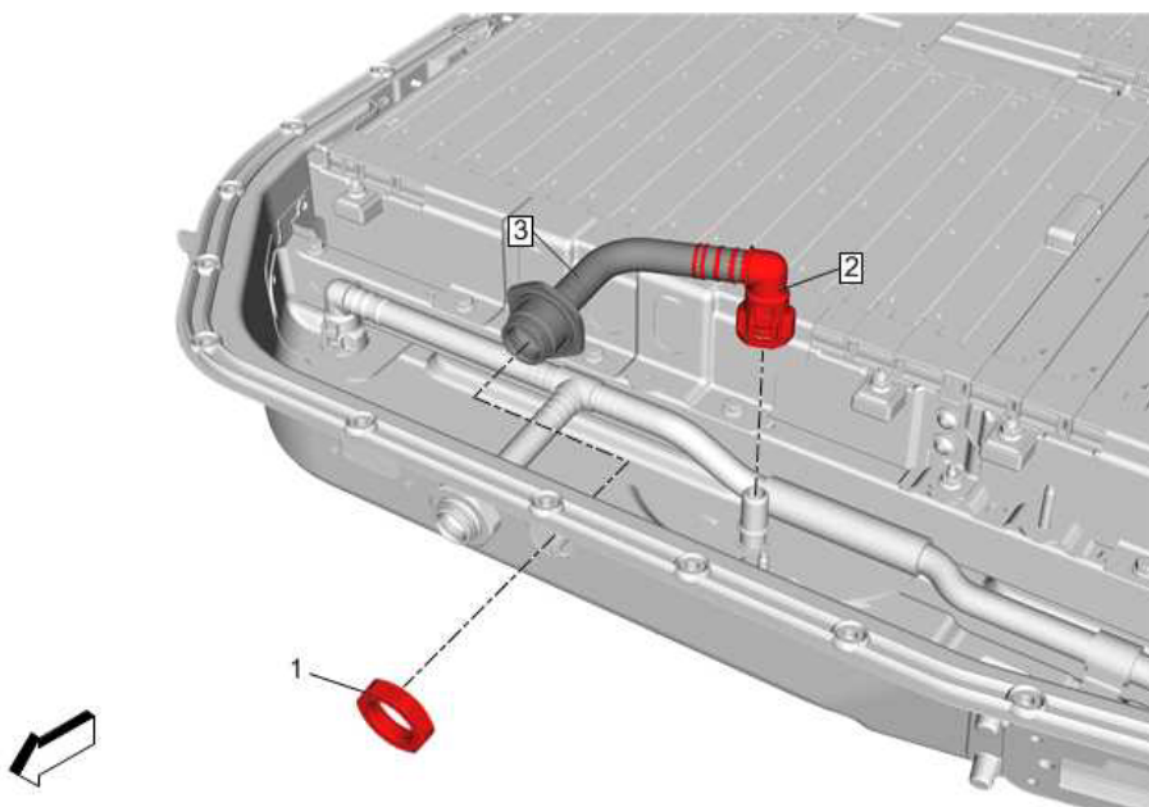


Fig. 223: Drive Motor Battery Coolant Outlet Hose
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Ensure all High Voltage safety procedures are followed. Failure to follow the procedure exactly as written may result in serious injury or death. WARNING: Before working on any high voltage system, be sure to wear the following Personal Protection Equipment: • Safety glasses with appropriate side shields when within 50 feet of the vehicle, either indoors or outdoors • Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors • Visually and functionally inspect the gloves before use. • Wear the Insulation gloves at all times when working with the high voltage battery assembly, whether the system is energized or not. Failure to follow the procedure exactly as written may result in serious injury or death. Preliminary Procedure 1. Remove the battery upper cover. Refer to Battery Upper Cover Replacement 2. Detach the high voltage connector X4 harness retainer from the outlet hose. Refer to High Voltage Connector Replacement (X4)	
1	Drive Motor Battery Coolant Port Nut (Qty: 1) CAUTION: Refer to Fastener Caution . Tighten 40 N.m (30 lb ft) NOTE: Use a suitable tool to hold the backside fastener (inside nut).
2	Drive Motor Battery Coolant Outlet Hose Quick Connectors (Qty: 1)
3	Drive Motor Battery Coolant Outlet Hose Procedure Check the battery pack cooling system for leaks before installing the battery pack to the vehicle. Refer to Hybrid Battery Pack Coolant Passage Leak Test

DRIVE MOTOR BATTERY RADIATOR OUTLET HOSE REPLACEMENT (SURGE TANK TO CHILLER)

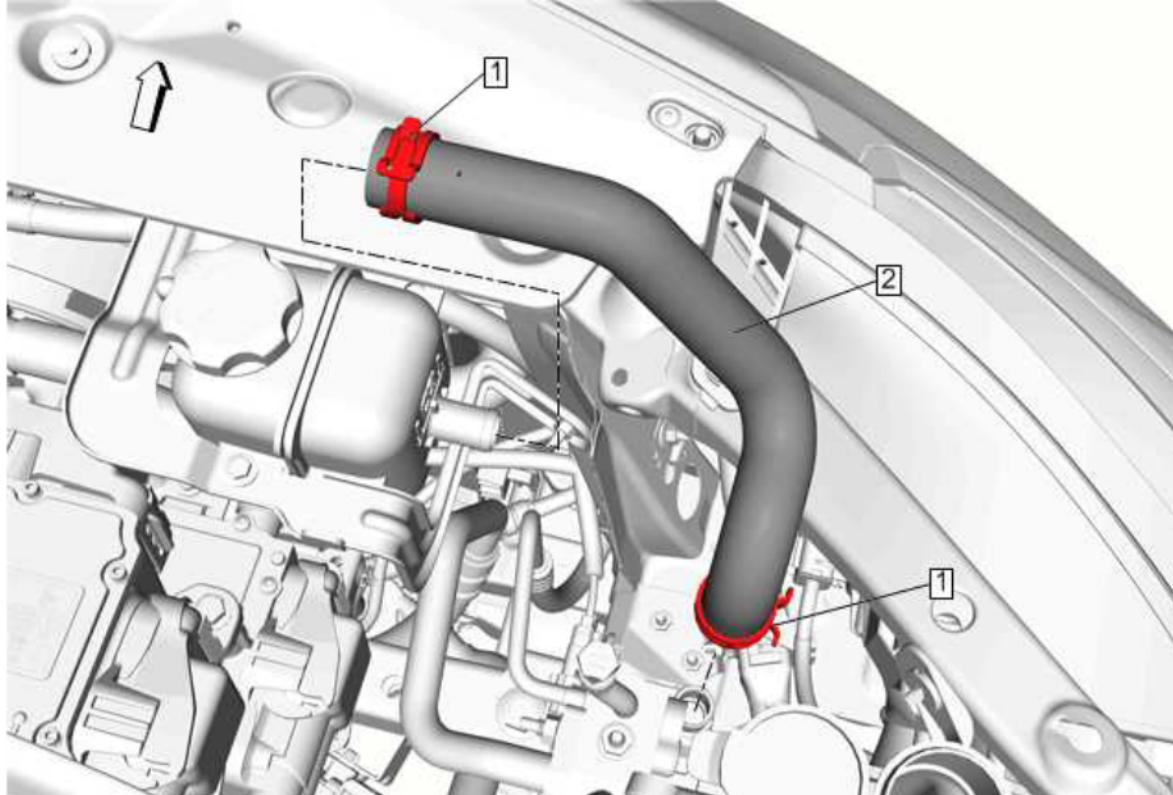


Fig. 224: Drive Motor Battery Radiator Outlet Hose (Surge Tank To Chiller)

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.	
Preliminary Procedures 1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle. 2. Drain the drive motor battery cooling system. Refer to Drive Motor Battery Cooling System Draining and Filling	
1	Clamp (Qty: 2) Procedure Reposition the drive motor battery radiator outlet hose clamps. Refer to Hose Clamp Replacement Guidelines - Spring Type
2	Drive Motor Battery Radiator Outlet Hose Procedure 1. Fill the coolant to the proper level. Refer to Drive Motor Battery Cooling System Draining and Filling 2. Check the cooling system for leaks.

DRIVE MOTOR BATTERY COOLANT COOLER INLET HOSE REPLACEMENT (PUMP TO RESS HEATER)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any

cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.

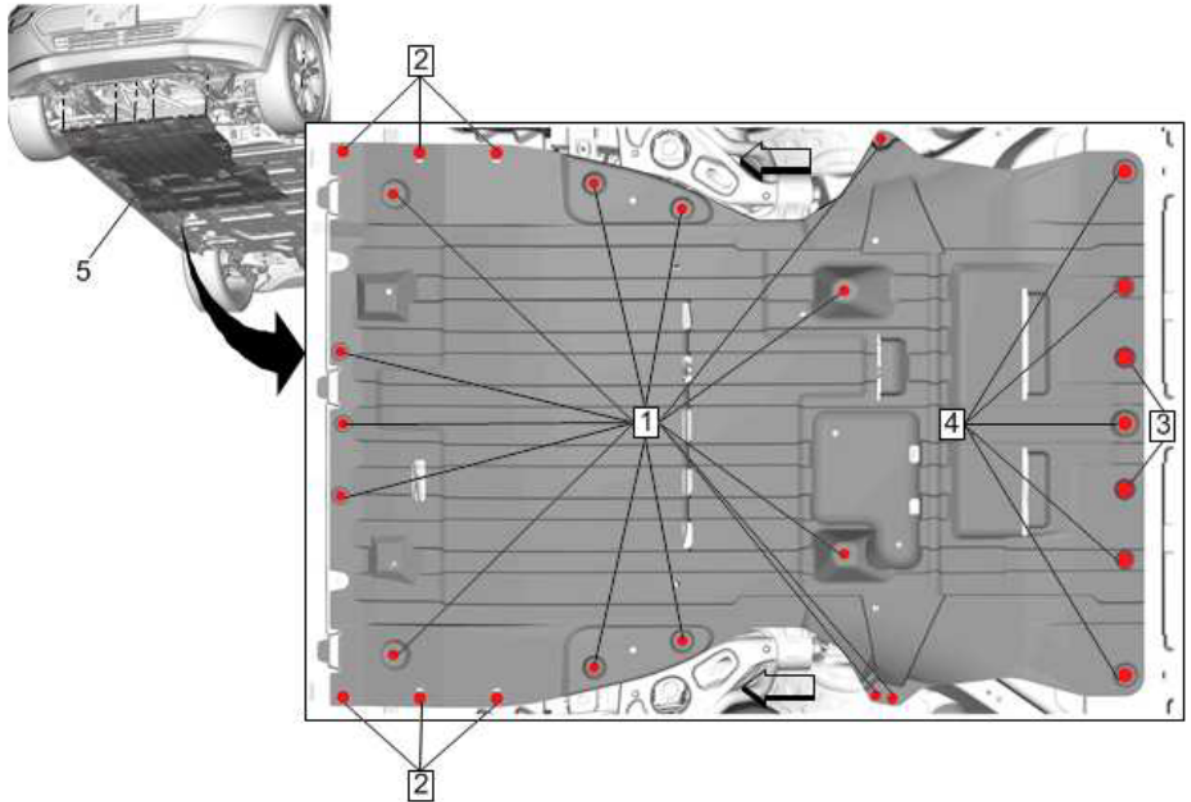


Fig. 225: Front Compartment Air Deflector And Fasteners
Courtesy of GENERAL MOTORS COMPANY

2. Remove Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
3. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

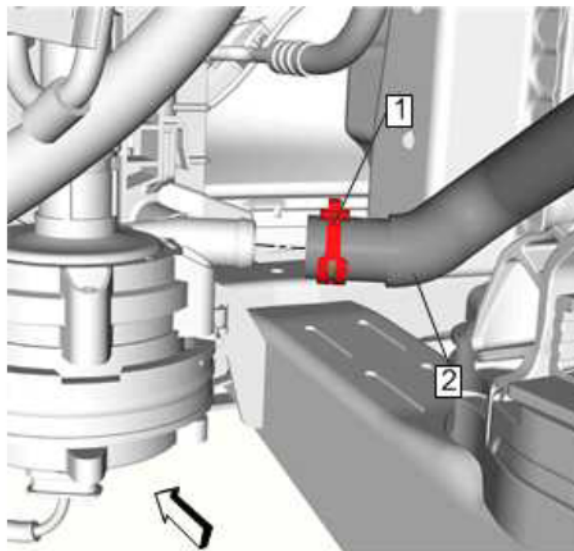


Fig. 226: Drive Motor Battery Coolant Cooler Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove Drive Motor Battery Coolant Cooler Inlet Hose (2)

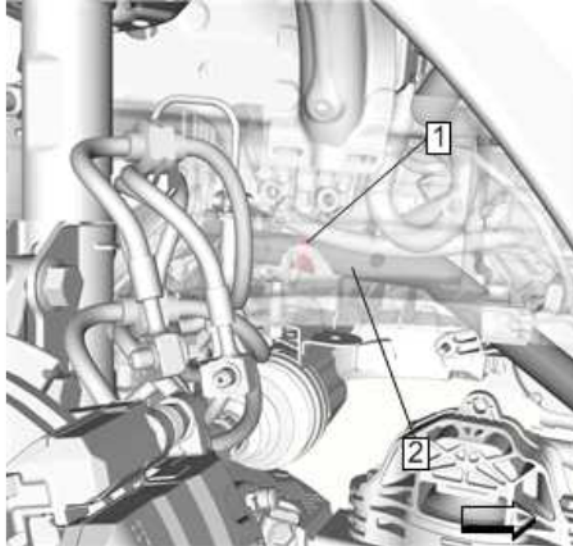


Fig. 227: Drive Motor Battery Coolant Cooler Inlet Hose And Retainer
Courtesy of GENERAL MOTORS COMPANY

6. Remove Retainer (1)
7. Remove Drive Motor Battery Coolant Cooler Inlet Hose (2)

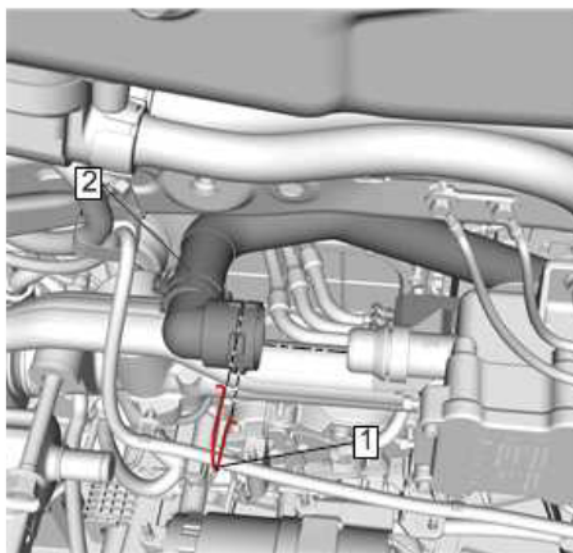


Fig. 228: Drive Motor Battery Coolant Cooler Inlet Hose And Clip
Courtesy of GENERAL MOTORS COMPANY

8. Release Clip (1)
9. Remove Drive Motor Battery Coolant Cooler Inlet Hose (2)

Installation Procedure

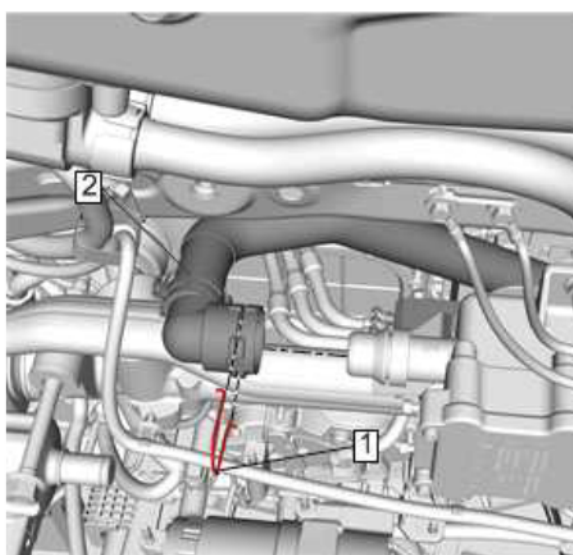


Fig. 229: Drive Motor Battery Coolant Cooler Inlet Hose And Clip
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Coolant Cooler Inlet Hose (2)
2. Install Clip (1)

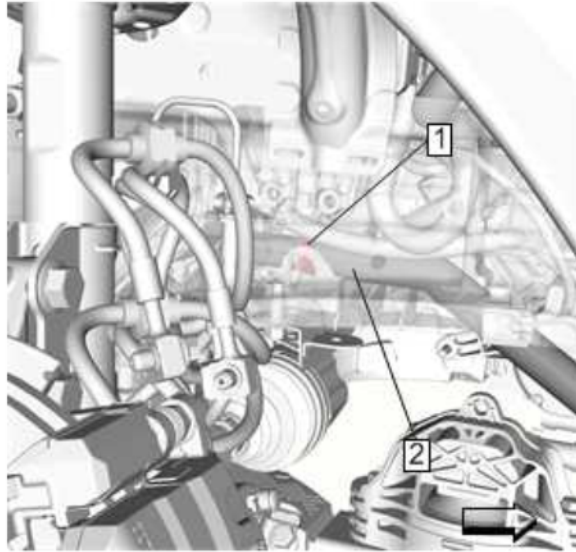


Fig. 230: Drive Motor Battery Coolant Cooler Inlet Hose And Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Battery Coolant Cooler Inlet Hose (2)
4. Install Retainer (1)

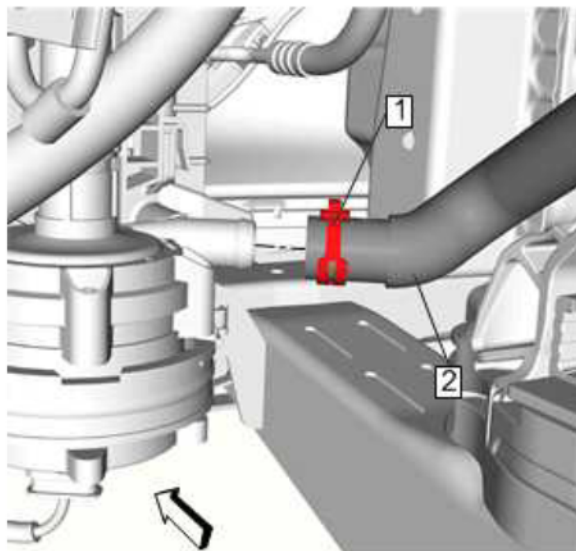


Fig. 231: Drive Motor Battery Coolant Cooler Inlet Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

5. Install Drive Motor Battery Coolant Cooler Inlet Hose (2)
6. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

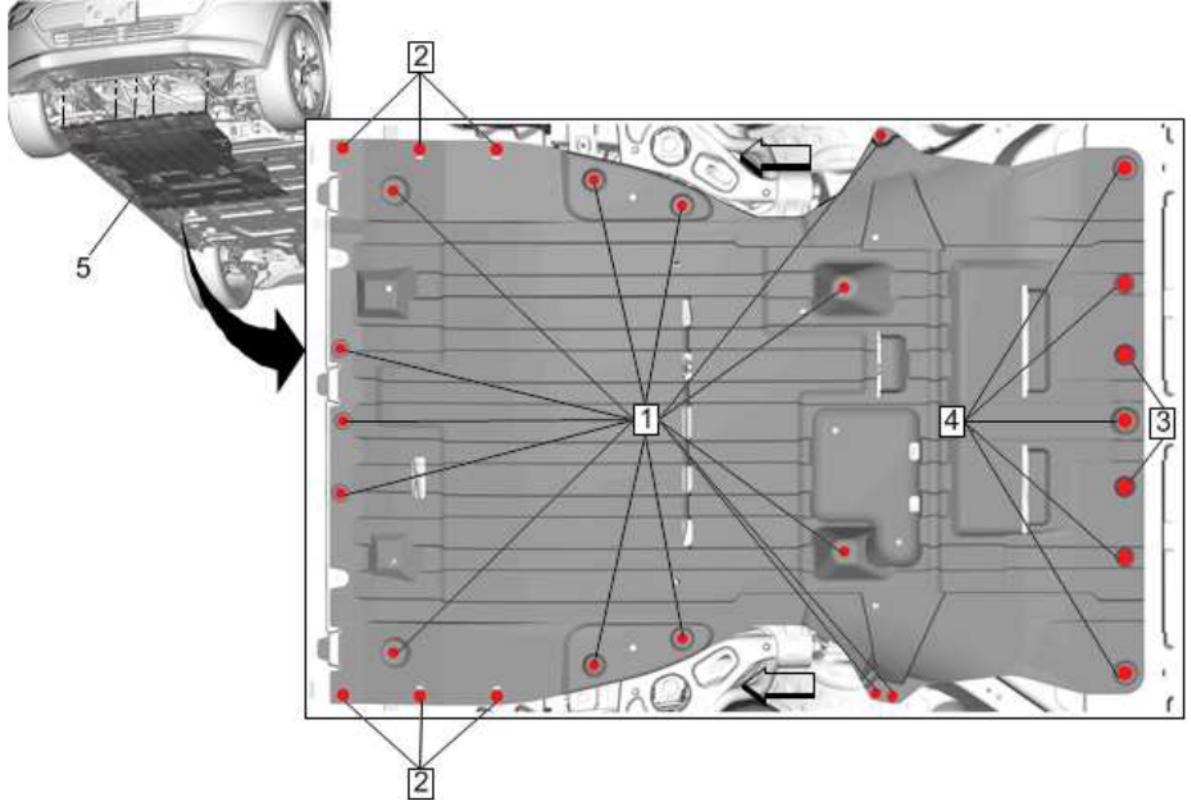


Fig. 232: Front Compartment Air Deflector And Fasteners

Courtesy of GENERAL MOTORS COMPANY

7. Install Front Compartment Air Deflector (5). Refer to [Front Compartment Air Deflector Replacement](#)
8. Fill the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)
9. Check the cooling system for leaks.

BATTERY VENT HOSE REPLACEMENT (RESS HTR TO RESS)

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#)
3. Drain the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)

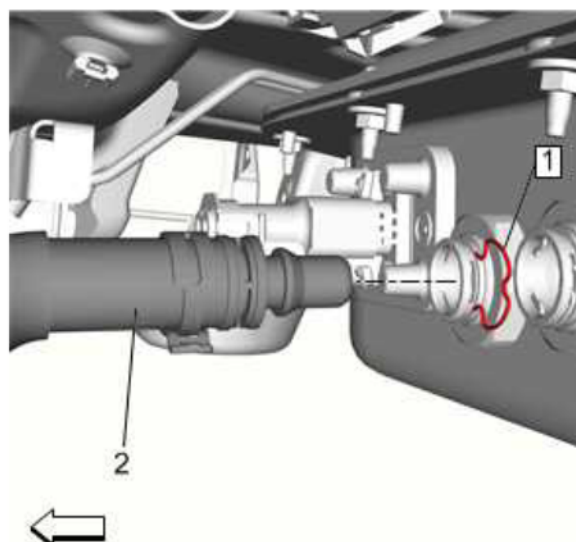


Fig. 233: Battery Vent Hose And Clip
Courtesy of GENERAL MOTORS COMPANY

4. Remove Clip (1)
5. Remove Battery Vent Hose (2)

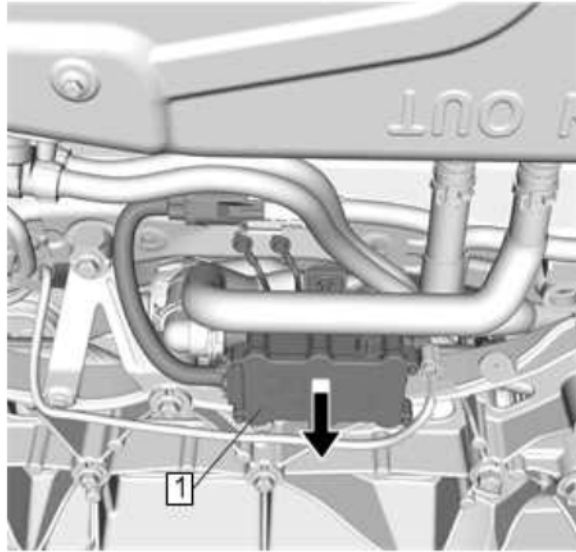


Fig. 234: High Voltage Battery Heater Assembly
Courtesy of GENERAL MOTORS COMPANY

6. Lower the high voltage battery heater assembly (1) to get the space enough to access to the battery vent hose. Refer to [High Voltage Battery Heater Replacement](#)

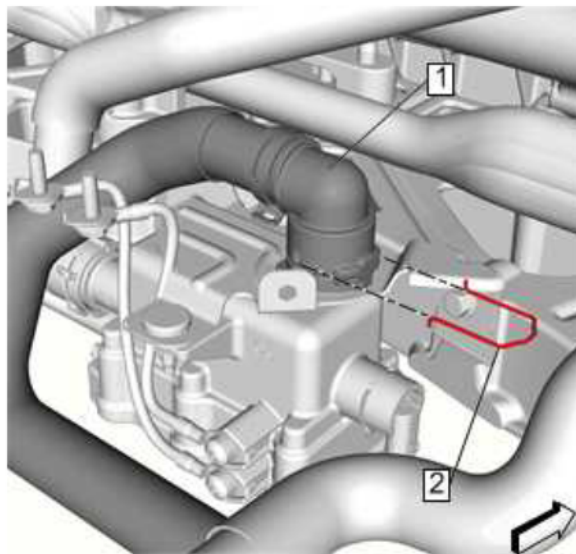


Fig. 235: Battery Vent Hose And Clip
Courtesy of GENERAL MOTORS COMPANY

7. Release Clip (2)
8. Remove Battery Vent Hose (1)

Installation Procedure

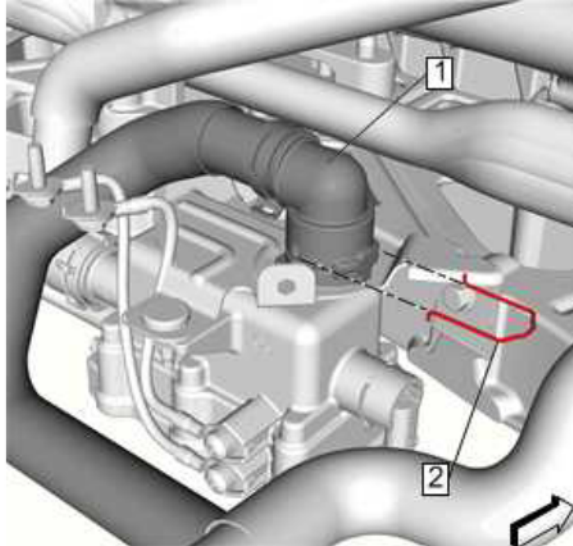


Fig. 236: Battery Vent Hose And Clip

Courtesy of GENERAL MOTORS COMPANY

1. Install Battery Vent Hose (1)
2. Install Clip (2)

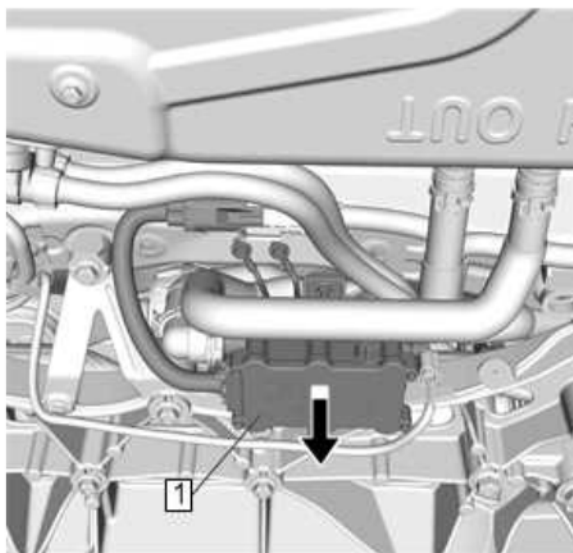


Fig. 237: High Voltage Battery Heater Assembly

Courtesy of GENERAL MOTORS COMPANY

3. Install High Voltage Battery Heater (1). Refer to [High Voltage Battery Heater Replacement](#)

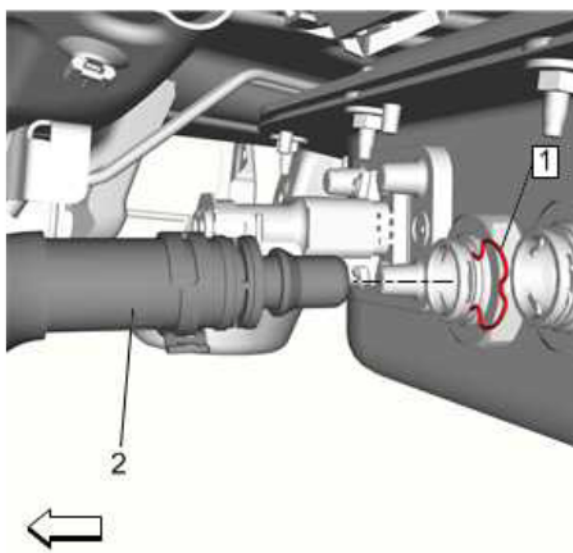


Fig. 238: Battery Vent Hose And Clip

Courtesy of GENERAL MOTORS COMPANY

4. Install Clip (1)

NOTE: When installing the inlet or outlet hose, be careful not to confuse the inlet port and outlet port.

5. Install Battery Vent Hose (2)
6. Fill the drive motor battery cooling system. Refer to [Drive Motor Battery Cooling System Draining and Filling](#)
7. Check the cooling system for leaks.

HEATER COOLANT SURGE TANK REPLACEMENT

Removal Procedure

WARNING: Before conducting any repair to this high voltage cooling system, it is necessary to determine/verify whether no high-voltage system faults exist. If high-voltage faults exist, follow published DTC diagnostics/repair procedures prior to performing any cooling system repairs. Failure to correct High Voltage Faults before working on the high voltage cooling system could result in personal injury or death.

1. Turn vehicle power OFF and remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Drain the heater coolant heater system. Refer to [Heater Coolant Heater Draining and Filling](#)

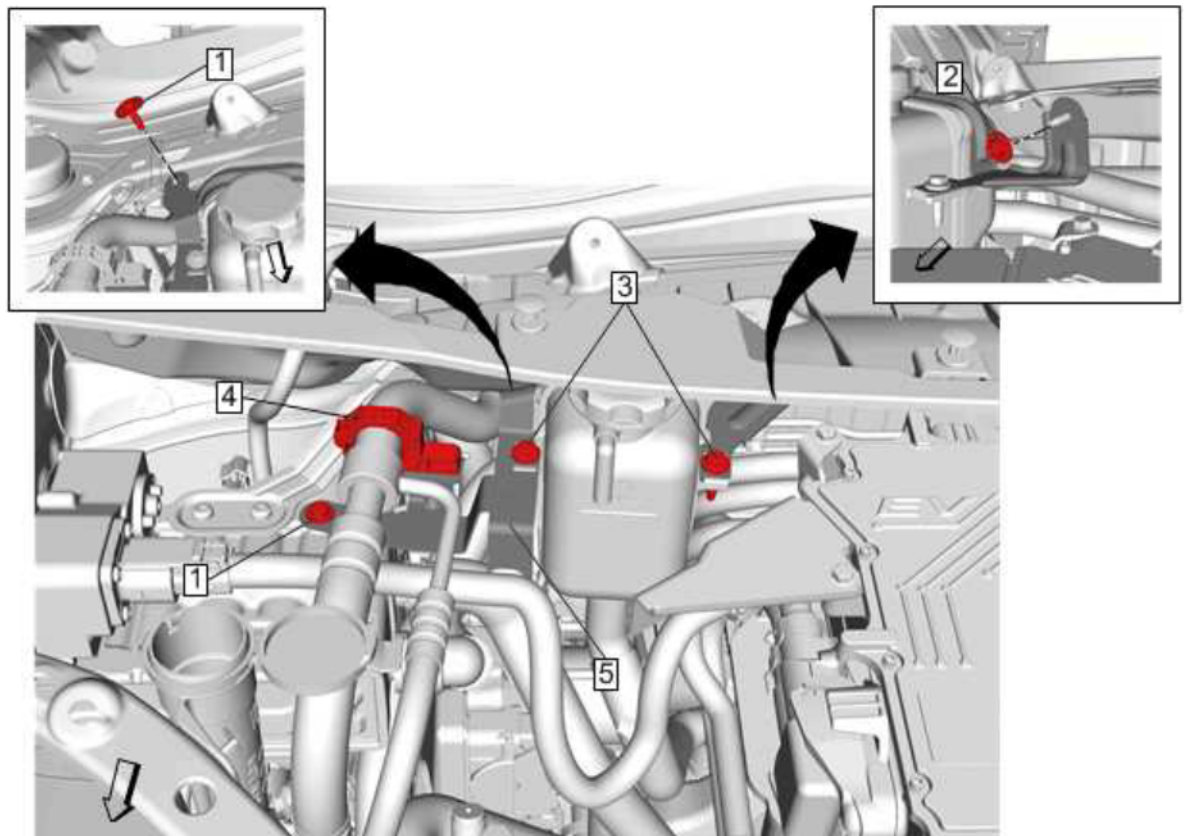


Fig. 239: Radiator Surge Tank Bracket-Heater Bracket

Courtesy of GENERAL MOTORS COMPANY

3. Remove Radiator Surge Tank Bracket-Heater Bracket (4). Refer to [Radiator Surge Tank Support Bracket Replacement \(Heater\)](#)

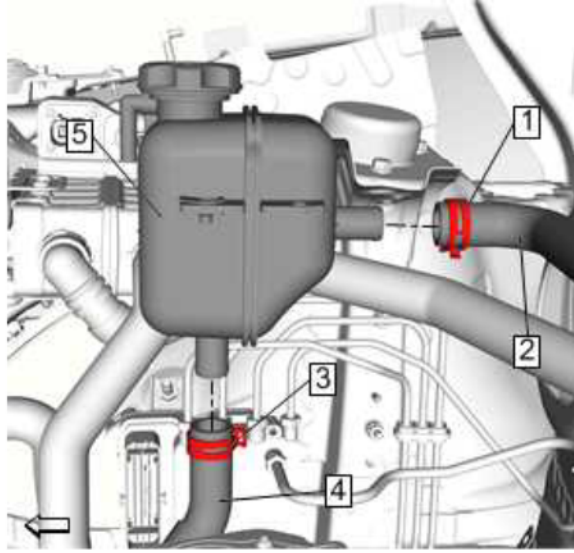


Fig. 240: Heater Coolant Surge Tank And Attaching Components
 Courtesy of GENERAL MOTORS COMPANY

4. Disengage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
5. Remove Heater Inlet Hose (2)
6. Disengage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
7. Remove Auxiliary Heater Inlet Hose (4)
8. Remove the heater coolant surge tank (5).
9. Transfer components as necessary.

Installation Procedure

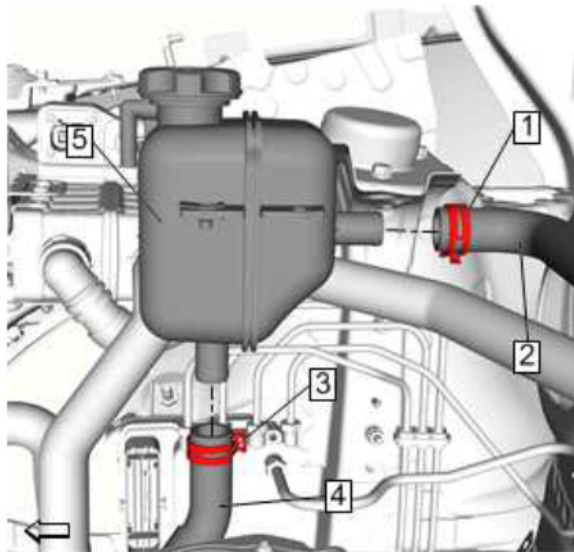


Fig. 241: Heater Coolant Surge Tank And Attaching Components
 Courtesy of GENERAL MOTORS COMPANY

1. Install the heater coolant surge tank (5).
2. Auxiliary Heater Inlet Hose (4)
3. Engage Clamp (3). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)
4. Install Heater Inlet Hose (2)
5. Engage Clamp (1). Refer to [Hose Clamp Replacement Guidelines - Spring Type](#)

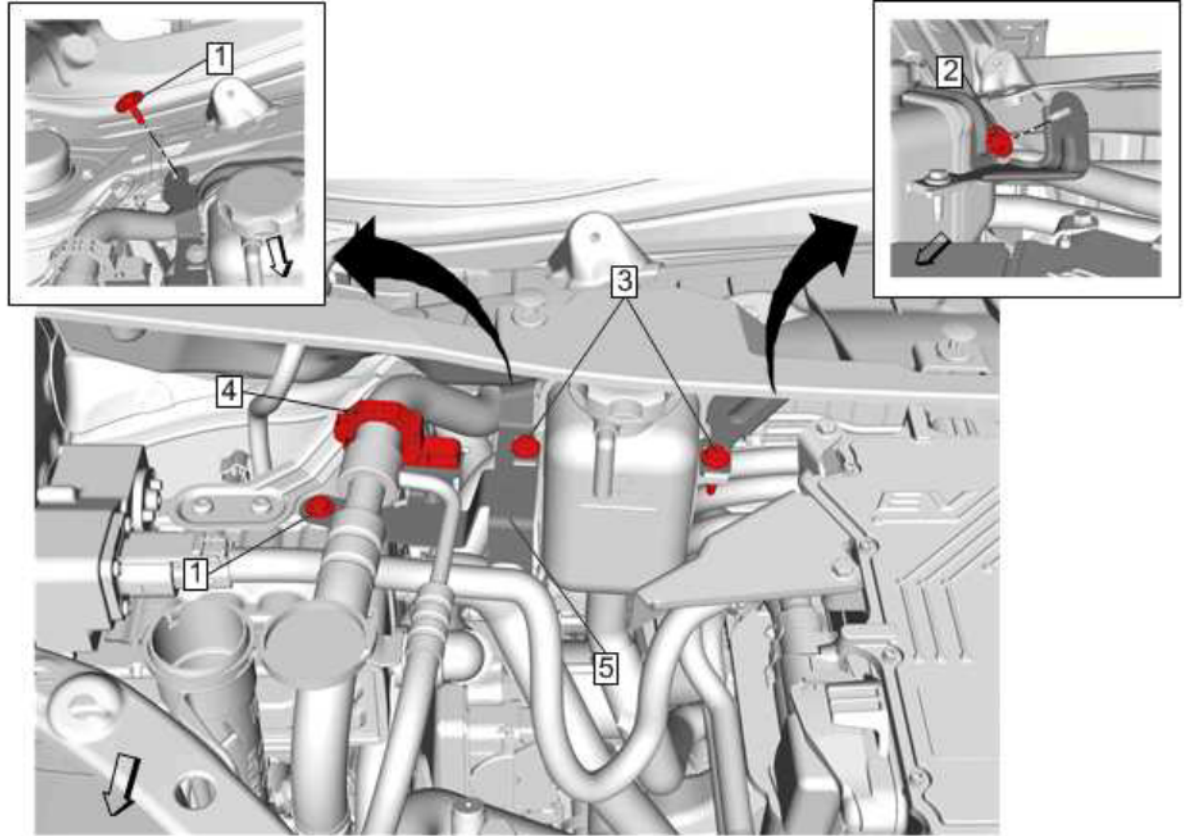


Fig. 242: Radiator Surge Tank Bracket-Heater Bracket
Courtesy of GENERAL MOTORS COMPANY

6. Install Radiator Surge Tank Bracket-Heater Bracket (4). Refer to [**Radiator Surge Tank Support Bracket Replacement \(Heater\)**](#)
7. Fill the heater coolant heater system. Refer to [**Heater Coolant Heater Draining and Filling**](#)
8. Check the cooling system for leaks.

DESCRIPTION AND OPERATION

HYBRID/EV COOLING SYSTEM DESCRIPTION AND OPERATION

This vehicle is equipped with three fully independent cooling systems.

1. The hybrid/EV electronics cooling system is dedicated to cooling the power electronics components.
2. The hybrid/EV battery pack cooling system is dedicated to cooling and heating the high voltage hybrid/EV battery.
3. The passenger compartment heater system is dedicated to providing heat to the passenger compartment.

Hybrid Electronics Cooling System Description and Operation

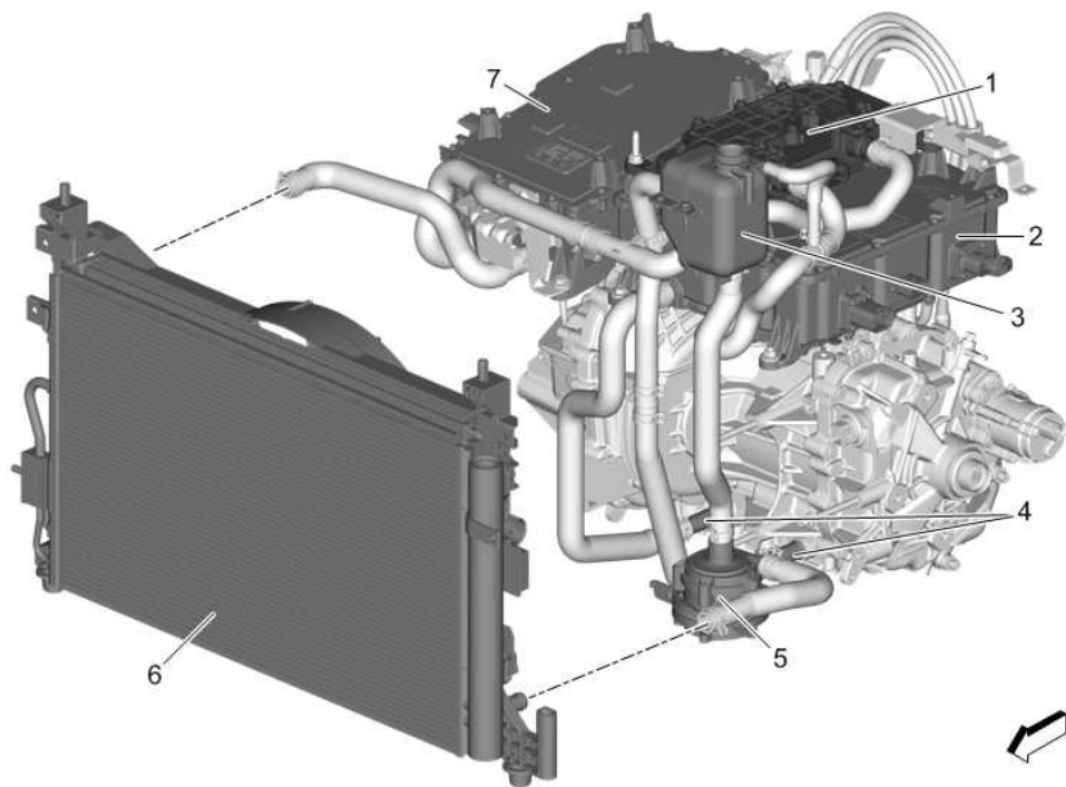


Fig. 243: Hybrid Electronics Cooling System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Schematic Reference or Generic Name	Scan Tool Reference	Service Information Part Name or Electronic Part Catalog Name
1	K1 14V Power Module	14V Power Module	Accessory DC Power Control Module
2	T18 Battery Charger	Battery Charger Control Module data list within Hybrid Powertrain Control Module 2	Drive Motor Battery Charger
3	Electronics Coolant Reservoir	Not Applicable	Drive Motor Battery Radiator Surge Tank
4	T12 Automatic Transmission Assembly coolant inlet and outlet ports	Not Applicable	Not Applicable
5	G35 Hybrid/EV Electronics Coolant Pump	Hybrid/EV Electronics Coolant Pump	Drive Motor Battery Coolant Pump
6	Power Electronics Coolant Radiator	Not Applicable	Engine Coolant Fan Module Radiator
7	T6 Power Inverter Module	- Hybrid Powertrain Control Module - Drive Motor Control Module 1	Drive Motor Power Inverter Module

The primary purpose of the hybrid/EV electronics cooling loop is to cool the T6 power inverter module, T18 battery charger, K1 14V power module and the transmission. The hybrid/EV electronics cooling system uses the hybrid/EV electronics radiator, engine control module inputs, a radiator fan and the 12 V G35 hybrid/EV electronics coolant pump to circulate coolant through the system. The K114B hybrid/EV powertrain control module 2 activates the G35 hybrid/EV electronics coolant pump and monitors the B202 hybrid/EV electronics coolant temperature sensor in the radiator. The coolant pump will be activated when the vehicle is on and during charging.

The hybrid/EV electronics cooling system circulates a pre-mixed DEX-COOLÂ® which is a 50/50 mixture of DEX-COOLÂ® and de-ionized water. De-ionized water is required for high voltage isolation and to prevent corrosion.

from effecting heat sink performance. Always use pre-mixed coolant and never use tap water in the hybrid/EV electronics coolant system.

Hybrid/EV Battery Pack Cooling System Description and Operation

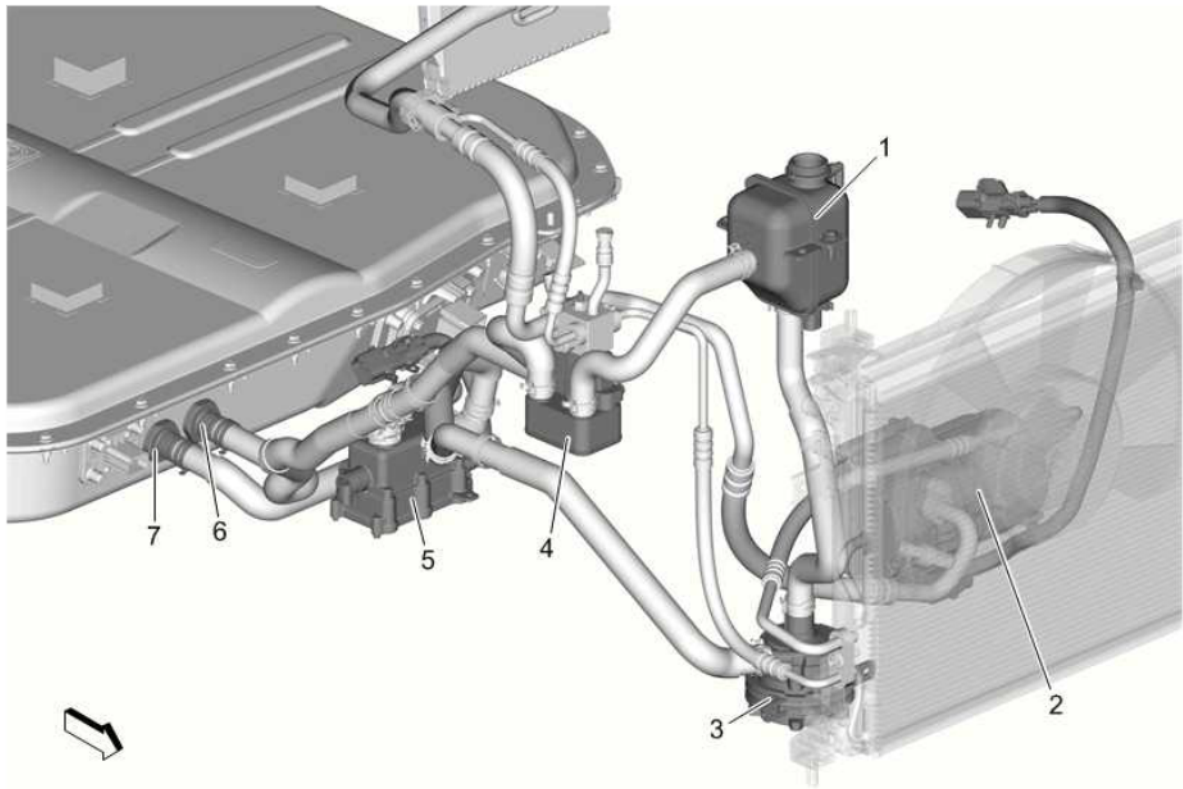


Fig. 244: Hybrid/EV Battery Pack Cooling System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Schematic Reference or Generic Name	Scan Tool Reference	Service Information Part Name or Electronic Part Catalog Name
1	Coolant Surge Tank	Not Applicable	Drive Motor Battery Radiator Surge Tank
2	G1 A/C Compressor	Electric A/C Compressor Control Module	Air Conditioning Compressor
3	G37 Hybrid/EV Battery Pack Coolant Pump	Hybrid/EV Battery Pack Coolant Pump	Drive Motor Battery Coolant Pump
4	Refrigerant/Coolant Heat Exchanger or Chiller	Not Applicable	Drive Motor Battery Coolant Cooler
5	E54 Hybrid/EV Battery Pack Coolant Heater	Hybrid/EV Battery Pack Heater	High Voltage Battery Heater
6	Hybrid/EV Battery Pack Coolant Outlet	Not Applicable	Cell Battery Cooling Manifold - Outlet
7	Hybrid/EV Battery Pack Coolant Inlet	Not Applicable	Cell Battery Cooling Manifold - Inlet

The Hybrid/EV battery pack cooling system uses a 12 V G37 hybrid/EV battery pack coolant pump, a refrigerant/coolant heat exchanger (chiller) and the G1 A/C compressor to cool down the high voltage hybrid/EV battery. There is also the high voltage E54 Hybrid/EV Battery Pack Coolant Heater external of the hybrid/EV battery to heat the coolant entering the hybrid/EV battery when needed. The K114B hybrid/EV powertrain control module 2 monitors the B204A hybrid/EV battery coolant temperature sensor 1, hybrid/EV battery cell temperature sensors, refrigerant temperature, refrigerant pressure, and the B258 hybrid/EV battery coolant level switch. The K114B hybrid/EV powertrain control module 2 determines how much hybrid/EV battery cooling or heating is required and turns on the G37 hybrid/EV battery pack coolant pump. Depending on what is required, it will operate the radiator fan and request the A/C Compressor Module to turn on the high voltage A/C compressor, or turn on the high voltage E54 hybrid/EV battery pack coolant heater. The hybrid/EV battery pack cooling system could be activated when the vehicle is operating, during charging, or when the vehicle is OFF and maintaining the hybrid/EV battery pack temperature. Refer to [Automatic HVAC Description and Operation](#).

The B258 hybrid/EV battery pack coolant level switch is attached to the coolant surge tank. The level sensor is a 2 state switch which changes state when the level in the surge tank gets low. The K114B hybrid/EV powertrain control module 2 uses the coolant level switch to determine if disabling the hybrid/EV battery pack charging operation is necessary due to a loss of coolant.

The hybrid/EV battery pack cooling system circulates a pre-mixed DEX-COOLÂ® which is a 50/50 mixture of DEX-COOLÂ® and de-ionized water. De-ionized water is required for high voltage isolation and to prevent corrosion from effecting heat sink performance. Always use pre-mixed coolant and never use tap water in the battery coolant system.

Passenger Compartment Heater System Description and Operation

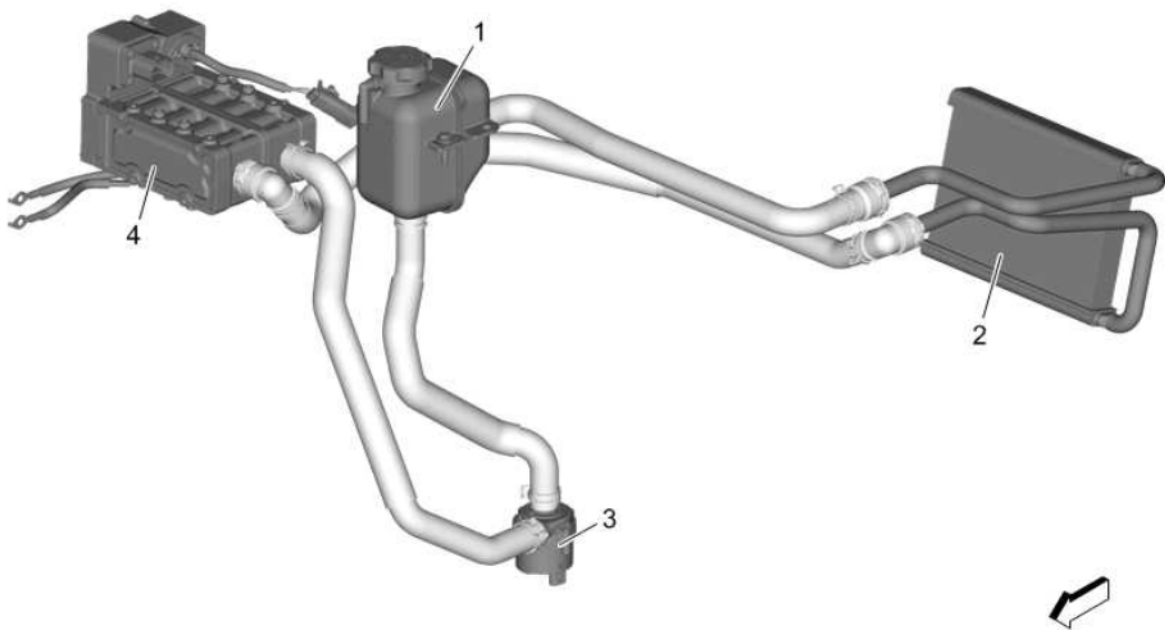


Fig. 245: Passenger Compartment Heater System Components
Courtesy of GENERAL MOTORS COMPANY

Callout	Schematic Reference or Generic Name	Scan Tool Reference	Service Information Part Name or Electronic Part Catalog Name
1	Coolant Surge Tank	Not Applicable	Heater Coolant Surge Tank
2	Heater Core	Not Applicable	Heater Assembly
3	G17 Heater Coolant Pump	Not Applicable	Heater Coolant Pump
4	K10 Coolant Heater Control Module	Electric Passenger Compartment Heater	Heater Coolant Heater

The passenger compartment heater system uses the 12 V G17 heater coolant pump, high voltage K10 coolant heater control module and a heater core.

The K33 HVAC control module monitors the temperature sensors in the passenger compartment and coolant loop to determine if high voltage K10 coolant heater control module and G17 heater coolant pump operation is needed. Passenger compartment heat is provided by air flowing through the heater core. Refer to [Automatic HVAC Description and Operation](#) .

The passenger compartment heater cooling system circulates a 50/50 mixture of DEX-COOLÂ® and deionized water.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description
	BO 38185 J 38185 Hose Clamp Pliers

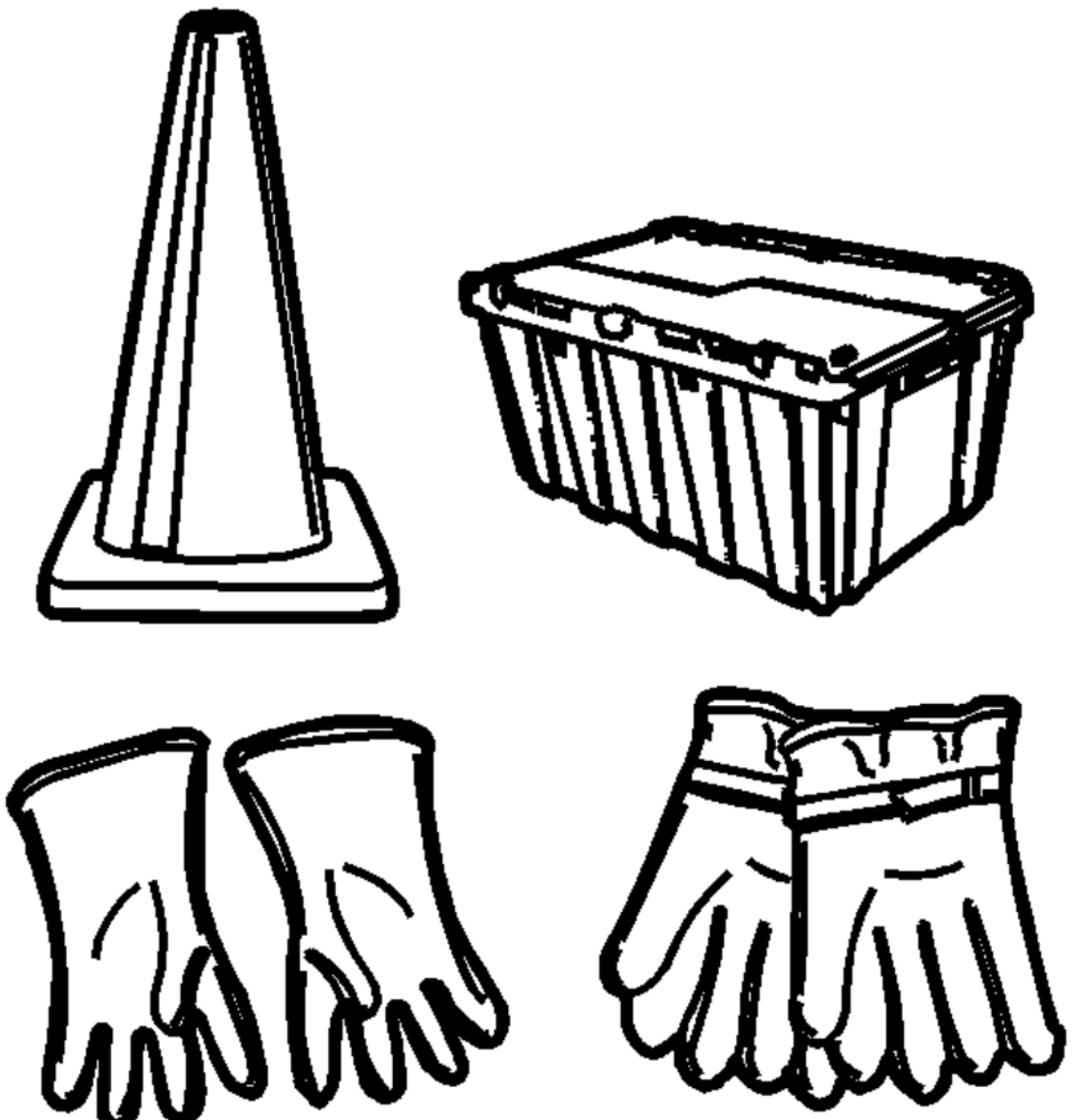
Illustration	Tool Number/Description
 The illustration shows four items: a traffic cone on the top left, a rectangular storage bin with vertical ridges on the top right, a pair of short gloves on the bottom left, and a pair of long gloves on the bottom right. All items are drawn in a simple line-art style.	EL 48900-A HEV Safety Kit

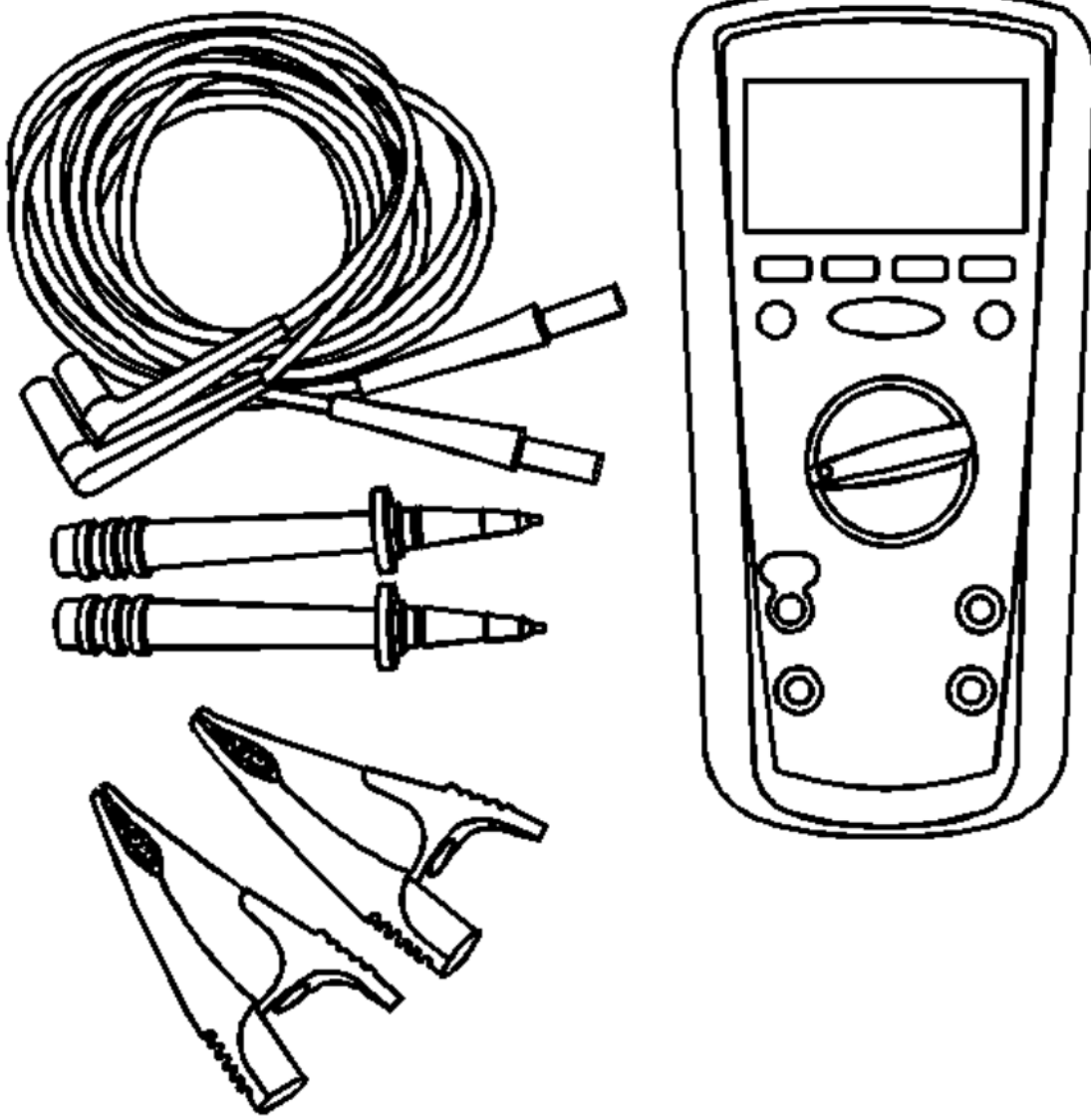
Illustration	Tool Number/Description
	EL 50772 Insulation Multimeter
	EN 24460-A J 24460-A Cooling System Pressure Tester

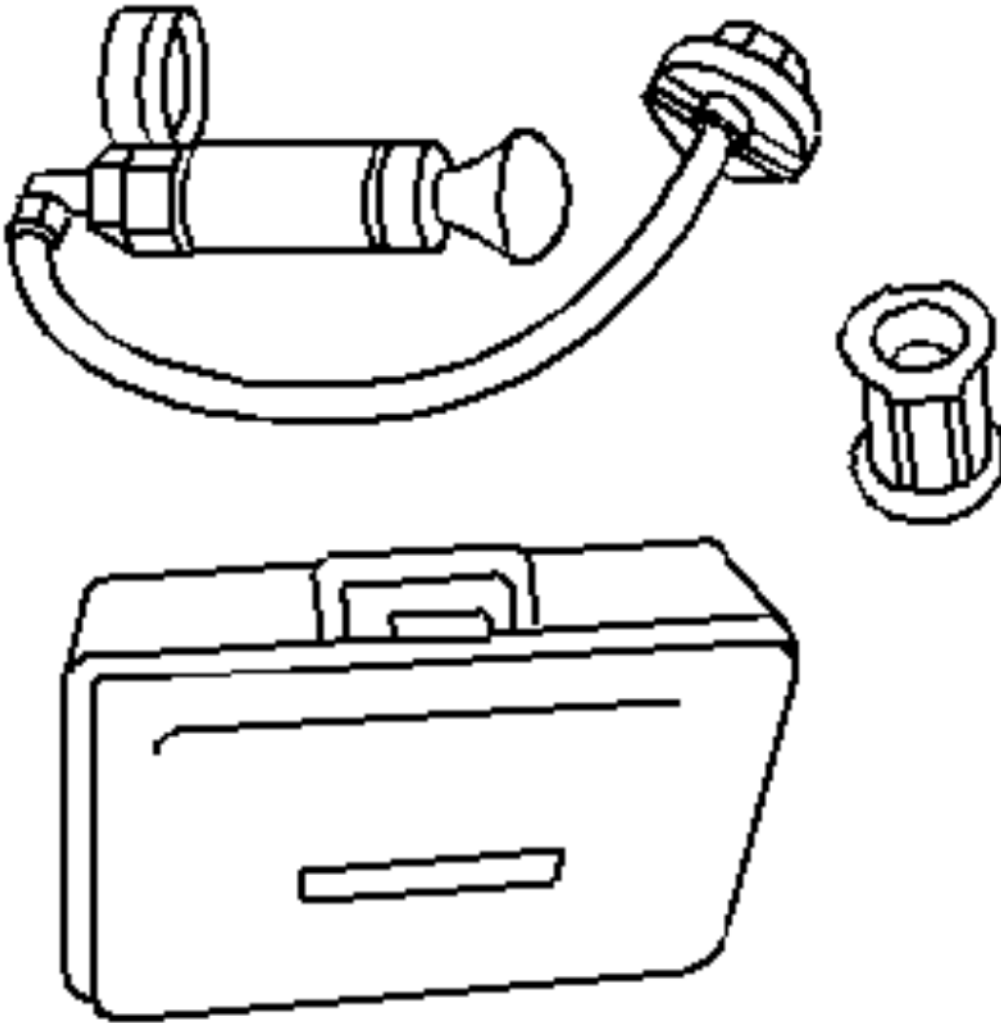
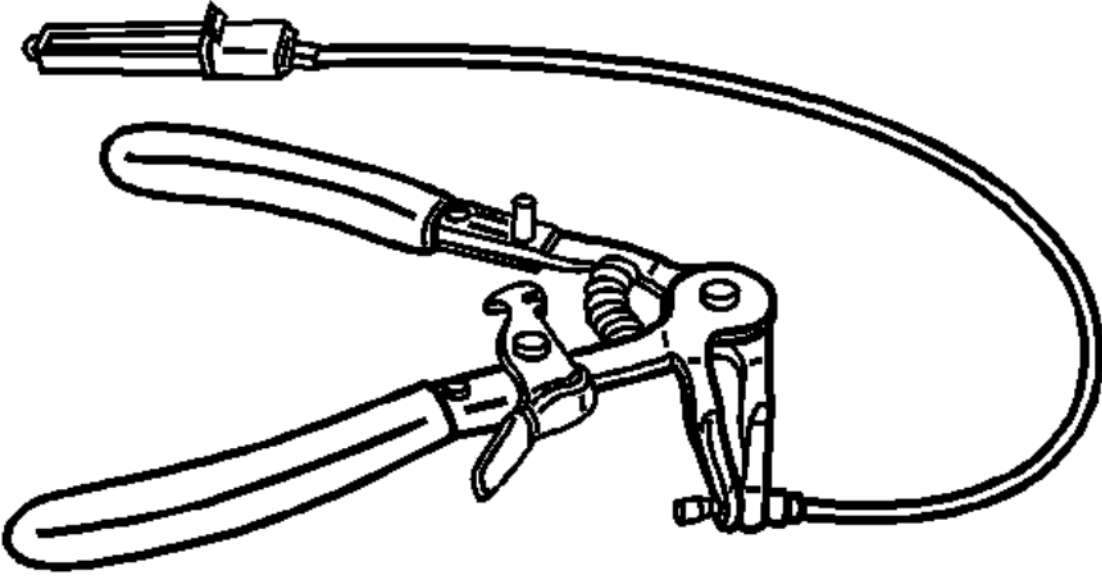
Illustration	Tool Number/Description
 The illustration shows a medical device assembly. At the top, there is a cylindrical component with a handle on the right and a pump mechanism on the left. A tube connects the pump to a small container on the right. Below this assembly is a rectangular container with a handle on top and a slot on the front. To the right of the container is a small, cylindrical component with a flange.	

Illustration	Tool Number/Description
	EN 6182-3 GE 47622 GE 49731 Hose Clamp Pliers
	GE 26568 J 26568 Coolant and Battery Tester

Illustration

Tool
Number/Description

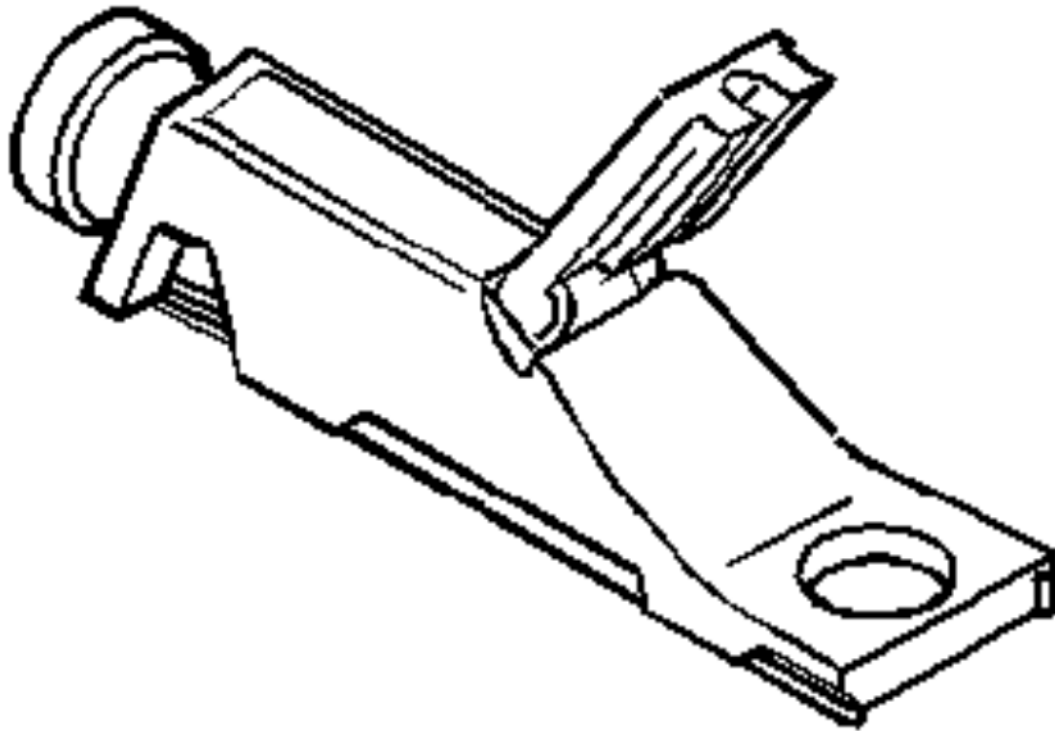
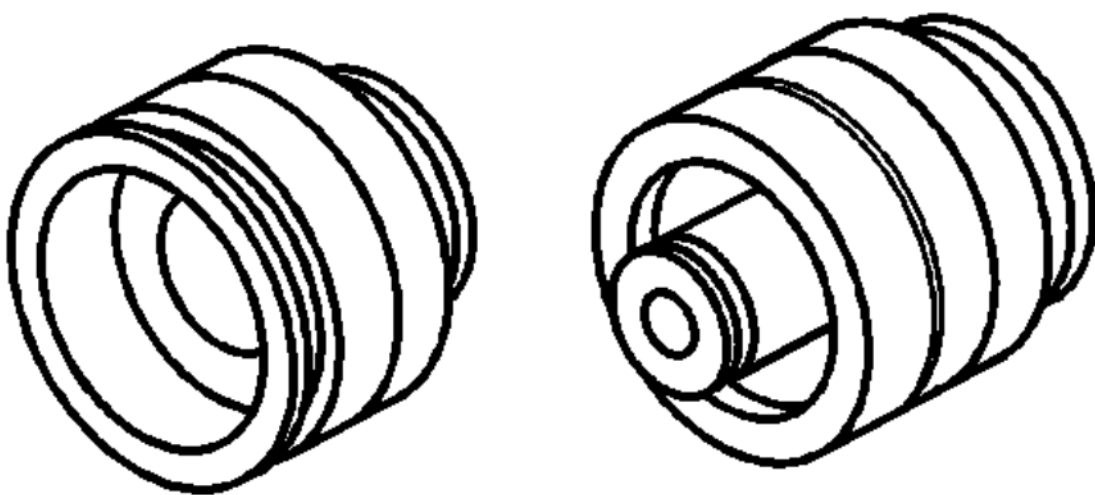
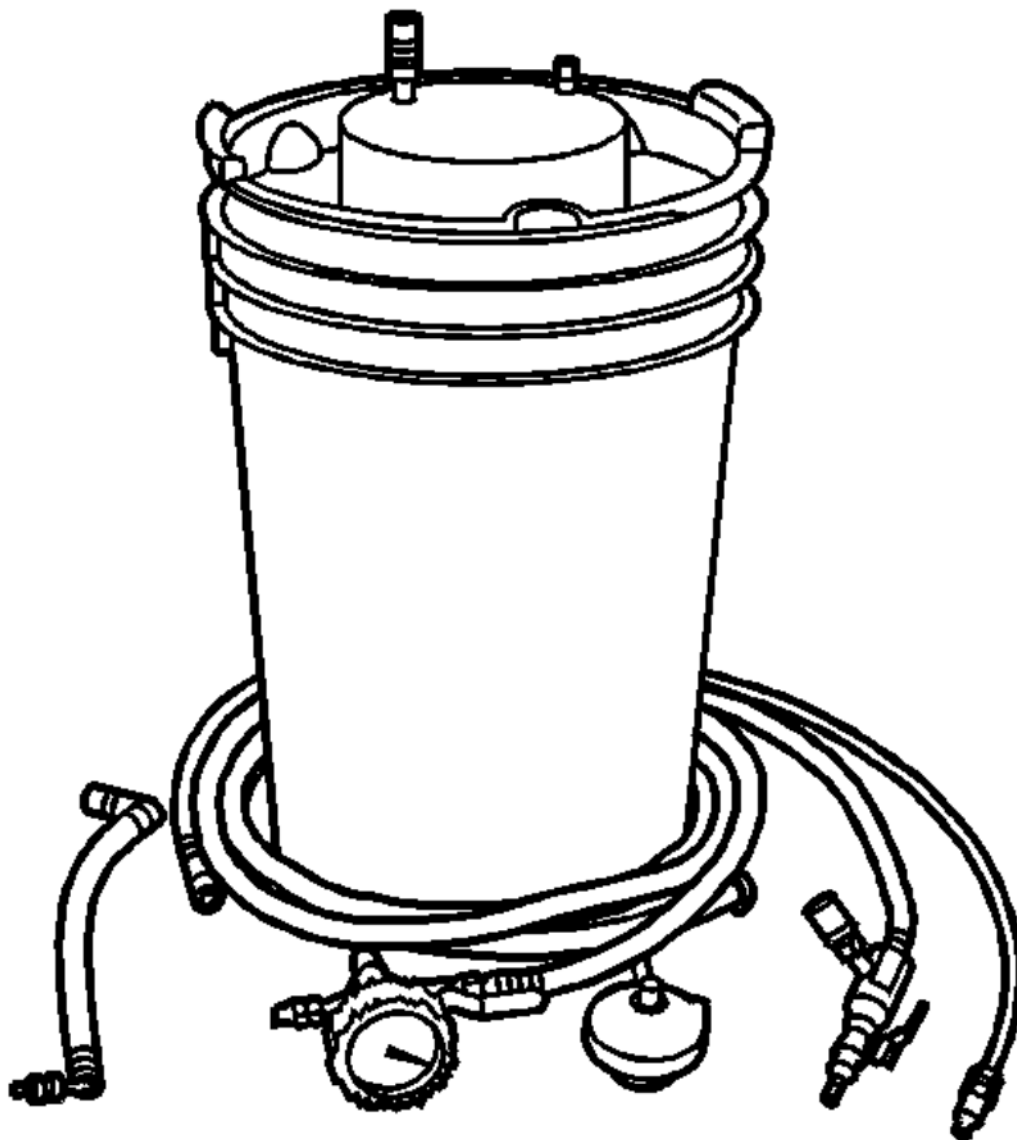


Illustration	Tool Number/Description
	GE 46143-2 J 46143-2 Cooling System Adapter

Illustration

Tool
Number/Description



GE 47716
Vac-N-Fill Coolant
Refill Tool

Illustration	Tool Number/Description
	EL-52016-1A Battery Pack Cooling Passage Test Adapter

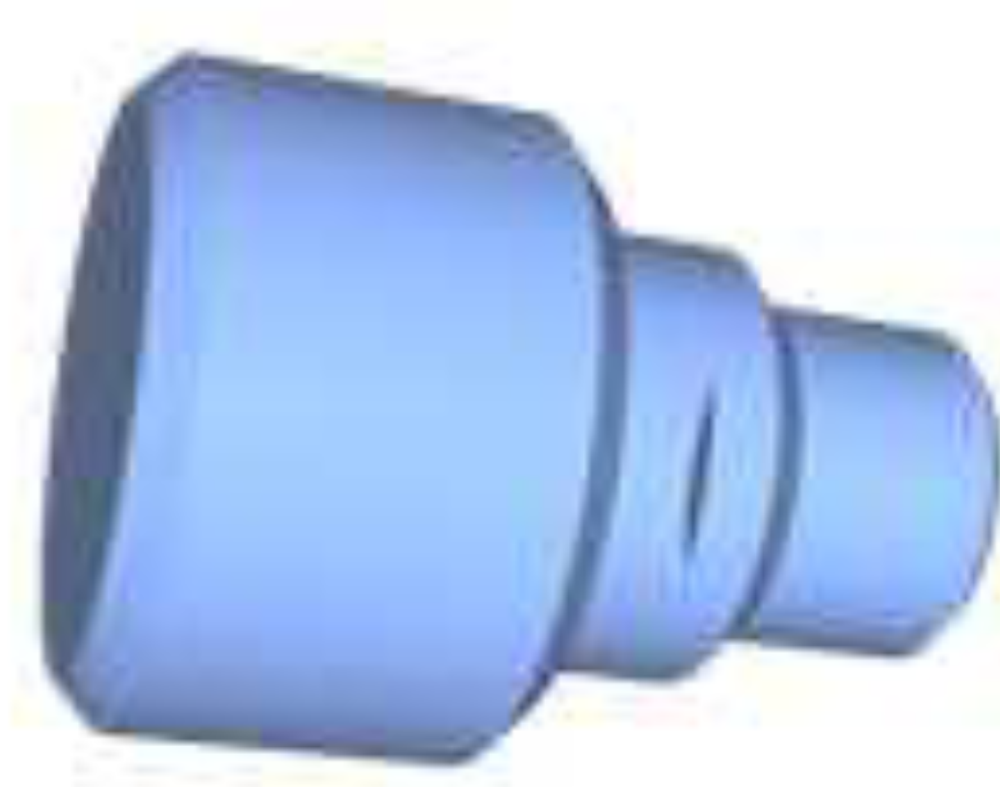
Illustration	Tool Number/Description
	EL-52016-2 Coolant Pressure Tester Adapter

Illustration	Tool Number/Description
	EL-52016-2A Coolant Pressure Tester Adapter

Illustration	Tool Number/Description
	GE 50389 Coolant Pressure Test Quick Connector