

## HYBRID SERVICE DISABLE PROCEDURES

GM - LaCrosse, Regal, Malibu - 2012-13

### HIGH VOLTAGE SYSTEM DISABLE

**NOTE:** For further information, see the [HYBRID/EV ENERGY STORAGE SYSTEM](#) article.

### HIGH VOLTAGE SAFETY

**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.

**WARNING:** High voltage circuits should only be tested using a digital multimeter (DMM) and test leads with at least a CAT III rating, such as the J 39200-A Digital Multimeter. Failure to follow the procedures may result in serious injury or death.

**WARNING:** This vehicle is equipped with a high voltage battery that is completely isolated from the chassis ground. Never utilize AC powered test

equipment to probe the high voltage system. Serious injury, death and component damage could occur if the high voltage system is grounded through the electric utility.

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

## Special Tools

**EL-48900** HEV Safety Kit

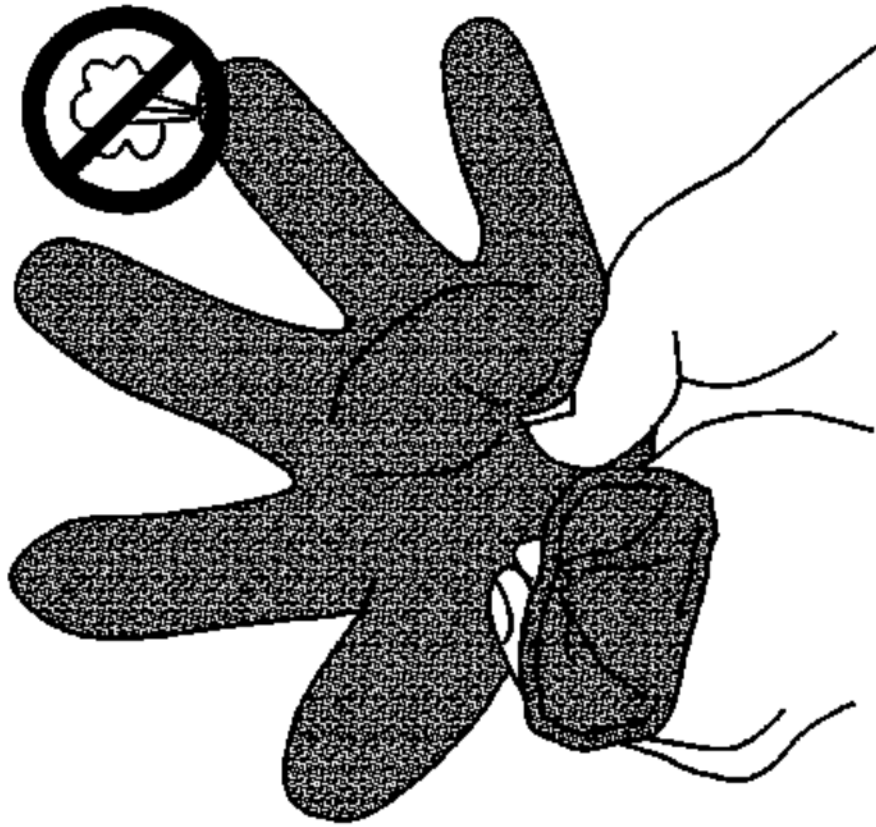
## Precautions when Performing Service or Inspections

- Always verify that the high voltage has been disabled before working on or around high voltage components, wires, cables, or harnesses.
- Remove all metal objects such as rings and watches.
- The **EL-48900** HEV safety kit contains safety cones. Place the safety cones around the vehicle to alert other technicians that you are working on the high voltage system.
- Remove all vehicle keys and secure in a location outside the vehicle. If the vehicle is equipped with push button start, the keys must remain at least 3 meters (15 feet) from the vehicle.
- Ensure that the manual service disconnect lever is secured in the open position with a zip tie.
- Always wear certified and tested high voltage insulation gloves when inspecting or testing any high voltage wires and components.
- Use the "One Hand" rule:
  - Work with only one hand whenever possible.
  - Keep the other hand behind your back.
- DO NOT carry any metal objects such as a mechanical pencil or a measuring tape that could fall and cause a short circuit.
- After removing any high voltage wires, protect and insulate the terminal ends immediately with UL® Listed or equivalent insulation tape rated at a minimum of 600 V.
- Always tighten the high voltage terminal fasteners to the specified torque. Insufficient or excessive torque will cause malfunctions or damage.
- After finishing work on the high voltage systems and before closing the manual service disconnect lever, inspect for the following:
  - Verify high voltage system integrity and that all connectors are installed.
  - Verify that all tools or loose components have been removed.

## Labels for Components, Wire Harness, and Connectors

The wire harnesses and cables for high voltage circuits are encased in an orange colored covering. In addition, the high voltage energy storage device (battery) is affixed with a RED DANGER label and other high voltage components (e.g. starter/generator) are affixed with ORANGE WARNING labels.

## High Voltage Insulation Glove Inspection Procedure



**Fig. 1: Glove Inspection Procedure**  
Courtesy of GENERAL MOTORS COMPANY

The following procedure visually and functionally inspects the insulation gloves to be used while performing service on high voltage systems. This inspection procedure should be performed prior to any procedure that requires the use of class "0" insulation gloves rated at 1000 V.

1. Remove glove from leather protector.
2. Inflate glove and seal opening. Pinch the opening closed tightly to prevent any air loss.
3. Press glove to increase pressure.
4. Inspect for any of the following conditions:
  - pin holes
  - air leaks
  - wear, tears, or abrasions
  - damp or wet material
  - certified up-to-date
  - If any of the above conditions exist, do not use the gloves.

## HIGH VOLTAGE DISABLING

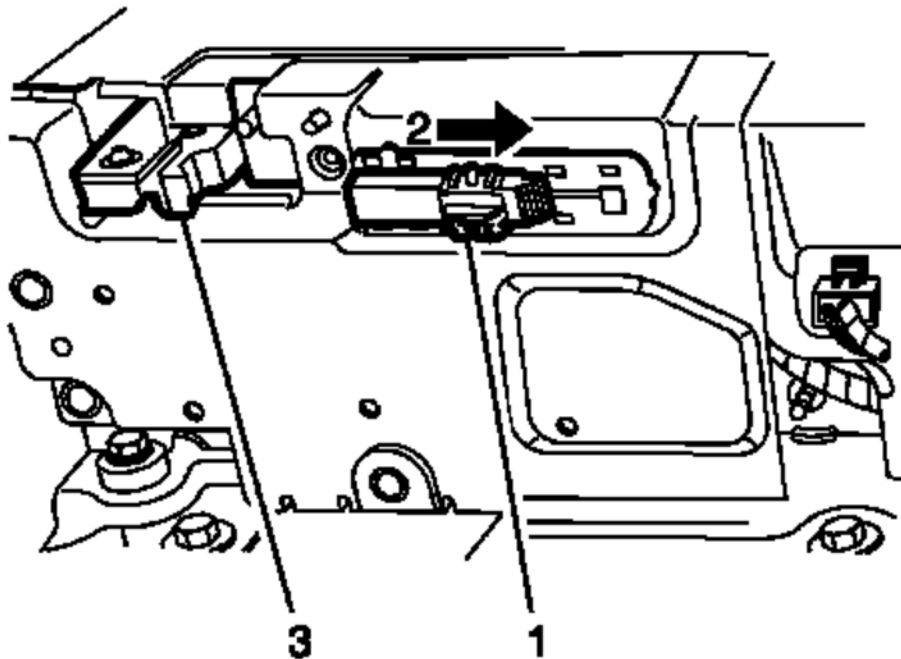
**WARNING:** Ensure all High Voltage safety procedures are followed. Failure to follow the procedure exactly as written may result in serious injury or death. See High Voltage Safety.

### **Servicing the A4 Hybrid/EV Battery Pack, A15 Starter/Generator, High Voltage 3-Phase Cables, and General Vehicle Servicing**

This disabling procedure should only be used when service is being performed on components that are located outside of the A4 hybrid/EV battery pack, such as the A15 starter/generator and high voltage 3-phase cables, or when the A4 hybrid/EV battery pack is being replaced as a complete assembly. This procedure will only verify that high voltage has been removed from locations outside the A4 hybrid/EV battery pack. If testing or replacement requires disassembling the A4 hybrid/EV battery pack and accessing any components within, Servicing Any Internal Components Within the A4 Hybrid/EV Battery Pack, located below, must be used. The Servicing Any Internal Components Within the A4 Hybrid/EV Battery Pack procedure must be used because of the constant presence of high voltage when the A4 hybrid/EV battery pack is disassembled.

1. Disconnect and remove any 12 V battery chargers.
2. Turn the ignition OFF and wait 5 minutes to allow the high voltage capacitors to discharge.
3. Remove all vehicle keys and secure in a location outside the vehicle. If the vehicle is equipped with push button start, the keys must remain at least 3 meters (10 feet) away from the vehicle.
4. Disconnect the 12 V battery. Refer to Battery Negative Cable Disconnection and Connection .
5. Lower the rear seatback and reposition the trunk liner to gain access to the A4 hybrid/EV battery pack.

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**Fig. 2: Blue Connector Position Assurance**  
Courtesy of GENERAL MOTORS COMPANY

6. Disengage the blue connector position assurance (1) from the high voltage interlock switch by pulling the CPA straight out. See **Fig. 2**. Do not fully remove the CPA from the switch or damage to the CPA will result.
7. Depress the tab on the high voltage interlock switch and slide the interlock switch toward the left side of the vehicle (2). See **Fig. 2**.
8. Flip the S15 hybrid/EV battery pack high voltage manual disconnect lever, located on the A4 hybrid/EV battery pack, toward the right side of the vehicle and secure in the open position with a zip tie (3). See **Fig. 2**.

**WARNING:** Wear high voltage insulation gloves with leather protectors until it has been determined that a high voltage exposure risk is no longer present. Failure to follow the procedures exactly as written may result in serious injury or death.

9. Remove the F102 hybrid/EV battery pack cable cover from the A4 hybrid/EV battery pack.

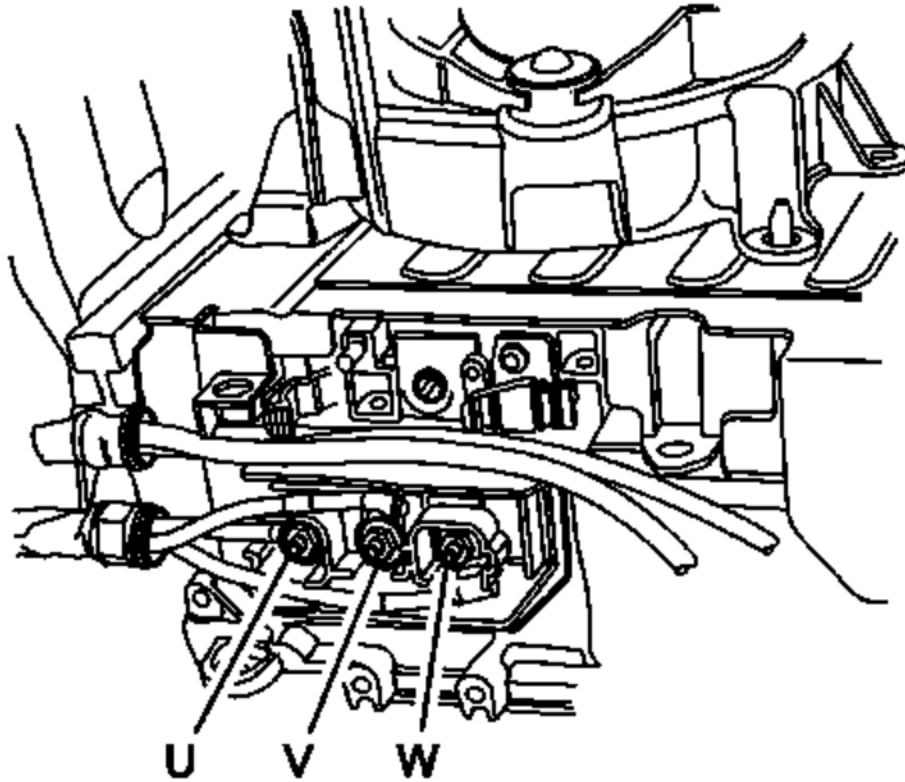
**NOTE:** A 9 V DC battery can be used to test the DMM.

10. Test the DMM by measuring a 12 V battery. The reading on the DMM should accurately reflect the battery voltage.

- If the DMM does not properly measure a 12 V battery

Repair or replace the DMM.

- If the DMM properly measures a 12 V battery



**Fig. 3: Phase Terminal V, U And W**

Courtesy of GENERAL MOTORS COMPANY

11. Verify that the voltage has been disabled at the energy storage system. Using the DMM on the DC voltage scale, test for less than 3 V at the following points:

- High voltage 3-Phase terminal V to vehicle chassis ground
- High voltage 3-Phase terminal W to vehicle chassis ground
- High voltage 3-Phase terminal U to vehicle chassis ground
- High voltage 3-Phase terminal U to High voltage 3-Phase terminal V
- High voltage 3-Phase terminal V to High voltage 3-Phase terminal W
- High voltage 3-Phase terminal W to High voltage 3-Phase terminal U

- If 3 V or greater

A contactor is stuck closed or a loss of isolation has occurred within the A4 hybrid/EV battery pack. Refer to **HYBRID\EV BATTERY VOLTAGE PRESENT** in the HYBRID/EV ENERGY STORAGE article.

- If less than 3 V

**NOTE: A 9 V DC battery can be used to test the DMM.**

12. Test the DMM by measuring a 12 V battery. The reading on the DMM should accurately reflect the battery voltage.

- If the DMM does not properly measure a 12 V battery

Repair or replace the DMM and perform step 11 again.

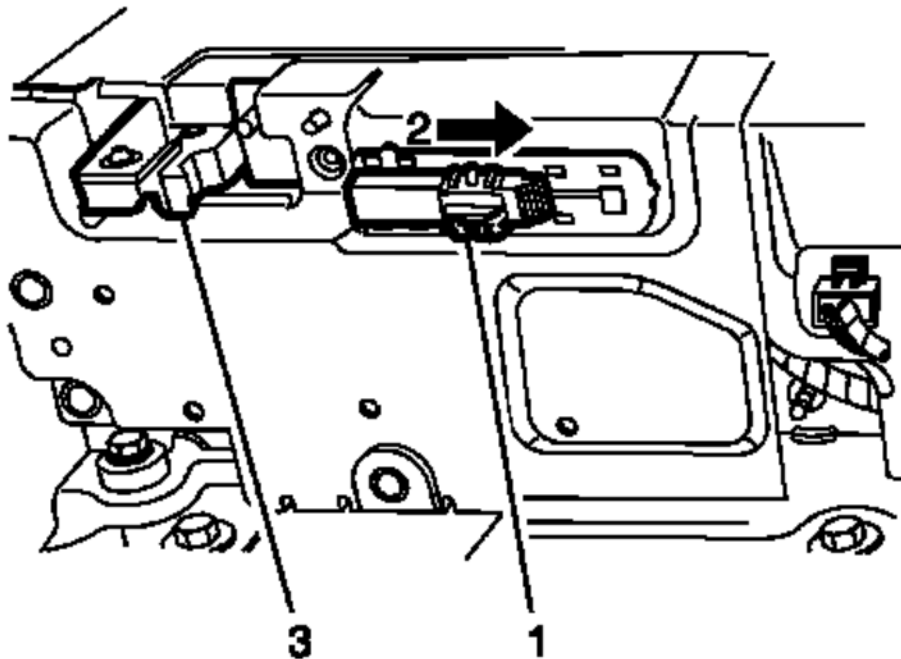
- If the DMM properly measures a 12 V battery

13. If all the test results were less than 3 V, the A4 hybrid/EV battery pack, A15 starter/generator, high voltage 3-phase cables, or general vehicle can now be serviced.

### **Servicing Any Internal Components Within the A4 Hybrid/EV Battery Pack**

This disabling procedure should be used when any service is being performed on components that are internal to the A4 hybrid/EV battery pack, such as the K59 starter/generator control module and K16 battery energy control module. If a diagnostic instructs to perform any testing or replacement of components within the A4 hybrid/EV battery pack, this procedure must be used. This procedure will completely disconnect and isolate the C4A hybrid/EV battery section 1 and C4B hybrid/EV battery section 2 from the vehicle, allowing testing or replacement to occur in a safer environment.

1. Review the high voltage safety information. Refer to **High Voltage Safety**.
2. Disconnect and remove any 12 V battery chargers.
3. Turn the ignition OFF and wait 5 minutes to allow the high voltage capacitors to discharge.
4. Remove all vehicle keys and secure in a location outside the vehicle. If the vehicle is equipped with push button start, the keys must remain at least 3 meters (10 feet) away from the vehicle.
5. Disconnect the 12 V battery. Refer to **Battery Negative Cable Disconnection and Connection**.
6. Lower the rear seatback and reposition the trunk liner to gain access to the A4 hybrid/EV battery pack.



**Fig. 4: Blue Connector Position Assurance**  
Courtesy of GENERAL MOTORS COMPANY

7. Disengage the blue connector position assurance (1) from the high voltage interlock switch by pulling the CPA straight out. See **Fig. 4**. Do not fully remove the CPA from the switch or damage to the CPA will result.
8. Depress the tab on the high voltage interlock switch and slide the interlock switch (2) toward the left side of the vehicle. See **Fig. 4**.
9. Flip the S15 hybrid/EV battery pack high voltage manual disconnect lever, located on the A4 hybrid/EV battery pack, toward the right side of the vehicle and secure in the open position with a zip tie (3). See **Fig. 4**.

**WARNING:** Wear high voltage insulation gloves with leather protectors until it has been determined that a high voltage exposure risk is no longer present. Failure to follow the procedures exactly as written may result in serious injury or death.

10. Remove the F102 hybrid/EV battery pack cable cover from the A4 hybrid/EV battery pack.

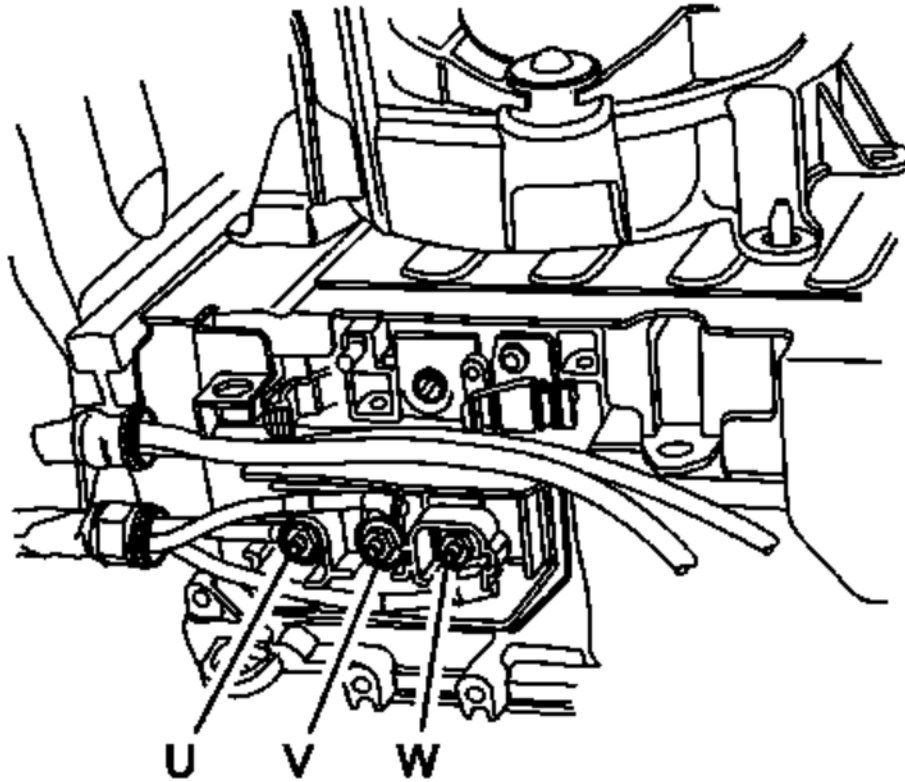
**NOTE:** A 9 V DC battery can be used to test the DMM.

11. Test the DMM by measuring a 12 V battery. The reading on the DMM should accurately reflect the battery voltage.

- If the DMM does not properly measure a 12 V battery

Repair or replace the DMM.

- If the DMM properly measures a 12 V battery



**Fig. 5: Phase Terminal V, U And W**

Courtesy of GENERAL MOTORS COMPANY

12. Verify that the voltage has been disabled at the energy storage system. Using the DMM on the DC voltage scale, test for less than 3 V at the following points:

- High voltage 3-Phase terminal V to vehicle chassis ground
- High voltage 3-Phase terminal W to vehicle chassis ground
- High voltage 3-Phase terminal U to vehicle chassis ground
- High voltage 3-Phase terminal U to High voltage 3-Phase terminal V
- High voltage 3-Phase terminal V to High voltage 3-Phase terminal W
- High voltage 3-Phase terminal W to High voltage 3-Phase terminal U

- If 3 V or greater

A contactor is stuck closed or a loss of isolation has occurred within the A4 hybrid/EV battery pack. Refer to **HYBRID\EV BATTERY VOLTAGE PRESENT** in the HYBRID/EV ENERGY STORAGE article.

- If less than 3 V

**NOTE:** A 9 V DC battery can be used to test the DMM.

13. Test the DMM by measuring a 12 V battery. The reading on the DMM should accurately reflect the battery voltage.

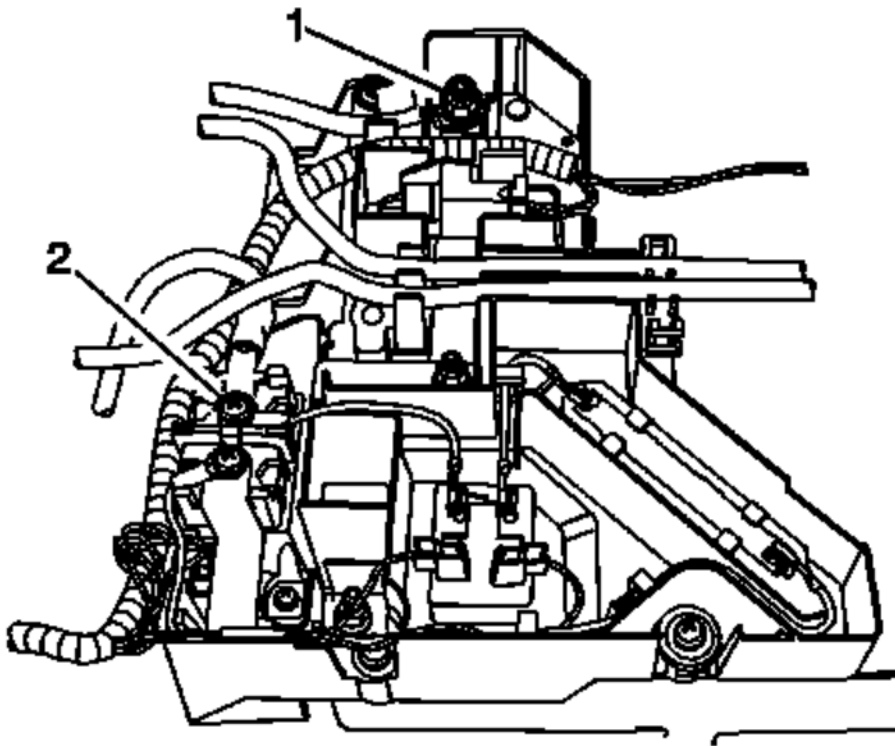
- If the DMM does not properly measure a 12 V battery

Repair or replace the DMM and perform step 11 again.

- If the DMM properly measures a 12 V battery

**WARNING:** High voltage insulation gloves with leather protectors **MUST** be worn at all times when the A4 hybrid/EV battery pack cover has been removed. When testing within the A4 hybrid/EV battery pack, 60 V **WILL** be present. If the S15 hybrid/EV battery pack high voltage manual disconnect lever is compromised and stuck closed, 120 V **WILL** be present. Failure to follow the procedures exactly as written may result in serious injury or death.

14. Remove the A4 hybrid/EV battery pack cover. Refer to **GENERATOR CONTROL MODULE COVER REPLACEMENT** in the HYBRID/EV ENERGY STORAGE article.



**Fig. 6: High Voltage DC Terminal**

Courtesy of GENERAL MOTORS COMPANY

15. Verify that the S15 hybrid/EV battery pack high voltage manual disconnect lever is functioning properly. Using the DMM on the DC voltage scale, test for less than 3 V between the High Voltage DC terminal (1) and the High Voltage DC terminal (2).

- **If 3 V or greater**

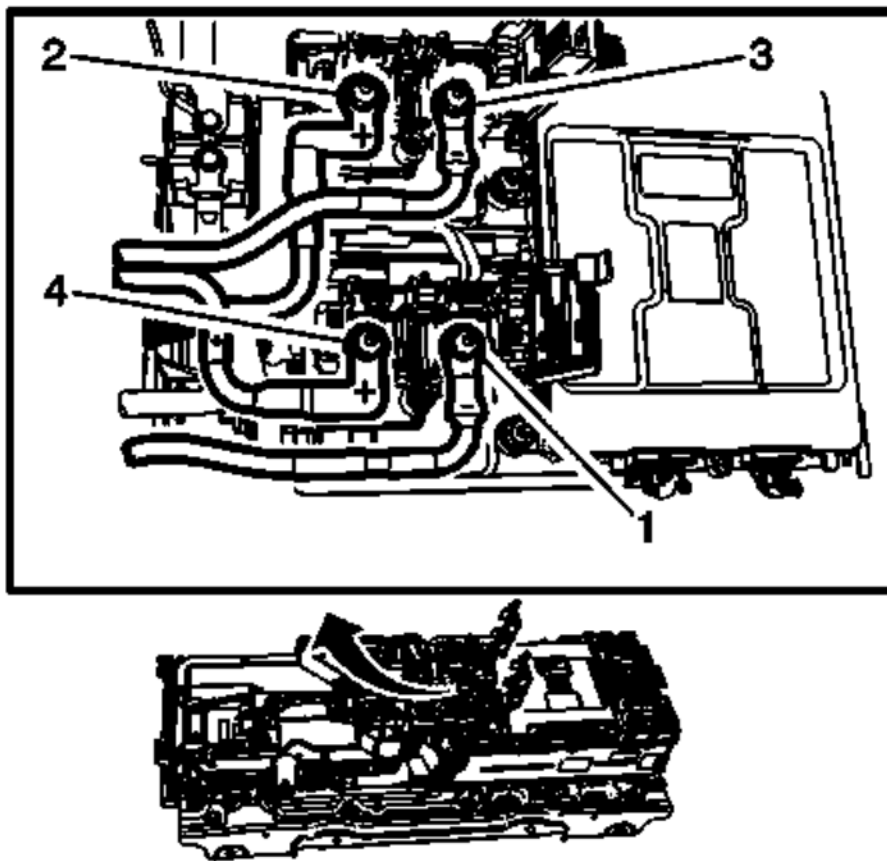
The S15 hybrid/EV battery pack high voltage manual disconnect lever is stuck closed. Replace the S15 hybrid/EV battery pack high voltage manual disconnect lever immediately after completing this disabling procedure.

- **If less than 3 V**

**WARNING:** High voltage insulation gloves with leather protectors **MUST** be worn at all times when the A4 hybrid/EV battery pack cover has been removed. 120 V WILL be present at the battery terminals. Failure to follow the procedures exactly as written may result in serious injury or death.

16. Flip open the orange battery terminal covers at the C4A hybrid/EV battery section 1 and C4B hybrid/EV

battery section 2.



**Fig. 7: C4A Hybrid/EV Battery Section And Battery Terminals**  
Courtesy of GENERAL MOTORS COMPANY

17. Disconnect the battery terminals at the C4A hybrid/EV battery section 1 and C4B hybrid/EV battery section 2 in the order specified in the above graphic.
18. Remove the high voltage cables from the battery terminals and close the battery terminal covers, with the cables on the outside of the closed terminal covers.
19. Tape the battery terminal covers closed with UL® listed, or equivalent, insulation tape rated at a minimum of 600 V.

**NOTE: A 9 V DC battery can be used to test the DMM.**

20. Test the DMM by measuring a 12 V battery. The reading on the DMM should accurately reflect the battery voltage.
  - If the DMM does not properly measure a 12 V battery  
Repair or replace the DMM and perform the disabling procedure again.
  - If the DMM properly measures a 12 V battery

21. Test for less than 1 ohms across the 125 A fuse located under the clear cover in the S15 hybrid/EV battery pack high voltage manual disconnect lever.

- **If 1 ohms or greater**

The 125 A fuse is open. If the fuse is open, verify the S15 hybrid/EV battery pack high voltage manual disconnect lever is also open by testing for infinite resistance across the switch terminals. Replace the fuse after high voltage testing is complete and a system repair has been made. Torque fasteners to 9 N.m (80 lb in).

- **If less than 1 ohms**

22. With the high voltage cables disconnected and the battery terminal covers secured, the K59 starter/generator control module, K16 battery energy control module, S15 hybrid/EV battery pack high voltage manual disconnect lever, KR38 main contactor, R25 hybrid/EV battery pre-charge resistor, KR134 pre-charge contactor, B30 hybrid/EV battery pack current sensor, C4A hybrid/EV battery section 1, C4B hybrid/EV battery section 2, and any components within the A4 hybrid/EV battery pack can now be serviced.

## HIGH VOLTAGE ENABLING

**WARNING:** Ensure all High Voltage safety procedures are followed. Failure to follow the procedure exactly as written may result in serious injury or death. See High Voltage Safety.

1. Verify that the 12 V battery is disconnected.

- **If the 12 V battery is connected**

Disconnect the 12 V battery. Refer to Battery Negative Cable Disconnection and Connection.

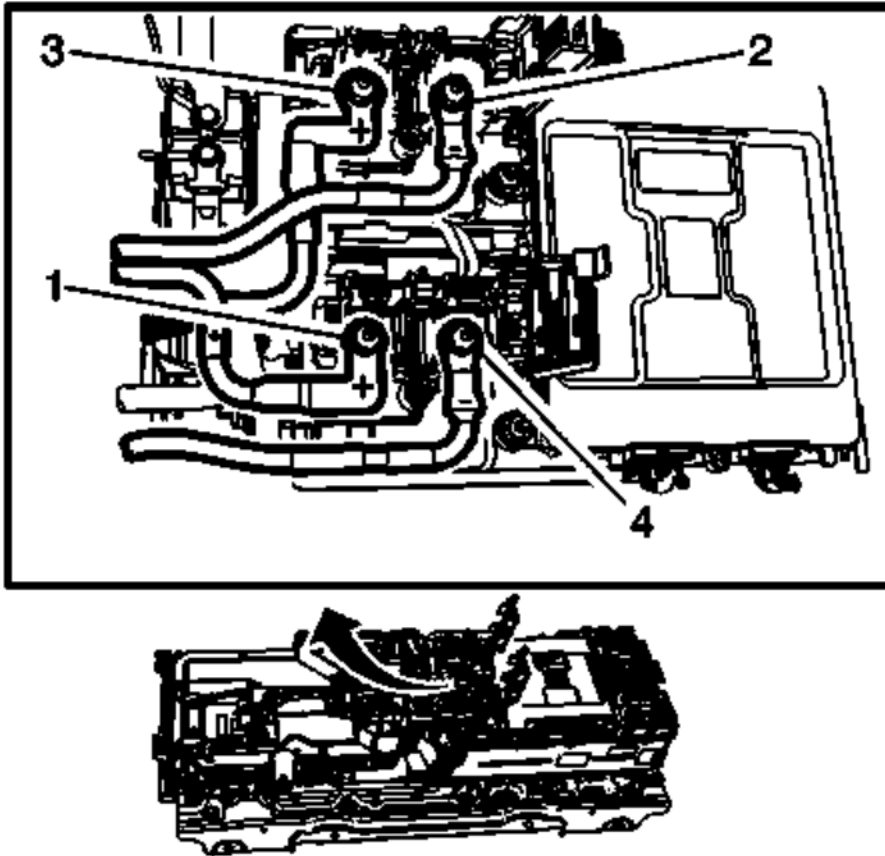
- **If the 12 V battery is disconnected**

**NOTE:** Always tighten the high voltage fasteners to the specified torque. Insufficient or excessive torque will cause malfunctions or damage.

2. After completing testing or any repairs on the high voltage systems and before closing the S15 hybrid/EV battery pack high voltage manual disconnect lever, inspect for the following:
  - Verify that all tools and loose components have been removed from the A4 hybrid/EV battery pack area and all items are accounted for.
  - Verify high voltage system integrity and that all connectors are installed.
  - Install any components or connectors that have been removed or replaced during diagnosis.

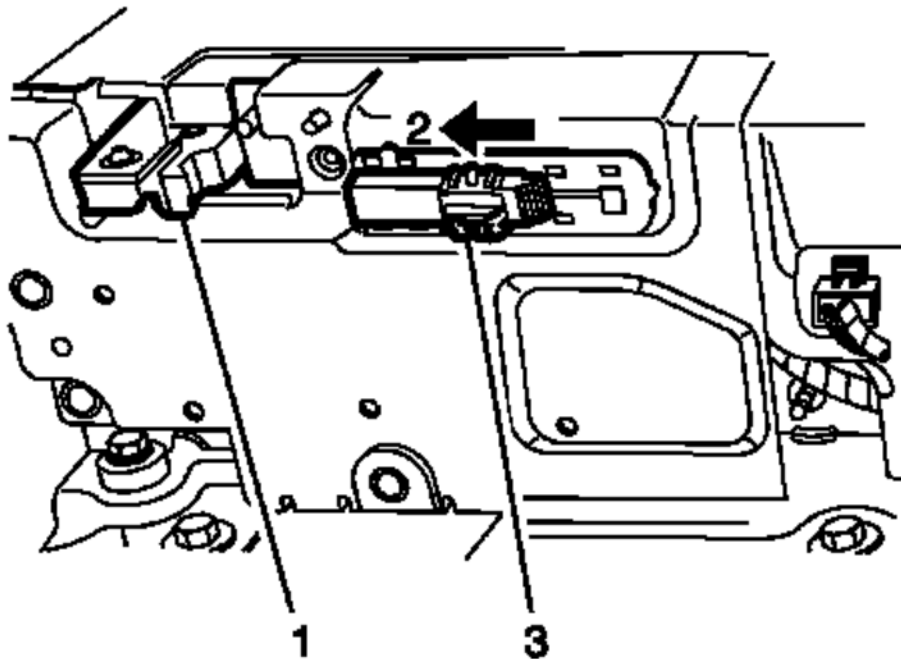
**WARNING:** High voltage insulation gloves with leather protectors **MUST** be worn at all times when the A4 hybrid/EV battery pack cover has been removed. When testing within the A4 hybrid/EV battery pack, 60 V **WILL** be present. If the S15 hybrid/EV battery pack high voltage manual disconnect lever is compromised and stuck closed, 120 V

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



**Fig. 8: C4A Hybrid/EV Battery And C4B Hybrid/EV Battery Section**  
Courtesy of GENERAL MOTORS COMPANY

3. If the battery terminals at the C4A hybrid/EV battery section 1 and C4B hybrid/EV battery section 2 have been removed, reconnect the high voltage battery cables in the order shown above and close the battery terminal covers. Torque fasteners to 9 N.m (80 lb in).
4. If the A4 hybrid/EV battery pack cover has been removed, reinstall the cover. Refer to **GENERATOR CONTROL MODULE COVER REPLACEMENT** in the HYBRID/EV ENERGY STORAGE article.
5. Connect the U, V, and W 3-phase cables. Torque fasteners to 9 N.m (80 lb in).
6. Connect the 12 V battery cable at the K59 starter/generator control module. Torque fastener to 9 N.m (80 lb in).
7. Install the F102 hybrid/EV battery pack cable cover. Torque fastener to 9 N.m (80 lb in).



**Fig. 9: S15 hybrid/EV Battery Pack High Voltage Manual Disconnect Lever**  
Courtesy of GENERAL MOTORS COMPANY

8. Push in the red safety plunger and flip the S15 hybrid/EV battery pack high voltage manual disconnect lever (1) to the closed position.
9. Slide the interconnect switch (2) to the closed position and push in the blue CPA (3).
10. Connect the 12 V battery. Refer to **Battery Negative Cable Disconnection and Connection** . If a control module has been replaced, it should be programmed now. Refer to **Control Module References** .
11. Start the engine, then turn the ignition OFF.
12. Ignition ON, clear all DTC Information with a scan tool.
13. Ignition OFF, wait 2 minutes, ignition ON.
14. Verify no DTCs are set.

○ **If any DTCs are set**

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

○ **If no DTCs are set**

15. Start and idle the engine for 2 minutes.
16. Ignition OFF, wait 5 minutes, ignition ON.

17. Verify that the following DTCs have Ran Since Code Clear and have not set:

- Contactor DTCs P0ADB, P0ADC, P0AE6, or P0AE7
- Discharge and Pre-charge DTCs P0C77 or P0AFB.
- High voltage loss of isolation DTCs P0AA6 or P1AF0

○ **If any of the DTCs are set**

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

○ **If any of the DTCs have not Ran Since Code Clear**

Review and operate the vehicle according to the DTC Conditions for Running and ensure the DTCs run and pass.

○ **If all the DTCs have Ran Since Code Clear and are not set**

18. All OK.