

2017 ELECTRICAL

Plug-In Charging - Bolt EV

SPECIFICATIONS

FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Drive Motor Battery Charger Bolt	22 N.m (16 lb ft)
Drive Motor Battery Charger Bolt	25 N.m (18 lb ft)
Drive Motor Battery Charger Nut	22 N.m (16 lb ft)
Drive Motor Battery Charger Receptacle Bolt	9 N.m (80 lb in)
Engine Wiring Harness Bracket Bolt	9 N.m (80 lb in)
Ground Nut	9 N.m (80 lb in)
Power Line Communication Module Nut	9 N.m (80 lb in)

SCHEMATIC WIRING DIAGRAMS

PLUG-IN CHARGING WIRING SCHEMATICS

Battery State of Charge Indicators

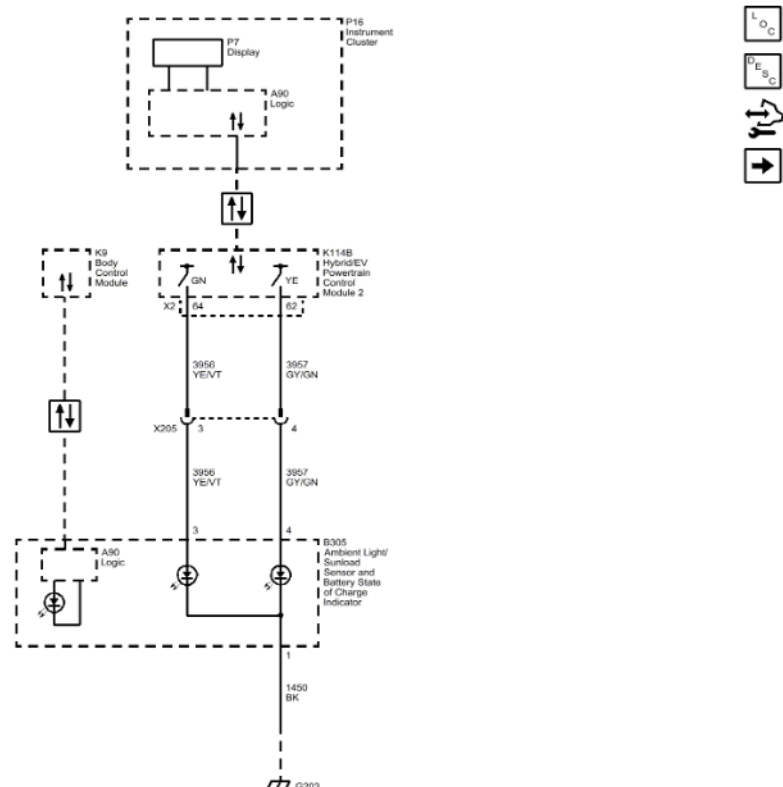


Fig. 1: Battery State of Charge Indicators

Courtesy of GENERAL MOTORS COMPANY

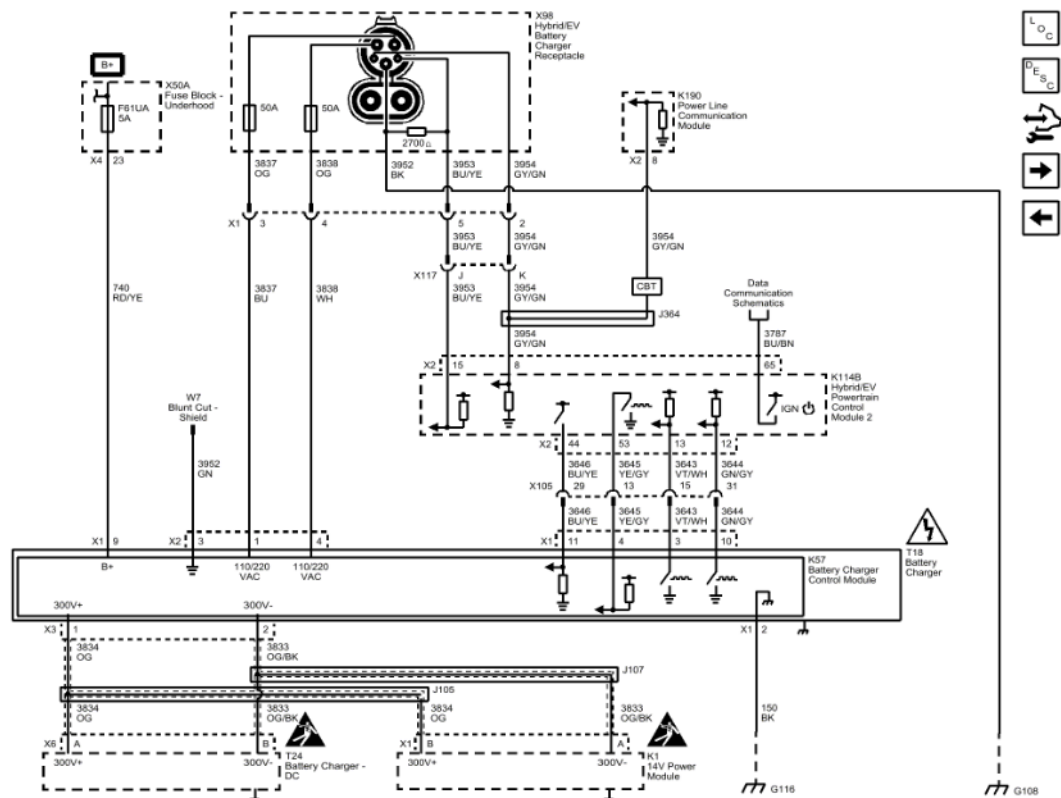


Fig. 2: AC Battery Charging (EF7/Z49/CW1)
Courtesy of GENERAL MOTORS COMPANY

AC Battery Charging (MBM)

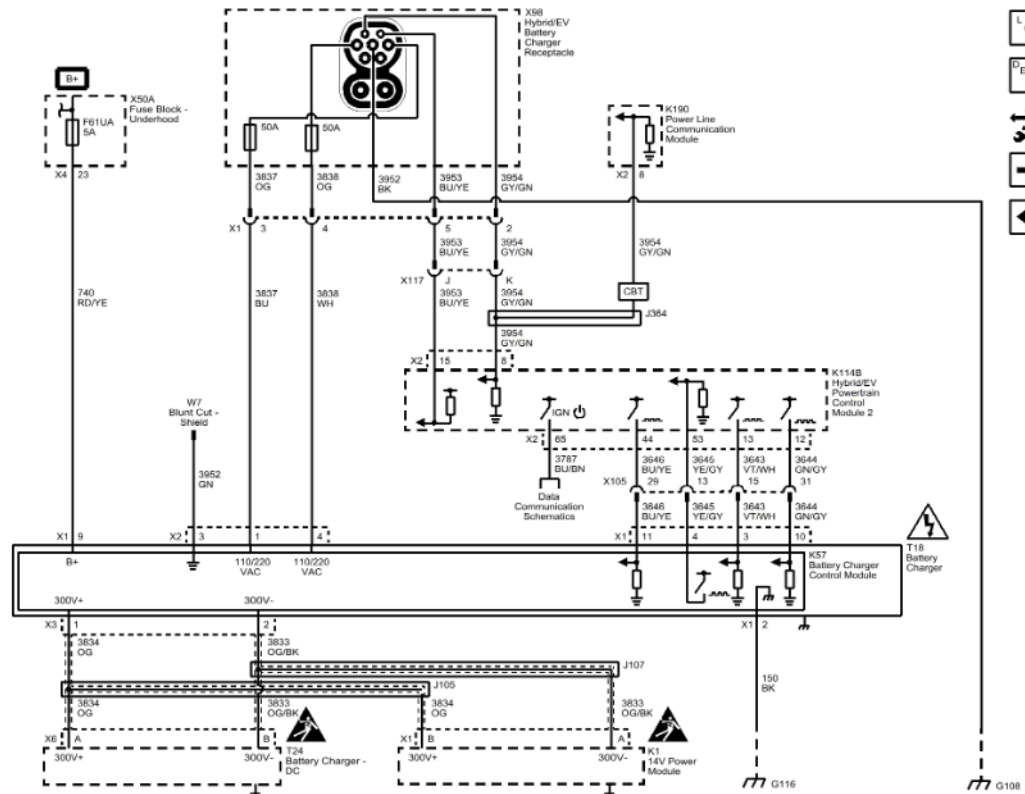


Fig. 3: AC Battery Charging (MBM)
Courtesy of GENERAL MOTORS COMPANY

DC Battery Charging - Power, Ground, Serial Data, and Receptacle Signals (CBT)

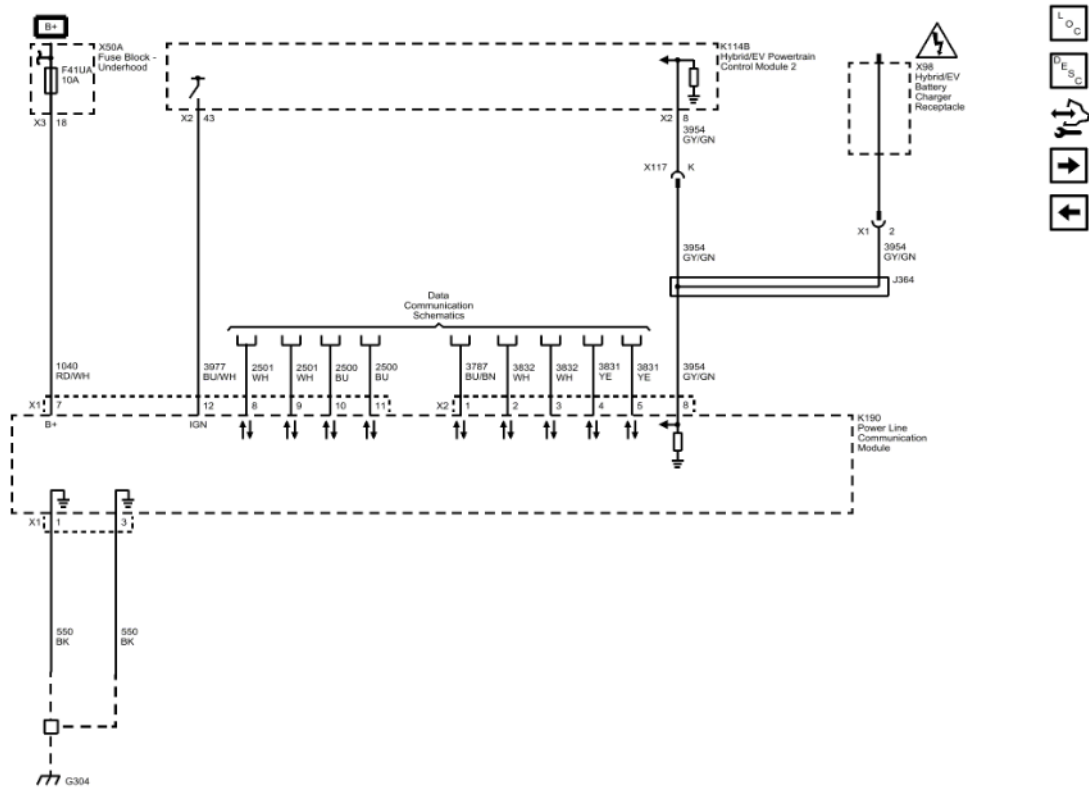


Fig. 4: DC Battery Charging - Power, Ground, Serial Data, and Receptacle Signals (CBT)
 Courtesy of GENERAL MOTORS COMPANY

DC Battery Charging - Sense Signals and Contactor Controls (CBT)

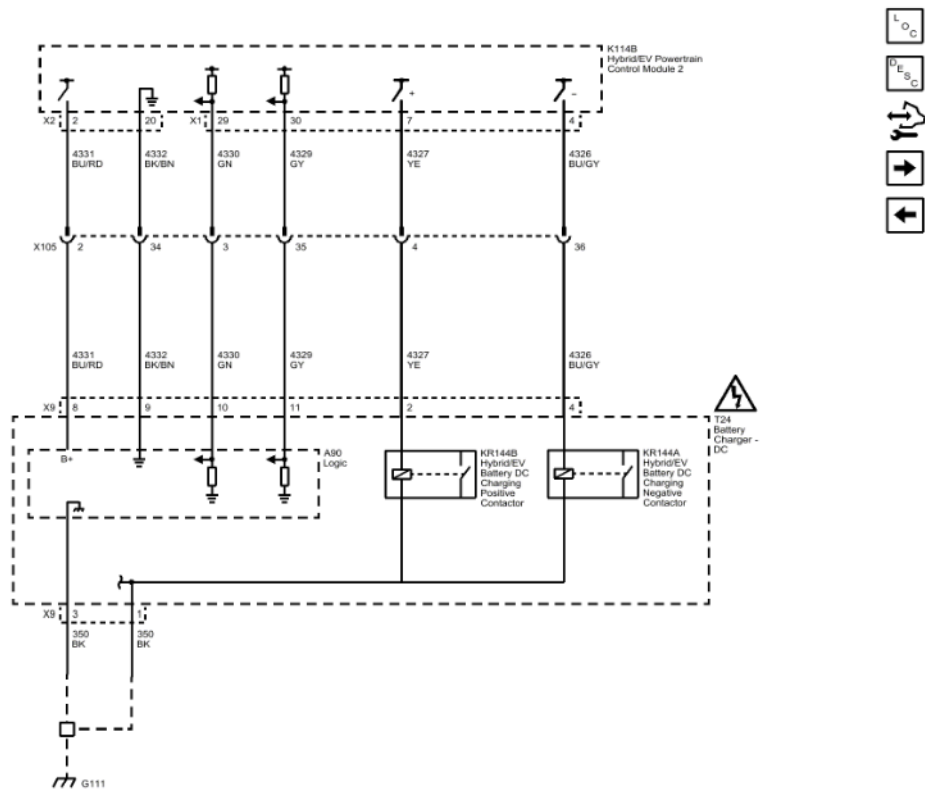
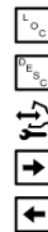


Fig. 5: DC Battery Charging - Sense Signals and Contactor Controls (CBT)
 Courtesy of GENERAL MOTORS COMPANY

DC Battery Charging - Contactors and Receptacle (CBT) with (EF7/Z49/CW1)



Courtesy of GENERAL MOTORS COMPANY

DC Battery Charging - Contactors and Receptacle (CBT) with (MBM)

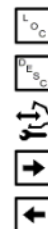


Fig. 7: DC Battery Charging - Contactors and Receptacle (CBT) with (MBM).
Courtesy of GENERAL MOTORS COMPANY

Battery Charging Door/Receptacle (CBT)

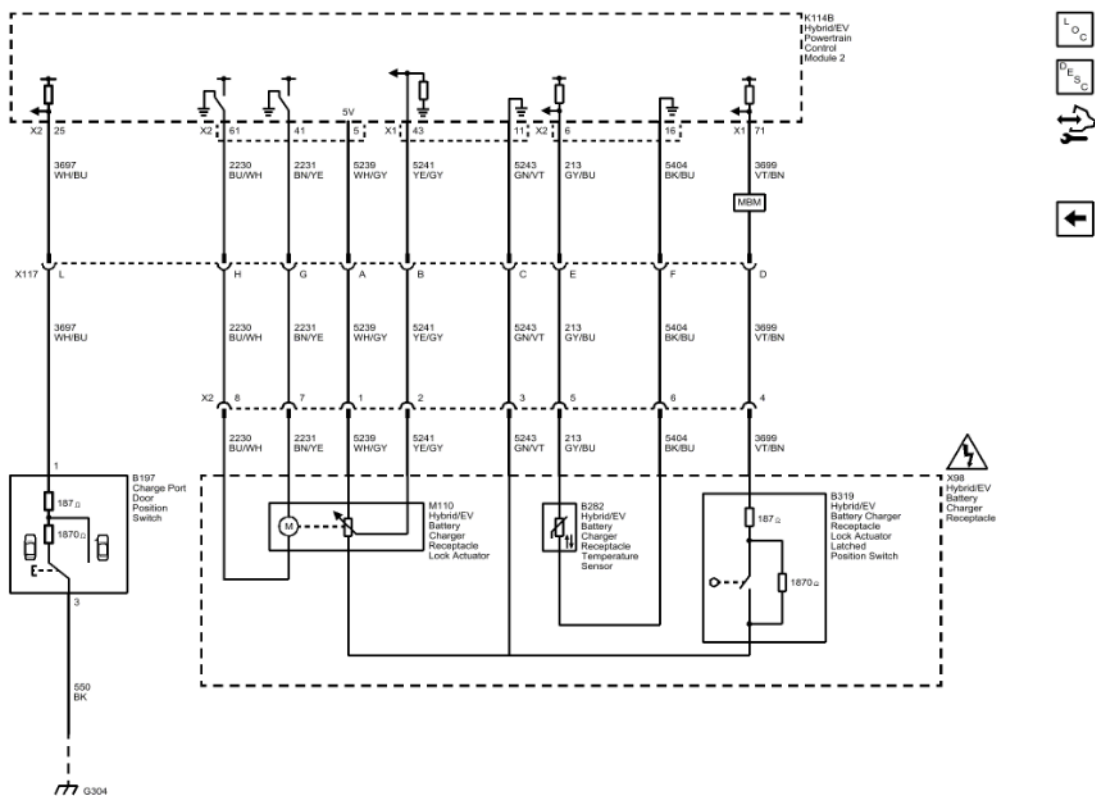


Fig. 8: Battery Charging Door/Receptacle (CBT)
 Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0CF4-P0CF6: CONTROL PILOT CIRCUIT (NORTH AMERICA, KOREA)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0CF4

Control Pilot Circuit Performance

DTC P0CF5

Control Pilot Circuit Low Voltage

DTC P0CF6

Control Pilot Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control Pilot Signal	P0CF4, P0CF5, P0CF6, P0CF9, P0D01, 1	P0CF4, P0CF5, P0CF6, 1	P0CF4, P0CF5, P0CF6, P0CF9, 1	P0CF4, P0CF5, P0CF6, 1
Proximity Status Signal	P0D58, 1	P0D59, 1	P0D59, 1	cardiagn.com
Voltage A/C Line 1	1	P0D3F, P1EE6	1	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Voltage A/C Neutral Line 2	1	P1EE6	1	-
Voltage A/C Ground	-	P0D59, 1	1	-
1. Plug In Charging Malfunction				

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors a control pilot signal from the drive motor battery charger cable. The hybrid/EV powertrain control module 2 utilizes this signal to manage the charging process between the drive motor battery charger cable and the hybrid/EV powertrain control module 2.

Under normal charging conditions the control pilot signal is generated by the drive motor battery charger cable. This diagnostic runs with the drive motor battery charger cable disconnected to verify the vehicle side circuit integrity. The diagnostic signal is generated internally by the hybrid/EV powertrain control module 2.

Conditions for Running the DTC

DTC P0CF4

- The vehicle 12 V battery system voltage needs to be above 10.2 V.
- The drive motor battery charger cable is disconnected and the charge port door is closed.
- The vehicle needs to be driven above 8 km/h (5 mph).

DTC P0CF5

- The vehicle 12 V battery system voltage needs to be above 10.2 V.
- The drive motor battery charger cable is disconnected and the charge port door is closed.

DTC P0CF6

- The vehicle 12 V battery system voltage needs to be above 10.2 V.
- The drive motor battery charger cable is disconnected and the charge port door is closed.
- Vehicle needs to be driven above 8 km/h (5 mph).

Conditions for Setting the DTC

DTC P0CF4

The control pilot circuit is not meeting its internal range requirements for 5 seconds. This can only be set internal to the hybrid/EV powertrain control module 2. This is an internal circuit voltage in the hybrid/EV powertrain control module 2 and can not be measured.

DTC P0CF5

The control pilot circuit voltage divided by the system voltage is less than 0.03 V for 5 seconds. This is an internal circuit voltage in the hybrid/EV powertrain control module 2 and can not be measured.

DTC P0CF6

The control pilot circuit voltage divided by the system voltage is greater than 0.55 V for 5 seconds. This is an internal circuit voltage in the hybrid/EV powertrain control module 2 and can not be measured.

Actions Taken When the DTC Sets

- DTC P0CF4-P0CF6 are type A DTCs.
- Disables high voltage battery charging.

Conditions for Clearing the DTC

DTC P0CF4-P0CF6 are type A DTCs.

Reference Information

Schematic Reference

[Plug-In Charging Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Plug-In Charging 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

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

[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 at the T18 Battery Charger. Refer to [High Voltage Disabling](#). Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

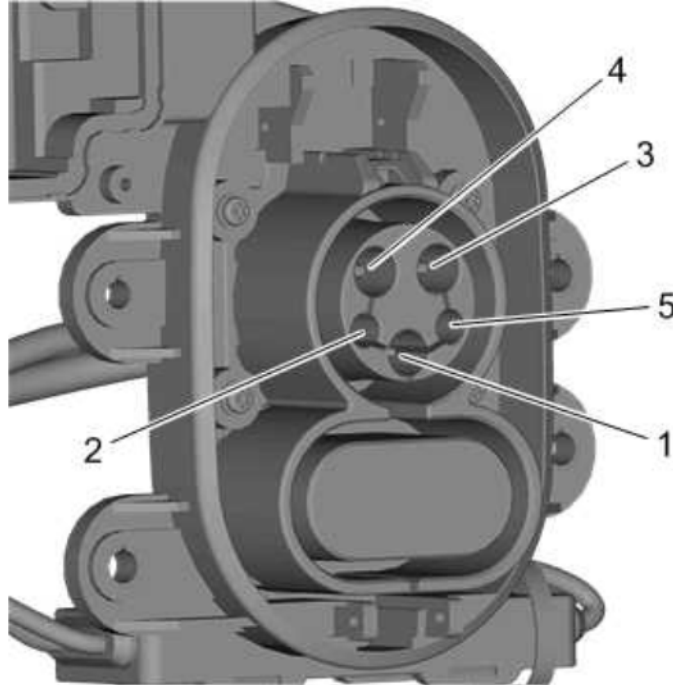


Fig. 9: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for infinite resistance between the control pilot signal circuit terminal 2 of the X98 Hybrid/EV Battery Charger Receptacle and the terminals listed below:
 - Terminal 1
 - Terminal 3
 - Terminal 4
 - Terminal 5

- **If less than infinite resistance**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: This test is performed on the vehicle side of the harness connector.

2. Test for infinite resistance between the harness connector control pilot signal circuit terminal 2 and the terminals listed below:
 - Terminal 1
 - Terminal 3
 - Terminal 4
 - Terminal 5

- If less than infinite resistance, repair the short between the circuits.
 - If infinite resistance, replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If infinite resistance**

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

- **If 2 Ω or greater**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: This test is performed at the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for less than 2 Ω in the control pilot signal circuit end to end.
 - If 2 Ω or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If less than 2 Ω , repair the open/high resistance in the circuit.

- **If less than 2 Ω**

4. Replace the K114B Hybrid/EV Powertrain Control Module 2.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)
- [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P0CF9 OR P0D01: CONTROL PILOT CHARGING SWITCH/VENTILATION SWITCH PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0CF9

Control Pilot Charging Switch Performance

DTC P0D01

Control Pilot Charging Ventilation Switch Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control Pilot Signal	P0CF4, P0CF5, P0CF6, P0CF9, P0D01, 1	P0CF4, P0CF5, P0CF6, 1	P0CF4, P0CF5, P0CF6, P0CF9, 1	P0CF4, P0CF5, P0CF6, 1
Proximity Signal	P0D58, 1	P0D59, 1	P0D59, 1	-
Voltage A/C Line 1	1	P0D3F, P1EE6	1	-
Voltage A/C Neutral Line 2	1	P1EE6	1	-
Voltage A/C Ground	-	P0D59, 1	1	-
1. Plug In Charging Malfunction				

Circuit/System Description

The hybrid/EV powertrain control module 2 has two internal switches used to modify the control pilot signal. The first internal switch modifies the control pilot signal to indicate to the drive motor battery charger cable that the vehicle is either ready or not ready to accept energy. The second internal switch modifies the control pilot signal to indicate to some drive motor battery charger cables (currently not used) if indoor ventilation is required.

Conditions for Running the DTC

DTC P0CF9

- The 12 V battery voltage is greater than 10.2 V.
- The drive motor battery charger cable is disconnected and the charge port door is closed.
- The diagnostics for DTC P0CF4 - P0CF6 must have passed.

DTC P0D01

- The 12 V battery voltage is greater than 10.2 V.
- The drive motor battery charger cable is disconnected and the charge port door is closed.

- The diagnostics for DTC P0CF4 - P0CF6 and P0CF9 must have passed.

Conditions for Setting the DTC

The hybrid/EV powertrain control module 2 measures the control pilot signal voltage out of range for 5 seconds. This is an internal circuit voltage in the hybrid/EV powertrain control module 2 and can not be measured.

Actions Taken When the DTC Sets

- DTC P0CF9 and P0D01 are type A DTCs
- Disables the high voltage battery charging.

Conditions for Clearing the DTC

DTC P0CF9 and P0D01 are type A DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Description and Operation

Plug-In Charging 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 P0CF9 or P0D01 is not set.
 - **If either of the DTCs are set**
 Replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If none of the DTCs are set**
3. All OK.

Repair Instructions

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

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

DTC P0D1F: CONTROL MODULE DATE/TIME SYNCHRONIZATION PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D1F

Control Module Date/Time Synchronization Performance

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors the date and time data it receives from the radio. This time information is used to ensure the module's internal clock is synchronized to the customer's local time. The Time of Day Charging feature utilizes this internal clock to keep track of time and alarms for delayed charging modes. If this radio time data is received during a drive cycle, the system is considered synchronized.

Conditions for Running the DTC

Vehicle in Service Mode.

Conditions for Setting the DTC

The vehicle is driven for more than 5 consecutive drive cycles where trip distance exceeds 15 Km (9.3 mi), and the date and time were unavailable from the radio.

Actions Taken When the DTC Sets

- DTC P0D1F is a type C DTC.
- On the Navigation screen "Default Charge Mode: Immediately" is displayed.
- The battery charger Time Of Day charging option is disabled, and charging mode is set to IMMEDIATE.

Conditions for Clearing the DTC

DTC P0D1F is a type C DTC.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- [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, verify no radio DTCs are set.

- **If any radio DTC's are set**

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

- **If no radio DTC's are set**

2. Replace the K114B Hybrid/EV Powertrain Control Module 2.

Repair Instructions

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

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

DTC P0D26: BATTERY CHARGER SYSTEM PRECHARGE TIME TOO LONG

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D26

Battery Charger System Precharge Time Too Long

Circuit/System Description

In order to prevent large in-rush current, battery charger bus high voltage is routed through a pre-charge resistor whenever high voltage charging is commanded ON. The hybrid/EV powertrain control module 2 monitors the time it takes the battery charger bus voltage to attain the same level as the battery pack voltage. If it takes too long, a DTC is set.

Conditions for Running the DTC

- Battery charger must go from disconnected to connected.
- Drive motor battery charger cable must be connected and vehicle receiving power.

Conditions for Setting the DTC

The hybrid/EV powertrain control module 2 determines the battery charger does not reach its pre-charge voltage within 1 second.

Actions Taken When the DTC Sets

DTC P0D26 is a Type A DTC.

Conditions for Clearing the DTC

DTC P0D26 is a Type A DTC.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Special Tools

- **EL-48900** HEV Safety Kit
- For equivalent regional tools, refer to [Special Tools](#) .

Circuit/System Verification

1. Verify DTC P0C78 is not set.

- **If the DTC is set**

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

- **If the DTC is not set**

2. Verify DTC P0CF4, P0CF5, P0CF6, P0D4E, P0D4F, P0D58, or P0D59 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. Connect the drive motor battery charger cable. Verify DTC P0D26 is not set and the vehicle will charge.

- **If the DTC is set and the vehicle will not charge**

Refer to Circuit/System Testing.

- **If the DTC is not set and the vehicle charges**

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 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. Remove the G37 Hybrid/EV Battery Pack Coolant Pump fuse. Set the vehicle Charge Mode to IMMEDIATE. Connect the charge cord set. Vehicle in Service Mode.

NOTE: Do not command the heater ON any longer than is necessary to confirm the heater has high voltage and is functioning.

2. Verify the scan tool Hybrid/EV Battery Pack Coolant Temperature Sensor parameter increases 2.75Å, Å°C (4.9Å, Å°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**
 1. Install the G37 Hybrid/EV Battery Pack Coolant Pump fuse. Disable the high voltage system for servicing the T24 Battery Charger and the A4 Battery Pack. Refer to [High Voltage Disabling](#).
 2. Disconnect the T24 battery charger X7 connector and the A4 battery pack X4 connector.
 3. Inspect all connector ends for evidence of poor terminal contact and/or arc flash damage.
 - If a terminal concern is observed, replace all affected components.
 - If a terminal concern is not observed
 4. Test the following HV harness terminals for less than 2 Ω end to end:
 - X7-A to X4-A
 - X7-B to X4-B
 - If greater than 2 Ω, replace the HV Bat Pos & Neg (300V) Cable.
 - If less than 2 Ω
 5. Remove and open the A4 Battery Pack. Refer to [Battery Upper Cover Replacement](#). Inspect for any of the following INTERNAL concerns:
 - Drive motor battery charger cable for loose/damaged terminal fasteners
 - High voltage battery disconnect relay fuse for loose/damaged fasteners or an open fuse condition
 - If a terminal concern is found, replace all affected components.
 - If an open fuse condition is found, replace the fuse, the T18 Battery Charger and the K1 14V Power Module.
 - If no internal concerns are observed, replace the A28 Hybrid/EV Battery Contactor Assembly.
 - **If the Hybrid/EV Battery Pack Coolant Temperature Sensor did increase**
3. Install the G37 Hybrid/EV Battery Pack Coolant Pump fuse. Disable the high voltage system for servicing the T18 Battery Charger, K1 14V Power Module and the T24 Battery Charger-DC. Refer to [High Voltage Disabling](#).
4. Disconnect the X3 connector at the T18 Battery Charger, the X1 connector at the K1 14V Power Module and the X6 connector at the T24 Battery Charger-DC.
5. Verify that all HV harness connector and the mating module connector terminals are free from moisture, corrosion, and arc flash damage.
 - **If any terminals show signs of damage**

Replace the HV wiring harness and affected modules as necessary.
 - **If no arc flash damage, moisture, or corrosion is found**
6. Test the following HV harness terminals for less than 2 Ω end to end:
 - X6-A to X1-A
 - X6-A to X3-A

- X6-B to X1-B
- X6-B to X3-B
- **If greater than 2 Ω**

Replace the HV wiring harness.

- **If less than 2 Ω**

7. Replace the T18 Battery Charger.

Repair Instructions

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

- [300-Volt Battery Positive and Negative Cable Replacement \(Generator Battery Control Wiring Junction Block to Drive Motor Battery\)](#) for T24 Battery Charger-DC to A4 Battery Pack cable
- [Battery to Battery Positive Cable Replacement](#) for K1 14V Power Module/T18 Battery Charger combination cable - includes G1 A/C compressor cable
- [High Voltage Battery Disconnect Relay Replacement](#) for A28 Hybrid/EV Battery Contactor Assembly
- [High Voltage Battery Disconnect Relay Fuse Replacement](#) for F1HA 40A charging system fuse
- [Control Module References](#) for T18 Battery Charger, T24 Battery Charger-DC, or K1 14V Power Module replacement, programming and setup

DTC P0D2B OR P0D2C: CONTROL PILOT INDICATOR CONTROL CIRCUIT/CHARGE STATUS INDICATOR CONTROL CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D2B

Control Pilot Indicator Control Circuit

DTC P0D2C

Charge Status Indicator Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Charge Pilot Indicator Control	P0D2B	P0D2B	P0D2B	-
Charge Status Indicator Control	P0D2C	P0D2C, 1	P0D2C	-
Charge Complete Indicator Control	1	1	1	-
Low Reference	-	P0D2C, P0D2B	-	-
1. Plug In Charging Indicator Malfunction				

Circuit/System Description

The status of charging events (including delays) is communicated to the user through a charge status indicator and audio tones. The vehicle charge status indicator, located on the top middle of the instrument panel, contains a green LED (charge status indicator) and yellow LED (charge pilot indicator) controlled by the Hybrid Powertrain Control Module 2 and a second green LED (charge complete indicator) controlled by the BCM. The indicator will have a short flash green when the vehicle is charging under automatic control. The flash rate increases from one to four as the battery charges. It will have a long flash green if the charging is delayed and will begin later. It will be illuminated solid green when charging is complete. A solid lit yellow indicator means the vehicle is not able to accept a charge.

And if there is no indicator lit it means the electronic vehicle supply equipment is not working properly or connected.

Conditions for Running the DTC

Both conditions need to run for diagnostic to pass.

Condition 1

The drive motor battery charger cable is disconnected (charge status indicator commanded OFF).

Condition 2

The vehicle is connected to an AC supply and the battery charger is charging the vehicle (charge status indicator commanded ON).

Conditions for Setting the DTC

- Charge status indicator Commanded OFF, The hybrid/EV powertrain control module 2 detects a short to battery for about 4 s.
- Charge status indicator Commanded ON, The hybrid/EV powertrain control module 2 detects a short to ground or an open/high resistance for 4 s.

Actions Taken When the DTC Sets

DTC P0D2B and P0D2C are type C DTCs.

Conditions for Clearing the DTC

DTC P0D2B and P0D2C are type C DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator.
2. Test for less than 10 Ω between the low reference terminal 1 and ground.

- **If 10 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 10 Ω**

NOTE: If the drive motor battery charger cable is connected. The drive motor battery charger cable must be disconnected for more than 10 seconds before performing the next step.

3. Connect a test lamp between the control circuit terminal 4 and ground.
4. Verify the test lamp does not illuminate.
 - **If the test lamp does illuminate**
 1. 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 in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp does not illuminate**
5. Connect the drive motor battery charger cable.
6. Verify that the test lamp illuminates within the first 5 seconds of connecting the drive motor battery charger cable.
 - **If the test lamp does not illuminate**
 1. Disconnect the drive motor battery charger cable. 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.
 - **If the test lamp does illuminate**
7. Disconnect the drive motor battery charger cable for at least 10 seconds. Connect a test lamp between the control circuit terminal 3 and ground.
8. Verify the test lamp does not illuminate.
 - **If the test lamp does illuminate**
 1. 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 in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp does not illuminate**
9. Connect the drive motor battery charger cable.
10. Verify that the test lamp illuminates within 25 seconds of connecting the drive motor battery charger cable.
 - **If the test lamp does not illuminate**
 1. Disconnect the drive motor battery charger cable. 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.
 - **If the test lamp does illuminate**
11. Replace the B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator.

Repair Instructions

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

- [Sun Load, Ambient Light, and Charge Indicator Sensor Replacement](#) for B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator replacement.
- [Control Module References](#) for K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P0D3E-P0D40: BATTERY CHARGER INPUT VOLTAGE SENSOR

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D3E

Battery Charger Input Voltage Sensor Performance

DTC P0D3F

Battery Charger Input Voltage Sensor Circuit Low Voltage

DTC P0D40

Battery Charger Input Voltage Sensor Circuit High Voltage

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors the AC voltage sensor inside the battery charger. The signal is pulse-width modulated and the duty cycle increases as the AC voltage increases. The duty cycle equals 10% when the AC voltage sensor reports less than 60 V. The duty cycle equals 90% when the AC voltage sensor reports more than 280 V. Therefore, during normal operation the duty cycle is between 10% and 90%.

Conditions for Running the DTC

P0D3E

- The 12 V battery voltage is greater than 10.2 V.
- The vehicle is driven above 16 km/h (10 mph).

P0D3F and P0D40

- The 12 V battery voltage is greater than 10.2 V.
- The vehicle is connected to an AC supply and the battery charger is charging the vehicle.

Conditions for Setting the DTC

DTC P0D3E

The battery charger AC input duty cycle is greater than 12% or less than 8%.

DTC P0D3F

The battery charger AC input duty cycle is between 1% and 8%.

OR

The battery charger AC input duty cycle equals 100%.

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DTC P0D40

The battery charger AC input duty cycle is between 92% and 99%.

OR

The battery charger AC input duty cycle equals 0%.

Actions Taken When the DTC Sets

- DTC P0D3E, P0D3F and P0D40 are type B DTCs.
- Disables high voltage battery charging.

Conditions for Clearing the DTC

DTC P0D3E, P0D3F and P0D40 are type B DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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. Drive the vehicle above 16 km/h (10 mph).
2. Vehicle OFF. Connect the vehicle to an AC supply to begin charging.
3. Vehicle in Service Mode.
4. Verify that DTC P0D3E, P0D3F, or P0D40 is not set.

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

Refer to Circuit/System Testing.

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

5. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the X1 harness connector at the T18 Battery Charger. Vehicle in Service Mode.
2. Verify the scan tool Battery Charger AC Input Status Duty Cycle 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 AC voltage sensor circuit terminal 10 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%**
3. Install a 3 A fused jumper wire between the AC voltage sensor circuit terminal 10 and the ground circuit terminal 2.
4. Verify the scan tool Battery Charger AC Input Status Duty Cycle 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 in Service Mode.
 2. Test for less than 1 V between the AC voltage sensor circuit terminal 10 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 AC voltage sensor 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%**
5. Replace the T18 Battery Charger.

Repair Instructions

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

[Control Module References](#) for K114B Hybrid/EV Powertrain Control Module 2 or T18 Battery Charger replacement, programming and setup

DTC P0D4D-P0D4F: BATTERY CHARGER HYBRID/EV BATTERY OUTPUT VOLTAGE SENSOR

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D4D

Battery Charger Hybrid/EV Battery Output Voltage Sensor Performance

DTC P0D4E

Battery Charger Hybrid/EV Battery Output Voltage Sensor Circuit Low Voltage

DTC P0D4F

Battery Charger Hybrid/EV Battery Output Voltage Sensor Circuit High Voltage

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors the DC voltage sensor inside the battery charger. The signal is pulse-width modulated and the duty cycle increases as the DC voltage increases. The duty cycle equals 10% when the DC voltage sensor reports less than 0 V. The duty cycle equals 90% when the DC voltage sensor reports more than 500 V. Therefore, during normal operation the duty cycle is between 10% and 90%.

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Conditions for Running the DTC

- The 12 V battery voltage is greater than 10.2 V.
- The vehicle is connected to an AC supply and the battery charger is charging the vehicle.

Conditions for Setting the DTC

DTC P0D4D

The difference between the battery charger DC output voltage and hybrid/EV battery DC input voltage is greater than 30 V.

DTC P0D4E

The battery charger DC output duty cycle is between 1% and 8%.

OR

The battery charger DC output duty cycle equals 100%.

DTC P0D4F

The battery charger DC output duty cycle is between 92% and 99%.

OR

The battery charger DC output duty cycle equals 0%.

Actions Taken When the DTC Sets

- DTC P0D4D, P0D4E and P0D4F are type B DTCs.
- Disables high voltage battery charging.

Conditions for Clearing the DTC

DTC P0D4D, P0D4E and P0D4F are type B DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Verify that DTC P0D4E or P0D4F is not set.

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

Refer to Circuit/System Testing.

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

2. Connect the vehicle to an AC supply to begin charging. Vehicle in Service Mode.

3. Verify that DTC P0D26 is not set.

- **If the DTC is set**

Refer to [DTC P0D26](#).

- **If the DTC is not set**

4. Verify that DTC P0D4D is not set.

- **If the DTC is set**

Refer to Circuit/System Testing.

- **If the DTC is not set**

5. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the X1 harness connector at the T18 Battery Charger. Vehicle in Service Mode.

2. Verify the scan tool Battery Charger DC Output Status Duty Cycle 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 DC voltage sensor circuit terminal 3 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%**

3. Install a 3 A fused jumper wire between the DC voltage sensor circuit terminal 3 and the ground circuit terminal 2.

4. Verify the scan tool Battery Charger DC Output Status Duty Cycle 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. Vehicle in Service Mode.

2. Test for less than 1 V between the DC voltage sensor circuit terminal 3 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 DC voltage sensor 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%**

5. Replace the T18 Battery Charger.

Repair Instructions

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

Control Module References for K114B Hybrid/EV Powertrain Control Module 2 or T18 Battery Charger replacement, programming and setup.

DTC P0D57-P0D59: PROXIMITY DETECTION CIRCUIT(NORTH AMERICA, KOREA)

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Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D57

Proximity Detection Circuit Performance

DTC P0D58

Proximity Detection Circuit Low Voltage

DTC P0D59

Proximity Detection Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
AC Voltage Line 1	P1EE6	P1EE6	-	-
AC Voltage Line 2	P1EE6	P1EE6	-	-
AC Voltage Ground	1	P1EE6	1	-
Control Pilot Signal	1	1	1	-
Proximity Signal	P0D57, P0D58	P0D57, P0D59	P0D57, P0D59	P0D57
1. Plug In Charging Malfunction				

Circuit/System Description

The proximity detection circuit prevents movement of the vehicle while the drive motor battery charger cable is connected. This diagnostic runs with the drive motor battery charger cable disconnected to verify the vehicle side circuit integrity.

Conditions for Running the DTC

P0D57

- The 12 V battery voltage is greater than 10.2 V.
- DTC P0D58 and P0D59 are not set.

P0D58 and P0D59

- The 12 V battery voltage is greater than 10.2 V.
- The vehicle speed is greater than 20 km/h (15 mph).
- No vehicle speed DTCs are set.

Conditions for Setting the DTC

DTC P0D57

The hybrid/EV powertrain control module 2 measures a voltage less than 1.0 V or greater than 4.8 V on the Proximity Detection circuit.

OR

The hybrid/EV powertrain control module 2 measures a voltage between 2.0 V and 2.2 V on the Proximity Detection circuit.

OR

The hybrid/EV powertrain control module 2 measures a voltage between 3.4 V and 4.2 V on the Proximity Detection circuit.

DTC P0D58

The hybrid/EV powertrain control module 2 measures a voltage less than 4.2 V for 5 seconds.

DTC P0D59

The hybrid/EV powertrain control module 2 measures a voltage greater than 4.8 V for 5 seconds.

Actions Taken When the DTC Sets

- DTC P0D57 is a type B DTCs.
- DTC P0D58 and P0D59 are type A DTCs

Conditions for Clearing the DTC

- DTC P0D57 is a type B DTCs.
- DTC P0D58 and P0D59 are type A DTCs

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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

For equivalent regional tools, refer to **Special Tools**.

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 at the T18 Battery Charger. Refer to [High Voltage Disabling](#).

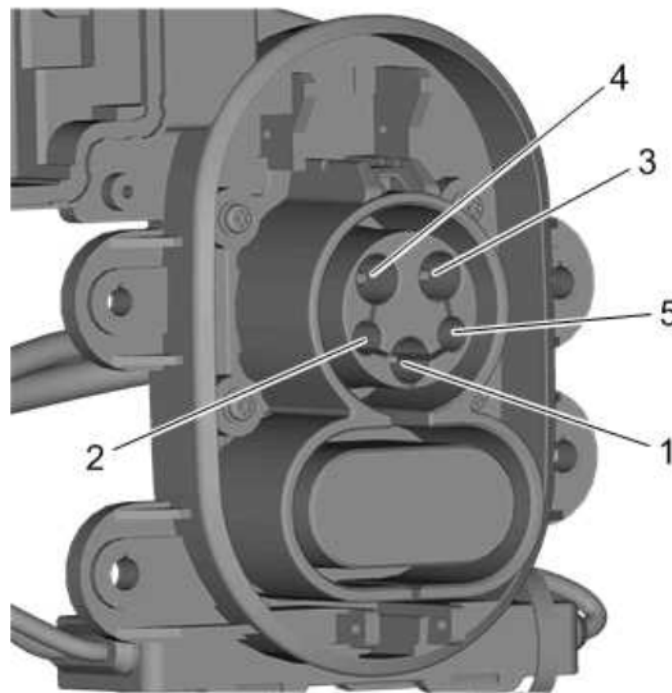


Fig. 10: Hybrid/EV Battery Charger Receptacle
Courtesy of GENERAL MOTORS COMPANY

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle face and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for less than 10 Ω between the low reference circuit terminal 1 and ground.

- If 10 Ω or greater

NOTE: G108 is located behind the front fender.

1. Disconnect the G108 ring terminal. Refer to Ground Nut removal in [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#) [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#).
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If less than 2 Ω , clean and reinstall the G108 ring terminal and ground nut.

- If less than 10 Ω

3. Connect the 12 V battery. Vehicle in Service Mode.

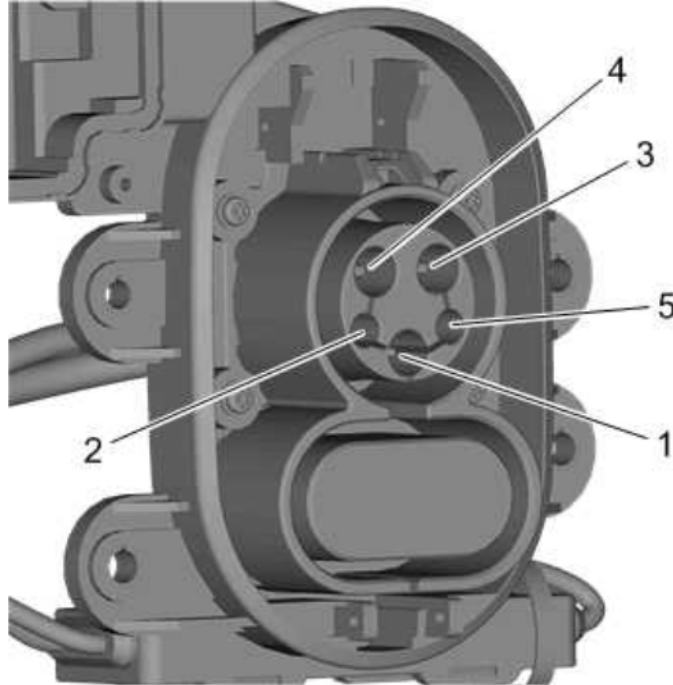


Fig. 11: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

4. Test for 4.2 - 4.8 V between the signal circuit terminal 5 and ground.

- **If less than 4.2 V**

1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for 4.8 V or greater between the signal circuit terminal 5 and ground.

- If less than 4.8 V

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

2. Test for infinite resistance between the signal circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground in 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 4.8 V or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If greater than 4.8 V**

1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

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

- If greater than 5.2 V

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

2. Vehicle in Service Mode. Test for less than 1 V between the signal circuit terminal 5 and ground.

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

- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- If within 4.8 - 5.2 V

3. Test for 2.565 - 2.835K Ω between the signal circuit terminal 5 and the low reference circuit terminal 1 at the face of the X98 Hybrid/EV Battery Charger Receptacle.

- If not within the specified range, replace the X98 Hybrid/EV Battery Charger Receptacle.
- If within the specified range, replace the K114B Hybrid/EV Powertrain Control Module 2.

• **If within 4.2 - 4.8 V**

5. Test for infinite resistance between signal circuit terminal 5 of the X98 Hybrid/EV Battery Charger Receptacle and the terminals listed below:

- Terminal 2
- Terminal 3
- Terminal 4

• **If less than infinite resistance**

1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Retest for infinite resistance between signal circuit terminal 5 of the X98 Hybrid/EV Battery Charger Receptacle and the terminals listed below:

- Terminal 2
- Terminal 3
- Terminal 4
- If less than infinite resistance replace the X98 Hybrid/EV Battery Charger Receptacle.
- If infinite resistance, repair the short between the circuits in the vehicle wiring harness.

• **If infinite resistance**

6. Replace the K114B Hybrid/EV Powertrain Control Module 2.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#) for X98 Hybrid/EV Battery Charger Receptacle.
- [Control Module References](#) for battery charger or hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P0D5A: PROXIMITY DETECTION CIRCUIT ERRATIC

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D5A

Proximity Detection Circuit Erratic

Circuit/System Description

This diagnostic runs with the drive motor battery charger cable connected. The hybrid/EV powertrain control module 2 uses a 5 V regulated signal through a 2700 Ω resistor to a low reference circuit in the battery charger to detect if the drive motor battery charger cable is attached.

Conditions for Running the DTC

The drive motor battery charger cable is connected.

Conditions for Setting the DTC

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The hybrid/EV powertrain control module 2 determines the proximity signal voltage is erratic for 40 seconds.

Actions Taken When the DTC Sets

DTC P0D5A is a type C DTC.

Conditions for Clearing the DTC

DTC P0D5A is a type C DTC.

Diagnostic Aids

The proximity status circuit is susceptible to moisture intrusion. If signs of moisture intrusion are observed in the hybrid/EV battery charger receptacle harness connector, the hybrid/EV battery charger receptacle should be replaced. If moisture is detected on one connector, always be sure to inspect the mating connector as well.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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. Connect the drive motor battery charger cable.
2. Verify DTC P0D5A is not set.
 - **If the DTC is set**

Replace the X98 Hybrid/EV Battery Charger Receptacle.
 - **If the DTC is not set**
3. All OK.

Repair Instructions

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

Drive Motor Battery Charger Receptacle Replacement (Except Dubai with quick charge)Drive Motor Battery Charger Receptacle Replacement (Except Dubai without quick charge)Drive Motor Battery Charger Receptacle Replacement (Dubai only with quick charge)Drive Motor Battery Charger Receptacle Replacement (Dubai only without quick charge)

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0D5E

Battery Charger System High Voltage Present

Circuit/System Description

The hybrid/EV battery contains 4 high voltage contactors. The high voltage contactors allow the high voltage DC batteries to be connected to the vehicle or contain the high voltage DC within the hybrid/EV battery assembly. The 4 high voltage contactors are a main positive high voltage contactor, main negative high voltage contactor, charge positive high voltage contactor, and precharge high voltage contactor. These contactors close and open in sequence and are controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 supplies voltage to the control circuit for the high voltage contactors. Ground is provided through the case ground.

Conditions for Running the DTC

- All contactors are commanded open.
- Runs once per charger contacts discharge event.
- None of the following DTCs are set: P0D4D, P0D4E or P0D4F.

Conditions for Setting the DTC

High voltage bus does not discharge to below 60 V within 4 seconds of the charger contactors being commanded open.

Actions Taken When the DTC Sets

- DTC P0D5E is a type A DTC.
- The hybrid/EV powertrain control module 2 opens the high voltage contactors.

Conditions for Clearing the DTC

- DTC P0D5E is a type A DTC.
- The [Clear Secured High Voltage DTCs](#) reset function must be performed with a scan tool before clear codes.

Reference Information

Schematic Reference

Hybrid/EV Energy Storage Schematics

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Description and Operation

Drive Motor Battery System Description

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

NOTE: The following setup steps must be performed exactly in order to exercise the contactors.

1. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.
2. OPEN the driver door using outside door handle. Leave driver door OPEN.

NOTE: The brake pedal must remain depressed throughout the remainder of the contactor steps.

3. PRESS and HOLD the brake pedal.

NOTE: DO NOT press the power button and enter Vehicle in Service Mode.

4. Command the Hybrid/EV Battery Contactors ALL OPEN with a scan tool.
5. Disconnect the S15 Manual Service Disconnect.

NOTE: DO NOT use the Release Control button to turn OFF any of the contactors. Once the Release Control button is pushed the Circuit/System Verification will need to be restarted from the beginning.

6. Command the Battery Charging System Positive Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to close and open. The KR116B Battery Charging System Positive Contactor should be heard closing and opening.

- If the Battery Charging System Positive Contactor does not open and close

Refer to Circuit/System Testing.

- If the Battery Charging System Positive Contactor does open and close

7. Replace the T18 Battery Charger.

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, disconnect the X358 harness connector at the A4 Hybrid/EV Battery Pack.
2. Test for less than 10 Ω between the ground circuit terminal 10 and ground.
 - **If 10 Ω or greater**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Disconnect the X357 harness connector at the A4 Hybrid/EV Battery Pack.
4. Verify that a test lamp illuminates between the A4 Hybrid/EV Battery Pack harness B+ circuit terminal 1 X357 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 A28 Hybrid/EV Battery Contactor Assembly and K16 Battery Energy Control Module ensuring you reconnect the connectors in the sequence provided in Repair Instructions. Refer to [Battery Energy Control Module Replacement](#).
 - **If the test lamp illuminates**
5. Vehicle in Service Mode.
6. Verify that a test lamp does not illuminate between the A4 Hybrid/EV Battery Pack harness control circuit terminal 5 X358 and ground.
 - **If the test lamp illuminates**
 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 control 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 the test lamp does not illuminate**
7. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
8. Test for infinite resistance between the A4 Hybrid/EV Battery Pack harness control circuit terminal 5 X358 and ground.
 - **If less than infinite resistance**

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

Repair the open/high resistance in the circuit.
 - **If less than 2 Ω**

10. Replace the K114B Hybrid/EV Powertrain Control Module 2.

11. Verify that DTC P0D5E does not set while operating the vehicle within the Conditions for Running the DTC.

- **If DTC P0D5E is set**

Replace the A28 Hybrid/EV Battery Contactor Assembly.

- **If DTC P0D5E is not set**

12. All OK.

Repair Instructions

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

- [High Voltage Battery Disconnect Relay Replacement](#) for A28 Hybrid/EV Battery Contactor Assembly.
- [Control Module References](#) for T18 Battery Charger, K16 Battery Energy Control Module, or K114B Hybrid/EV Powertrain Control Module 2 replacement, programming and setup.

DTC P0E61 OR P0E65: BATTERY CHARGER ENABLE/CONTROL CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P0E61

Battery Charger Enable Circuit

DTC P0E65

Battery Charger Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Battery Charger Enable	P0E61	P0E61	P0E61	-
Battery Charger Control	P0E65	P0E65	P0E65	-

Circuit/System Description

The battery charger is controlled with a charger enable signal and a pulse width modulated (PWM) charger control circuit from the hybrid/EV powertrain control module 2. The charger enable signal is set to 12 V when the hybrid/EV powertrain control module 2 is awake. This allows the battery charger to operate while driving to allow DC voltage sensor operation.

Conditions for Running the DTC

DTC P0E61

The 12 V battery voltage is greater than 10.2 V.

DTC P0E65

- The 12 V battery voltage is greater than 10.2 V.
- Vehicle in Service Mode or the drive motor battery charger cable is connected.

Conditions for Setting the DTC

DTC P0E61

The hybrid/EV powertrain control module 2 detects an open, short to ground, or short to voltage on battery charger enable circuit for 1 second.

DTC P0E65

The hybrid/EV powertrain control module 2 detects an open, short to ground, or short to voltage on battery charger control circuit for 1 second.

Actions Taken When the DTC Sets

- DTC P0E61 and P0E65 are type B DTCs.
- Disables high voltage battery charging.

Conditions for Clearing the DTC

DTC P0E61 and P0E65 are type B DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Description and Operation

Plug-In Charging 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 Testing

1. Vehicle OFF. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2. Disconnect the X1 harness connector at the T18 Battery Charger.
2. Test for infinite resistance between the terminals listed below at the T18 Battery Charger X1 harness connector:
 - Battery charger enable terminal 11 and B+ terminal 9
 - Battery charger enable terminal 11 and ground terminal 2
 - Battery charger control terminal 4 and B+ terminal 9
 - Battery charger control terminal 4 and ground terminal 2
 - **If less than infinite resistance**

Repair the short between the circuits.

- **If infinite resistance**

3. Test for less than 2 Ω between the terminals listed below end to end:

- T18 Battery Charger terminal 11 X1 and K114B Hybrid/EV Powertrain Control Module 2 terminal 44 X2
- T18 Battery Charger terminal 4 X1 and K114B Hybrid/EV Powertrain Control Module 2 terminal 53 X2
- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 2 Ω**

4. Replace the K114B Hybrid/EV Powertrain Control Module 2.
5. Verify DTC P0E61 or P0E65 is not set.

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

Replace the T18 Battery Charger.

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

6. All OK.

Repair Instructions

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

[Control Module References](#) for battery charger or hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P1ECE: BATTERY CHARGER TOTAL OUTPUT POWER PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P1ECE

Battery Charger Total Output Power Performance

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors the hybrid/EV battery pack voltage and current sensors to determine battery charger output power efficiency.

Conditions for Running the DTC

- The vehicle 12 V battery system voltage needs to be 10.2 V or greater.
- There cannot be any high voltage or current sensor faults present.
- Drive motor battery charger cable must be connected and vehicle receiving power.

Conditions for Setting the DTC

- Battery charger output power efficiency is less than 62% or greater than 167% for 80 minutes.
- Hybrid/EV electronics coolant temperature is between -12 Å , $\text{Å}^{\circ}\text{C}$ (+10 Å , $\text{Å}^{\circ}\text{F}$) and +65 Å , $\text{Å}^{\circ}\text{C}$ (+149 Å , $\text{Å}^{\circ}\text{F}$).

Actions Taken When the DTC Sets

- DTC P1ECE is a type A DTC.
- Disables the high voltage battery charging.

Conditions for Clearing the DTC

DTC P1ECE is a type A DTC.

Diagnostic Aids

The diagnostic consists of a passive efficiency test and active efficiency test. The passive test runs first, which takes a minimum of 80 minutes to mature. If the passive test fails, the active test is then run, which is intrusive. The DTC sets upon failure of the active test. The scan tool control function allows the active test to be run directly, eliminating the need to wait for the failure of the passive test.

The efficiency value is calculated by dividing the battery charger's output power by input power. A value less than 100% indicates power loss. A value more than 100% indicates an overcurrent condition and is less likely to occur.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Connect the drive motor battery charger cable. Vehicle in Service Mode.
2. Perform the scan tool control function: Battery Charging System Efficiency Test (Active Test) @ K114B Hybrid/EV Powertrain Control Module 2 - On. Wait for test to complete.
3. Verify DTC P1ECE is not set.
 - **If the DTC is set**

Replace the T18 Battery Charger.
 - **If the DTC is not set**
4. All OK.

Repair Instructions

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

Control Module References for T18 Battery Charger, often referred to as the Drive Motor Battery Charger, replacement, programming, and setup

DTC P1EE6 : BATTERY CHARGER AC VOLTAGE NOT PRESENT (NORTH AMERICA, KOREA)
cardiagn.com

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P1EE6

Battery Charger AC Voltage Not Present

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Voltage AC Line 1	P1EE6	P1EE6	-	-
Voltage AC Neutral Line 2	P1EE6	P1EE6	-	-
Voltage AC Ground	-	P1EE6	1	-
1. Plug In Charging Malfunction				

Circuit/System Description

The hybrid battery charger receptacle is connected to the battery charger through two AC circuits and one ground circuit. When the battery charger has been enabled by the hybrid/EV powertrain control module 2, the battery charger will provide an AC voltage measurement to the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 allows charging to occur if proper AC voltage is present.

Conditions for Running the DTC

- The 12 V battery voltage is greater than 10.2 V.
- The drive motor battery charger cable is connected.
- DTCs P0D3E, P0D3F, P0D40, or P0D5C is not set.

Conditions for Setting the DTC

The battery charger AC input voltage is below 5 V.

Actions Taken When the DTC Sets

- DTC P1EE6 is a type C DTC.
- Disables the vehicle high voltage battery charging.

Conditions for Clearing the DTC

DTC P1EE6 is a type C DTC.

Diagnostic Aids

The hybrid/EV battery charger receptacle contains internal fuses on Voltage AC Line 1 and Voltage AC Neutral Line 2 circuits. A battery charger internal failure may cause these fuses to blow. If an open circuit is found in the hybrid/EV battery charger receptacle, the battery charger may also need to be replaced.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

EL-48900 HEV Safety Kit

For equivalent regional tools, refer to **Special Tools**.

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. Clear DTC, connect a known good drive motor battery charger cable to vehicle and household supply voltage.
2. Verify DTC P1EE6 is set.

- **If DTC P1EE6 is not set**

Replace customer's drive motor battery charger cable.

- **If DTC P1EE6 is set**

3. Vehicle OFF, disable the high voltage at the T18 Battery Charger. Refer to **High Voltage Disabling**
4. Disconnect the X2 harness connector at the T18 Battery Charger.
5. Test into the harness for infinite resistance between the AC circuit terminals listed below and ground.
 - T18 Battery Charger terminal 1 X2

- T18 Battery Charger terminal 4 X2

- **If less than infinite resistance**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Test into the harness for infinite resistance between the appropriate AC circuit terminal and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance

3. Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If infinite resistance**

6. Test into the harness for infinite resistance between all the AC circuit terminals listed below:

- T18 Battery Charger terminal 1 X2
- T18 Battery Charger terminal 3 X2
- T18 Battery Charger terminal 4 X2

- **If less than infinite resistance**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Test into the harness for infinite resistance between the three AC circuit terminals.
 - If less than infinite resistance, repair the short between the circuits.
 - If infinite resistance

3. Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If infinite resistance**

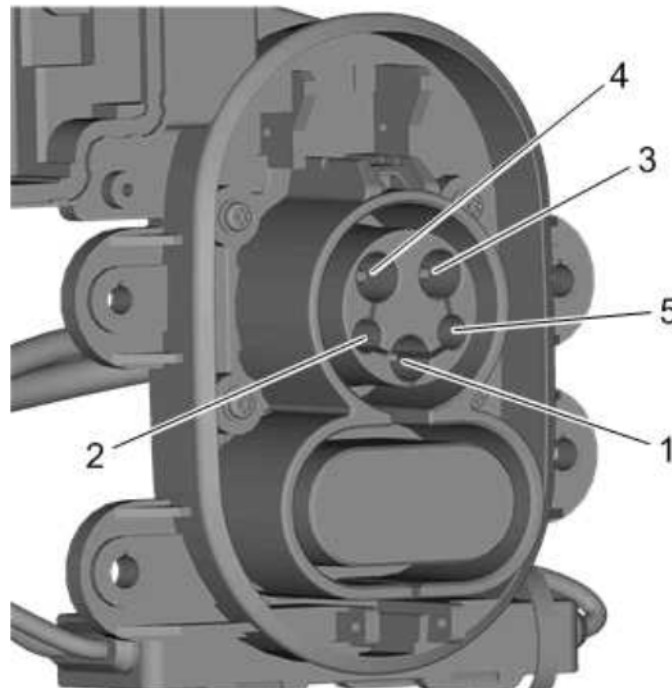


Fig. 12: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

7. Test for less than 10 Ω between the AC circuit terminals listed below:

- T18 Battery Charger terminal 1 X2 and X98 Hybrid/EV Battery Charger Receptacle 3
- T18 Battery Charger terminal 3 X2 and X98 Hybrid/EV Battery Charger Receptacle 1
- T18 Battery Charger terminal 4 X2 and X98 Hybrid/EV Battery Charger Receptacle 4

- **If 10 Ω or greater**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Test for less than 2 Ω in the AC circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω

3. Replace the X98 Hybrid/EV Battery Charger Receptacle.

4. Verify the DTC does not set.

- If the DTC sets, replace the T18 Battery Charger and X98 Hybrid/EV Battery Charger Receptacle.
- If the DTC does not set

5. All OK.

- **If less than 10 Ω**

8. Replace the T18 Battery Charger.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for battery charger replacement, programming and setup.

DTC P3002, P3003, P301F, OR P3020: HYBRID/EV BATTERY DC CHARGING POSITIVE VOLTAGE SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P3002

Hybrid/EV Battery DC Charging Positive Voltage Sensor Circuit Low Voltage

DTC P3003

Hybrid/EV Battery DC Charging Positive Voltage Sensor Circuit High Voltage

DTC P301F

Hybrid/EV Battery DC Charging Positive Voltage Sensor Stuck Low

DTC P3020

Hybrid/EV Battery DC Charging Positive Voltage Sensor Stuck High

Circuit/System Description

The hybrid/EV battery contains 4 high voltage contactors for normal operation and regular (AC) charging, and 1 module. In vehicles with DC charging capability, there are two additional DC contactors that are housed in the battery charger - DC. The high voltage contactors allow the high voltage DC batteries to be connected to the vehicle or safely contain the high voltage DC within the hybrid/EV battery assembly. The 6 high voltage contactors consist of a main positive high voltage contactor, main negative high voltage contactor, AC charge positive high voltage contactor, precharge contactor, DC positive contactor, and DC negative contactor. The 1 module is the hybrid/EV battery pack coolant heater module. The contactors and module close and open in a specific sequence controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 supplies voltage to the control circuit for the high voltage contactors/module. Ground is provided through the case ground and chassis.

The hybrid/EV powertrain control module 2 measures internal voltages, currents, and temperatures within the battery charger - DC and charge receptacle and verifies they are within the proper range.

Conditions for Running the DTC

P3002 and P3003

The vehicle 12 V battery system voltage is greater than 10.2 V.

P301F

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is ready to be charged.
- The DC positive contactor is commanded OPEN.
- The charge control mode is precharge.
- The off board charger voltage limit command is greater than or equal to 201 V.
- DTC P3002 or P3003 is not set.

OR

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is ready to be charged.
- The DC positive contactor is commanded CLOSED.
- The charge control mode is constant current.
- DTC P3002 or P3003 is not set.

P3020

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is ready to be charged.
- The DC positive contactor is commanded CLOSED.
- The charge control mode is constant current.
- DTC P3002 or P3003 is not set.

OR

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- Vehicle in Service Mode or Vehicle ON.
- The DC charge cable is disconnected.
- The DC positive contactor is commanded OPEN.
- DTC P3002 or P3003 is not set.

Conditions for Setting the DTC

P3002

The hybrid/EV powertrain control module 2 detects the DC charging positive voltage sensor signal is out of range low. The signal percent is less than 5% for 1 s.

P3003

The hybrid/EV powertrain control module 2 detects the DC charging positive voltage sensor signal is out of range high. The signal percent is greater than 90% for 1 s.

P301F

- The DC Charging Positive Voltage Sensor bus voltage is less than or equal to 30 V.

AND

- The DC Charging Negative Voltage Sensor bus voltage is greater than 30 V.

P3020

- The DC Charging Positive Voltage Sensor bus voltage is not within 20% of the hybrid/EV powertrain control module 1 bus voltage.

AND

- The DC Charging Positive Voltage Sensor bus voltage is greater than 20 V.

Action Taken When the DTC Sets

- DTC P3002, P3003, and P3020 are type A DTCs.
- DTC P301F is type B DTC.
- Disables DC high voltage battery charging.

Conditions for Clearing the DTC

- DTC P3002, P3003, and P3020 are type A DTCs.
- DTC P301F is type B DTC.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- [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. Observe the scan tool DC Positive Supply Isolation Voltage parameter. The reading should be 0 V.
 - **If greater than 0 V**

Refer to Circuit/System Testing
 - **If 0 V**
3. Verify that DTC P3002, P3003, P301F, or P3020 does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing.
 - **If none of the DTCs are set**
4. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
Disconnect the X9 harness connector at the T24 Battery Charger - DC.
2. Test for less than 10 Ω between the ground circuit terminal 9 and ground.
 - **If 10 Ω or greater**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 8 and ground.
 - **If less than 4.8 V**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the 5 V reference circuit terminal 8 X9 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for infinite resistance between the 5 V reference circuit terminal 5 X2 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω in the 5 V reference circuit terminal 8 X9 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 5.2 V or greater**
 1. Vehicle OFF, disconnect the X2 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 5 V reference circuit terminal 8 X9 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 1 V between the 5 V reference circuit terminal 5 X2 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 within the specified range**
5. Test for less than 1 V between the signal circuit terminal 10 X9 and ground.
 - **If 1 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 between 1 - 5 V, repair the short to voltage on the circuit.
 - If greater than 5 V, repair the short to voltage on the circuit and replace the T24 Battery Charger - DC.
 - If less than 1 V
 3. Replace the K114B Hybrid/EV Powertrain Control Module 2.
 4. Verify that DTC P3002, P3003, P301F, or P3020 does not set while operating the vehicle within the Conditions for Running the DTC.
 - If any of the DTCs are set, replace the T24 Battery Charger - DC.
 - If none of the DTCs are set
5. All OK.
- **If less than 1 V**

6. Vehicle OFF, install a 3 A fused jumper wire between the signal circuit terminal 10 and the 5 V reference circuit terminal 8. Vehicle in Service Mode.
7. Verify the scan tool DC Positive Supply Isolation Voltage parameter is greater than 500 V.
 - **If less than 500 V**
 1. Test for infinite resistance between the signal circuit and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 2. 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 500 V or greater**
8. Replace the T24 Battery Charger - DC.

Repair Instructions

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

[Control Module References](#) for battery charger - DC and hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P3005, P3006, P3021, OR P3022: HYBRID/EV BATTERY DC CHARGING NEGATIVE VOLTAGE SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P3005

Hybrid/EV Battery DC Charging Negative Voltage Sensor Circuit Low Voltage

DTC P3006

Hybrid/EV Battery DC Charging Negative Voltage Sensor Circuit High Voltage

DTC P3021

Hybrid/EV Battery DC Charging Negative Voltage Sensor Stuck Low

DTC P3022

Hybrid/EV Battery DC Charging Negative Voltage Sensor Stuck High

Circuit/System Description

The hybrid/EV battery contains 4 high voltage contactors for normal operation and regular (AC) charging, and 1 module. In vehicles with DC charging capability, there are two additional DC contactors that are housed in the battery charger - DC. The high voltage contactors allow the high voltage DC batteries to be connected to the vehicle or safely contain the high voltage DC within the hybrid/EV battery assembly. The 6 high voltage contactors consist of a main positive high voltage contactor, main negative high voltage contactor, AC charge positive high voltage contactor, precharge contactor, DC positive contactor, and DC negative contactor. The 1 module is the hybrid/EV battery pack coolant heater module. The contactors and module close and open in a specific sequence controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 supplies voltage to the control circuit for the high voltage contactors/module. Ground is provided through the case ground and chassis.

The hybrid/EV powertrain control module 2 measures internal voltages, currents, and temperatures within the battery charger - DC and charge receptacle and verifies they are within the proper range. cardiagn.com

Conditions for Running the DTC

P3005 and P3006

The vehicle 12 V battery system voltage is greater than 10.2 V.

P3021

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is ready to be charged.
- The DC negative contactor is commanded OPEN.
- The charge control mode is precharge.
- The off board charger voltage limit command is greater than or equal to 201 V.
- DTC P3005 or P3006 is not set.

OR

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is ready to be charged.
- The charge control mode is constant current.
- The DC negative contactor is commanded CLOSED.
- DTC P3005 or P3006 is not set.

P3022

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The DC negative contactor is commanded CLOSED.
- The charge control mode is constant current.
- DTC P3005 or P3006 is not set.

OR

- Vehicle in Service Mode or Vehicle ON.
- The DC charge cable is disconnected.
- The DC negative contactor is commanded OPEN.

Conditions for Setting the DTC

P3005

The hybrid/EV powertrain control module 2 detects the DC charging negative voltage sensor signal is out of range low. The signal percent is less than 5% for 1 s.

P3006

The hybrid/EV powertrain control module 2 detects the DC charging negative voltage sensor signal is out of range high. The signal percent is greater than 90% for 1 s.

P3021

- The DC Charging Negative Voltage Sensor bus voltage is less than or equal to 30 V.

AND

- The DC Charging Positive Voltage Sensor bus voltage is greater than 30 V.

P3022

- The DC Charging Negative Voltage Sensor bus voltage is greater than 20 V.

AND

- The DC Charging Negative Voltage Sensor bus voltage is not within 20% of the hybrid/EV powertrain control module 1 bus voltage.

Action Taken When the DTC Sets

- DTC P3005, P3006, and P3022 are type A DTCs.
- DTC P3021 is type B DTC.
- Disables DC high voltage battery charging.

Conditions for Clearing the DTC

- DTC P3005, P3006, and P3022 are type A DTCs.
- DTC P3021 is type B DTC.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Vehicle in Service Mode.
2. Observe the scan tool DC Negative Supply Isolation Voltage parameter. The reading should be 0 V.
 - **If greater than 0 V**

Refer to Circuit/System Testing.
 - **If 0 V**
3. Verify that DTC P3005, P3006, P3021, or P3022 does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing.
 - **If none of the DTCs are set**
4. All OK.

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Disconnect the X9 harness connector at the T24 Battery Charger - DC.

2. Test for less than 10 Ω between the ground circuit terminal 9 and ground.

- **If 10 Ω or greater**

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

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

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

- **If less than 10 Ω**

3. Vehicle in Service Mode.

4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 8 and ground.

- **If less than 4.8 V**

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

2. Test for infinite resistance between the 5 V reference circuit terminal 8 X9 and ground.

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

3. Test for infinite resistance between the 5 V reference circuit terminal 5 X2 and ground.

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

4. Test for less than 2 Ω in the 5 V reference circuit terminal 8 X9 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 5.2 V or greater**

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 5 V reference circuit terminal 8 X9 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 1 V between the 5 V reference circuit terminal 5 X2 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 within the specified range**

5. Test for less than 1 V between the signal circuit terminal 11 and ground.

- **If 1 V or greater**

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

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

- If between 1 - 5 V, repair the short to voltage on the circuit.
- If greater than 5 V, repair the short to voltage on the circuit and replace the T24 Battery Charger - DC.
- If less than 1 V

3. Replace the K114B Hybrid/EV Powertrain Control Module 2.

4. Verify that DTC P3002, P3003, P301F, or P3020 does not set while operating the vehicle within the Conditions for Running the DTC.

- If any of the DTCs are set, replace the T24 Battery Charger - DC.
- If none of the DTCs are set

5. All OK.

- **If less than 1 V**

6. Vehicle OFF, install a 3 A fused jumper wire between the signal circuit terminal 11 and the 5 V reference circuit terminal 8. Vehicle in Service Mode.
7. Verify the scan tool DC Negative Supply Isolation Voltage parameter is greater than 500 V.
 - **If less than 500 V**
 1. Test for infinite resistance between the signal circuit and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 2. 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 500 V or greater**
8. Replace the T24 Battery Charger - DC.

Repair Instructions

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

[Control Module References](#) for battery charger - DC and hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P300B: HYBRID/EV BATTERY DC CHARGING OUTPUT CURRENT PERFORMANCE

Diagnostic Instructions

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

DTC Descriptors

DTC P300B

Hybrid/EV Battery DC Charging Output Current Performance

Circuit/System Description

The hybrid/EV battery contains 4 high voltage contactors for normal operation and regular (AC) charging, and 1 module. In vehicles with DC charging capability, there are two additional DC contactors that are housed in the battery charger - DC. The high voltage contactors allow the high voltage DC batteries to be connected to the vehicle or safely contain the high voltage DC within the hybrid/EV battery assembly. The 6 high voltage contactors consist of a main positive high voltage contactor, main negative high voltage contactor, AC charge positive high voltage contactor, precharge contactor, DC positive contactor, and DC negative contactor. The 1 module is the hybrid/EV battery pack coolant heater module. The contactors and module close and open in a specific sequence controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 supplies voltage to the control circuit for the high voltage contactors/module. Ground is provided through the case ground and chassis.

The hybrid/EV powertrain control module 2 measures internal voltages, currents, and temperatures within the battery charger - DC and charge receptacle and verifies they are within the proper range.

Conditions for Running the DTC

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The Charge Control Mode is Constant current or Constant Voltage.
- The Battery Charger DC positive and negative contactors are closed.
- The Battery Pack main positive, main negative, and multifunction contactors are closed.
- The Charge Power Level is DC.
- DTCs P0AC1, P0AC2 and P1EBA are not set.

Conditions for Setting the DTC

The percent current deviation is greater than the fail threshold for 80% of the samples in a 10 s window. The fail thresholds are as follows:

- 100% current deviation when the commanded current is less than 5 A
- 60% current deviation when the commanded current is greater than or equal to 5 A and less than 20 A
- 50% current deviation when the commanded current is greater than or equal to 20 A and less than 40 A
- 30% current deviation when the commanded current is greater than or equal to 40 A

Action Taken When the DTC Sets

DTC P300B is a type C DTC.

Conditions for Clearing the DTC

DTC P300B is a type C DTC.

Diagnostic Aids

Current deviation is defined as actual current minus commanded current. Percent current deviation is defined as current deviation divided by commanded current multiplied by 100. For example, if commanded current is 10 A and actual current is 18 A, the current deviation is 8 A and the percent current deviation is 80%. An 80% current deviation is greater than the 60% fail threshold for the 5 A to 20 A commanded current range.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Description and Operation

Plug-In Charging 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 P300B does not set while operating the vehicle within the Conditions for Running the DTC.
 - **If DTC P300B is set**

Contact the GM Technical Assistance Center to report a DC Fast charge station problem.
 - **If DTC P300B is not set**
2. All OK.

Repair Instructions

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

DTC P300C, P300D, OR P300F: HYBRID/EV BATTERY DC CHARGING PORT TEMPERATURE SENSOR CIRCUIT LOW/HIGH/ERRATIC

Diagnostic Instructions

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

DTC Descriptors

DTC P300C

Hybrid/EV Battery DC Charging Port Temperature Sensor Circuit Low

DTC P300D

Hybrid/EV Battery DC Charging Port Temperature Sensor Circuit High

DTC P300F

Hybrid/EV Battery DC Charging Port Temperature Sensor Circuit Erratic

Circuit/System Description

The hybrid/EV powertrain control module 2 monitors the receptacle temperature any time the hybrid/EV powertrain control module 2 is awake. The hybrid/EV powertrain control module 2 verifies the temperature signal is within the proper range.

Conditions for Running the DTC

P300C and P300D

The vehicle 12 V battery system voltage is greater than 10.2 V.

P300F

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- DTC P300C or P300D is not set.

Conditions for Setting the DTC

P300C

The charging port temperature sensor signal percent is less than 2.5% in 1 s.

P300D

The charging port temperature sensor signal percent is greater than 99.0% in 1 s.

P300F

The hybrid/EV powertrain control module 2 detects the charging port temperature sensor signal is erratic for 10 seconds.

Action Taken When the DTC Sets

DTC P300C, P300D, and P300F are type A DTCs.

Conditions for Clearing the DTC

- DTC P300C, P300D, and P300F are type A DTCs.

Reference Information

Schematic Reference

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

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

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

[Circuit/System Verification](#)

1. Vehicle in Service Mode.

NOTE: The DC Charge Port Temperature should be close to ambient temperature without the cord set plugged in.

2. Observe the scan tool DC Charge Port Temperature parameter. The reading should be between -40 and +125Å,Å° C (-40 and +257Å,Å° F).

- The reading is not within the specified range

Refer to Circuit/System Testing.

- The reading is within the specified range

3. Verify that DTC P300C, P300D, or P300F does not set while operating the vehicle within the Conditions for Running the DTC.

- If any of the DTCs are set

Refer to Circuit/System Testing.

- If none of the DTCs are set

4. All OK.

[Circuit/System Testing](#)

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference terminal 6 and ground.

- If 10 Ω or greater

1. Vehicle OFF, disconnect the X2 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 - 4.95 V between the signal circuit terminal 5 and ground.

- **If less than 4.8 V**

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

- **If greater than 4.95 V**

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 signal circuit and ground.
 - If between 1 - 5.2 V, repair the short to voltage on the circuit.
 - If greater than 5.2 V, repair the short to voltage on the circuit and replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If between 4.8 - 4.95 V**

5. Replace the X98 Hybrid/EV Battery Charger Receptacle.

Component Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Test for 2.76 - 2.93k Ω at approximately 25 Å , $\text{Å}^{\circ}\text{C}$ (77 Å , $\text{Å}^{\circ}\text{F}$) between the signal terminal 5 and the low reference terminal 6.

- **If not within the specified range**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If within the specified range**

3. All OK.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P3010, P3013, OR P3014: HYBRID/EV BATTERY DC CHARGING PORT LOCK

Diagnostic Instructions

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

DTC Descriptors

DTC P3010

DTC P3013

Hybrid/EV Battery DC Charging Port Lock Stuck Open

DTC P3014

Hybrid/EV Battery DC Charging Port Lock Stuck Closed

Circuit/System Description

The hybrid/EV powertrain control module 2 activates the charge port lock to prevent the DC charge cord from being disconnected during charging. The hybrid/EV powertrain control module 2 monitors the charge port lock any time the hybrid/EV powertrain control module 2 is awake. The hybrid/EV powertrain control module 2 monitors the command and the actuator position to verify proper operation.

Conditions for Running the DTC

P3010

The charge port lock actuator has been commanded to LOCK or UNLOCK.

P3013 and P3014

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The charge port lock actuator has not been commanded for more than 2 sec.
- DTC P302B, P302C, or P302D is not set.

Conditions for Setting the DTC

P3010

- The hybrid/EV powertrain control module 2 has detected a lock driver open circuit fault.
- OR
- The hybrid/EV powertrain control module 2 has detected a lock driver short circuit fault.

P3013

- The charge port lock actuator has been commanded to LOCK.
- The hybrid/EV powertrain control module 2 has determined a stuck open condition by comparing the charge port lock commanded lock position to the DC Charge Port Lock Actuator Engaged Position.

P3014

- The charge port lock actuator has been commanded to UNLOCK.
- The hybrid/EV powertrain control module 2 has determined a stuck closed condition by comparing the charge port lock commanded unlock position to the DC Charge Port Lock Actuator Disengaged Position.

Action Taken When the DTC Sets

DTC P3010, P3013, and P3014 are type C DTCs.

Conditions for Clearing the DTC

DTC P3010, P3013, and P3014 are type C DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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COMPONENT CONNECTOR END VIEWS - INDEX

Plug-In Charging 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 in Service Mode.
2. Command the DC Charge Port Lock to LOCK and UNLOCK with a scan tool while listening for the DC Charge Port Lock to lock and unlock. The DC Charge Port Lock should lock and unlock and the scan tool DC Charge Port Lock Actuator Position Sensor parameter should change between 0.15 - 4.85 V.
 - **If the DC Charge Port Lock does not LOCK or UNLOCK or the DC Charge Port Lock Actuator Position Sensor parameter does not change**

Refer to Circuit/System Testing.
 - **If the DC Charge Port Lock does LOCK and UNLOCK and the DC Charge Port Lock Actuator Position Sensor parameter changes**
3. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Connect a test lamp between the control circuit terminal 7 and ground. Vehicle in Service Mode.
2. Verify the test lamp illuminates.
 - **If the test lamp does not illuminate or is very Dim**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module
 2.
 1. Test for infinite resistance between the control circuit terminal 7 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the control circuit terminal 7 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 does illuminate**
3. Command the DC Charge Port Lock to LOCK and UNLOCK with a scan tool. Verify that the test lamp turns ON and OFF.
 - **If the test lamp does not turn OFF or Dims**
 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 terminal 7 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

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

4. Disconnect the test lamp. Connect a test lamp between the control circuit terminal 8 and ground.

- **If the test lamp does not illuminate or is very Dim**

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 terminal 8 and ground.
 - If less 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.

- **If the test lamp does illuminate**

5. Command the DC Charge Port Lock to UNLOCK and LOCK with a scan tool. Verify that the test lamp turns ON and OFF.

- **If the test lamp does not turn OFF or Dims**

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 terminal 8 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

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

6. Replace the X98 Hybrid/EV Battery Charger Receptacle.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P3015, P3018, P301C, OR P301D: HYBRID/EV BATTERY DC CHARGING POSITIVE/NEGATIVE CONTACTOR

Diagnostic Instructions

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

DTC Descriptors

DTC P3015

Hybrid/EV Battery DC Charging Positive Contactor Control Circuit

DTC P3018

Hybrid/EV Battery DC Charging Negative Contactor Control Circuit

DTC P301C

Hybrid/EV Battery DC Charging Positive Contactor Stuck Closed

DTC P301D

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Coil Control	P3015, P3018, P301C, P301D	P3015, P3018, P301C, P301D	P3015, P3018, P301C, P301D	-

Circuit/System Description

In vehicles with quick charge DC charging capability, RPO: CBT, there are two high voltage contactors that are housed in the T24 battery charger - DC. These additional high voltage contactors allow the high voltage DC batteries to be connected to the X98 Hybrid/EV Battery Charger Receptacle DC charge terminals.

The hybrid/EV powertrain control module 2 measures internal voltages, currents, and temperatures within the T24 battery charger - DC and charge receptacle and verifies they are within the proper range.

Conditions for Running the DTC**P3015 and P3018**

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The hybrid/EV battery current is less than 999 A.

P301C

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The main positive and negative contactors are CLOSED.
- The DC charging positive contactor is OPEN.

P301D

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The main positive and negative contactors are CLOSED.
- The DC charging negative contactor is OPEN.

Conditions for Setting the DTC**P3015**

- The DC charging positive contactor is commanded OPEN and the output voltage is greater than battery voltage minus 0.4 V.

OR

- The DC charging positive contactor is commanded CLOSED and the current sense feedback is less than 194 mA.

P3018

- The DC charging negative contactor is commanded OPEN and the output voltage is greater than battery voltage minus 0.4 V.

OR

- The DC charging negative contactor is commanded CLOSED and the current sense feedback is less than 194 mA.

P301C

The DC charging positive bus voltage is within 80% to 120% of the hybrid/EV powertrain control module 1 positive bus voltage.

P301D

The DC charging negative bus voltage is within 80% to 120% of the hybrid/EV powertrain control module 1 negative bus voltage.

Action Taken When the DTC Sets

DTC P3015, P3018, P301C and P301D are type B DTCs.

Conditions for Clearing the DTC

DTC P3015, P3018, P301C and P301D are type B DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Plug-In Charging System Description and Operation

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- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: The following setup steps MUST BE PERFORMED EXACTLY in order to exercise the contactors.

1. Vehicle OFF. Turn ON the park lamps.

NOTE: DO NOT press the power button and enter Vehicle in Service Mode or Vehicle ON.

NOTE: There are two contactor control functions available on the scan tool. Make sure you select the DC charging contactor control and not the battery contactor control.

2. Command the hybrid powertrain control module 2, Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore DTC P0ABC after pulling the S15 Manual Service Disconnect.

3. Disconnect the S15 Manual Service Disconnect.

NOTE: DO NOT use the scan tool Release Control button to turn OFF any of the

contactors. Once the scan tool Release Control button is pushed the Circuit/System Verification will need to be restarted from the beginning, including reinstalling the S15 Manual Service Disconnect and clearing DTCs.

4. Command the Hybrid/EV Battery DC Charging Negative Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to open.

NOTE: It is normal for the charging contactors to only make noise while opening.

5. Verify the Hybrid/EV Battery DC Charging Negative Contactor is heard opening.
 - **If the Hybrid/EV Battery DC Charging Negative Contactor operation cannot be heard**
Refer to Hybrid/EV Battery DC Charging Negative Contactor.
 - **If the Hybrid/EV Battery DC Charging Negative Contactor operation can be heard**
6. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to open.
7. Verify the Hybrid/EV Battery DC Charging Positive Contactor is heard opening.
 - **If the Hybrid/EV Battery DC Charging Positive Contactor operation cannot be heard**
Refer to Hybrid/EV Battery DC Charging Positive Contactor.
 - **If the Hybrid/EV Battery DC Charging Positive Contactor operation can be heard**

NOTE: It is normal for the Hybrid/EV Battery DC Charging Negative Contactor to be slightly quieter than the positive contactor.

8. Repeat opening and closing of both DC Charging contactors several times while comparing the sound made by each contactor.
 - **If either contactor intermittently stops working**
Replace the T24 Battery Charger - DC
 - **If both contactors consistently generate sound**
9. All OK.

Circuit/System Testing

Hybrid/EV Battery DC Charging Negative Contactor

1. Vehicle OFF. Disconnect the X9 harness connector at the T24 Battery Charger - DC.
2. Test for less than 10 Ω between the ground circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 3
 - **If 10 Ω or greater**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Connect the X9 harness connector at the T24 Battery Charger - DC.

NOTE: The following setup steps **MUST BE PERFORMED EXACTLY** in order to exercise the contactor.

4. Vehicle OFF, turn ON the park lamps.

NOTE: **DO NOT** press the power button and enter Vehicle in Service Mode or Vehicle ON.

5. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore P0ABC after pulling the S15 Manual Service Disconnect.

6. Disconnect the S15 Manual Service Disconnect. Disconnect the X9 harness connector at the T24 Battery Charger - DC. Connect a test lamp between the control circuit terminal 4 and ground.

7. Verify that the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid 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, replace the K114B Hybrid Powertrain Control Module 2.

- **If the test lamp is OFF**

NOTE: DO NOT use the scan tool Release Control button to turn OFF the contactor. Once the scan tool Release Control button is pushed the setup steps will need to be restarted from the beginning.

8. Command the Hybrid/EV Battery DC Charging Negative Contactor CLOSED and ALL OPEN with a scan tool. Verify that the test lamp turns ON and OFF.

- **If the test lamp does not turn ON and OFF**

1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid Powertrain Control Module 2.

2. Test for infinite resistance between 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 Powertrain Control Module 2.

- **If the test lamp does turn ON and OFF**

9. Replace the T24 Battery Charger - DC.

Hybrid/EV Battery DC Charging Positive Contactor

1. Vehicle OFF. Disconnect the X9 harness connector at the T24 Battery Charger - DC.

2. Test for less than 10 Ω between the ground circuit terminals listed below and ground.

- Terminal 1

- Terminal 3

- **If 10 Ω or greater**

1. Vehicle OFF.

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

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , repair the open/high resistance in the ground connection.

- **If less than 10 Ω**

3. Connect the X9 harness connector at the T24 Battery Charger - DC.

NOTE: The following setup steps MUST BE PERFORMED EXACTLY in order to exercise the contactor.

4. Vehicle OFF, turn ON the park lamps.

NOTE: DO NOT press the power button and enter Vehicle in Service Mode or Vehicle ON.

5. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore P0ABC after pulling the S15 Manual Service Disconnect.

6. Disconnect the S15 Manual Service Disconnect. Disconnect the X9 harness connector at the T24 Battery Charger - DC. Connect a test lamp between the control circuit terminal 2 and ground.

NOTE: DO NOT use the scan tool Release Control button to turn OFF the contactor. Once the scan tool Release Control button is pushed the setup steps will need to be restarted from the beginning.

7. Verify that the test lamp is OFF.

- **If the test lamp is ON**

1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid 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, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If the test lamp is OFF**

8. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool.

9. Verify that the test lamp turns ON and OFF.

- **If the test lamp does not turn ON and OFF**

1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.

2. Test for infinite resistance between 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.

- **If the test lamp does turn ON and OFF**

10. Replace the T24 Battery Charger - DC.

Repair Instructions

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

[Control Module References](#) for T24 battery charger - DC and hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P301E: HYBRID/EV BATTERY DC CHARGING CONTACTORS OPENED UNDER LOAD - DC CHARGING 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P301E

Hybrid/EV Battery DC Charging Contactors Opened Under Load - DC Charging Disabled

Circuit/System Description

The hybrid/EV battery contains 4 high voltage contactors for normal operation and regular (AC) charging, and 1 module. In vehicles with DC charging capability, there are two additional DC contactors that are housed in the battery charger - DC. The high voltage contactors allow the high voltage DC batteries to be connected to the vehicle or safely contain the high voltage DC within the hybrid/EV battery assembly. The 6 high voltage contactors consist of a main positive high voltage contactor, main negative high voltage contactor, AC charge positive high voltage contactor, precharge contactor, DC positive contactor, and DC negative contactor. The 1 module is the hybrid/EV battery pack coolant heater module. The contactors and module close and open in a specific sequence controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 supplies voltage to the control circuit for the high voltage contactors/module. Ground is provided through the case ground and chassis.

The hybrid/EV powertrain control module 2 measures internal voltages, currents, and temperatures within the battery charger - DC and charge receptacle and verifies they are within the proper range. During DC charging the hybrid/EV powertrain control module 2 monitors for the charging cable being disconnected while under load during DC charging.

Conditions for Running the DTC

The charge current is greater than 5 A for 12.5 ms.

Conditions for Setting the DTC

The accumulated current when DC charging contactors are opened is greater than 30, 000 A.

Action Taken When the DTC Sets

DTC P301E is a type A DTC.

Conditions for Clearing the DTC

- DTC P301E is a type A DTC.
- The **DC Charging Disabled Reset** function must be performed with a scan tool before clear codes

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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 in Service Mode.

NOTE: The DC Charge Port Temperature should be close to ambient temperature without the cord set plugged in.

2. Observe the scan tool DC Charge Port Temperature parameter. The reading should be between -40 and +125 $\text{Å},\text{Å}^{\circ}\text{C}$ (-40 and +257 $\text{Å},\text{Å}^{\circ}\text{F}$).

- **The reading is not within the specified range**

Refer to Circuit/System Testing.

- **The reading is within the specified range**

NOTE: Damage can include cracks, breaks, bent pins or missing parts.

3. Vehicle OFF. Visually inspect the X98 Hybrid/EV Battery Charger Receptacle and high voltage cables for damage.

- **The receptacle or cables are damaged**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **The receptacle and cables are visually OK**

4. Verify that DTC P301F does not set while operating the vehicle within the Conditions for Running the DTC.

- **If the DTC is set**

Contact the GM Technical Assistance Center to report a DC Charge Station problem.

- **If the DTC is not set**

5. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 10 Ω between the low reference terminal 6 and ground.

- **If 10 Ω or greater**

1. Vehicle OFF, disconnect the X2 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 - 4.95 V between the signal circuit terminal 5 and ground.

- **If less than 4.8 V**

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

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

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

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

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

- **If greater than 4.95 V**

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 signal circuit and ground.

- If between 1 - 5.2 V, repair the short to voltage on the circuit.

- If greater than 5.2 V, repair the short to voltage on the circuit and replace the X98 Hybrid/EV Battery Charger Receptacle.
- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If between 4.8 - 4.95 V**

5. Replace the X98 Hybrid/EV Battery Charger Receptacle.

Component Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.
2. Test for 2.76 - 2.93k Ω at approximately 25 Å , $\text{Å}^{\circ}\text{C}$ (77 Å , $\text{Å}^{\circ}\text{F}$) between the signal terminal 5 and the low reference terminal 6.
 - **If not within the specified range**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If within the specified range**

3. All OK.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P3027-P302A: CHARGE PORT LOCK POSITION SENSOR (DUBAI)

Diagnostic Instructions

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

DTC Descriptors

DTC P3027

Charge Port Lock Position Sensor Performance - Signal Low

DTC P3028

Charge Port Lock Position Sensor Performance - Signal High

DTC P3029

Charge Port Lock Position Sensor Performance

DTC P302A

Charge Port Lock Actuator Position Sensor Not Plausible

Circuit/System Description

The hybrid/EV powertrain control module 2 activates the charge port lock to prevent the DC charge cord from being disconnected during charging. The hybrid/EV powertrain control module 2 monitors the charge port lock any time the hybrid/EV powertrain control module 2 is awake. The hybrid/EV powertrain control module 2 monitors the command and the actuator position to verify proper operation.

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Conditions for Running the DTC

P3027 and P3028

The vehicle 12 V battery system voltage is greater than 10.2 V.

P3029

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The charge port lock actuator has been commanded to LOCK for greater than 2 s.

P302A

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The charge port lock actuator has been commanded to LOCK for greater than 2 s.
- None of the following DTCs are set: P3027, P3028, P3029, P302B, P302C, P302D.

Conditions for Setting the DTC

P3027

The hybrid/EV powertrain control module 2 detects the charge port lock position sensor signal is out of range low. The signal is less than 22.94% of range for 4 s.

P3028

The hybrid/EV powertrain control module 2 detects the charge port lock position sensor signal is out of range high. The signal is greater than 94.50% of range for 4 s.

P3029

The hybrid/EV powertrain control module 2 detects the charge port lock position sensor signal is not within a valid range. The signal is within 65.80% to 81.56% of range for 4 s.

P302A

The hybrid/EV powertrain control module 2 detects the charge port lock actuator position sensor signal does not match the charge port lock position sensor signal for 8 s.

Action Taken When the DTC Sets

DTC P3027, P3028, P3029, and P302A are Type C DTCs.

Conditions for Clearing the DTC

DTC P3027, P3028, P3029, and P302A are Type C DTCs.

Reference Information

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Plug-In Charging Schematics

Connector End View Reference

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- **Wiring Repairs**

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. With a scan tool command the DC Charge Port Lock between UNLOCK and LOCK.
2. Observe the scan tool DC Charge Port Lock Position Sensor parameter. The value should change between 4.08 - 4.73 V (UNLOCKED) and 1.15 - 3.29 V (LOCKED).
 - **The value is not within the specified ranges**

Refer to Circuit/System Testing.

- **The value is within the specified ranges**
3. Begin charging using a DC Fast Charge station. Wait 1 minute. Stop charging and remove plug. Verify that P3027 - P302A is not set.

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

Refer to Circuit/System Testing.

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

4. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.
2. Test for 1.15 V or greater between the signal circuit terminal 4 and ground.
 - **If less than 1.15 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the signal circuit terminal 4 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit terminal 4 end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 4. Replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 1.15 V or greater**
3. Command the DC Charge Port Lock to LOCK with a scan tool. Test for 3.29 V or less between the signal circuit terminal 4 and ground.
 - **If greater than 3.29 V**
 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 terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V
 3. Replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If 3.29 V or less**
4. Replace the X98 Hybrid/EV Battery Charger Receptacle.

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

- [Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for hybrid/EV powertrain control module 2 replacement, programming, and setup.

DTC P302B-P302D: CHARGE PORT LOCK ACTUATOR POSITION SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P302B

Charge Port Lock Actuator Position Sensor Signal Out of Range Low

DTC P302C

Charge Port Lock Actuator Position Sensor Signal Out of Range High

DTC P302D

Charge Port Lock Actuator Position Sensor Circuit Performance

Circuit/System Description

The hybrid/EV powertrain control module 2 activates the charge port lock to prevent the DC charge cord from being disconnected during charging. The hybrid/EV powertrain control module 2 monitors the charge port lock any time the hybrid/EV powertrain control module 2 is awake. The hybrid/EV powertrain control module 2 monitors the command and the actuator position to verify proper operation.

Conditions for Running the DTC

P302B and P302C

The vehicle 12 V battery system voltage is greater than 10.2 V.

P302D

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The charge port lock actuator has been commanded to LOCK for greater than 2 s.

Conditions for Setting the DTC

P302B

The hybrid/EV powertrain control module 2 detects the charge port lock actuator position sensor signal is out of range low. The signal is less than 3% of range for 4 s.

P302C

The hybrid/EV powertrain control module 2 detects the charge port lock actuator position sensor signal is out of range high. The signal is greater than 97% of range for 4 s.

P302D

The hybrid/EV powertrain control module 2 detects the charge port lock actuator position sensor signal is not within a valid range. The signal is within 35% to 75% of range for 4 s.

Action Taken When the DTC Sets

DTC P302B, P302C, and P302D are type C DTCs.

Conditions for Clearing the DTC

DTC P302B, P302C, and P302D are type C DTCs.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Plug-In Charging System Description and Operation

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Vehicle in Service Mode. Depress the receptacle switch with a small screw driver. With a scan command the DC Charge Port Lock between UNLOCK and LOCK.

NOTE: If the receptacle switch is not fully depressed the reading will remain below 2 V.

2. Observe the scan tool DC Charge Port Lock Actuator Position Sensor parameter. The reading should change between 0.15 - 1.75 V (UNLOCKED) and 3.75 - 4.85 V (LOCKED).

- **The reading are not within the specified ranges**

Refer to Circuit/System Testing.

- **The reading are within the specified ranges**

3. Verify that DTC P302B, P302C, or P302D is not set.

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

Refer to Circuit/System Testing.

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

4. All OK.

Circuit/System Testing

1. Vehicle OFF and all vehicle systems OFF. Disconnect the X2 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference terminal 3 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 reference circuit terminal 1 and ground.
 - **If less than 4.8 V**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 5.2 V**
 1. Vehicle OFF, disconnect the X2 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 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If between 4.8 - 5.2 V**
5. Verify the scan tool DC Charge Port Lock Actuator Position Sensor parameter is less than 0.5 V.
 - **If 0.5 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 terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 0.5 V**
6. Install a 3 A fused jumper wire between the signal circuit terminal 2 and the 5 V reference circuit terminal 1.
7. Verify the scan tool DC Charge Port Lock Actuator Position Sensor parameter is greater than 4.95 V.
 - **If 4.95 V or less**
 1. Vehicle OFF, remove the jumper wire. 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 infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If greater than 4.95 V**
8. Replace the X98 Hybrid/EV Battery Charger Receptacle.

Repair Instructions

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

- **Drive Motor Battery Charger Receptacle Replacement (Dubai only with quick charge)****Drive Motor Battery Charger Receptacle Replacement (Dubai only without quick charge)**

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

DTC P302F: HYBRID/EV BATTERY DC CHARGING SYSTEM ISOLATION FAULT (NORTH AMERICA, KOREA)

Diagnostic Instructions

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

DTC Descriptors

DTC P302F

Hybrid/EV Battery DC Charging System Isolation Fault

Circuit/System Description

In vehicles with quick charge DC charging capability, RPO CBT, there are two high voltage contactors housed within the T24 battery charger - DC. These additional high voltage contactors allow the high voltage DC batteries to be connected to the X98 Hybrid/EV Battery Charger Receptacle DC charge terminals.

The hybrid/EV powertrain control module 2 measures a high impedance network within the T24 battery charger - DC to verify isolation between the DC high voltage positive and negative circuits and the vehicle chassis are within the proper range.

Conditions for Running the DTC

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The vehicle is charging.
- The battery charger - DC positive contactor is commanded CLOSED.
- The battery charger - DC negative contactor is commanded CLOSED.
- DTC P3002, P3003, P3005, P3006, P301F, P3020, P3021, or P3022 is not set.

OR

- The vehicle 12 V battery system voltage is greater than 10.2 V.
- The DC charge cable is connected.
- The charge mode is precharge.
- The battery charger - DC positive contactor is commanded OPEN.
- The battery charger - DC negative contactor is commanded OPEN.
- The difference between the sum of DC charger positive and negative voltage sensors and the battery voltage is less than 45 V for 2 s.
- DTC P3002, P3003, P3005, P3006, P301F, P3020, P3021, or P3022 is not set.

Conditions for Setting the DTC

The ratio between DC negative supply isolation voltage and DC positive supply isolation voltage is greater than 19.

Action Taken When the DTC Sets

DTC P302F is type A DTC.

Conditions for Clearing the DTC

DTC P302F is type A DTC.

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- A single high voltage contactor stuck closed may set DTC P302F.

- Condensation or water intrusion into the battery charger - DC may cause DTC P302F to set.
- A vehicle-level loss of isolation concern may cause DTC P302F to set.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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Plug-In Charging System Description and Operation

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

1. Verify that DTC P0AA1, P0AA4, P0AD9, P0ADD, P0AE2, P0AE4, P0D0A, P0D11, P1EBC, P1EBE-P1EC0, P1EC3-P1EC5, P1AF0, P1AF4, P1AF5, P1E1B-P1E1F, P1E20-P1E22, P1B0B, P1B0C, P3002, P3003, P3005, P3006, P3015, P3018, P301B-P301F, P3020, P3021, or P3022 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. Remove all vehicle chargers.
3. Vehicle ON.
4. Observe the scan tool hybrid powertrain control module 2 DC Negative Supply Isolation Voltage parameter. The reading should be 0 V.
 - **If greater than 0 V**

NOTE: The following setup steps **MUST BE PERFORMED EXACTLY** in order to exercise the contactors.

1. Vehicle OFF. Turn ON the park lamps.
2. DO NOT press the power button and enter Vehicle in Service Mode or Vehicle ON.

NOTE: There are two contactor control functions available on the scan tool. Make sure you select the DC charging contactor control and not the battery contactor control.

3. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore P0ABC after pulling the S15 Manual Service Disconnect. cardiagn.com

4. Disconnect the S15 Manual Service Disconnect.

5. DO NOT use the scan tool Release Control button to turn OFF any of the contactors. Once the scan tool Release Control button is pushed the Circuit/System Verification will need to be restarted from the beginning including reinstalling the S15 Manual Service Disconnect and clearing DTCs.

6. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to open.

NOTE: It is normal for the charging contactors to only make noise while opening.

7. Verify the Hybrid/EV Battery DC Charging Positive Contactor is heard opening.

- If the Hybrid/EV Battery DC Charging Positive Contactor operation cannot be heard, refer to Circuit/System Testing, Hybrid/EV Battery DC Charging Positive Contactor.
- If the Hybrid/EV Battery DC Charging Positive Contactor operation is heard, refer to Circuit/System Testing, Hybrid/EV Battery DC Charging Negative Voltage Sensor.

• **If 0 V**

5. Observe the scan tool hybrid powertrain control module 2 DC Positive Supply Isolation Voltage parameter. The reading should be 0 V.

• **If greater than 0 V**

NOTE: The following setup steps **MUST BE PERFORMED EXACTLY** in order to exercise the contactors.

1. Vehicle OFF. Turn ON the park lamps.

2. DO NOT press the power button and enter Vehicle in Service Mode or Vehicle ON.

NOTE: There are two contactor control functions available on the scan tool. Make sure you select the DC charging contactor control and not the battery contactor control.

3. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore P0ABC after pulling the S15 Manual Service Disconnect.

4. Disconnect the S15 Manual Service Disconnect.

5. DO NOT use the scan tool Release Control button to turn OFF any of the contactors. Once the scan tool Release Control button is pushed the Circuit/System Verification will need to be restarted from the beginning including reinstalling the S15 Manual Service Disconnect and clearing DTCs.

6. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to open.

NOTE: It is normal for the charging contactors to only make noise while opening.

7. Verify the Hybrid/EV Battery DC Charging Positive Contactor is heard opening.

- If the Hybrid/EV Battery DC Charging Negative Contactor operation cannot be heard, refer to Circuit/System Testing, Hybrid/EV Battery DC Charging Negative Contactor.
- If the Hybrid/EV Battery DC Charging Negative Contactor operation is heard, refer to Circuit/System Testing, Hybrid/EV Battery DC Charging Positive Voltage Sensor.

• **If 0 V**

6. Refer to Circuit/System Testing, DC Charging System Isolation Fault.

Circuit/System Testing

Hybrid/EV Battery DC Charging Negative Voltage Sensor

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Disconnect the X9 harness connector at the T24 Battery Charger - DC. cardiagh.com

2. Test for less than 10 Ω between the ground circuit terminal 9 and ground.

- **If 10 Ω or greater**

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

- **If less than 10 Ω**

3. Vehicle in Service Mode.

4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 8 and ground.

- **If less than 4.8 V**

1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the 5 V reference circuit terminal 8 X9 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for infinite resistance between the 5 V reference circuit terminal 5 X2 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
4. Test for less than 2 Ω in the 5 V reference circuit terminal 8 X9 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 5.2 V or greater**

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 5 V reference circuit terminal 8 X9 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 1 V between the 5 V reference circuit terminal 5 X2 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 within the specified range**

5. Test for less than 1 V between the signal circuit terminal 11 X9 and ground.

- **If 1 V or greater**

1. Vehicle OFF, disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2. Vehicle in Service Mode.
2. Test for less than 1 V between the signal circuit and ground.
 - If between 1 - 5 V, repair the short to voltage on the circuit.
 - If greater than 5 V, repair the short to voltage on the circuit and replace the T24 Battery Charger - DC.
 - If less than 1 V
3. Replace the K114B Hybrid/EV Powertrain Control Module 2.
4. Verify that DTC P3002, P3003, P301F, or P3020 does not set while operating the vehicle within the Conditions for Running the DTC.
 - If any of the DTCs are set, replace the T24 Battery Charger - DC.
 - If none of the DTCs are set

5. All OK.

- **If less than 1 V**

6. Vehicle OFF, install a 3 A fused jumper wire between the signal circuit terminal 11 and the 5 V reference circuit terminal 8. Vehicle in Service Mode.

7. Verify the scan tool DC Negative Supply Isolation Voltage parameter is greater than 500 V. [vardagn.com](http://www.vardagn.com)

- **If less than 500 V**

1. Test for infinite resistance between the signal circuit and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
2. 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 500 V or greater**

8. Replace the T24 Battery Charger - DC.

Hybrid/EV Battery DC Charging Positive Voltage Sensor

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Disconnect the X9 harness connector at the T24 Battery Charger - DC.
2. Test for less than 10 Ω between the ground circuit terminal 9 and ground.
 - **If 10 Ω or greater**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 10 Ω**
3. Vehicle in Service Mode.
4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 8 and ground.
 - **If less than 4.8 V**
 1. Vehicle OFF, disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the 5 V reference circuit terminal 8 X9 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for infinite resistance between the 5 V reference circuit terminal 5 X2 and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω in the 5 V reference circuit terminal 8 X9 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 5.2 V or greater**
 1. Vehicle OFF, disconnect the X2 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 5 V reference circuit terminal 8 X9 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 1 V between the 5 V reference circuit terminal 5 X2 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 within the specified range**
5. Test for less than 1 V between the signal circuit terminal 10 X9 and ground.
 - **If 1 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 between 1 - 5 V, repair the short to voltage on the circuit.

- If greater than 5 V, repair the short to voltage on the circuit and replace the T24 Battery Charger - DC.
 - If less than 1 V
3. Replace the K114B Hybrid/EV Powertrain Control Module 2.
 4. Verify that DTC P3002, P3003, P301F, or P3020 does not set while operating the vehicle within the Conditions for Running the DTC.
 - If any of the DTCs are set, replace the T24 Battery Charger - DC.
 - If none of the DTCs are set
 5. All OK.
 - **If less than 1 V**
 6. Vehicle OFF, install a 3 A fused jumper wire between the signal circuit terminal 10 and the 5 V reference circuit terminal 8. Vehicle in Service Mode.
 7. Verify the scan tool DC Positive Supply Isolation Voltage parameter is greater than 500 V.
 - **If less than 500 V**
 1. Test for infinite resistance between the signal circuit and ground.
 - If less infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 2. 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 500 V or greater**
 8. Replace the T24 Battery Charger - DC.

Hybrid/EV Battery DC Charging Negative Contactor

1. Vehicle OFF. Disconnect the X9 harness connector at the T24 Battery Charger - DC.
2. Test for less than 10 Ω between the ground circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 3
 - **If 10 Ω or greater**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Connect the X9 harness connector at the T24 Battery Charger - DC.

NOTE: The following setup steps **MUST BE PERFORMED EXACTLY** in order to exercise the contactor.

4. Vehicle OFF, turn ON the park lamps.

NOTE: **DO NOT** press the power button and enter Vehicle in Service Mode or Vehicle ON.

5. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: Ignore P0ABC after pulling the S15 Manual Service Disconnect.

6. Disconnect the S15 Manual Service Disconnect. Disconnect the X9 harness connector at the T24 Battery Charger - DC. Connect a test lamp between the control circuit terminal 4 and ground.
7. Verify that the test lamp is OFF.
 - **If the test lamp is ON**

1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid 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, replace the K114B Hybrid Powertrain Control Module 2.
- **If the test lamp is OFF**

NOTE: **DO NOT use the scan tool Release Control button to turn OFF the contactor. Once the scan tool Release Control button is pushed the setup steps will need to be restarted from the beginning.**

8. Command the Hybrid/EV Battery DC Charging Negative Contactor CLOSED and ALL OPEN with a scan tool. Verify that the test lamp turns ON and OFF.
 - **If the test lamp does not turn ON and OFF**
 1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid Powertrain Control Module 2.
 2. Test for infinite resistance between 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 Powertrain Control Module 2.
 - **If the test lamp does turn ON and OFF**
9. Replace the T24 Battery Charger - DC.

Hybrid/EV Battery DC Charging Positive Contactor

1. Vehicle OFF. Disconnect the X9 harness connector at the T24 Battery Charger - DC.
2. Test for less than 10 Ω between the ground circuit terminals listed below and ground.
 - Terminal 1
 - Terminal 3
 - **If 10 Ω or greater**
 1. Vehicle OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Connect the X9 harness connector at the T24 Battery Charger - DC.

NOTE: **The following setup steps MUST BE PERFORMED EXACTLY in order to exercise the contactor.**

4. Vehicle OFF, turn ON the park lamps.

NOTE: **DO NOT press the power button and enter Vehicle in Service Mode or Vehicle ON.**

5. Command the Hybrid/EV Battery DC Charging Contactors ALL OPEN with a scan tool.

NOTE: **Ignore P0ABC after pulling the S15 Manual Service Disconnect.**

6. Disconnect the S15 Manual Service Disconnect. Disconnect the X9 harness connector at the T24 Battery Charger - DC. Connect a test lamp between the control circuit terminal 2 and ground.

NOTE: **DO NOT use the scan tool Release Control button to turn OFF the contactor. Once the scan tool Release Control button is pushed the setup steps will need**

to be restarted from the beginning.

7. Verify that the test lamp is OFF.
 - **If the test lamp is ON**
 1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid 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, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If the test lamp is OFF**
8. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool.
9. Verify that the test lamp turns ON and OFF.
 - **If the test lamp does not turn ON and OFF**
 1. Vehicle OFF, turn OFF the park lamps. Remove the test lamp. Disconnect the X1 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between 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.
 - **If the test lamp does turn ON and OFF**
10. Replace the T24 Battery Charger - DC.

DC Charging System Isolation Fault

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. Perform the Circuit/System Verification steps of the [Loss of Isolation on the High Voltage Main Bus](#) procedure.

- If the Circuit/System Verification steps identify a vehicle-level loss of isolation concern

Repair vehicle as applicable.

- If the Circuit/System Verification steps do not identify a vehicle-level loss of isolation concern

2. Vehicle OFF, disable the high voltage. Refer to [High Voltage Disabling](#).

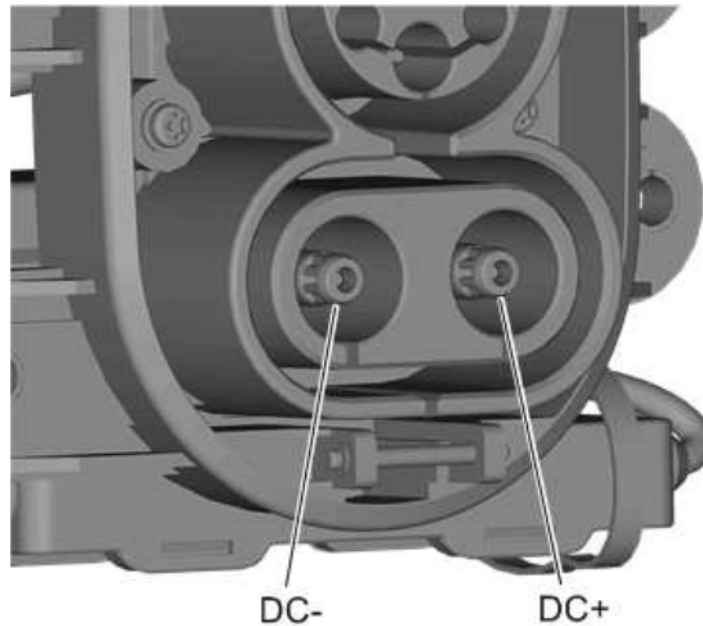


Fig. 13: Terminal DC- And DC+

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NOTE: Only perform the following continuity tests using the EL-50772 Insulation Multimeter or equivalent.

NOTE: Unlike other HV components in the system, the DC charge terminals of the T24 Battery Charger - DC should not be tested at the 500 V range.

3. Ensure only the **EL-50772** Insulation Multimeter or equivalent is used with this procedure. Select the Isolation Test setting, then select the 250 V range. Refer to [Troubleshooting With an Insulation Multimeter](#) for important usage instructions.

NOTE: The following step assumes the X98 Hybrid/EV Battery Charger Receptacle high voltage DC cable is connected to the T24 Battery Charger - DC.

4. Test for 15M Ω between the terminals listed below at the X98 Hybrid/EV Battery Charger Receptacle and chassis ground:

- Terminal DC-
- Terminal DC+
- **If less than 15M Ω on either circuit**

1. Disconnect the X2 harness connector at the T24 Battery Charger - DC.

2. Select the Isolation Test setting, then change the voltage range from 250 V to the 500 V range.

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle.

3. Test for 550M Ω between the circuit terminals listed below and chassis ground:

- Terminal DC-
- Terminal DC+
- If less than 550M Ω , replace the X98 Hybrid/EV Battery Charger Receptacle.
- If 550M Ω replace the T24 Battery Charger - DC.

- **If greater than 15M Ω on either circuit**

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Replace the T24 Battery Charger - DC and the X98 Hybrid/EV Battery Charger Receptacle.

- If 15M Ω on both circuits

5. Connect all disconnected components and connectors and enable high voltage.

NOTE: It may be necessary to connect the vehicle to a DC Charge Station.

6. Verify that DTC P302F does not set while operating the vehicle within the Conditions for Running the DTC.

- If DTC P302F is set

Contact the GM Technical Assistance Center to report a DC Charge Station problem.

- If DTC P302F is not set

7. All OK.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#) for X98 Hybrid/EV Battery Charger Receptacle and harness replacement.
- [Control Module References](#) for the T24 battery charger - DC and hybrid/EV powertrain control module 2 replacement, programming and setup.

DTC P325C OR P325D: HYBRID/EV BATTERY DC CHARGING COMMUNICATION GATEWAY MODULE PROCESSOR PERFORMANCE

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P325C

Hybrid/EV Battery DC Charging Communication Gateway Module Processor Performance

DTC P325D

Hybrid/EV Battery DC Charging Communication Gateway Module Main Processor Performance

Circuit/System Description

This diagnostic runs when the vehicle is connected to a DC fast charge station. This is an internal fault detection of the power line communication module and no external circuits are involved.

Conditions for Running the DTC

Vehicle is connected to a DC fast charge station.

Conditions for Setting the DTC

The control module has detected an internal malfunction.

Actions Taken When the DTC Sets

DTC P325C or P325D is a type B DTC.

Conditions for Clearing the DTC

DTC P325C or P325D is a type B DTC.

Reference Information

Schematic Reference

[Plug-In Charging Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Description and Operation

[Plug-In Charging 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. Connect the vehicle to a DC fast charge station.
2. Verify DTC P325C or P325D is not set.
 - **If either of the DTCs are set**

Replace the K190 Power Line Communication Module.
 - **If none of the DTCs are set**
3. All OK.

[Repair Instructions](#)

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

[Control Module References](#) for Power Line Communication Module replacement, programming, and setup.

DTC P325F : HYBRID/EV BATTERY DC CHARGING COMMUNICATION GATEWAY MODULE - OFFBOARD DC CHARGER COMMUNICATION INTERRUPTED (NORTH AMERICA, KOREA)

[Diagnostic Instructions](#)

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

[DTC Descriptor](#)

DTC P325F

Hybrid/EV Battery DC Charging Communication Gateway Module - Offboard DC Charger Communication Interrupted

[Circuit/System Description](#)

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The hybrid/EV powertrain control module 2 monitors the control pilot signal from the DC fast station. When the hybrid/EV powertrain control module 2 detects a 5% duty cycle pulse width modulated (PWM) signal on the control

pilot circuit, the hybrid/EV powertrain control module 2 commands the power line communication module to begin communication with the DC fast charge station.

The power line communication module communicates to the DC fast charge station using power line communication (PLC) over the control pilot circuit. The specific PLC technology used is HomePlug Green PHY to allow for digital communication over a single wire.

Conditions for Running the DTC

Vehicle is connected to a DC fast charge station and is charging.

Conditions for Setting the DTC

Communication between the power line communication module and the DC fast charge station is interrupted.

Actions Taken When the DTC Sets

DTC 325F is type C DTC.

Conditions for Clearing the DTC

DTC 325F is type C DTC.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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

For equivalent regional tools, refer to **Special Tools**.

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:

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- 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. Clear the DTC, connect the vehicle to a known good DC fast charge station.
2. Allow the vehicle to charge for at least 20 minutes.
3. Verify DTC P325F is set.

- **If DTC P325F is not set**

Contact the GM Technical Assistance Center to report a DC fast charge station problem.

- **If DTC P325F is set**

4. Vehicle OFF, disable the high voltage at the T18 Battery Charger. Refer to [High Voltage Disabling](#) . Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2. Disconnect the X2 harness connector at the K190 Power Line Communication Module.

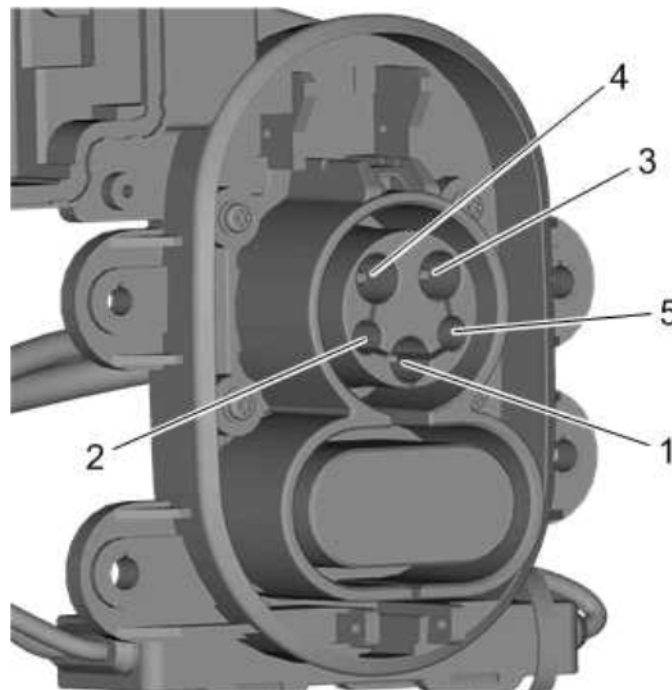


Fig. 14: Hybrid/EV Battery Charger Receptacle

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NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

5. Test for infinite resistance between the control pilot signal circuit terminal 2 of the X98 Hybrid/EV Battery Charger Receptacle and the terminals listed below:
 - Terminal 1

- Terminal 3
- Terminal 4
- Terminal 5
- DC+
- DC-
- **If less than infinite resistance**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: This test is performed on the vehicle side of the harness connector.

2. Test for infinite resistance between the harness connector control pilot signal circuit terminal 2 and the terminals listed below:

- Terminal 4
- Terminal 1
- Terminal 5
- Terminal 3
- DC+
- DC-
 - If less than infinite resistance, repair the short between the circuits.
 - If infinite resistance, replace the X98 Hybrid/EV Battery Charger Receptacle.
- **If infinite resistance**

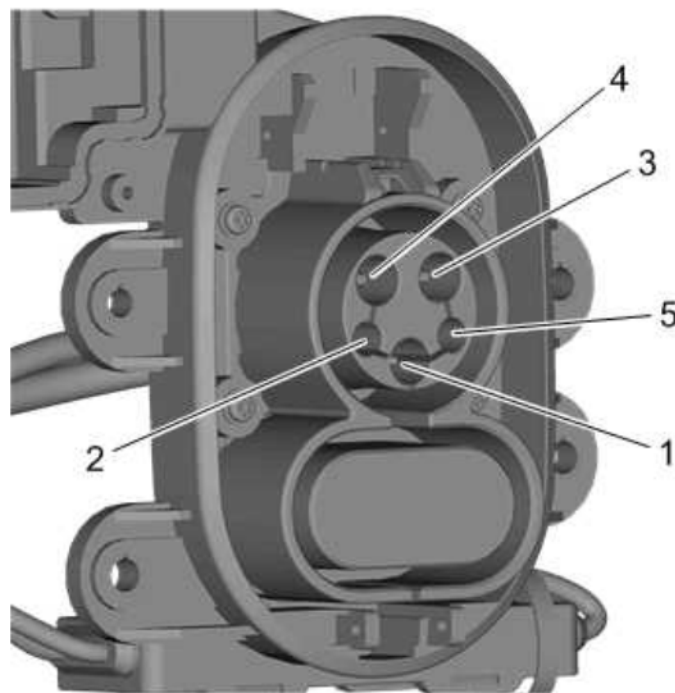


Fig. 15: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

6. Test for less than 2 Ω in the control pilot signal circuit end to end between the terminals listed below:

- K190 Power Line Communication Module terminal 8 X2 and X98 Hybrid/EV Battery Charger Receptacle 2
- K114B Hybrid/EV Powertrain Control Module 2 terminal 8 X2 and X98 Hybrid/EV Battery Charger Receptacle 2
- **If 2 Ω or greater**

1. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: This test is performed at the X98 Hybrid/EV Battery Charger Receptacle.

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

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- If 2 Ω or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.

- If less than 2 Ω , repair the open/high resistance in the circuit.
- If less than 2 Ω

7. Replace the K190 Power Line Communication Module.

Repair Instructions

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

- **Drive Motor Battery Charger Receptacle Replacement (Except Dubai with quick charge)Drive Motor Battery Charger Receptacle Replacement (Except Dubai without quick charge)**
- **Control Module References** for Power Line Communication Module replacement, programming and setup.

PLUG-IN CHARGING MALFUNCTION (AC CHARGING (NORTH AMERICA, KOREA))

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control Pilot Signal	P0CF4, P0CF5, P0CF6, P0CF9, P0D01, 1	P0CF4, P0CF5, P0CF6, 1	P0CF4, P0CF5, P0CF6, P0CF9, 1	P0CF4, P0CF5, P0CF6, 1
Proximity Status Signal	P0D58, 1	P0D59, 1	P0D59, 1	-
Voltage AC Line 1	1	P0D3F, P1EE6	1	-
Voltage AC Neutral Line 2	1	P1EE6	1	-
Voltage AC Ground	-	P0D59, 1	1	-
1. Plug In Charging Malfunction				

Circuit/System Description

The drive motor battery charger cable allows the vehicle to be charged using a common household power outlet. The drive motor battery charger cable contains LEDs that indicate the status of the drive motor battery charger cable. The drive motor battery charger cable automatically prohibits voltage transfer to the hybrid/EV battery charger receptacle and the Fault Indicator is illuminated red if it senses internal faults or inadequate household voltage. If the drive motor battery charger cable senses no faults, the AC Present Indicator is illuminated solid green.

When the hybrid/EV powertrain control module 2 senses the drive motor battery charger cable is connected to the vehicle charge receptacle, it will communicate with the off-vehicle charge equipment to ensure compatibility and proper function. The hybrid/EV powertrain control module 2 will then indicate the status of charging events (including user-programmable delays) to the user via instrument panel mounted plug-in charging status indicator LEDs and audio tones.

Diagnostic Aids

- If the drive motor battery charger cable Fault Indicator is illuminated solid red or flashing red before plugging into the vehicle, the charger cable will need to be diagnosed first.
- Ensure delayed charging is not enabled. Delay charging can be programmed either in the vehicle or also in certain off-vehicle Charge Stations.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

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COMPONENT CONNECTOR END VIEWS - INDEX

Plug-In Charging 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

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

Circuit/System Verification

1. Vehicle ON, verify no DTCs are set.

- **If DTCs are set**

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

- **If no DTCs are set**

2. Vehicle OFF. With the charge cord NOT connected to the vehicle battery charger receptacle, verify the vehicle plug-in charging status indicators are OFF.

- **If the vehicle plug-in charging status indicators are not OFF with the charge cord disconnected from the vehicle**

Refer to [Plug-In Charging Indicator Malfunction](#).

- **If the vehicle plug-in charging status indicators are OFF**

3. Vehicle OFF and connect the charge cord to the vehicle battery charger receptacle.

4. Verify the vehicle charge status indicator is operating properly.

- **If the vehicle charge status indicator is solid yellow**

Refer to Circuit/System Testing.

- **If the vehicle charge status indicator is not illuminated**

1. Vehicle ON.

NOTE: **Vehicle must be ON and not in Service Mode for message operation.**

2. Verify the Charge Cord Connected message is displayed in the instrument panel/message center.

- If the Charge Cord Connected message is displayed, refer to [Plug-In Charging Indicator Malfunction](#).
- If the Charge Cord Connected message is NOT displayed

3. Refer to Circuit/System Testing.

- **If the vehicle charge indicator is operating properly**

NOTE: **The Charge History parameters record the conditions present during the last 5 charge events.**

5. Review the K114B Hybrid/EV Powertrain Control Module 2, Charge History Scan Tool Parameters. Inspect for any conditions that prohibited AC Charging.

- **If an off-vehicle charge cord/station condition or delayed charging prohibited AC Charging**

The vehicle is OK. Advise customer about delayed charging operation or charge cord/station condition.

- **If an off-vehicle condition or delayed charging was not observed**

6. 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. Connect the customer's drive motor battery charger cable to household power outlet, but not the vehicle battery charger receptacle.

2. After 25 seconds, verify the drive motor battery charger cable AC Present Indicator illuminates solid green.

- **If the drive motor battery charger cable AC Present Indicator does not illuminate solid green**

1. Connect a known good drive motor battery charger cable to the same household power outlet.

2. After 25 seconds, verify the known good drive motor battery charger cable AC Present Indicator illuminates solid green.

- If the known good drive motor battery charger cable AC Present Indicator illuminates solid green, replace the customer's drive motor battery charger cable.
- If the known good drive motor battery charger cable AC Present Indicator does not illuminate solid green, have the service provider inspect the household power outlet for insufficient voltage, high frequency noise, or open/high resistance.
- **If the drive motor battery charger cable AC Present Indicator does illuminate solid green**

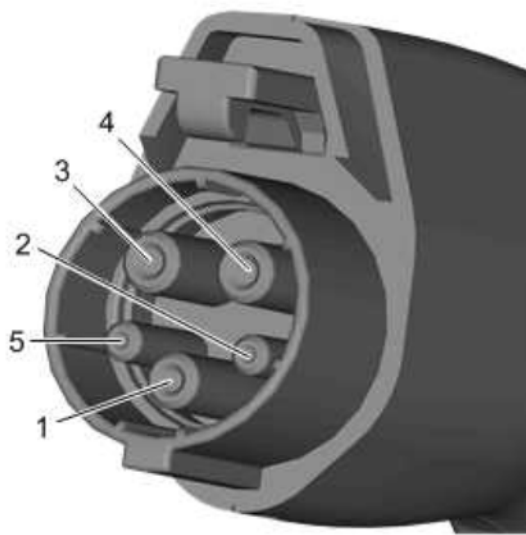


Fig. 16: Drive Motor Battery Charger Cable Terminals

Courtesy of GENERAL MOTORS COMPANY

3. Test for greater than 1 V between the low voltage circuits listed below on drive motor battery charger cable.
 - Control pilot signal circuit terminal 2
 - Proximity status signal circuit terminal 5
 - **If less than 1 V**

Replace drive motor battery charger cable.

- **If greater than 1 V**

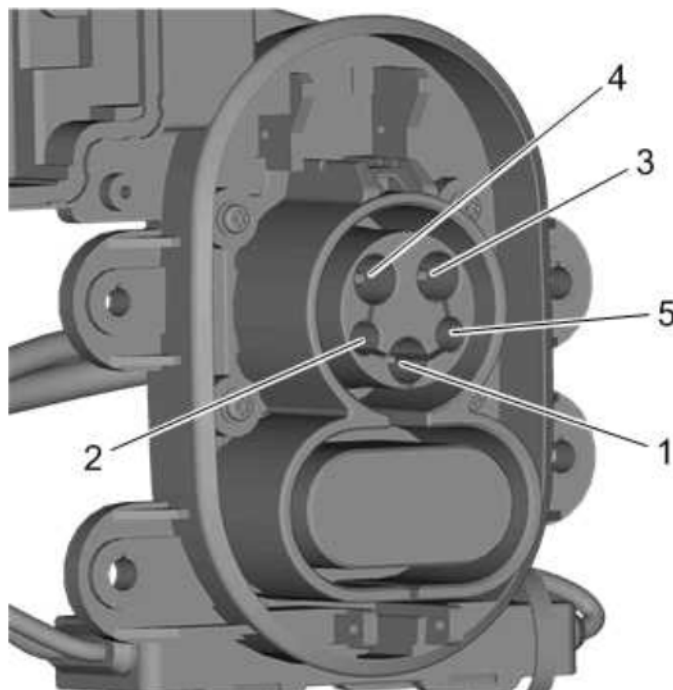


Fig. 17: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: When measuring resistance observe proper meter polarity by connecting the common/ground meter probe to ground/vehicle chassis.

NOTE: You must measure with a high-impedance Digital Multimeter (DMM) such as the EL-39200 or equivalent.

4. Vehicle OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Test for 100k Ω - 4M Ω between the control pilot signal terminal 2 at the X98 Hybrid/EV Battery Charger Receptacle and ground.
 - **If 4M Ω greater**
 1. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2
 2. Test for 2 Ω in the control pilot signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 100k Ω**
 1. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2
 2. Test for infinite resistance between the control pilot signal circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If within the specified range**
5. Test for less than 10 Ω between the Voltage AC Ground terminal 1 at the X98 Hybrid/EV Battery Charger Receptacle and ground.
 - **If 10 Ω or greater**

NOTE: G108 is located behind the front fender.

1. Disconnect the G108 ring terminal. Refer to Ground Nut removal in [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#).
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If less than 2 Ω , clean and reinstall the G108 ring terminal and ground nut.
 - **If less than 10 Ω**
6. Vehicle in Service Mode.
 7. Test for less than 1 V between the control pilot signal terminal 2 at the X98 Hybrid/EV Battery Charger Receptacle and ground.
 - **If 1 V or greater**
 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 pilot signal circuit and ground.
 - If greater than 1 V, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If less than 1 V**

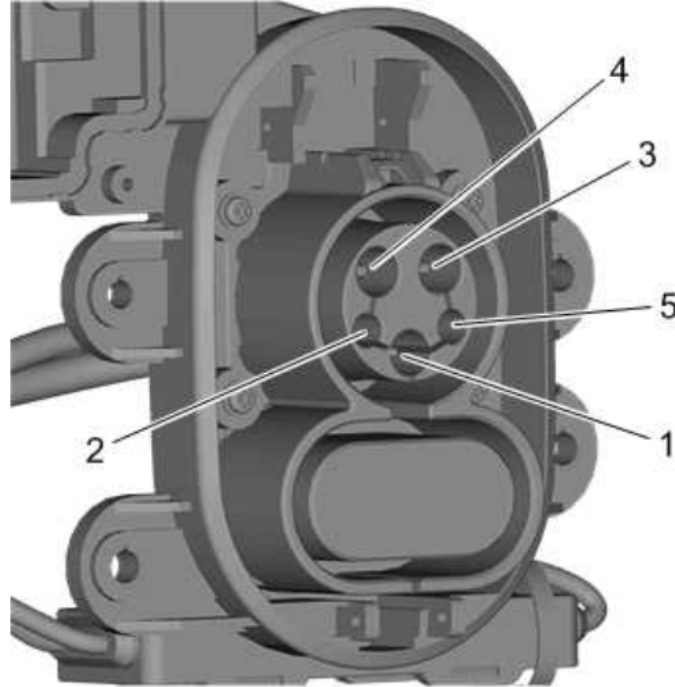


Fig. 18: Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

8. Test for 4.2 - 4.8 V between the signal circuit terminal 5 and ground.

- **If less than 4.2 V**

1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for 4.8 V or greater between the signal circuit terminal 5 and ground.

- If less than 4.8 V

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

2. Test for infinite resistance between the signal circuit terminal 5 and ground.

- If less than infinite resistance, repair the short to ground in 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 4.8 V or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If greater than 4.8 V**

1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

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

- If greater than 5.2 V

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

2. Vehicle in Service Mode. Test for less than 1 V between the signal circuit terminal 5 and ground.

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

- If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

- If within 4.8 - 5.2 V

3. Test for 2.565 - 2.835K Ω between the signal circuit terminal 5 and the low reference circuit terminal 1 at the face of the X98 Hybrid/EV Battery Charger Receptacle.

- If not within the specified range, replace the X98 Hybrid/EV Battery Charger Receptacle.
- If within the specified range, replace the K114B Hybrid/EV Powertrain Control Module 2.

• **If within 4.2 - 4.8 V**

9. Vehicle OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the X2 harness connector at the T18 Battery Charger, the X2 connector at the K114B Hybrid/EV Powertrain Control Module 2 and the X2 connector at the K190 Power Line Communication Module.

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

10. Test for infinite resistance between the terminals listed below at the X98 Hybrid/EV Battery Charger Receptacle:

- Voltage AC Line 1 terminal 3 and Voltage AC Neutral Line 2 terminal 4
- Voltage AC Line 1 terminal 3 and Voltage AC Ground terminal 1
- Voltage AC Line 1 terminal 3 and Control pilot signal circuit terminal 2
- Voltage AC Line 1 terminal 3 and Proximity status signal circuit terminal 5
- Voltage AC Neutral Line 2 terminal 4 and Voltage AC Ground terminal 1
- Voltage AC Neutral Line 2 terminal 4 and Control pilot signal circuit terminal 2
- Voltage AC Neutral Line 2 terminal 4 and Proximity status signal circuit terminal 5
- Voltage AC Ground terminal 1 and Control pilot signal circuit terminal 2
- Control pilot signal circuit terminal 2 and Proximity status signal circuit terminal 5
- **If less than infinite resistance**

Repair the short between the circuits.

- **If infinite resistance**

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

11. Test for less than 10 Ω between the terminals listed below:

- Voltage AC Line 1 terminal 3 at the X98 Hybrid/EV Battery Charger Receptacle and T18 Battery Charger terminal 1 X2
- Voltage AC Neutral Line 2 terminal 4 at the X98 Hybrid/EV Battery Charger Receptacle and T18 Battery Charger terminal 4 X2
- **If 10 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 10 Ω**
- **If infinite resistance**

12. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

13. Test for 2.56 - 2.84k Ω between the Voltage AC Ground terminal 1 and Proximity status signal circuit terminal 5 at the face of the X98 Hybrid/EV Battery Charger Receptacle.

- **If not within the specified range**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If within the specified range**

NOTE: This test is performed on the vehicle side of the harness connector.

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14. Test for infinite resistance between the Proximity status signal circuit terminal 5 of the harness connector and ground.

- **If less than infinite resistance**

Repair short to ground on the circuit.

- **If infinite resistance**

15. Replace and program the K114B Hybrid/EV Powertrain Control Module 2.

16. Repeat Circuit/System Verification and confirm vehicle is All OK.

- **If Circuit/System Verification was not All OK**

Replace the T18 Battery Charger.

- **If Circuit/System Verification was All OK**

17. All OK.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Dubai only without quick charge\)](#)
- [Control Module References](#) for T18 battery charger or K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

PLUG-IN CHARGING MALFUNCTION (DC CHARGING (NORTH AMERICA, KOREA))

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control Pilot Signal	P0CF4, P0CF5, P0CF6, P0CF9, P0D01, 1	P0CF4, P0CF5, P0CF6, 1	P0CF4, P0CF5, P0CF6, P0CF9, 1	P0CF4, P0CF5, P0CF6, 1
Proximity Status Signal	P0D58, 1	P0D59, 1	P0D59, 1	-
DC Negative Contactor	P3022, 1	P3015, P3020, 1	P3015, P301C, P1FF4**, 1	-
DC Positive Contactor	P0AA1*, P0AA4*, 1	P3018, 1	P3018, P301D, P1FF4**, 1	-
High Voltage DC+	1	1	1	-
High Voltage DC-	1	1	1	-
1. Plug In Charging Malfunction * DTCs set with Pass/Fail Status ** DTC set if 120/240 volt cordset is used				

Circuit/System Description

A direct current (DC) fast charge drive motor battery charger cable allows vehicles equipped with RPO CBT to be charged using a 480 V offboard DC charger. The hybrid/EV powertrain control module 2 and power line communication module automatically prohibit voltage transfer to the hybrid/EV battery charger receptacle if an internal fault or inadequate voltage is detected. If no faults are detected, voltage transfer to the hybrid/EV battery charger receptacle occurs.

Diagnostic Aids

- Most DC fast charge concerns, especially those without an accompanying DTC set, are the result of off-vehicle charge station or electrical infrastructure issues. Always verify a DC Fast charge concern by connecting to a known good charge station.
- Some off-vehicle DC Charge Stations allow for multiple vehicle connection and authorization yet they will only charge one vehicle at a time.
- DC charging requires positive locking of the charge cord to the vehicle charge receptacle. Ensure the customer is inserting the charge cord into the charge receptacle completely. Ease of insertion and locking may vary among DC Charge Stations.

Reference Information

Schematic Reference

Plug-In Charging Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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

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

Circuit/System Verification

1. Vehicle in Service Mode, verify no additional DTCs are set in other control modules.

- **If additional DTCs are set**

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

- **If no additional DTCs are set**

NOTE: Certain DTCs inhibit DC Charging, clearing the DTC alone will not clear the inhibit condition.

2. Verify DTCs that disable DC Charging were not recently cleared.

- **If DTCs were cleared**

Perform the [DC Charging Disabled Reset](#).

- **If DTCs were not cleared or the DC Charging Disable Reset had been performed**

NOTE: Loss of 12V or programming of the module will inhibit DC Charging.

3. Verify that a low/no 12V condition was not present at the K114B Hybrid/EV Powertrain Control Module or that the module was not recently programmed.

- **If the specified conditions occurred**

The vehicle must be driven at a speed greater than 30 km/h (19 mph) to re-enable DC Charging.

- **If the specified conditions had not occurred or the vehicle had been driven**

4. Connect a 120/220V AC charge cord and verify the vehicle will AC charge.

- **If the vehicle will not AC Charge**

Refer to the AC Charging document [Plug-In Charging Malfunction \(AC Charging \(North America, Korea\)\)](#)[Plug-In Charging Malfunction \(DC Charging \(North America, Korea\)\)](#).

- **If the vehicle will AC Charge**

NOTE: The DC Charge History parameters record the conditions present during the last 5 charge events.

5. Review the K114B Hybrid/EV Powertrain Control Module 2, DC Charge History Scan Tool Parameters (w/CBT). Inspect for any conditions that prohibited DC Charging.

- **If an off-vehicle charge station condition prohibited DC Charging**

The vehicle is OK. Contact the GM Technical Assistance Center to report a DC Charge Station problem.

- **If an off-vehicle condition was not observed**

NOTE: Review diagnostic aids.

6. Verify with the customer whether the off-vehicle DC Charge Station had multiple charge cords, or they had difficulty in connecting the charge cord to the receptacle.

- **If any of the conditions were observed**

The vehicle is OK. Contact the GM Technical Assistance Center to report a DC Charge Station problem.

- **If the conditions were not observed**

NOTE: The following setup steps MUST BE PERFORMED EXACTLY in order to exercise the contactors.

7. Vehicle OFF. Turn ON the park lamps.

- NOTE:**
- **DO NOT** press the power button and enter Vehicle in Service Mode or Vehicle ON.
 - Ignore P0ABC after pulling the S15 Manual Service Disconnect.

NOTE: There are two contactor control functions available on the scan tool from the Hybrid/EV Powertrain Control Module 2. Make sure you select the DC charging contactor control and not the battery contactor control.

8. Command the Hybrid/EV DC Charging Contactors ALL OPEN with a scan tool.

9. Disconnect the S15 Manual Service Disconnect.

- NOTE:**
- **DO NOT** use the Release Control button to turn OFF any of the contactors. Once the Release Control button is pushed the Circuit/System Verification will need to be restarted from the beginning including reinstalling the S15 Manual Service Disconnect and clearing DTCs.
 - The following steps can be performed in any sequence or a single contactor can be exercised to verify a complaint.

10. Command the Hybrid/EV Battery DC Charging Negative Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to close and open.

NOTE: It is normal for the charging contactors to only make noise while opening.

11. Verify the Hybrid/EV Battery DC Charging Negative Contactor is heard closing and opening.

- If the Hybrid/EV Battery DC Charging Negative Contactor does not open and close

Refer to Circuit/System Testing.

- If the Hybrid/EV Battery DC Charging Negative Contactor does open and close

12. Command the Hybrid/EV Battery DC Charging Positive Contactor CLOSED and ALL OPEN with a scan tool while listening for the contactor to close and open.

13. Verify the Hybrid/EV Battery DC Charging Positive Contactor is heard closing and opening.

- If the Hybrid/EV Battery DC Charging Positive Contactor does not open and close

Refer to Circuit/System Testing.

- If the Hybrid/EV Battery DC Charging Positive Contactor does open and close

NOTE: It is normal for the Hybrid/EV Battery DC Negative Contactor to be slightly quieter than the positive contactor.

14. Repeat opening and closing of both DC Charging contactors several times while comparing the sound made by each contactor.

- If either contactor intermittently stops working

Replace the T24 Battery Charger - DC.

- If both contactors consistently generate sound

15. Connect to a known good DC Charge Station. Verify vehicle will fast charge and no DTCs are set.

- If the vehicle will not fast charge and DTCs are set

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

- If the vehicle will not fast charge and no DTCs are set

Refer to Circuit/System Testing.

- If the vehicle will fast charge

16. 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.

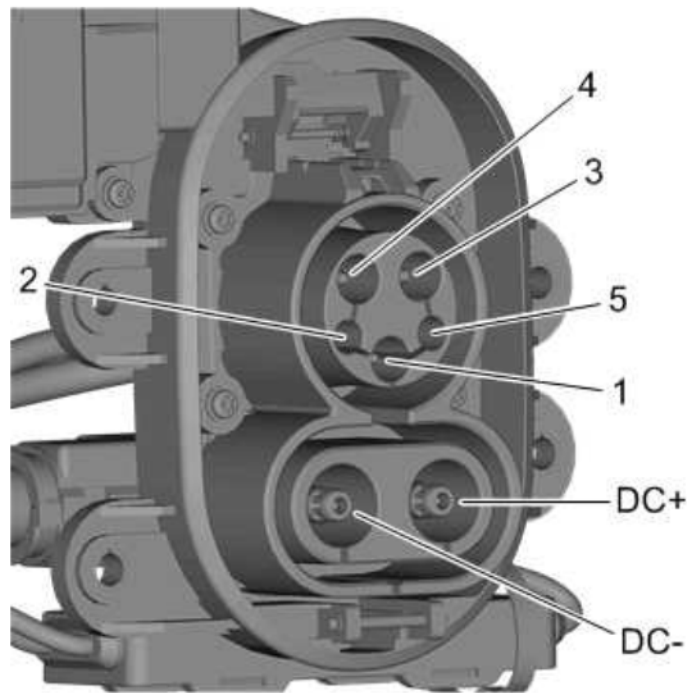


Fig. 19: X98 Hybrid/EV Battery Charger Receptacle

Courtesy of GENERAL MOTORS COMPANY

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle face and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: When measuring resistance observe proper meter polarity by connecting the common/ground meter probe to ground/vehicle chassis.

NOTE: You must measure with a high-impedance Digital Multimeter (DMM) such as the EL-39200 or equivalent.

1. Vehicle OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Test for 100k - 4M Ω between the control pilot signal terminal 2 at the X98 Hybrid/EV Battery Charger Receptacle and ground.

- **If 4M Ω or greater**

1. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2
2. Test for 2 Ω in the control pilot signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K114B Hybrid/EV Powertrain Control Module 2.

- **If less than 100k Ω**

1. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
2. Test for infinite resistance between the control pilot signal circuit and ground.
 - If infinite resistance, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - If less than infinite resistance
3. Vehicle OFF, disconnect the X9 harness connector at the T24 Battery Charger - DC.
4. Test for infinite resistance between the control pilot signal circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the T24 Battery Charger - DC.

- **If within the specified range**

2. Test for less than 10 Ω between the Voltage AC Ground terminal 1 at the X98 Hybrid/EV Battery Charger Receptacle and ground.

- If 10 Ω or greater

NOTE: G108 is located behind the front fender.

1. Disconnect the G108 ring terminal. Refer to Ground Nut removal in [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#).
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If less than 2 Ω , clean and reinstall the G108 ring terminal and ground nut.
- If less than 10 Ω
3. Vehicle in Service Mode.
4. Test for less than 1 V between the control pilot signal terminal 2 at the X98 Hybrid/EV Battery Charger Receptacle and ground.
 - If 1 V or greater
 - 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 pilot signal circuit and ground.
 - If greater than 1 V, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - If greater than 1 V
 - 3. Vehicle OFF, disconnect the X9 harness connector at the T24 Battery Charger - DC. Vehicle in Service Mode.
 - 4. Test for less than 1 V between the control pilot signal circuit and ground.
 - If greater than 1 V, repair the short to voltage in the circuit.
 - If less than 1 V, replace the T24 Battery Charger - DC.
- If less than 1 V

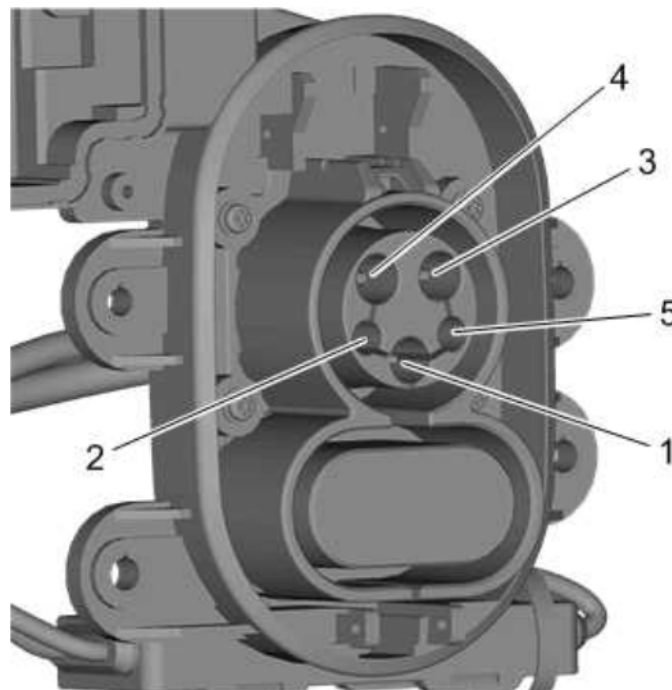


Fig. 20: Hybrid/EV Battery Charger Receptacle
Courtesy of GENERAL MOTORS COMPANY

5. Test for 4.2 - 4.8 V between the signal circuit terminal 5 and ground.
 - If less than 4.2 V
 - 1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for 4.8 V or greater between the signal circuit terminal 5 and ground.
 - If less than 4.8 V
 1. Vehicle OFF. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Test for infinite resistance between the signal circuit terminal 5 and ground.
 - If less than infinite resistance, repair the short to ground in 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 4.8 V or greater, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - **If greater than 4.8 V**
 1. Vehicle OFF, disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle. Vehicle in Service Mode.

NOTE:

The following tests are performed at the vehicle harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

2. Test for 4.8 - 5.2 V between the signal circuit terminal 5 and ground.
 - If greater than 5.2 V
 1. Vehicle OFF. Disconnect the X2 harness connector at the K114B Hybrid/EV Powertrain Control Module 2.
 2. Vehicle in Service Mode. Test for less than 1 V between the signal circuit terminal 5 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - If within 4.8 - 5.2 V
 - 3. Test for 2.565 - 2.835K Ω between the signal circuit terminal 5 and the low reference circuit terminal 1.
 - If not within the specified range, replace the X98 Hybrid/EV Battery Charger Receptacle.
 - If within the specified range, replace the K114B Hybrid/EV Powertrain Control Module 2.
 - **If within 4.2 - 4.8 V**
6. Disable the high voltage for servicing at the T24 Battery Charger. Refer to [High Voltage Disabling](#) . Disconnect the X2 harness connector at the T24 Battery Charger DC.

NOTE:

The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle face and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

7. Test for infinite resistance between the terminals listed below at the X98 Hybrid/EV Battery Charger Receptacle:
 - High Voltage DC Positive terminal DC+ and High Voltage DC Negative terminal DC-
 - Control pilot signal circuit terminal 2 and Proximity status signal circuit terminal 5
 - **If less than infinite resistance**

Replace the X98 Hybrid/EV Battery Charger Receptacle.
 - **If infinite resistance**
8. Test for less than 10 Ω between the terminals listed below:
 - High Voltage DC Positive terminal DC+ at the X98 Hybrid/EV Battery Charger Receptacle and terminal A X2
 - High Voltage DC Negative terminal DC- at the X98 Hybrid/EV Battery Charger Receptacle and terminal B X2
 - **If 10 Ω or greater**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If less than 10 Ω**

9. Disconnect the X1 harness connector at the X98 Hybrid/EV Battery Charger Receptacle.

NOTE: The following tests are performed at the X98 Hybrid/EV Battery Charger Receptacle face and not at the harness connector to the X98 Hybrid/EV Battery Charger Receptacle.

10. Test for 2.56 - 2.84k Ω between the Voltage AC Ground terminal 1 and Proximity status signal circuit terminal 5 at the X98 Hybrid/EV Battery Charger Receptacle.

- **If not within the specified range**

Replace the X98 Hybrid/EV Battery Charger Receptacle.

- **If within the specified range**

11. Replace the T24 Battery Charger - DC.

Repair Instructions

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

- [Drive Motor Battery Charger Receptacle Replacement \(Except Dubai with quick charge\)](#)[Drive Motor Battery Charger Receptacle Replacement \(Except Dubai without quick charge\)](#)
- [Control Module References](#) for T24 battery charger - DC or K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

PLUG-IN CHARGING INDICATOR MALFUNCTION

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Charge Pilot Indicator Control	P0D2B	P0D2B	P0D2B	-
Charge Status Indicator Control	P0D2C	P0D2C, 1	P0D2C	-
Charge Complete Indicator Control	1	1	1	-
Low Reference	-	P0D2C, P0D2B	-	-
1. Plug In Charging Indicator Malfunction				

Circuit/System Description

The status of charging events (including delays) is communicated to the user through a vehicle plug-in charge status indicator and audio tones. The vehicle plug-in charge status indicator, located on the top middle of the instrument panel, contains a green LED (charge status indicator) and yellow LED (charge pilot indicator) controlled by the Hybrid Powertrain Control Module 2 and a second green LED (charge complete indicator) controlled by the BCM. The indicator will have a short flash green when the vehicle is charging under automatic control. The flash rate increases from one to four as the battery charges. It will have a long flash green if the charging is delayed and will begin later. It will be illuminated solid green when charging is complete. A solid lit yellow indicator means the vehicle is not able to accept a charge.

Reference Information

Schematic Reference

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Plug-In Charging Schematics

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Plug-In Charging 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 in Service Mode.
2. Verify that DTC U135B is not set.
 - **If DTC U135B is set**

Refer to **DTC U1340-U135F**.
 - **If DTC U135B is not set**
3. Verify no other hybrid/EV battery-related DTCs are set.
 - **If any hybrid/EV battery-related DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**
 - **If no hybrid/EV battery-related DTCs are set**
4. Vehicle OFF. Ensure the charge cord is not connected to the vehicle.
5. Verify the vehicle charge indicator is OFF.
 - **If the vehicle charge indicator is not OFF**

Refer to Circuit/System Testing.

- **If the vehicle charge indicator is OFF**
6. Connect the charge cord.
 7. Verify the vehicle charge indicator is operating properly.
 - **If the vehicle charge indicator is solid yellow**

Refer to **Plug-In Charging Malfunction (AC Charging (North America, Korea))****Plug-In Charging Malfunction (DC Charging (North America, Korea))**

- **If the vehicle charge indicator is OFF**

1. Vehicle ON.

NOTE: **Vehicle must be ON and not in Service Mode for message operation.**

2. Verify the Charge Cord Connected message is displayed in the instrument panel/message center.
 - If the Charge Cord Connected message is displayed, refer to Circuit/System Testing.
 - If the Charge Cord Connected message is NOT displayed

3. Refer to **Plug-In Charging Malfunction (AC Charging (North America, Korea))Plug-In Charging Malfunction (DC Charging (North America, Korea))**.

- **If the vehicle charge indicator is operating properly**

8. All OK.

Circuit/System Testing

1. Vehicle OFF, disconnect the harness connector at the B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator.
2. Test for less than 10 Ω between the low reference terminal 1 and ground.

- **If 10 Ω or greater**

Repair the open/high resistance in the circuit.

- **If less than 10 Ω**

NOTE: If the drive motor battery charger cable is connected. The drive motor battery charger cable must be disconnected for more than 10 s before performing the next step.

3. Connect a test lamp between the yellow LED control circuit terminal 4 and ground.
4. Verify the test lamp does not illuminate.

- **If the test lamp illuminates**

1. 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 in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

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

5. Connect the drive motor battery charger cable.
6. Verify that the test lamp illuminates or flashes in the first 5 s of connecting the drive motor battery charger cable.

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

1. 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.

- **If the test lamp illuminates**

7. Disconnect the drive motor battery charger cable for at least 10 s. Connect a test lamp between the green LED control circuit terminal 3 and ground.

8. Verify test lamp does not illuminate.

- **If the test lamp illuminates**

1. 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 in the circuit.
 - If less than 1 V, replace the K114B Hybrid/EV Powertrain Control Module 2.

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

9. Connect the drive motor battery charger cable.

10. Verify that the test lamp illuminates or flashes within 25 s of connecting the drive motor battery charger cable.

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

1. 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.
- **If the test lamp illuminates**

11. Replace the B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator.

Repair Instructions

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

- **Sun Load, Ambient Light, and Charge Indicator Sensor Replacement** for B305 Ambient Light/Sunload Sensor and Battery State of Charge Indicator replacement.
- **Control Module References** for K114B hybrid/EV powertrain control module 2 replacement, programming and setup.

REPAIR INSTRUCTIONS

CHARGE PORT DOOR REPLACEMENT (EXCEPT DUBAI)

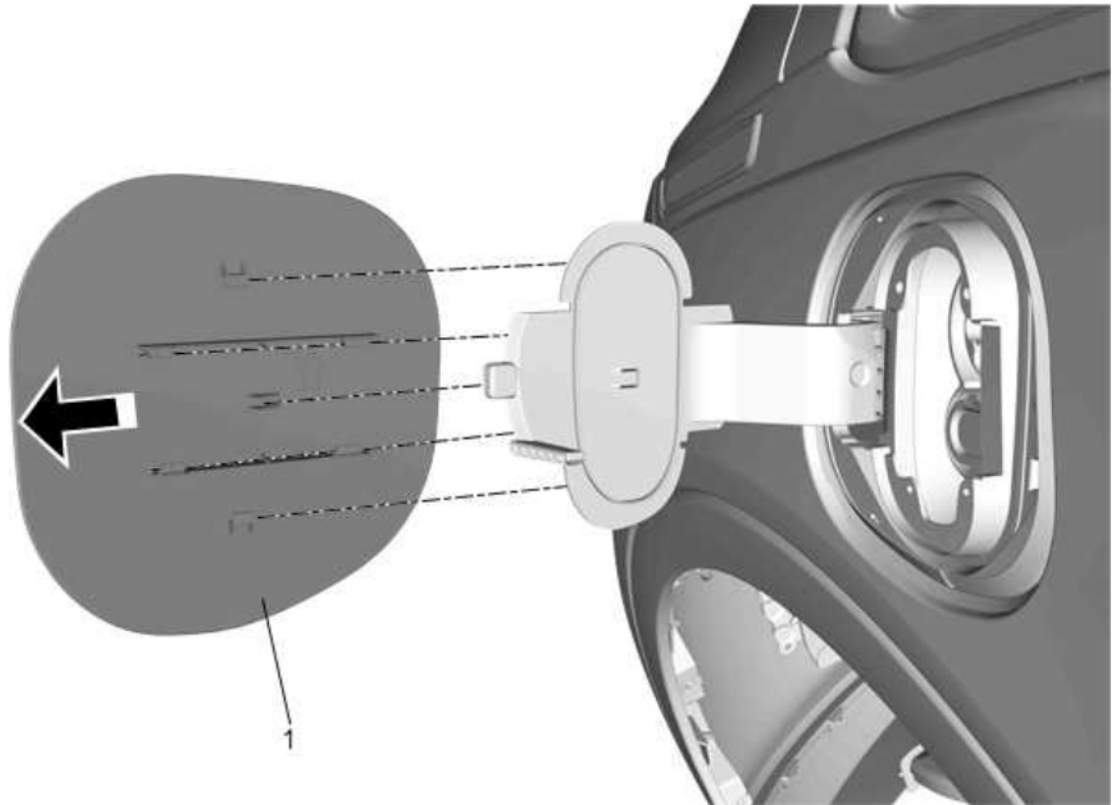


Fig. 21: Charge Port Door
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
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. Preliminary Procedure 1. Open the charge port door.	
1	Charge Port Door Procedure 1. Using a flat-bladed driver, lift slightly upward on the tab at the center of the hinge in order to release the door from the hinge assembly. 2. Slide the door outward, away from the hinge and remove.

CHARGE PORT DOOR REPLACEMENT (DUBAI)

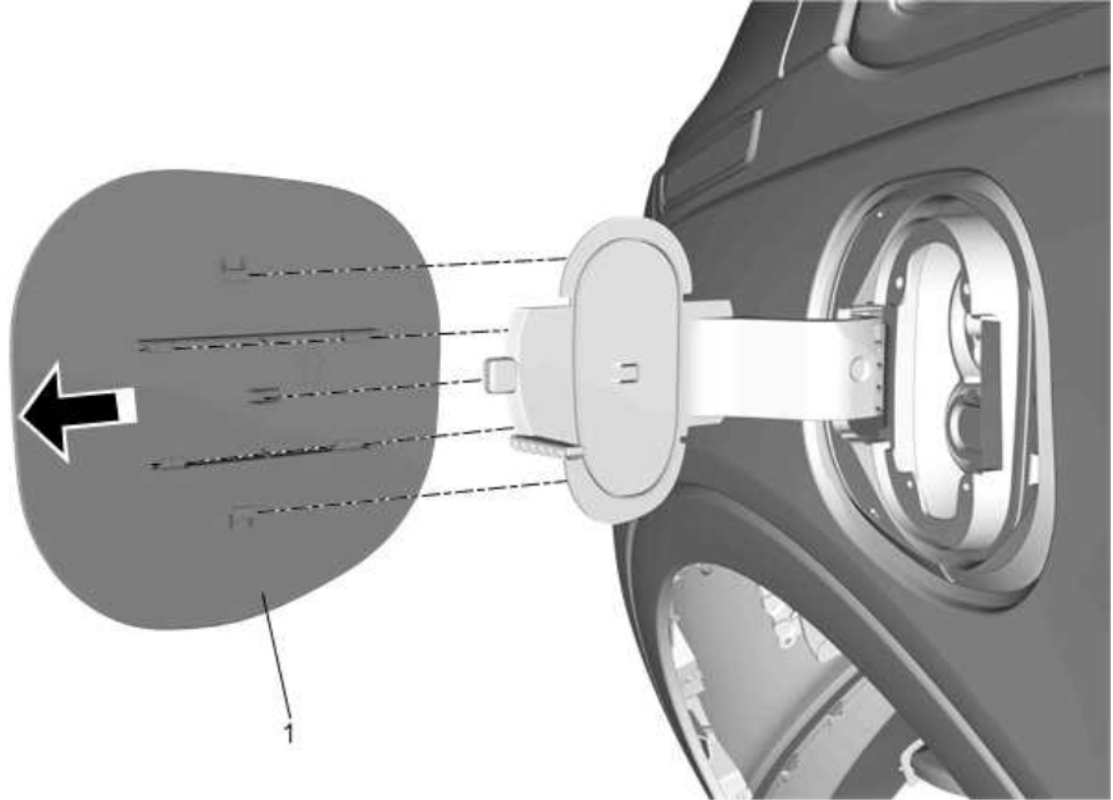


Fig. 22: Charge Port Door
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
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. Preliminary Procedure 1. Open the charge port door.	
1	Charge Port Door Procedure 1. Using a flat-bladed driver, lift slightly upward on the tab at the center of the hinge in order to release the door from the hinge assembly. 2. Slide the door outward, away from the hinge and remove.

CHARGE PORT HOUSING REPLACEMENT (EXCEPT DUBAI)

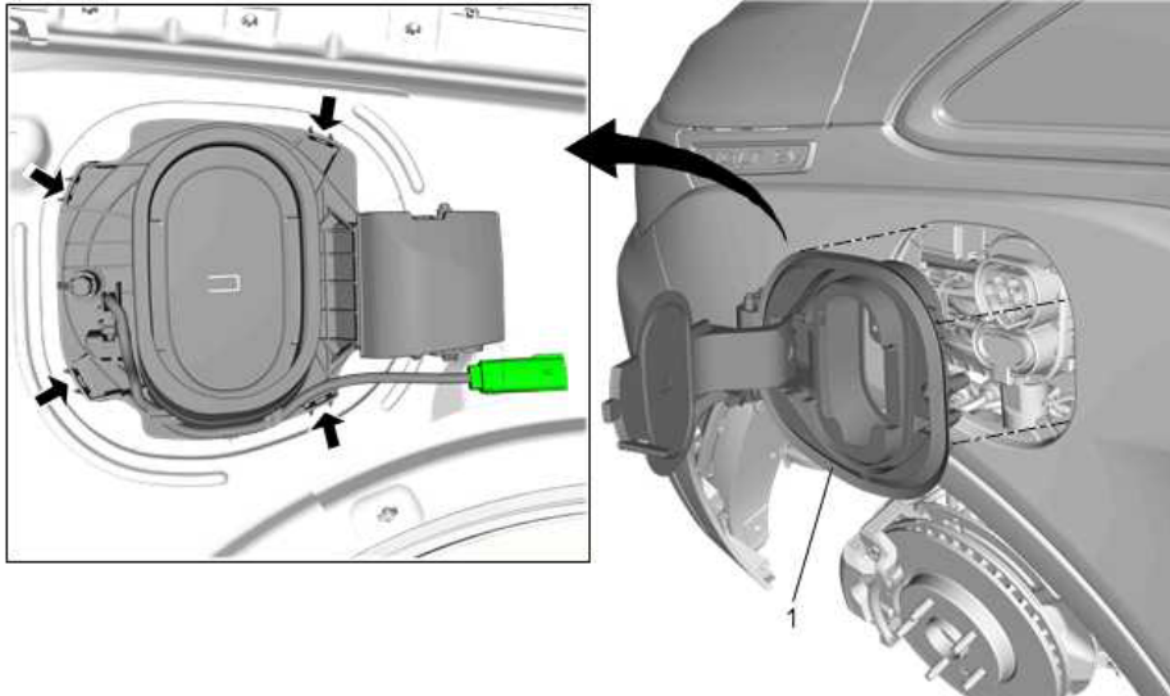


Fig. 23: Charge Port Housing

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
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. Preliminary Procedures 1. Disable the high voltage system. High Voltage Disabling . 2. Remove Front Wheelhouse Liner&ndash;Left Side Front Wheelhouse Liner Replacement . 3. Charge Port Door Replacement (Except Dubai)Charge Port Door Replacement (Dubai).	

Callout	Component Name
1	Charge Port Housing Procedure 1. Disconnect and unclip the electrical connector. 2. Using a plastic trim-type stick, release the tabs to the charge port housing assembly from inside the fender. 3. Push outward on the assembly housing. 4. Enable the high voltage system. High Voltage Enabling .

CHARGE PORT HOUSING REPLACEMENT (DUBAI)

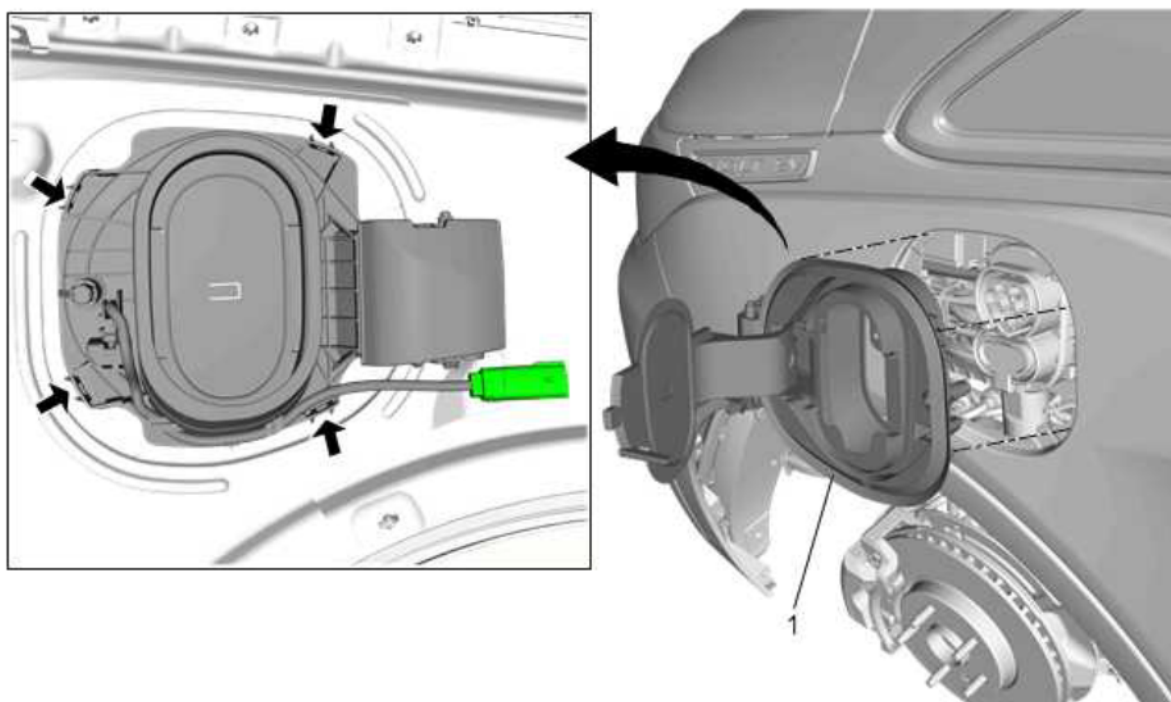


Fig. 24: Charge Port Housing

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
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. Preliminary Procedures 1. Disable the high voltage system. High Voltage Disabling . 2. Remove Front Wheelhouse Liner&ndash;Left Side Front Wheelhouse Liner Replacement . 3. Charge Port Door Replacement (Dubai).	
cardiagn.com	

Callout	Component Name
1	Charge Port Housing Procedure 1. Disconnect and unclip the electrical connector. 2. Using a plastic trim-type stick, release the tabs to the charge port housing assembly from inside the fender. 3. Push outward on the assembly housing. 4. Enable the high voltage system. High Voltage Enabling .

CHARGE PORT DOOR AJAR INDICATOR SWITCH REPLACEMENT (EXCEPT DUBAI)

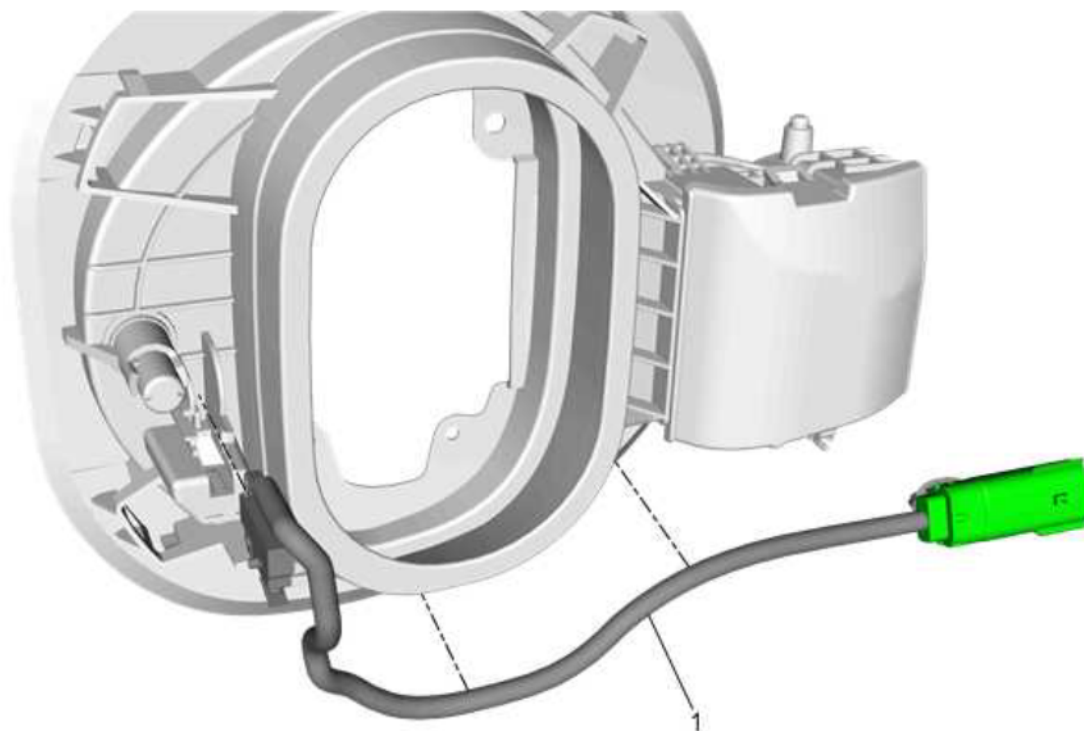


Fig. 25: Charge Port Door Ajar Indicator Switch
 Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name

Callout	Component Name
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. Preliminary Procedures 1. Disable the high voltage system. High Voltage Disabling 2. Charge Port Housing Replacement (Dubai)	
1	Charge Port Door Ajar Switch Procedure 1. Release the charge port door ajar indicator switch and connector from the charge port housing cavity. 2. Enable the high voltage system. High Voltage Enabling

CHARGE PORT DOOR AJAR INDICATOR SWITCH REPLACEMENT (DUBAI)

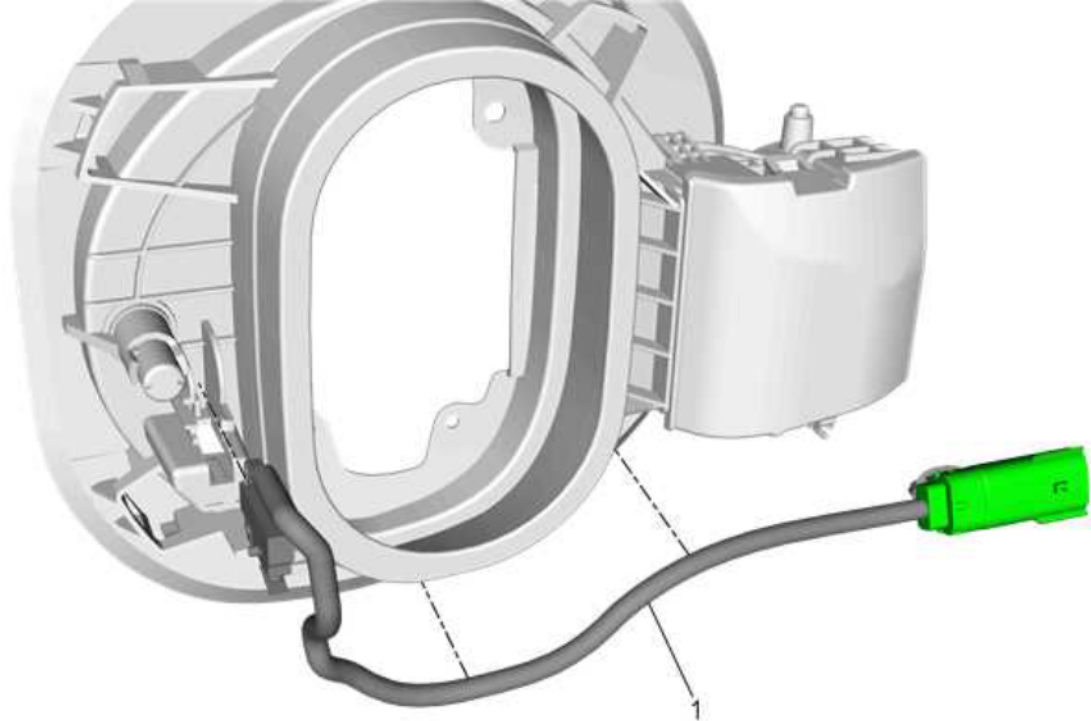


Fig. 26: Charge Port Door Ajar Indicator Switch

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
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. Preliminary Procedures 1. Disable the high voltage system. High Voltage Disabling 2. Charge Port Housing Replacement (Dubai)	
1	Charge Port Door Ajar Switch Procedure 1. Release the charge port door ajar indicator switch and connector from the charge port housing cavity. 2. Enable the high voltage system. High Voltage Enabling

DRIVE MOTOR BATTERY CHARGER REPLACEMENT (EXCEPT DUBAI)

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. [High Voltage Disabling](#)
2. Drain the drive motor generator power inverter module cooling system. [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
3. Remove Battery Tray [Battery Tray Replacement](#)
4. Remove Radiator Surge Tank [Radiator Surge Tank Replacement](#)
5. Remove Accessory DC Power Control Module [Accessory DC Power Control Module Replacement](#)

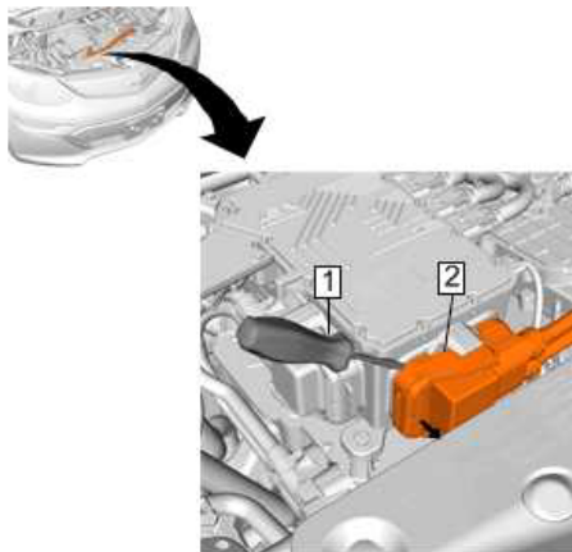


Fig. 27: Flat Bladed Screwdriver And Connector Handle Lock

Courtesy of GENERAL MOTORS COMPANY

6. {If Equipped} Using a flat bladed screwdriver (1), pry the edge of the connector handle lock (2) from the holding tab.
7. {If Equipped} Release the connector handle lock by rotating the connector handle forward.
8. {If Equipped} With the connector handle in the release position, disconnect the high voltage charger connector from the high power distribution module.

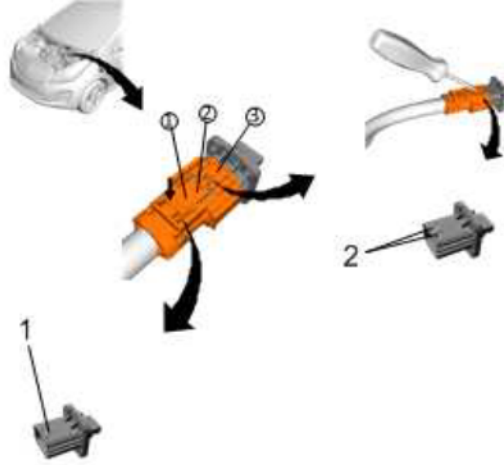


Fig. 28: First Stage Connector Tab And Connector Retaining Tabs
Courtesy of GENERAL MOTORS COMPANY

9. Disconnect the high voltage connectors in the following sequence:
 - Release the CPA. Push down on the connector tab, and release the connector.

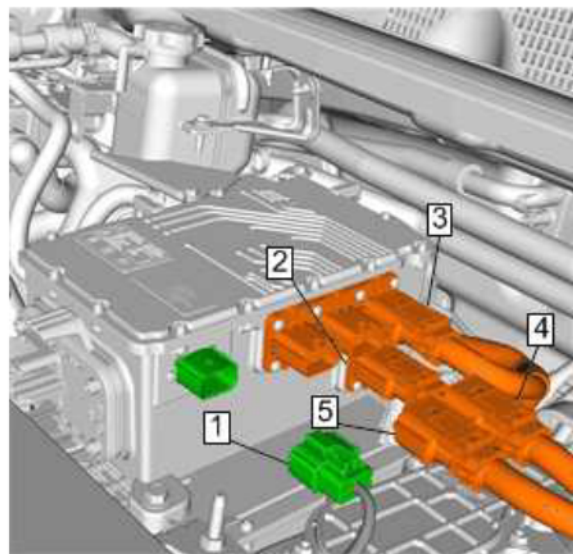


Fig. 29: Low Voltage Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

10. Disconnect Low Voltage Electrical Connector (1) @Generator Battery Control Wiring Junction Block
11. After releasing the 2-stage safety connectors, remove the A/C control module electrical connector (5) and the drive motor battery charger & auxiliary power module connector (4) from the generator battery control wiring junction block.
12. Remove the RESS heater electrical connector (3) and the drive motor battery charger & auxiliary power module to RESS electrical connector (2) from the generator battery control wiring junction block.

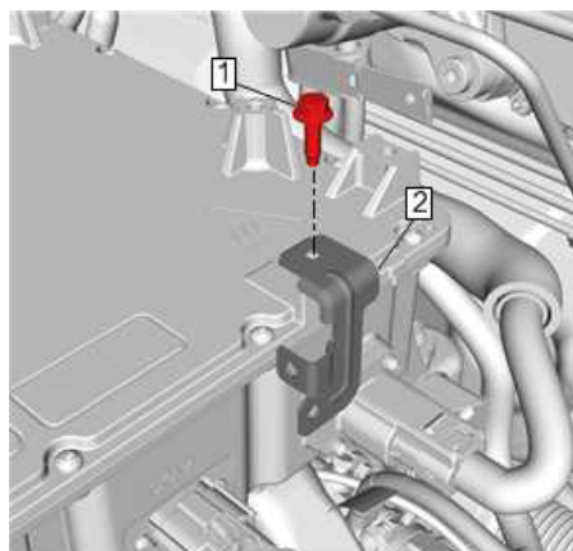


Fig. 30: Engine Wiring Harness Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

13. Remove Engine Wiring Harness Bracket Bolt (1)
14. Remove Engine Wiring Harness Bracket(2)



Fig. 31: Drive Motor Battery Charger Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

15. Disconnect Drive Motor Battery Charger Electrical Connector (1) (3)
16. Disconnect Signal & AC Electrical Connector (2)

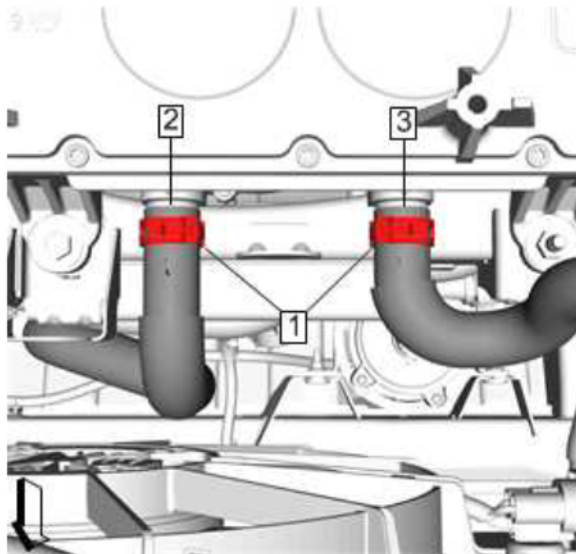


Fig. 32: Drive Motor Power Inverter Module Cooling Inlet Hose
Courtesy of GENERAL MOTORS COMPANY

17. Drive Motor Power Inverter Module Cooling Inlet Hose(2) - Release Clamp (1) and Remove the Hose
18. Electric Differential Drive Motor Power Inverter Module Cooling Hose (3) - Release Clamp (1) and Remove the Hose

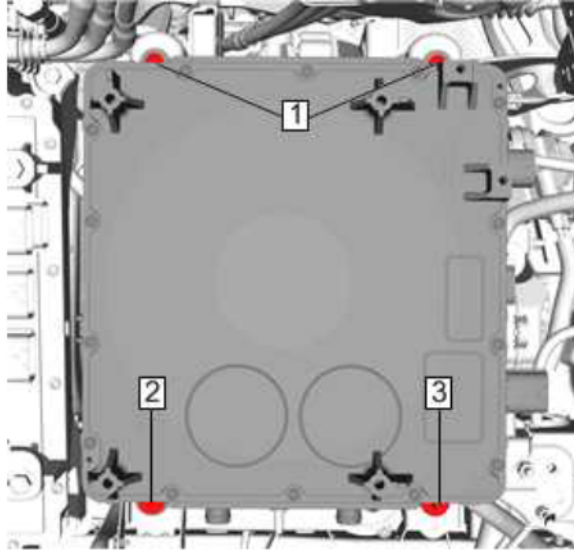


Fig. 33: Drive Motor Battery Charger Nut
Courtesy of GENERAL MOTORS COMPANY

19. Remove Drive Motor Battery Charger Bolt(1, 2)
20. Remove Drive Motor Battery Charger Nut(3)

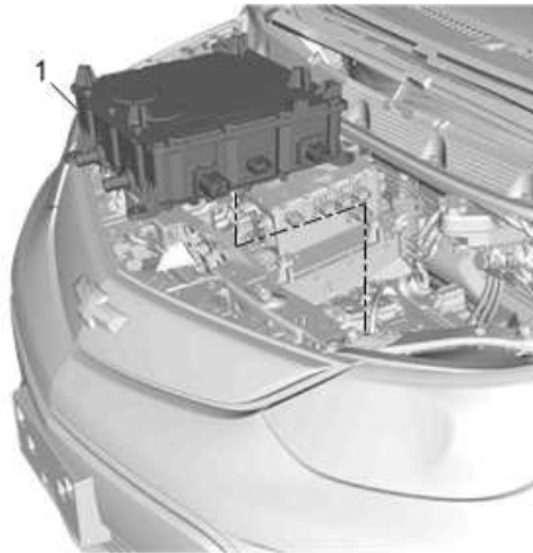
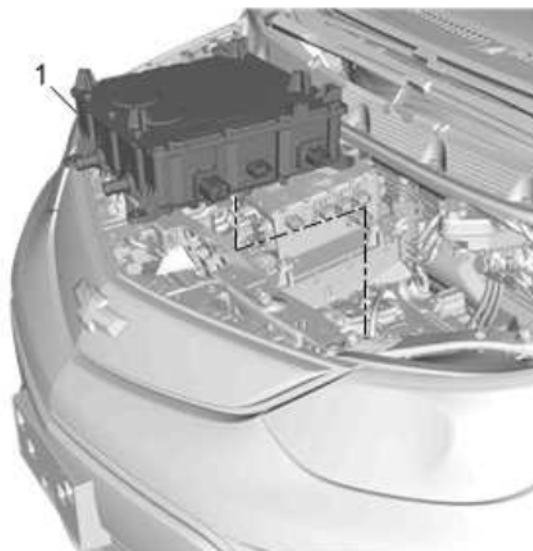


Fig. 34: Drive Motor Battery Charger
Courtesy of GENERAL MOTORS COMPANY

21. Remove Drive Motor Battery Charger (1)

Installation Procedure



1. Install Drive Motor Battery Charger(1)

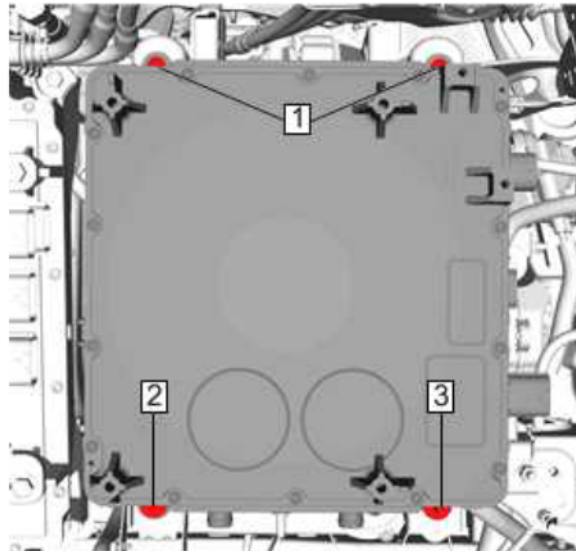


Fig. 36: Drive Motor Battery Charger Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

2. Install Drive Motor Battery Charger Bolt(1) 22 N.m (16 lb ft)
3. Install Drive Motor Battery Charger Bolt(2) 25 N.m (18 lb ft)
4. Install Drive Motor Battery Charger Nut(3) 25 N.m (18 lb ft)

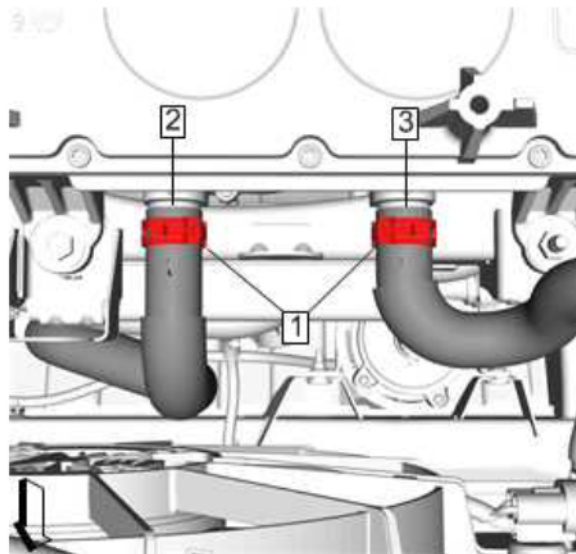


Fig. 37: Drive Motor Power Inverter Module Cooling Inlet Hose
Courtesy of GENERAL MOTORS COMPANY

5. Install Drive Motor Power Inverter Module Cooling Inlet Hose(2) @ the Hose and Engage the Clamp (1)
6. Electric Differential Drive Motor Power Inverter Module Cooling Hose (3) @ the Hose and Engage the Clamp (1)



Fig. 38: Drive Motor Battery Charger Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

7. Connect Drive Motor Battery Charger Electrical Connector (1, 3)
8. Connect Signal & AC Electrical Connector (2)

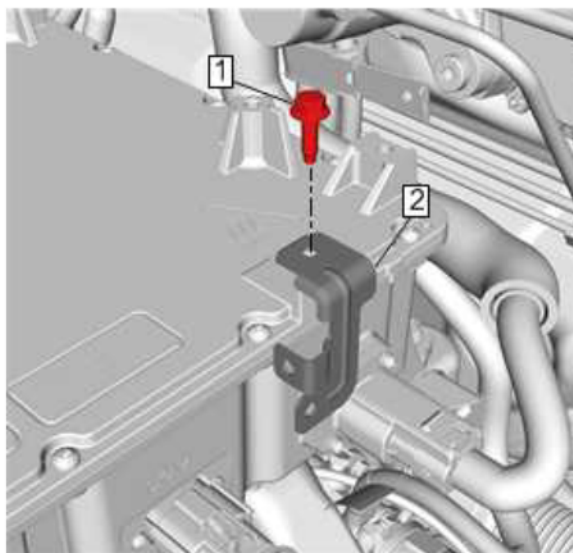


Fig. 39: Engine Wiring Harness Bracket Bolt

Courtesy of GENERAL MOTORS COMPANY

9. Install Engine Wiring Harness Bracket(2)
10. Install Engine Wiring Harness Bracket Bolt(1) 9 N.m (80 lb in)

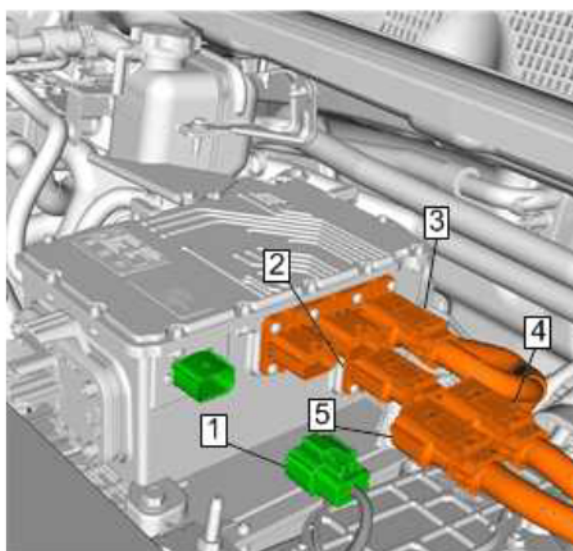


Fig. 40: Low Voltage Electrical Connector

Courtesy of GENERAL MOTORS COMPANY

11. Install the RESS heater electrical connector (3) and the drive motor battery charger & auxiliary power module to RESS connector (2) to the generator battery control wiring junction block.
12. Install the A/C control module electrical connector (5) and the drive motor battery charger & auxiliary power module connector (4) to the generator battery control wiring junction block.
13. Connect Low Voltage Electrical Connector (1) @ Generator Battery Control Wiring Junction Block

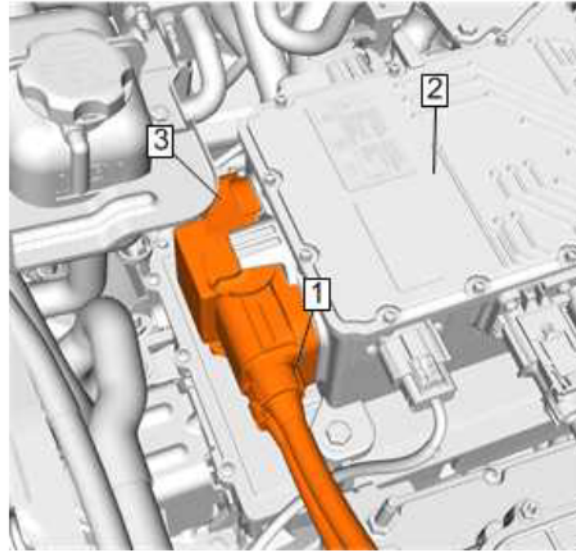


Fig. 41: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

14. {If Equipped} Install the drive motor battery charger receptacle electrical connector (1) to the generator battery control wiring junction block (2) and lock the handle (3) into the lock position.
15. Install Accessory DC Power Control Module [Accessory DC Power Control Module Replacement](#)
16. Install Radiator Surge Tank [Radiator Surge Tank Replacement](#)
17. Install Battery Tray [Battery Tray Replacement](#)
18. Fill the drive motor generator power inverter module cooling system. [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
19. Enable the high voltage system. [High Voltage Enabling](#)
20. Program the drive motor battery charger. [Control Module References](#)

DRIVE MOTOR BATTERY CHARGER REPLACEMENT (DUBAI)

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 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. Disable the high voltage system. [High Voltage Disabling](#)
2. Drain the drive motor generator power inverter module cooling system. [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
3. Remove Battery Tray [Battery Tray Replacement](#)
4. Remove Radiator Surge Tank [Radiator Surge Tank Replacement](#)
5. Remove Accessory DC Power Control Module [Accessory DC Power Control Module Replacement](#)

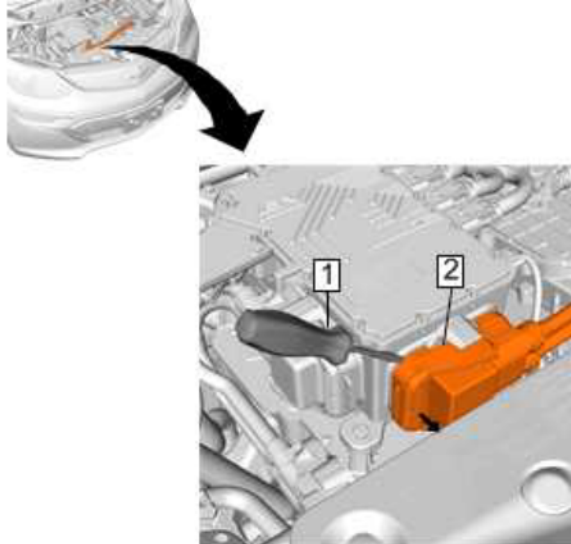


Fig. 42: Flat Bladed Screwdriver And Connector Handle Lock

Courtesy of GENERAL MOTORS COMPANY

6. {If Equipped} Using a flat bladed screwdriver (1), pry the edge of the connector handle lock (2) from the holding tab.
7. {If Equipped} Release the connector handle lock by rotating the connector handle forward.
8. {If Equipped} With the connector handle in the release position, disconnect the high voltage charger connector from the high power distribution module.

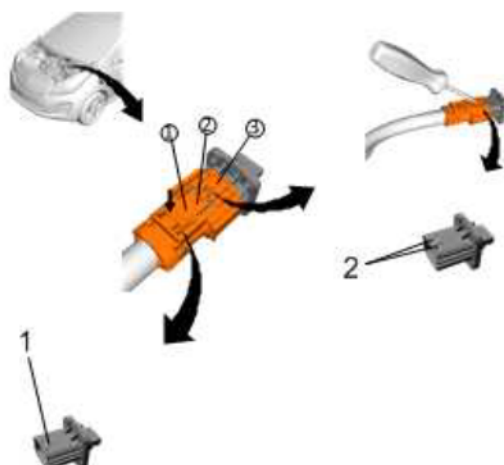


Fig. 43: First Stage Connector Tab And Connector Retaining Tabs

Courtesy of GENERAL MOTORS COMPANY

9. Disconnect the high voltage connectors in the following sequence:
 - Release the CPA. Push down on the connector tab, and release the connector.

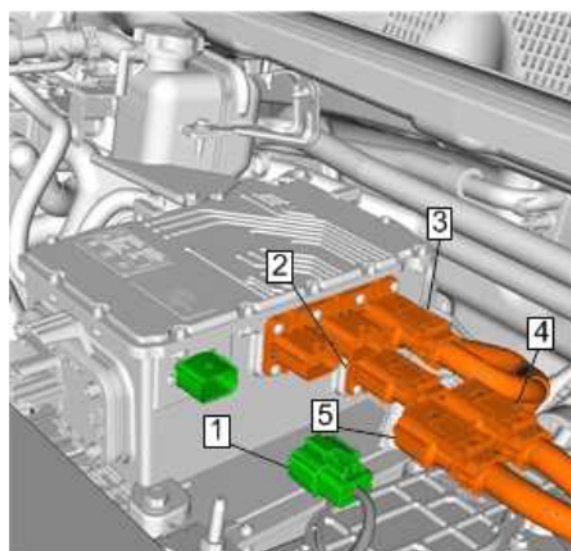


Fig. 44: Low Voltage Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

10. Disconnect Low Voltage Electrical Connector (1) @Generator Battery Control Wiring Junction Block
11. After releasing the 2-stage safety connectors, remove the A/C control module electrical connector (5) and the drive motor battery charger & auxiliary power module connector (4) from the generator battery control wiring junction block.
12. Remove the RESS heater electrical connector (3) and the drive motor battery charger & auxiliary power module to RESS electrical connector (2) from the generator battery control wiring junction block.

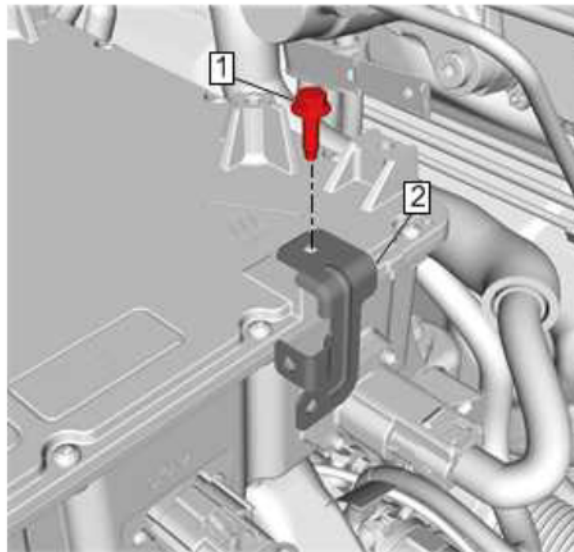


Fig. 45: Engine Wiring Harness Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

13. Remove Engine Wiring Harness Bracket Bolt(1)
14. Remove Engine Wiring Harness Bracket(2)



Fig. 46: Drive Motor Battery Charger Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

15. Disconnect Drive Motor Battery Charger Electrical Connector (1) (3)
16. Disconnect Signal & AC Electrical Connector (2)

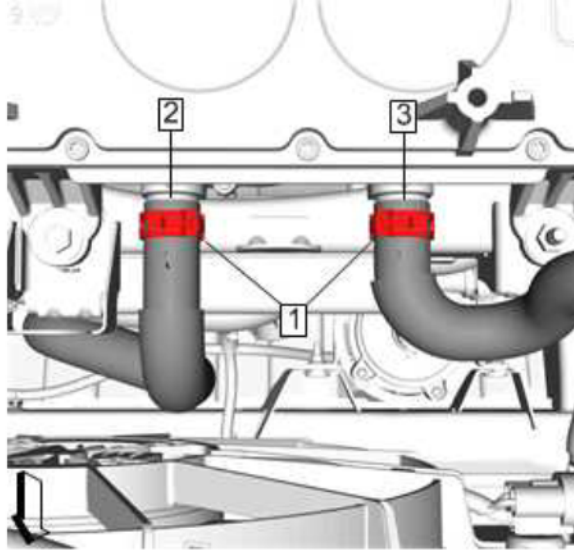


Fig. 47: Drive Motor Power Inverter Module Cooling Inlet Hose

Courtesy of GENERAL MOTORS COMPANY

17. Drive Motor Power Inverter Module Cooling Inlet Hose(2) - Release Clamp (1) and Remove the Hose
18. Electric Differential Drive Motor Power Inverter Module Cooling Hose (3) - Release Clamp (1) and Remove the Hose

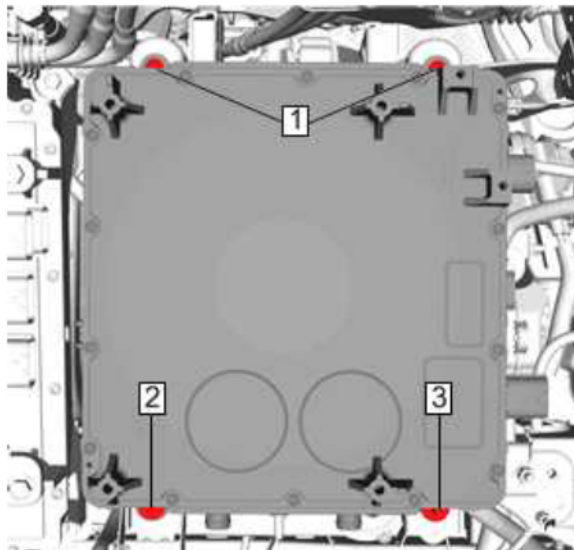
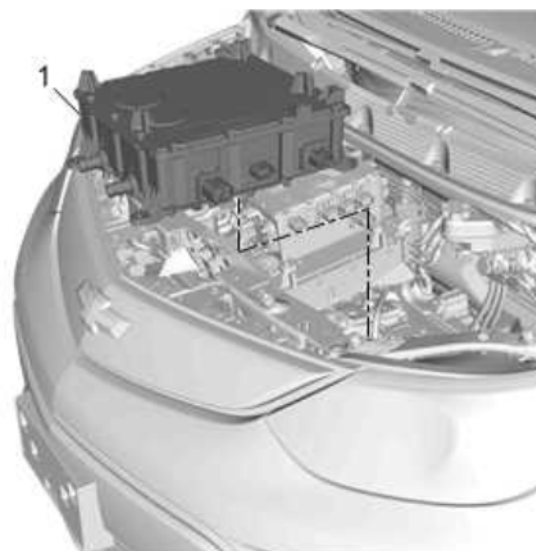


Fig. 48: Drive Motor Battery Charger Nut

Courtesy of GENERAL MOTORS COMPANY

19. Remove Drive Motor Battery Charger Bolt(1, 2)
20. Remove Drive Motor Battery Charger Nut(3)



21. Remove Drive Motor Battery Charger(1)

Installation Procedure

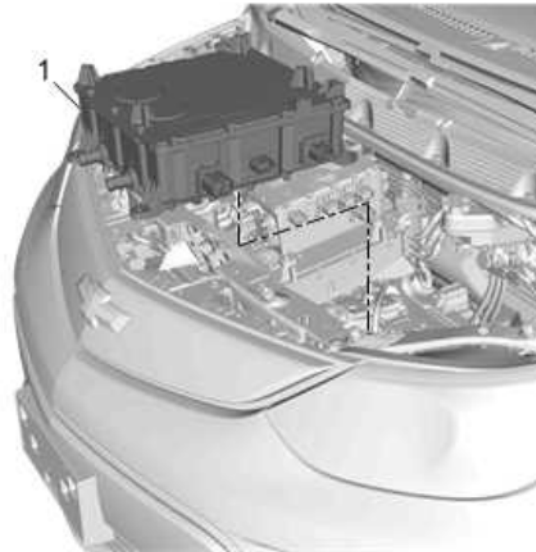


Fig. 50: Drive Motor Battery Charger
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Charger(1)

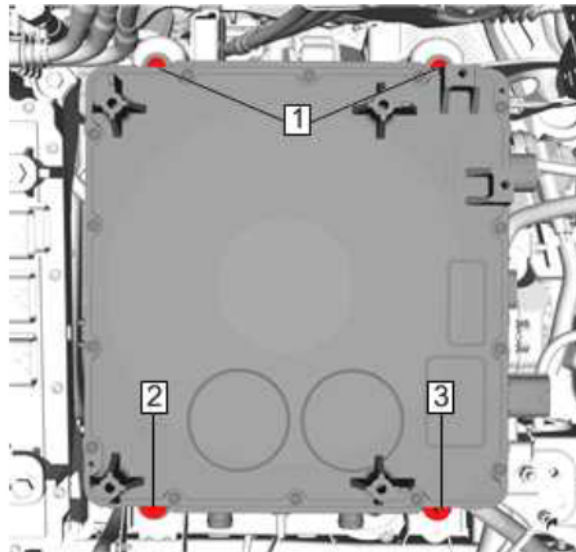


Fig. 51: Drive Motor Battery Charger Nut
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

2. Install Drive Motor Battery Charger Bolt(1) 22 N.m (16 lb ft)
3. Install Drive Motor Battery Charger Bolt(2) 25 N.m (18 lb ft)
4. Install Drive Motor Battery Charger Nut(3) 22 N.m (16 lb ft)

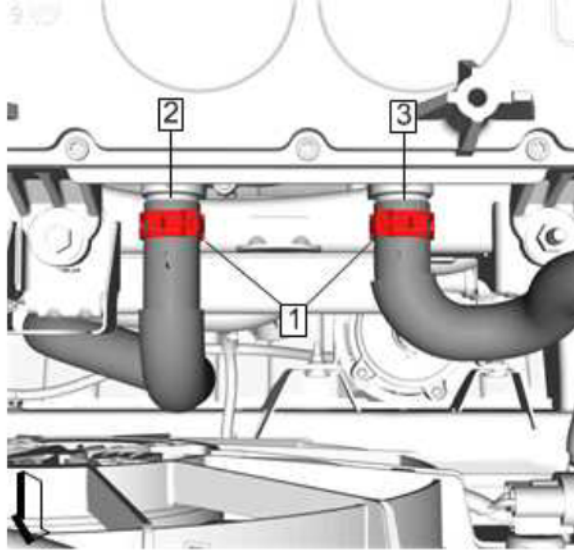


Fig. 52: Drive Motor Power Inverter Module Cooling Inlet Hose
 Courtesy of GENERAL MOTORS COMPANY

5. Install Drive Motor Power Inverter Module Cooling Inlet Hose(2) @ the Hose and Engage the Clamp (1)
6. Install Electric Differential Drive Motor Power Inverter Module Cooling Hose (3) @ the Hose and Engage the Clamp (1)



Fig. 53: Drive Motor Battery Charger Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

7. Connect Drive Motor Battery Charger Electrical Connector (1, 3)
8. Connect Signal & AC Electrical Connector (2)

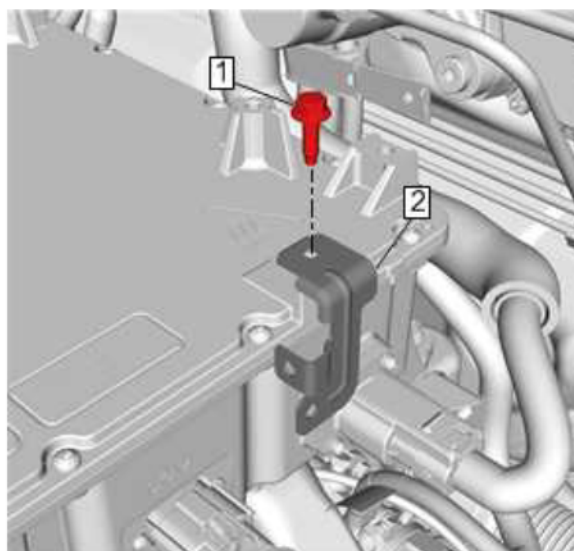


Fig. 54: Engine Wiring Harness Bracket Bolt
Courtesy of GENERAL MOTORS COMPANY

9. Install Engine Wiring Harness Bracket(2)
10. Install Engine Wiring Harness Bracket Bolt(1) 9 N.m (80 lb in)

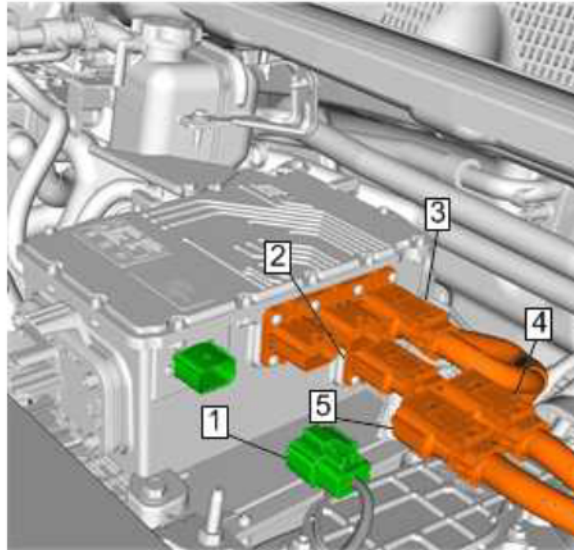


Fig. 55: Low Voltage Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

11. Install the RESS heater electrical connector (3) and the drive motor battery charger & auxiliary power module to RESS connector (2)to the generator battery control wiring junction block.
12. Install the A/C control module electrical connector (5)and the drive motor battery charger & auxiliary power module connector (4)to the generator battery control wiring junction block.
13. Connect Low Voltage Electrical Connector (1) @Generator Battery Control Wiring Junction Block

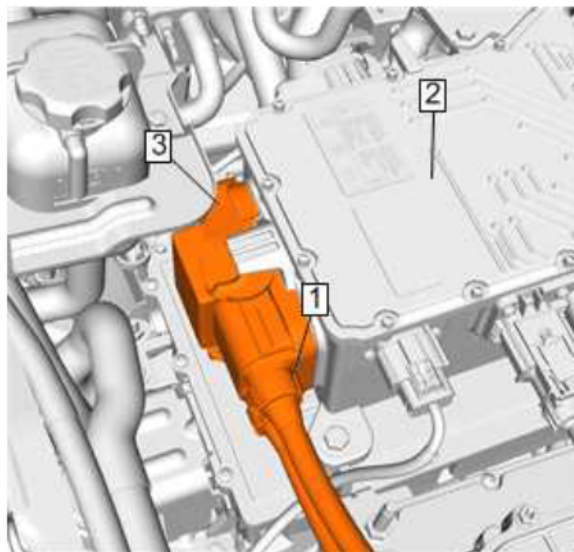


Fig. 56: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

14. {If Equipped} Install the drive motor battery charger receptacle electrical connector (1) to the generator battery control wiring junction block (2) and lock the handle (3)into the lock position.
15. Install Accessory DC Power Control Module [Accessory DC Power Control Module Replacement](#)
16. Install Radiator Surge Tank [Radiator Surge Tank Replacement](#)
17. Install Battery Tray [Battery Tray Replacement](#)
18. Fill the drive motor generator power inverter module cooling system. [Drive Motor Generator Power Inverter Module Cooling System Draining and Filling](#)
19. Enable the high voltage system. [High Voltage Enabling](#)
20. Program the drive motor battery charger. [Control Module References](#)

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. [High Voltage Disabling](#)
2. Remove Charge Port Housing [Charge Port Housing Replacement \(Except Dubai\)](#)
3. Remove Headlamp [Headlamp Replacement](#)

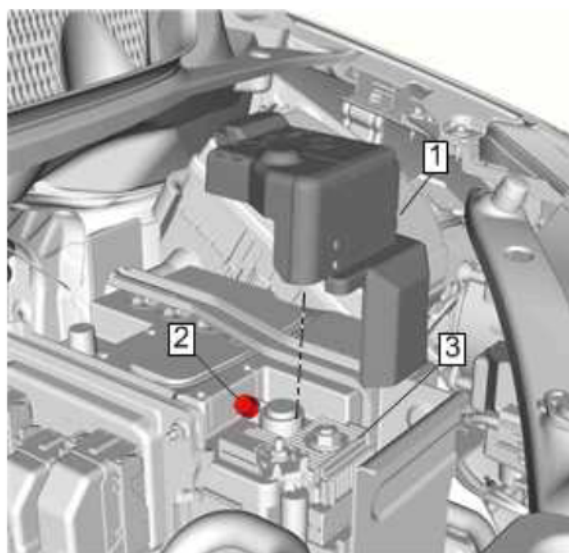


Fig. 57: Battery Positive Cable Protective Cover

Courtesy of GENERAL MOTORS COMPANY

4. Remove Battery Positive Cable Protective Cover (1)
5. Loosen Battery Positive Cable Clamp Fastener
6. Remove Battery Positive Cable (3) @ Battery Post

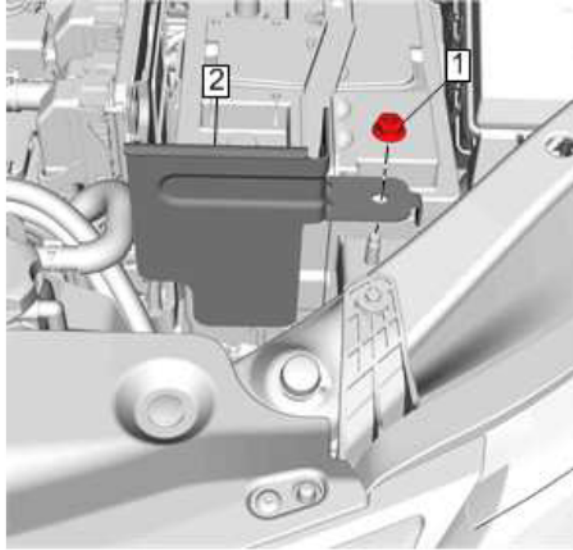


Fig. 58: Battery Tray Support Nut

Courtesy of GENERAL MOTORS COMPANY

7. Remove Battery Tray Support Nut (1)
8. Remove Battery Tray Support (2)

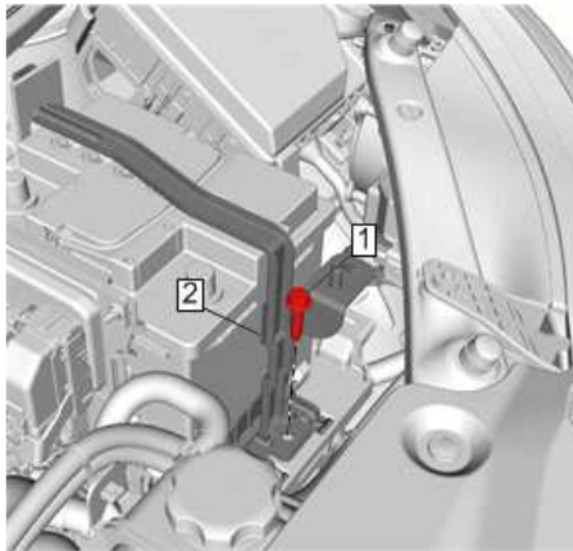


Fig. 59: Battery Retainer Assembly Bolt And Assembly

Courtesy of GENERAL MOTORS COMPANY

9. Remove Battery Retainer Assembly Bolt (1)
10. Remove Battery Retainer Assembly (2)

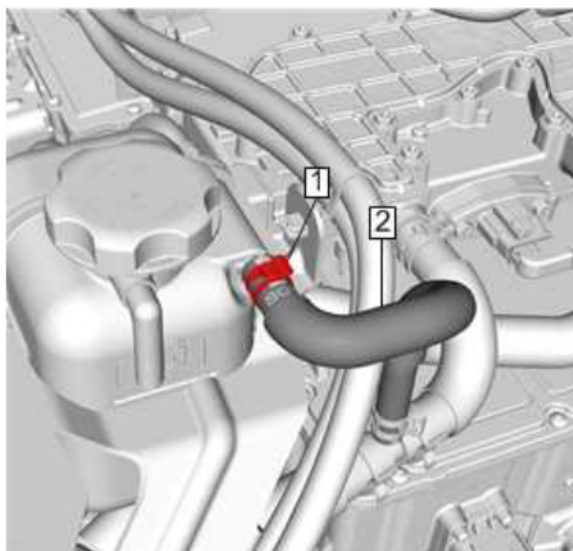


Fig. 60: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamp

Courtesy of GENERAL MOTORS COMPANY

11. Reposition Electric Differential Drive Motor Power Inverter Module Cooling Hose Clamp (2)
12. Position aside Electric Differential Drive Motor Power Inverter Module Cooling Hose @Radiator Surge Tank(1)



Fig. 61: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

13. Remove Drive Motor Battery Charger Receptacle Bolt(1)

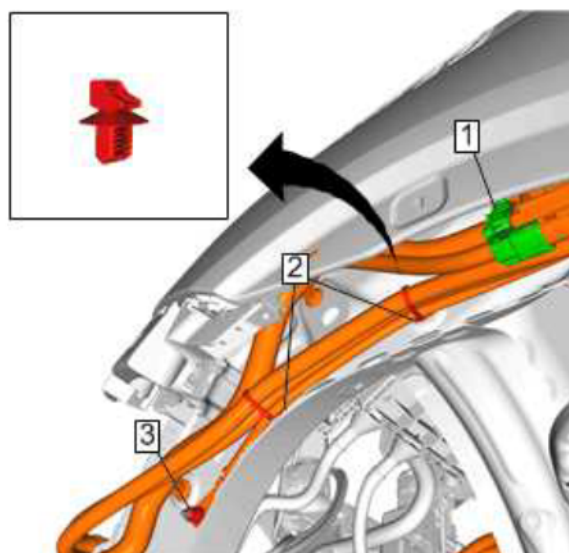


Fig. 62: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

14. Disconnect Drive Motor Battery Charger Receptacle Electrical Connector (1)
15. Detach Drive Motor Battery Charger Receptacle Retainer(2)
16. Remove Ground Nut(3)@Stud

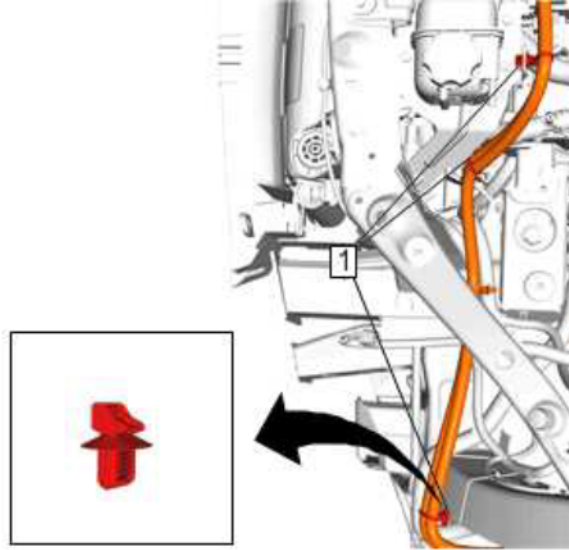


Fig. 63: Drive Motor Battery Charger Receptacle Retainer
Courtesy of GENERAL MOTORS COMPANY

17. Detach Drive Motor Battery Charger Receptacle Retainer(1)

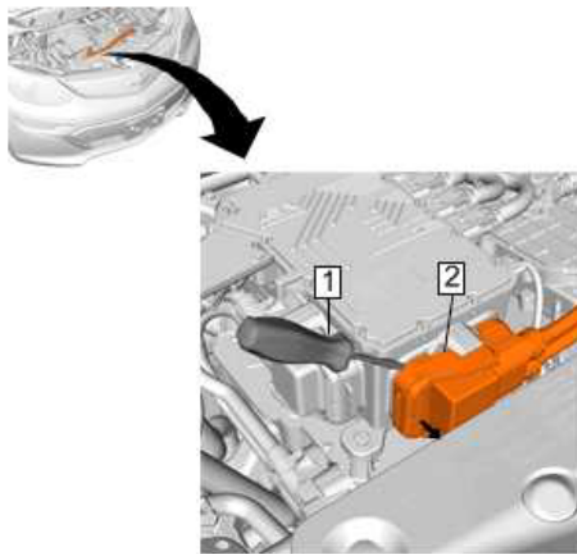
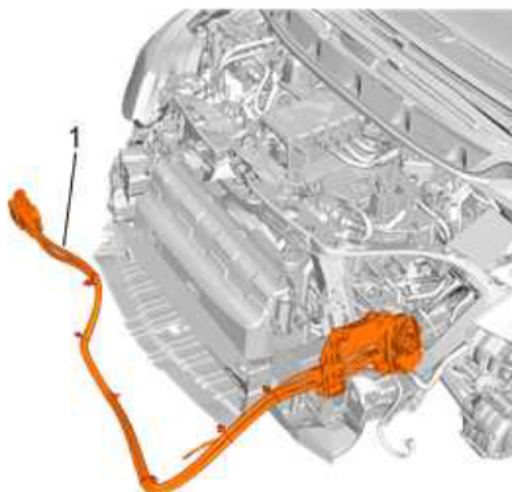


Fig. 64: Flat Bladed Screwdriver And Connector Handle Lock
Courtesy of GENERAL MOTORS COMPANY

18. Using a flat bladed screwdriver (1), pry the edge of the electrical connector handle lock (2) from the holding tab.
19. Release the electrical connector handle lock by rotating the electrical connector handle forward.
20. With the electrical connector handle in the release position, disconnect the high voltage charger electrical connector from the high power distribution module.



21. Remove Drive Motor Battery Charger Receptacle(1)

Installation Procedure

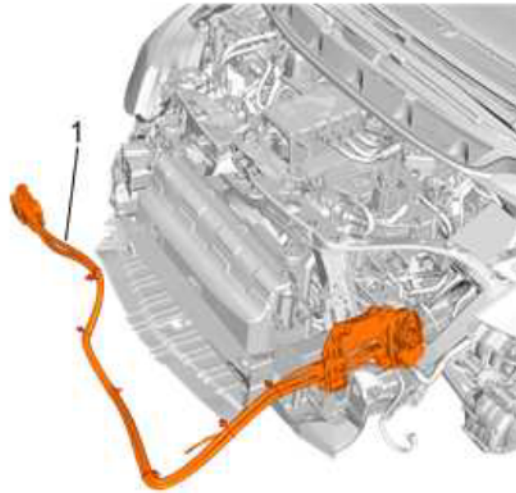


Fig. 66: Drive Motor Battery Charger Receptacle
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Charger Receptacle(1)

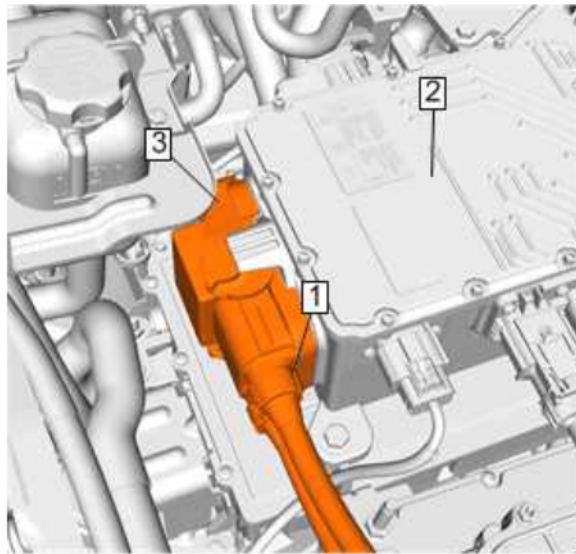


Fig. 67: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

2. Install the drive motor battery charger receptacle electrical connector (1) to the generator battery control wiring junction block (2) and lock the handle (3) into the lock position.

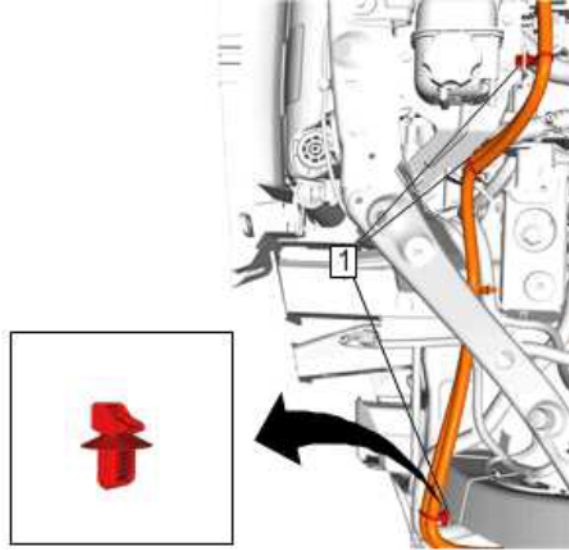


Fig. 68: Drive Motor Battery Charger Receptacle Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Battery Charger Receptacle Retainer(1)

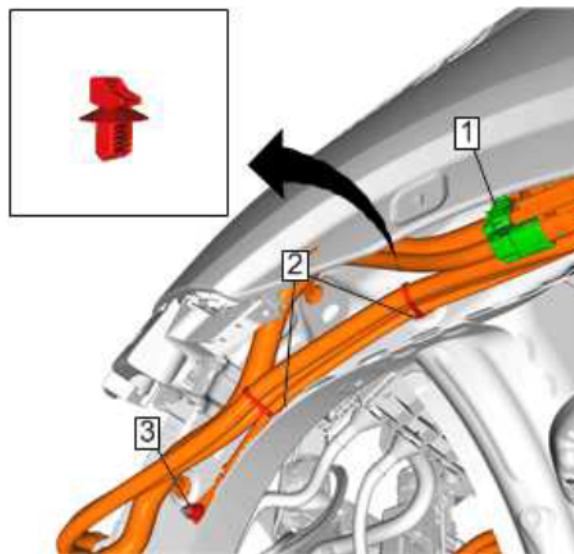


Fig. 69: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

4. Install Ground Nut(3)@Stud 9 N.m (80 lb in)
5. Install Drive Motor Battery Charger Receptacle Retainer(2)
6. Connect Drive Motor Battery Charger Receptacle Electrical Connector (1)

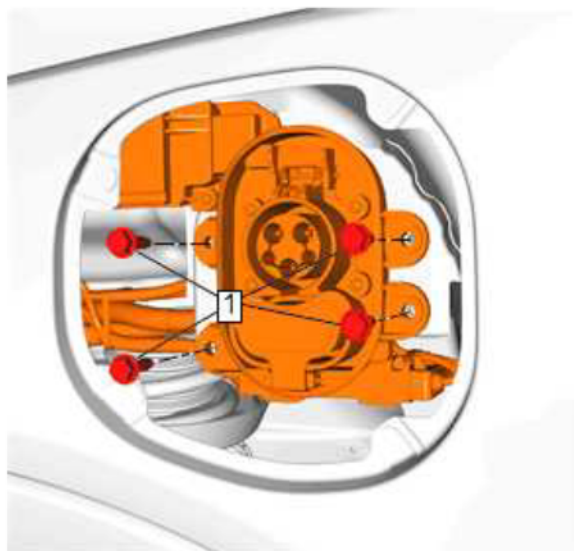


Fig. 70: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

7. Install Drive Motor Battery Charger Receptacle Bolt(1) 9 N.m (80 lb in)

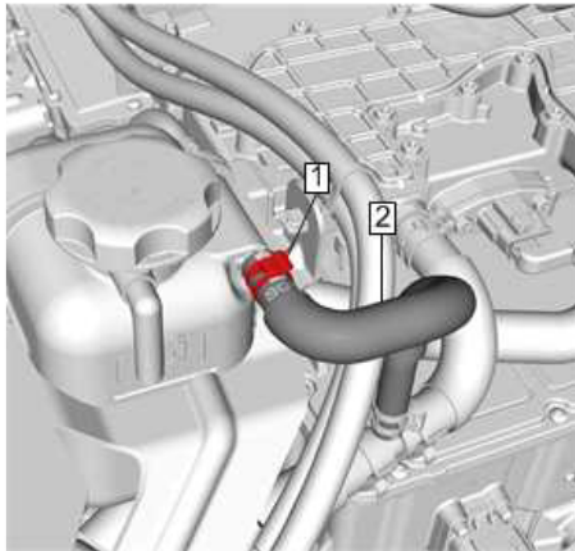


Fig. 71: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

8. Install Electric Differential Drive Motor Power Inverter Module Cooling Hose (1)
9. Install Electric Differential Drive Motor Power Inverter Module Cooling Hose Clamp (2)

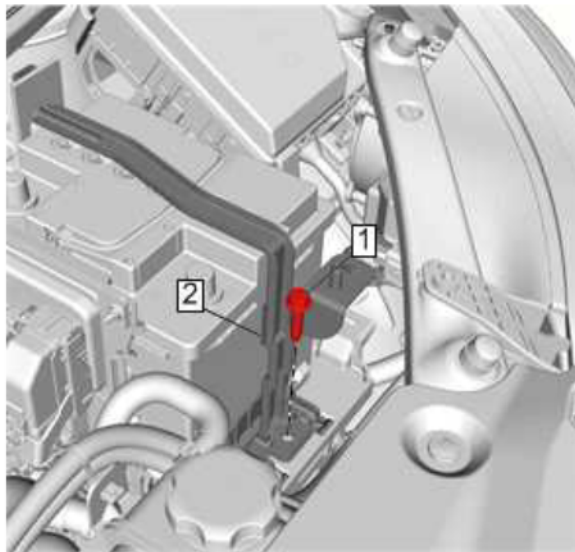


Fig. 72: Battery Retainer Assembly Bolt And Assembly
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

10. Install Battery Retainer Assembly (2)
11. Install Battery Retainer Assembly Bolt (1) and tighten 8 N.m (71 lb in)

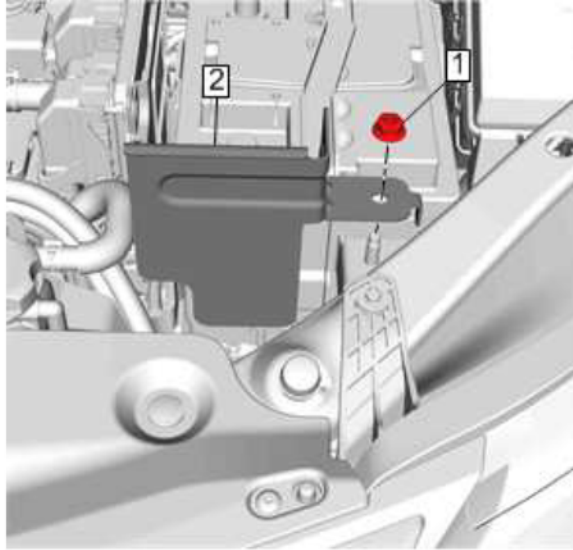


Fig. 73: Battery Tray Support Nut

Courtesy of GENERAL MOTORS COMPANY

12. Install Battery Tray Support (2)
13. Install Battery Tray Support Nut (1) and tighten 9 N.m (80 lb in)

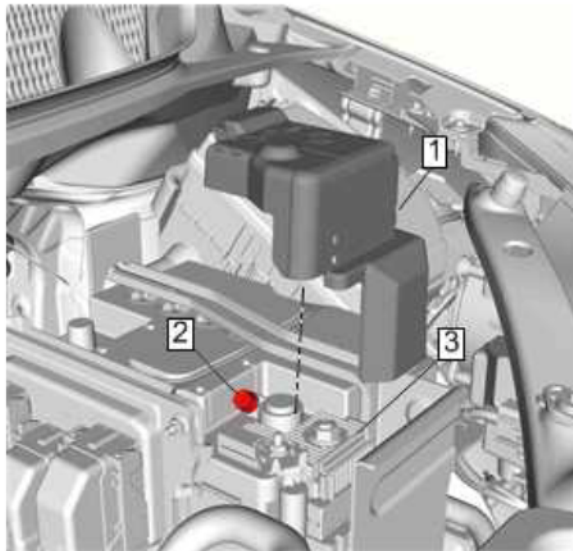


Fig. 74: Battery Positive Cable Protective Cover

Courtesy of GENERAL MOTORS COMPANY

14. Install Battery Positive Cable (3) @ Battery Post
15. Install Battery Positive Cable Clamp Fastener and tighten 5 N.m (44 lb in)
16. Install Battery Positive Cable Protective Cover (1)
17. Install Headlamp [Headlamp Replacement](#)
18. Install Charge Port Housing [Charge Port Housing Replacement \(Except Dubai\)](#)
19. Enable the high voltage system. [High Voltage Enabling](#)

DRIVE MOTOR BATTERY CHARGER RECEPTACLE REPLACEMENT (EXCEPT DUBAI WITHOUT QUICK CHARGE)

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. [High Voltage Disabling](#)
2. Remove Charge Port Housing [Charge Port Housing Replacement \(Except Dubai\)](#)

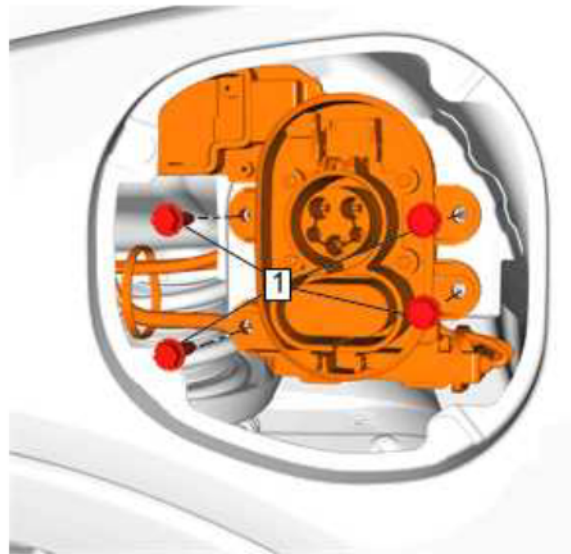


Fig. 75: Drive Motor Battery Charger Receptacle Bolt
 Courtesy of GENERAL MOTORS COMPANY

3. Remove Drive Motor Battery Charger Receptacle Bolt(1)

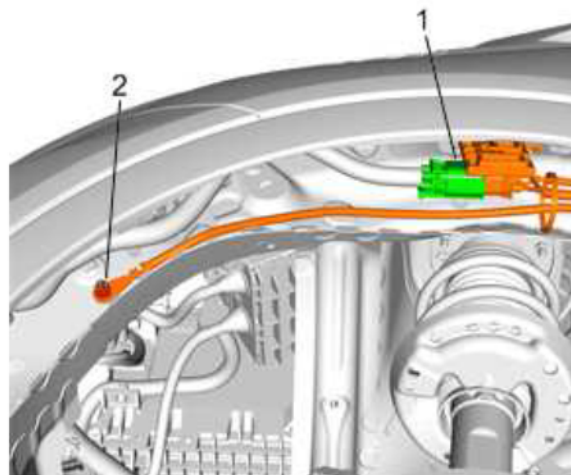


Fig. 76: Drive Motor Battery Charger Receptacle Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Drive Motor Battery Charger Receptacle Electrical Connector (1)
5. Remove Ground Nut(3)@Stud

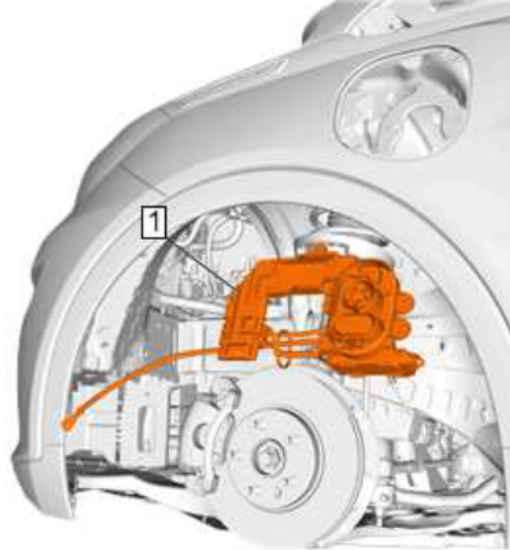


Fig. 77: Drive Motor Battery Charger Receptacle
Courtesy of GENERAL MOTORS COMPANY

6. Remove Drive Motor Battery Charger Receptacle(1)

Installation Procedure

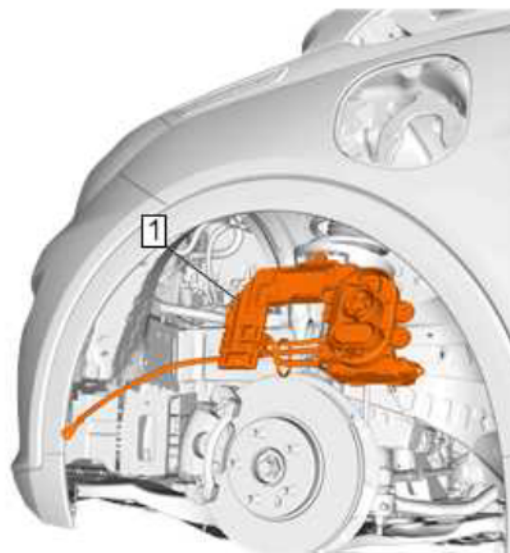


Fig. 78: Drive Motor Battery Charger Receptacle
Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Charger Receptacle(1)

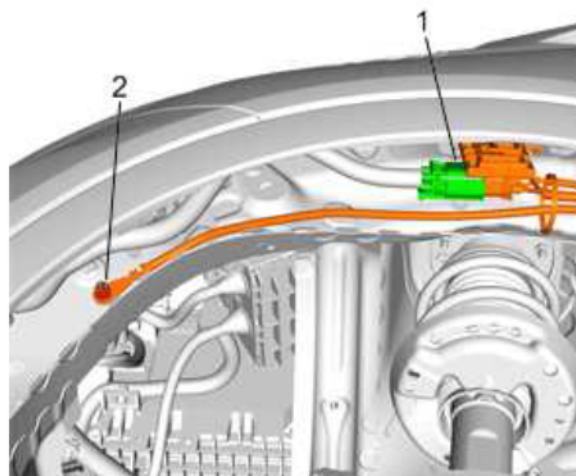


Fig. 79: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

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

2. Install Ground Nut(1)@Stud 9 N.m (80 lb in)
3. Connect Drive Motor Battery Charger Receptacle Electrical Connector (1)

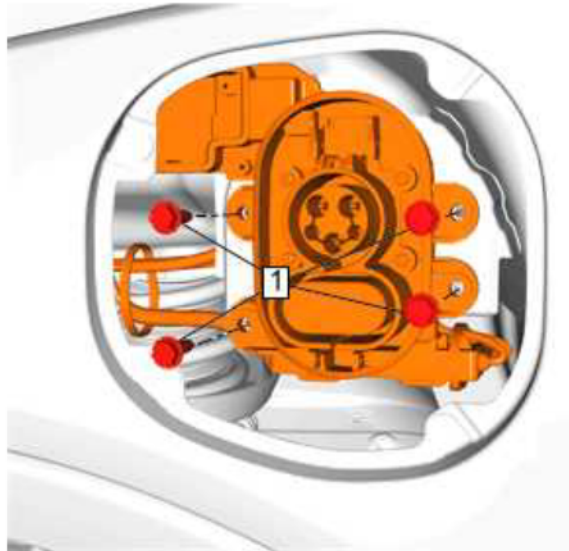


Fig. 80: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Install Drive Motor Battery Charger Receptacle Bolt(1) 9 N.m (80 lb in)
5. Install Charge Port Housing [Charge Port Housing Replacement \(Except Dubai\)](#)
6. Enable the high voltage system. [High Voltage Enabling](#)

DRIVE MOTOR BATTERY CHARGER RECEPTACLE REPLACEMENT (DUBAI ONLY WITH QUICK CHARGE)

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 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. Disable the high voltage system. [High Voltage Disabling](#)
2. Remove Charge Port Housing [Charge Port Housing Replacement \(Dubai\)](#)
3. Remove Headlamp [Headlamp Replacement](#)
4. Remove Battery Tray [Battery Tray Replacement](#)

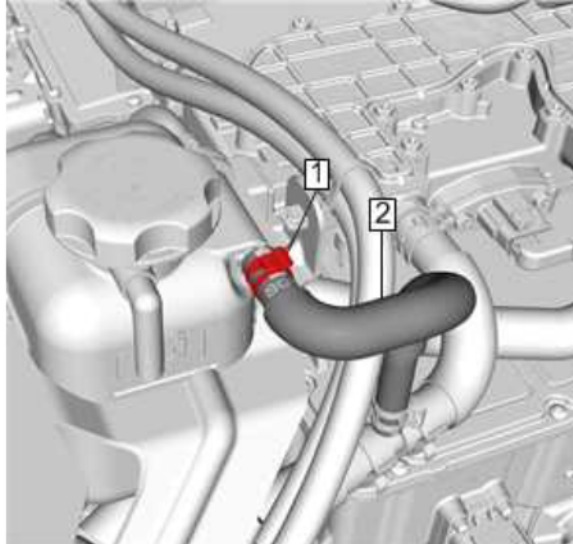


Fig. 81: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamp
 Courtesy of GENERAL MOTORS COMPANY

5. Reposition Electric Differential Drive Motor Power Inverter Module Cooling Hose Clamp (2)
6. Position aside Electric Differential Drive Motor Power Inverter Module Cooling Hose @Radiator Surge Tank(1)

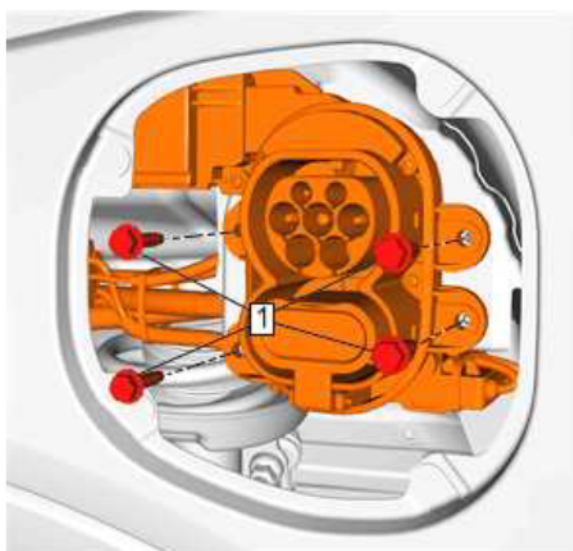


Fig. 82: Drive Motor Battery Charger Receptacle Bolt
 Courtesy of GENERAL MOTORS COMPANY

7. Remove Drive Motor Battery Charger Receptacle Bolt(1)

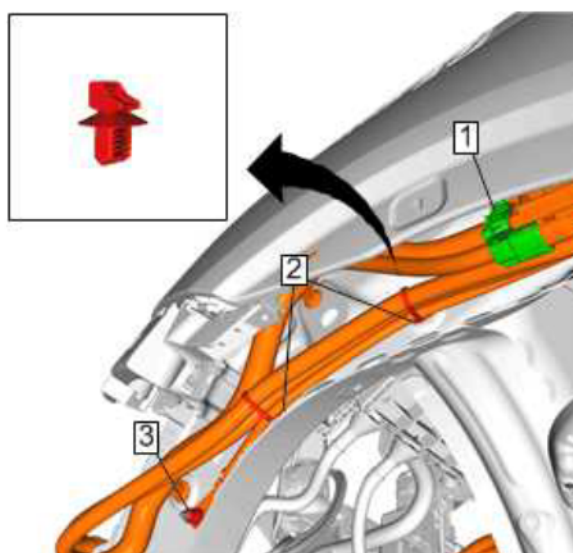


Fig. 83: Drive Motor Battery Charger Receptacle Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

8. Disconnect Drive Motor Battery Charger Receptacle Electrical Connector (1)
9. Detach Drive Motor Battery Charger Receptacle Retainer(2)
10. Remove Ground Nut(3)@Stud

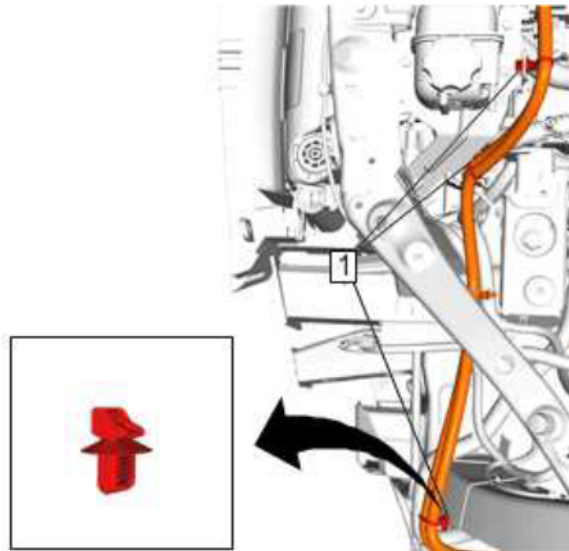


Fig. 84: Drive Motor Battery Charger Receptacle Retainer
Courtesy of GENERAL MOTORS COMPANY

11. Detach Drive Motor Battery Charger Receptacle Retainer(1)

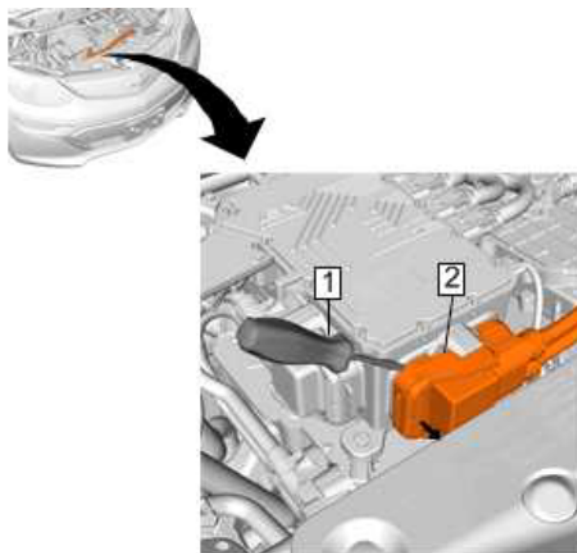


Fig. 85: Flat Bladed Screwdriver And Connector Handle Lock
Courtesy of GENERAL MOTORS COMPANY

12. Using a flat bladed screwdriver (1), pry the edge of the electrical connector handle lock (2) from the holding tab.
13. Release the electrical connector handle lock by rotating the electrical connector handle forward.
14. With the electrical connector handle in the release position, disconnect the high voltage charger electrical connector from the high power distribution module.

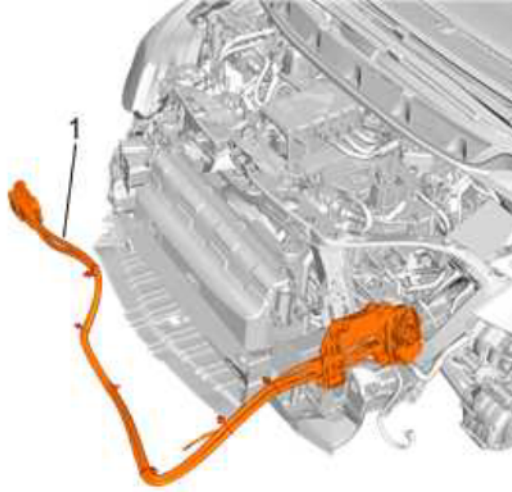


Fig. 86: Drive Motor Battery Charger Receptacle
 Courtesy of GENERAL MOTORS COMPANY

15. Remove Drive Motor Battery Charger Receptacle(1)

Installation Procedure

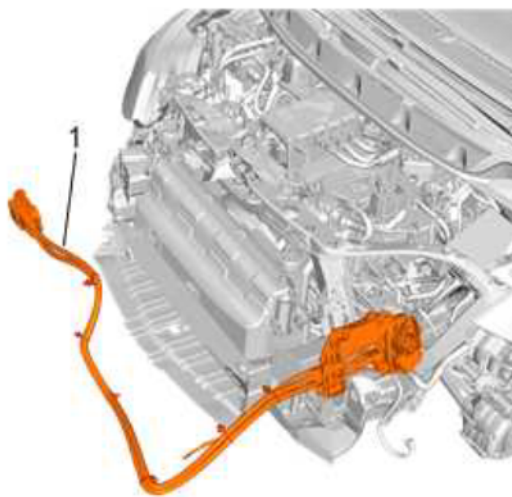


Fig. 87: Drive Motor Battery Charger Receptacle
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Charger Receptacle(1)

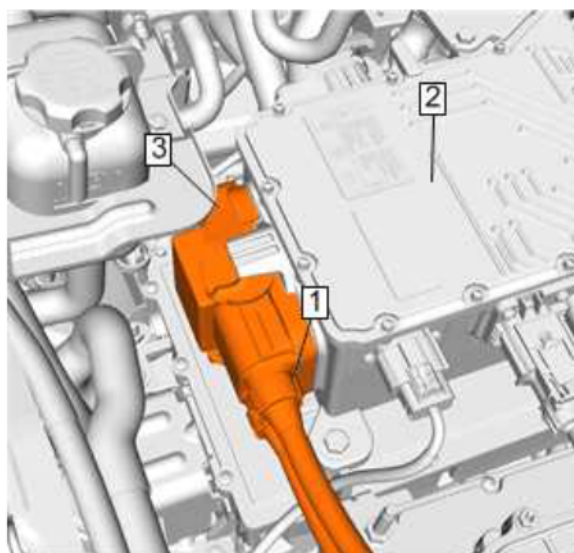


Fig. 88: Drive Motor Battery Charger Receptacle Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

2. Install the drive motor battery charger receptacle electrical connector (1) to the generator battery control wiring junction block (2) and lock the handle (3) into the lock position.

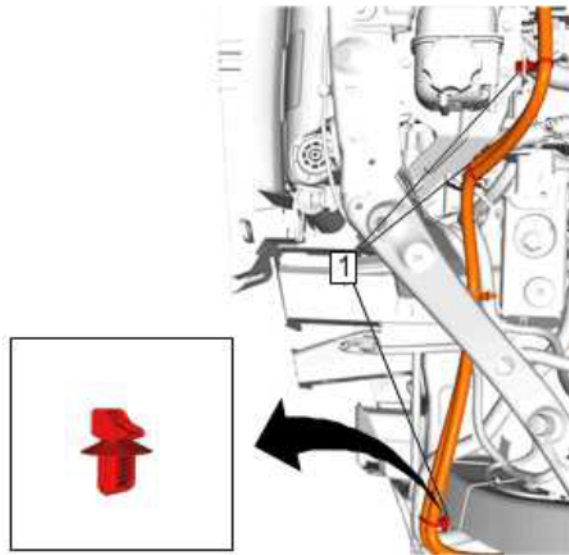


Fig. 89: Drive Motor Battery Charger Receptacle Retainer
Courtesy of GENERAL MOTORS COMPANY

3. Install Drive Motor Battery Charger Receptacle Retainer(1)

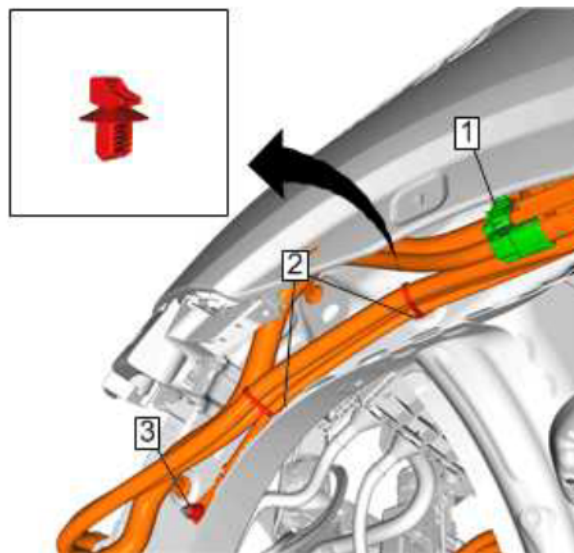


Fig. 90: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

4. Install Ground Nut(3)@Stud 9 N.m (80 lb in)
5. Install Drive Motor Battery Charger Receptacle Retainer(2)
6. Connect Drive Motor Battery Charger Receptacle Electrical Connector (3)

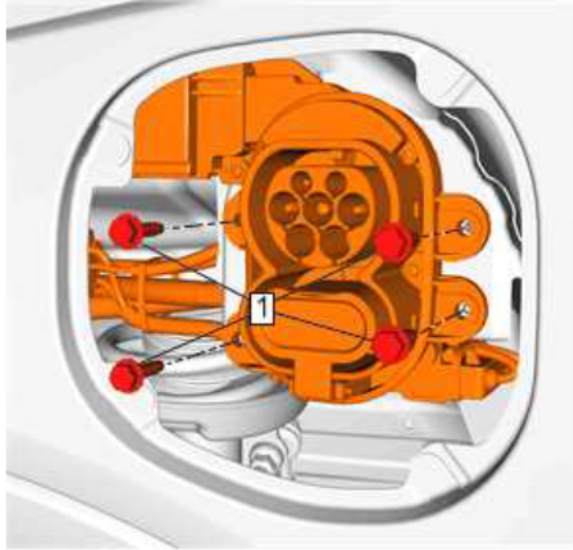


Fig. 91: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

7. Install Drive Motor Battery Charger Receptacle Bolt(1) 9 N.m (80 lb in)

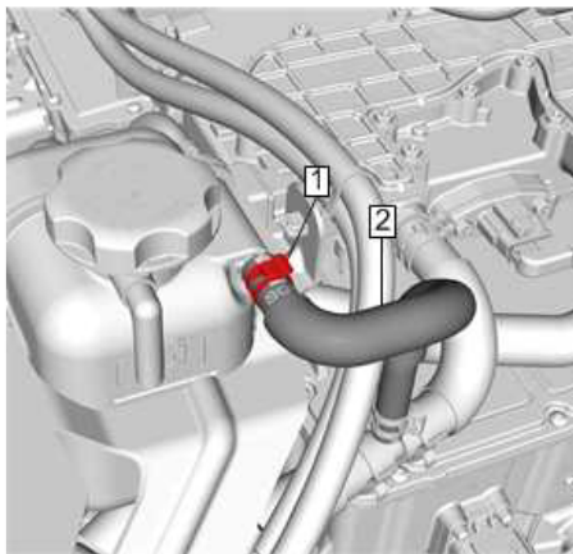


Fig. 92: Electric Differential Drive Motor Power Inverter Module Cooling Hose And Clamp
Courtesy of GENERAL MOTORS COMPANY

8. Install Electric Differential Drive Motor Power Inverter Module Cooling Hose (1)
9. Electric Differential Drive Motor Power Inverter Module Cooling Hose Clamp (2)
10. Install Battery Tray [Battery Tray Replacement](#)
11. Install Headlamp [Headlamp Replacement](#)
12. Install Charge Port Housing [Charge Port Housing Replacement \(Dubai\)](#)
13. Enable the high voltage system. [High Voltage Enabling](#)

DRIVE MOTOR BATTERY CHARGER RECEPTACLE REPLACEMENT (DUBAI ONLY WITHOUT QUICK CHARGE)

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 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. Disable the high voltage system. [High Voltage Disabling](#)
2. Remove Charge Port Housing [Charge Port Housing Replacement \(Dubai\)](#)

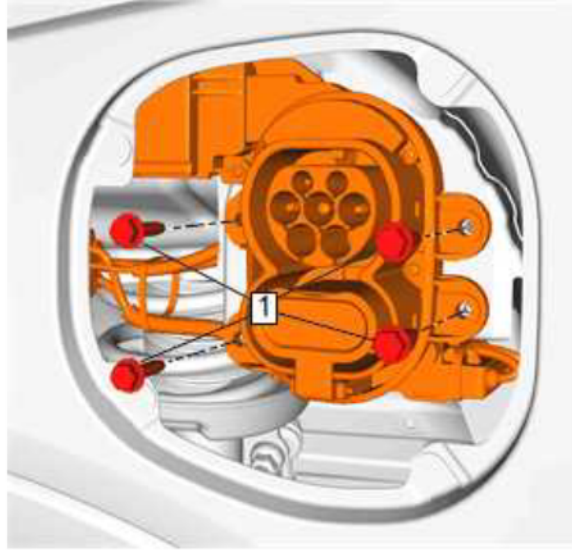


Fig. 93: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

3. Remove Drive Motor Battery Charger Receptacle Bolt(1)

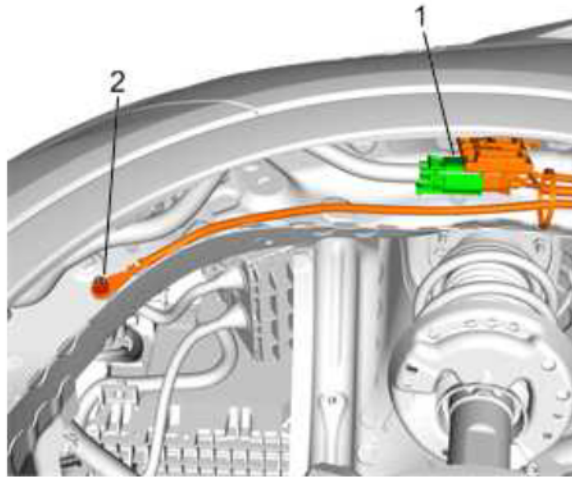


Fig. 94: Drive Motor Battery Charger Receptacle Electrical Connector
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Drive Motor Battery Charger Receptacle Electrical Connector (1)
5. Remove Ground Nut(3)@Stud

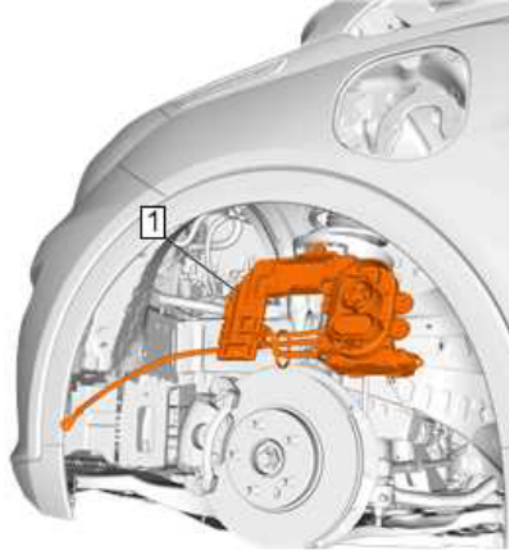


Fig. 95: Drive Motor Battery Charger Receptacle
 Courtesy of GENERAL MOTORS COMPANY

6. Remove Drive Motor Battery Charger Receptacle(1)

Installation Procedure

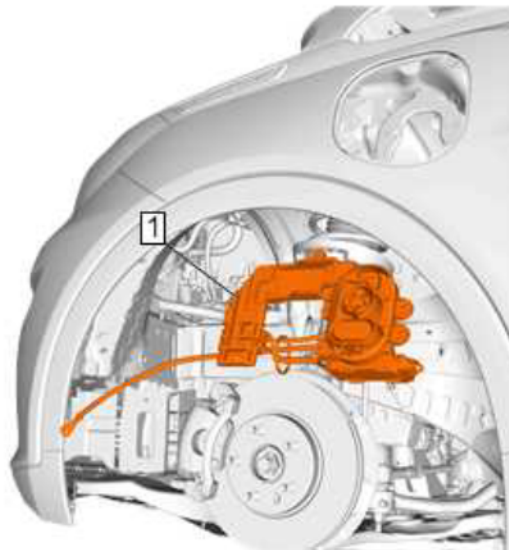


Fig. 96: Drive Motor Battery Charger Receptacle
 Courtesy of GENERAL MOTORS COMPANY

1. Install Drive Motor Battery Charger Receptacle(1) -

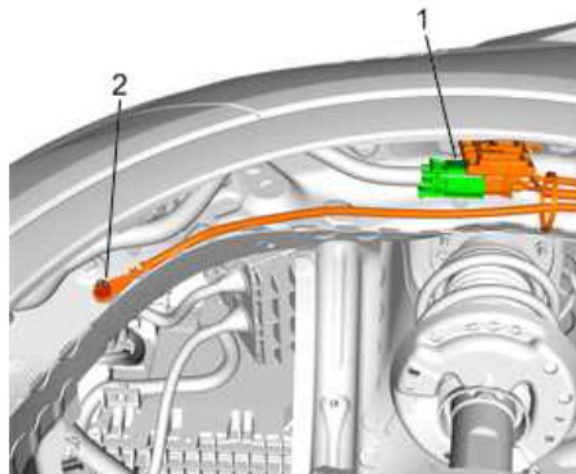


Fig. 97: Drive Motor Battery Charger Receptacle Electrical Connector
 Courtesy of GENERAL MOTORS COMPANY

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

2. Install Ground Nut(3)@Stud 9 N.m (80 lb in)
3. Connect Drive Motor Battery Charger Receptacle Electrical Connector (1)

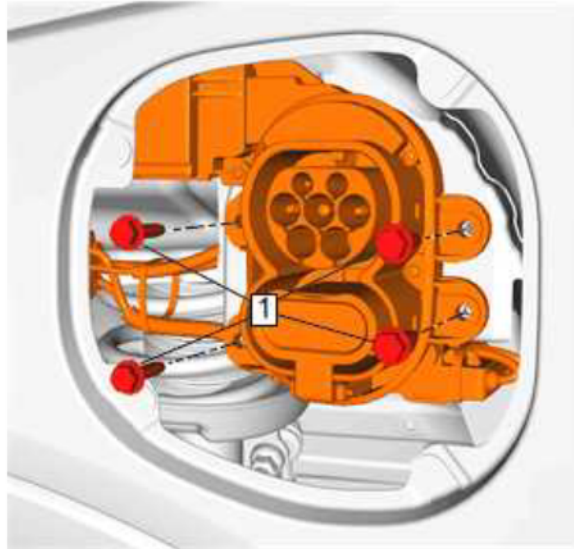


Fig. 98: Drive Motor Battery Charger Receptacle Bolt
Courtesy of GENERAL MOTORS COMPANY

4. Install Drive Motor Battery Charger Receptacle Bolt(1) 9 N.m (80 lb in)
5. Install Charge Port Housing [Charge Port Housing Replacement \(Except Dubai\)](#)[Charge Port Housing Replacement \(Dubai\)](#)
6. Enable the high voltage system. [High Voltage Enabling](#)

DC CHARGING DISABLED RESET

The DC Charging Disabled Reset procedure must be completed after Isolation Faults have been repaired.

The DC Charging Disabled Reset procedure requires a scan tool sequence and can be completed using the following steps:

1. Vehicle in Service Mode.
2. With a scan tool, select DC Charging Disabled Reset in the Hybrid/EV Powertrain Control Module 2 Configuration/Reset Functions, Reset Functions list.
3. Follow the scan tool directions to complete the procedure.
4. With a scan tool, clear any DTCs that may be set.
5. Vehicle OFF.

POWER LINE COMMUNICATION MODULE REPLACEMENT

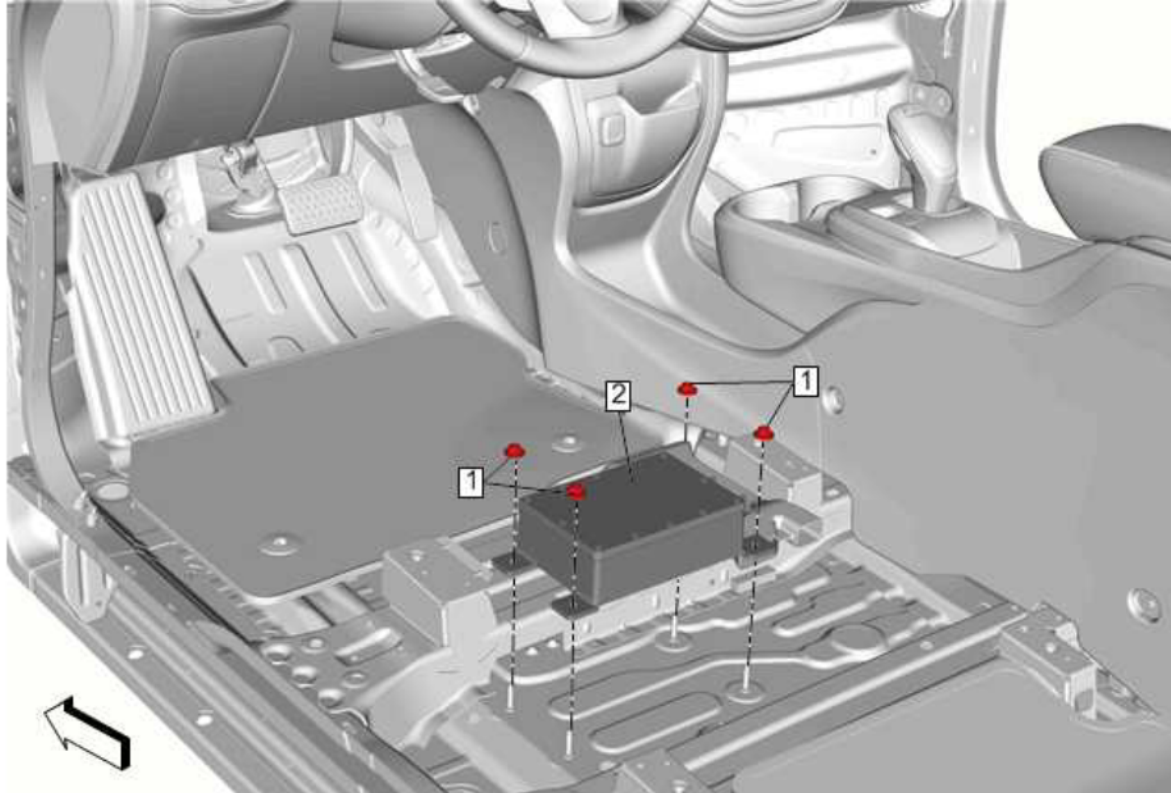


Fig. 99: Power Line Communication Module
Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
Preliminary Procedures WARNING: <u>Battery Disconnect Warning</u> 1. Disconnect the battery negative cable. <u>Battery Negative Cable Disconnection and Connection</u> 2. Remove the driver seat. <u>Driver or Passenger Seat Removal and Installation</u>	
1	Power Line Communication Module Nut CAUTION: <u>Fastener Caution</u> Tighten 9 N.m (80 lb in)
2	Power Line Communication Module Procedure 1. To access the module, open up the floor carpet along the cut line. 2. Disconnect the electrical connectors. 3. Connect the battery negative cable. <u>Battery Negative Cable Disconnection and Connection</u> 4. For programming and set up, refer to <u>Control Module References</u> .

DESCRIPTION AND OPERATION

PLUG-IN CHARGING SYSTEM DESCRIPTION AND OPERATION

Plug-In Charging System Components

cardiagn.com

The high voltage battery charging system consists of four main components:

1. The off-vehicle charging equipment:
 - Drive motor battery charger cable, often referred to as the travel cord set
 - Optional, permanent 220 - 240 V charge station
2. The hybrid/EV battery charger receptacle, often referred to as the drive motor battery charger receptacle.
3. The battery charger, often referred to as the drive motor battery charger.
4. The hybrid/EV battery pack.

A variety of mechanical, visual, and audio indicators/devices are used to communicate with the user of the charging equipment.

Drive Motor Battery Charger Cable/Charge Station

The drive motor battery charger cable provided with the vehicle features a standard household electrical plug on one end and a plug designed to interface with the vehicle's hybrid/EV battery charger receptacle on the other end. The drive motor battery charger cable features a charge current interrupt device with AC power and fault indicators, and it is stored in the vehicle's cargo area. An optional charge station is available for customers who want to reduce the amount of time needed to recharge. The optional charge station, if available, is hard-wired to a 220 - 240 V power supply and must be permanently mounted at the customer's location. The optional charge station features the same plug on the vehicle end as the drive motor battery charger cable.

The Drive Motor Battery Charger Cable Indicators and the Vehicle Indicators

The drive motor battery charger cable has two indicators, the AC Present Indicator and the Fault Indicator, which display its status.

- Solid green AC Present Indicator means AC voltage is present at the wall plug and there are no faults.
- Flashing green AC Present Indicator and solid red Fault Indicator means the electrical outlet or plug is faulty or overheated.
- Solid red Fault Indicator means the AC outlet does not have a proper ground and charging is not permitted for safety reasons.
- Flashing red Fault Indicator means there is a vehicle fault and the charger cable ground-fault circuit interrupter (GFCI) has tripped.
- Solid green AC Present Indicator and flashing red Fault Indicator means the charger cable has failed self-check.

The off-vehicle battery charging equipment is supervised and controlled by the hybrid/EV powertrain control module 2. The hybrid/EV powertrain control module 2 is the primary controller, and all diagnostic trouble codes will set in that module even though some of the diagnostics are actually run within the battery charger. Charging events can be delayed based on electric rates and departure time. The status of charging events, including delays, is communicated to the user through visual indications, instrument panel mounted charge status indicator, and audio tones. The vehicle charge status indicator, located on the top middle of the instrument panel, will be short flashing green when the vehicle is charging under automatic control. The flash rate increases from one to four as the battery charges. It will be long flashing green if the charging is delayed and will begin later. It will be solid green when charging is complete. A solid yellow indicator means the vehicle is not able to accept a charge. If there is no indicator, the drive motor battery charger cable is not working properly or not connected.

Vehicle Receptacle

The vehicle receptacle, or hybrid/EV battery charger receptacle, is located behind the charging port door on the driver's side rear quarter panel. The receptacle is accessed by depressing and opening the receptacle door.

Battery Charger

The battery charger is a serviceable assembly containing several micro-processors and two separate high voltage chargers. The battery charger is mounted beneath the vehicle under the hybrid/EV battery pack. DEX-COOL[®] coolant is used to ensure that the charger does not exceed its maximum designed operating temperature. The battery charger, along with the 14 V power module and the drive motor generator power inverter module, are cooled by a power electronics cooling loop, which is separate from other cooling systems.

12 V Battery Maintenance Mode

Battery Maintenance Mode is an automatic function that prevents deep discharge of the 12 V battery in specific circumstances. It is not dependent on the drive motor battery charger cable being plugged into the hybrid/EV battery charger receptacle. It functions either when the drive motor battery charger cable is plugged in or unplugged. Operation differs depending on whether the power mode is Vehicle Off or Vehicle in Service Mode.

With Vehicle Off, the 12 V battery is monitored at periodic intervals up to a maximum of 30 days. With Vehicle in Service Mode, the 12 V battery is monitored at periodic intervals up to a maximum of 60 hours. If voltage is low, the 12 V battery is charged by the 14 V power module using external power for up to four hours. This function is only intended to prevent a dead 12 V battery and does not provide a full charge. This is more efficient than continuously trickle charging, thus minimizing the usage of external power.

Under normal circumstances, with a 12 V battery that is charged when the vehicle is parked, Battery Maintenance Mode will simply monitor the voltage level, and no charging will be necessary. With Vehicle Off, Battery Maintenance Mode will maintain the 12 V battery for up to 30 days. For longer periods, refer to Owner Manual for instructions.

DC Fast Charging System (if equipped)

The DC high power fast charge system consists of the stationary DC fast charge station, the DC combo plug, the hybrid/EV battery charger receptacle, the battery charger - DC, and the hybrid/EV battery pack. The high voltage DC current is directly supplied to the hybrid/EV battery pack through the battery charger -DC, bypassing the battery charger, often referred to as the drive motor battery charger. The receptacle has a locking mechanism that locks the DC combo plug while power is being transferred to the hybrid/EV battery pack. The mechanical lock is a safety system that is controlled by the hybrid/EV powertrain control module 2. This locking mechanism will disengage once the charging process is completed or terminated and high voltage DC is reduced to a safe voltage level at the DC combo plug.

The hybrid/EV powertrain control module 2 monitors and verifies the following conditions before the charging process can begin:

- The stationary charge station is capable of providing high voltage DC power to the hybrid/EV battery pack.
- The hybrid/EV battery pack temperature can be maintained within the normal operating range.
- No high voltage electrical safety faults are present.
- The receptacle locking mechanism is operating properly.
- Vehicle immobilization is successful, if equipped.

If any of these conditions fail during the charging process, then the charging process will be terminated.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description

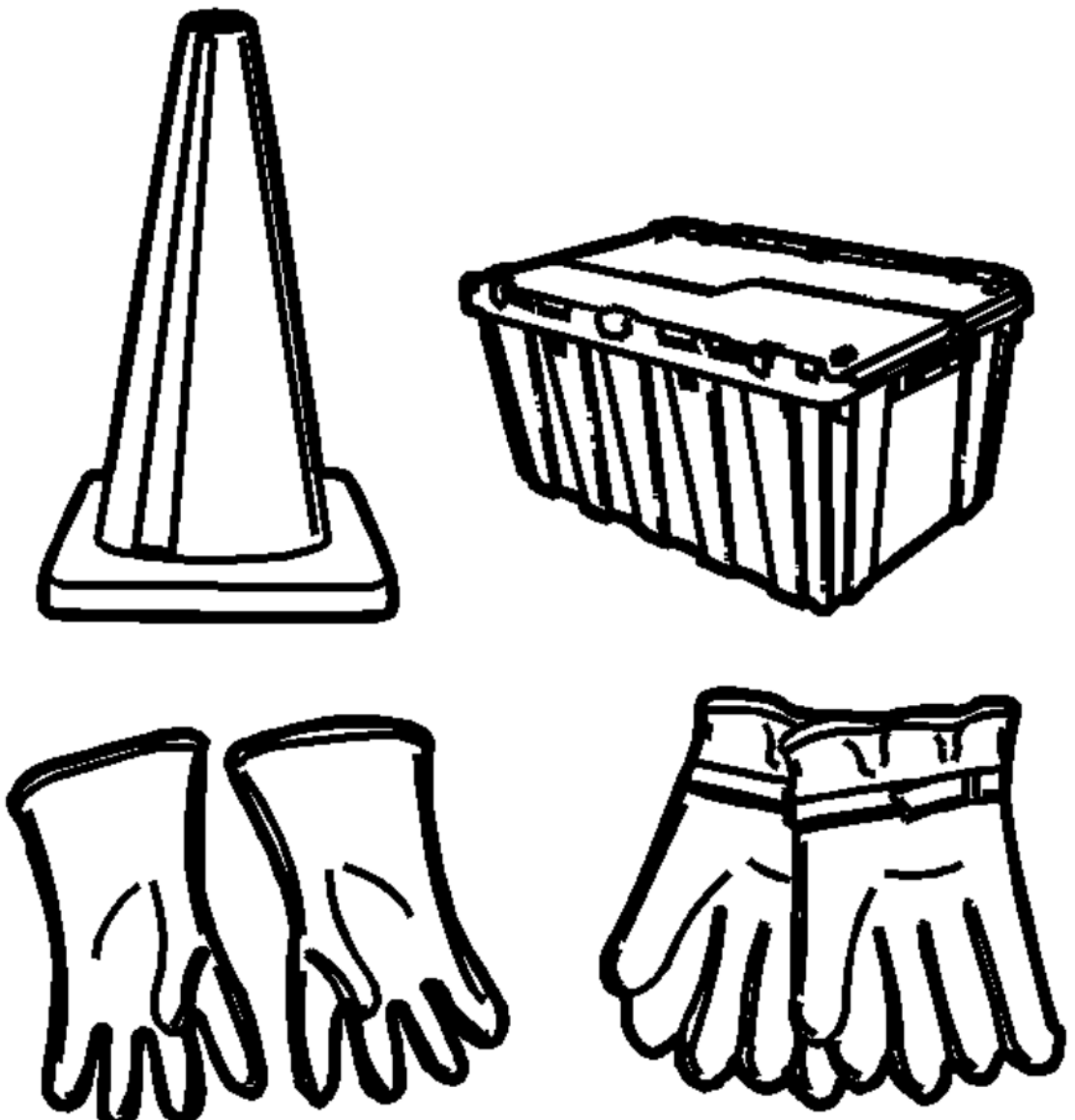
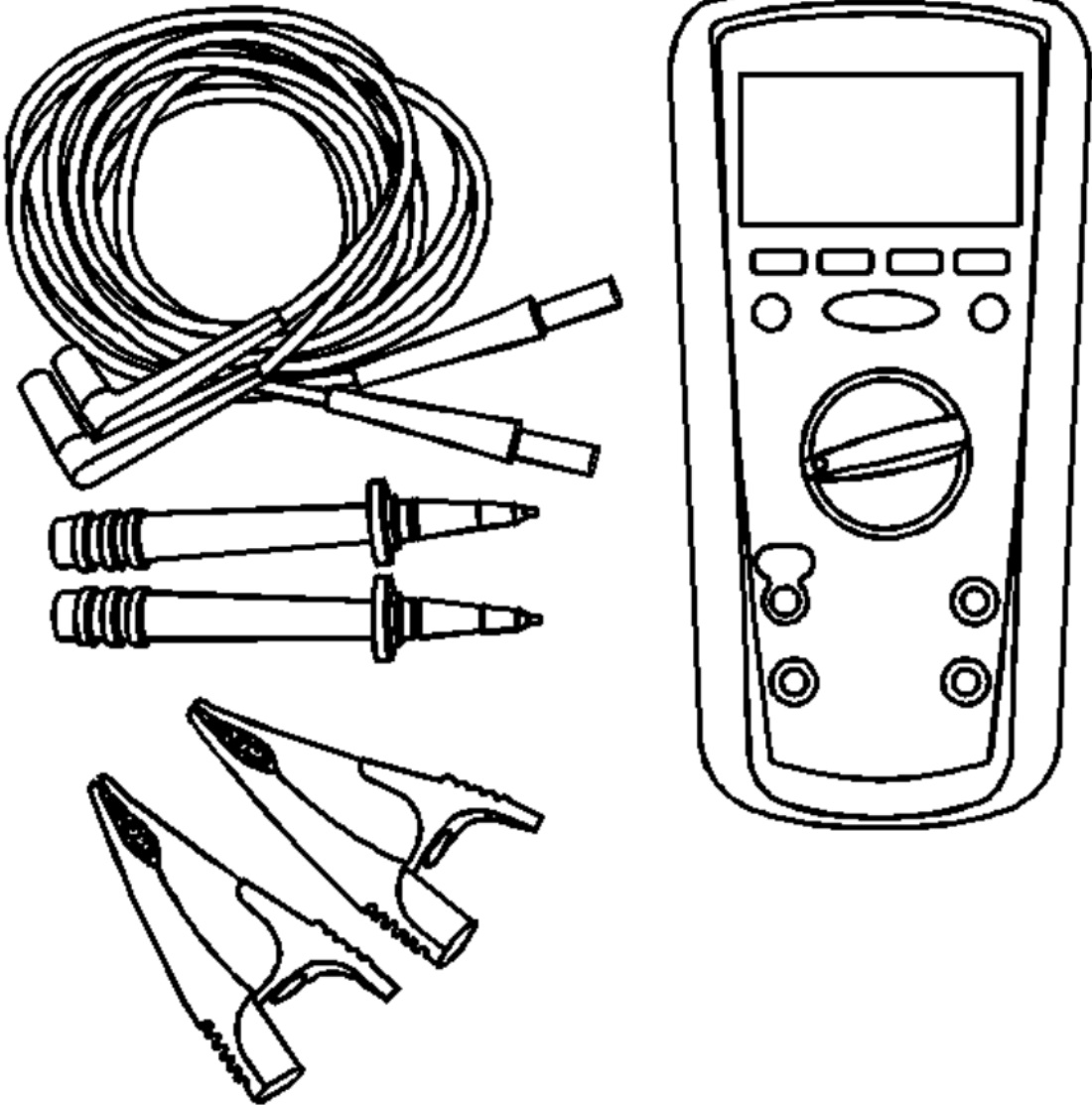
Illustration	Tool Number/Description
 The illustration shows four items: a traffic cone on the top left, a rectangular plastic storage bin with vertical ridges on the top right, a pair of work gloves on the bottom left, and another pair of work gloves on the bottom right. The gloves have a textured palm side and a smooth back side.	EL-48900 HEV Safety Kit or equivalent Dealer Equipment

Illustration	Tool Number/Description
	EL-50772 Insulation Multimeter