High Voltage Disabling

Diagnostic Instructions

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

Circuit/System Description

The 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.

The High Voltage Disabling procedure utilizes two possible methods to disable high voltage:

Note: The High Voltage Disable procedure, regardless of the method, only de-energizes the high voltage circuits and components outside of the Hybrid/EV battery pack, dangerous voltage levels always exist within the Hybrid/EV battery pack.

1. Scan Tool Method: The on-vehicle control module software, initiated by the GDS2 scan tool, disables and discharges high voltage outside of the Hybrid/EV battery pack.
2. DMM Method: If the GDS2 Scan Tool Method does not complete or cannot be implemented, A DMM-based physical measurement method is performed at certain high voltage connectors.

A successful GDS2 Scan Tool High Voltage Disable Procedure will:

1. Perform an analysis of the vehicle condition by verifying specific DTCs have run and passed.
2. Calculate the high voltage isolation resistance to the vehicle chassis.
3. Open the high voltage contactor relays and discharge the high voltage system by setting a crash event lockout. When this stage is reached the Clear Secured High Voltage DTCs procedure will have to be performed to enable the system again.
4. Latch a Service Lockout condition to prevent unintended enabling of the high voltage system.
5. Instruct you when to remove the manual service disconnect.
6. Indicate successful high voltage disabling by:
    - Displaying a PROCEDURE COMPLETE message on the scan tool
    - Displaying a CHECK VEHICLE'S HIGH VOLTAGE STATUS message on the scan tool which will require you to verify:
        1. Vehicle is displaying an Instrument Cluster DIC message.
        2. Vehicle is sounding a continuous audible response from the vehicle Pedestrian Alert alarm.
        3. High Voltage Inverter Voltage parameter on scan tool indicates system high voltage has been lowered to a safe level.

An Unsuccessful GDS2 Scan Tool High Voltage Disable Procedure:

If vehicle conditions DO NOT permit the GDS2 scan tool procedure to complete, you will have to verify high voltage disabling by measuring the applicable connectors for safe voltage level with a DMM.

Diagnostic Aids

Review the High Voltage Connectors information for connector identification and the approved procedures for disconnecting and connecting high voltage connectors.

Reference Information

Schematic Reference

Hybrid/EV Energy Storage Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Drive Motor Battery System Description

Electrical Information Reference

Circuit Testing

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

Danger: Ensure all High Voltage safety procedures are followed. You must have the appropriate level of up-to-date high voltage training and certification combined with Personal Protection Equipment (PPE) to continue. Review the procedure steps to ensure you have the proper qualifications. You must stop if not properly qualified. Failure to follow the procedure exactly as written may result in serious injury or death.

Danger: Always perform the High Voltage Disabling procedure prior to servicing any High Voltage componentor 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. Review the high voltage safety information. Refer to High Voltage Safety.

   Note: Ensure the 12V battery is fully charged and tested prior to continuing.
2. Disconnect and remove all 12 V Battery Chargers and the Charge Cable from the X98 Hybrid Battery Charger Receptacle.

   Note: If vehicle conditions do not allow for GDS2 scan tool usage, proceed to GDS2 Scan Tool Procedure Unsuccessful below.
3. Access the GDS2 scan tool High Voltage Disable Procedure located under HPCM2 Control Functions.
4. Perform the actions as specified within the GDS2 scan tool procedure.

   Note: If at any point the GDS2 scan tool displays a "PROCEDURE UNSUCCESSFUL" warning message or you lose communication, stop the GDS2 procedure and proceed to GDS2 Scan Tool Procedure Unsuccessful below.
5. WHEN INSTRUCTED by the GDS2 procedure, remove the S15 Manual Service Disconnect. Refer to Drive Motor Battery High Voltage Manual Disconnect Lever Replacement. Place the S15 Manual Service Disconnect in a secure place outside the vehicle. Cover the exposed high voltage opening with UL listed, or equivalent, insulation tape rated at a minimum of 600 V.
6. Verify the GDS2 scan tool procedure completed successfully by observing a GDS2 scan tool "PROCEDURE COMPLETE" message followed by a "CHECK VEHICLE'S HIGH VOLTAGE STATUS" message. Verify these messages are combined with ALL the following conditions:
   - A Continuous Audible Vehicle Response of the Pedestrian Alert alarm
   - DIC message
   - High Voltage Inverter Voltage parameter on scan tool indicates system high voltage is less than 10 volts

⇒ **If the procedure was unsuccessful**

Proceed to GDS2 Scan Tool Procedure Unsuccessful below.

⇓ **If the procedure successfully completed**

6.1. Turn the vehicle power mode to OFF.

Note: Disconnecting the 12 V battery is the only method to deactivate the audible vehicle response. If the 12 V battery is reconnected while the S15 Manual Service Disconnect is removed, the audible vehicle response will continue for several minutes.

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

Note: You will have to perform the Clear Secured High Voltage DTCs GDS2 scan tool procedure in order to re-enable the high voltage system upon completion of the required vehicle servicing.

6.3. The high voltage circuits and components OUTSIDE of the Hybrid/EV battery pack are now disabled/discharged.

Note: Print the High Voltage Disable Confirmation table if necessary. Circle Steps Completed to identify which components have been disabled.

High Voltage Disable Confirmation Table

Was the GDS2 Scan Tool Procedure SUCCESSFUL?	**Circle One:**	**NO**	**YES**
	If YES, all high voltage external of the A4 Hybrid/EV Battery Pack is now disabled. Fill-out Technician, VIN and License Plate and Print form as necessary.		

	If NO, perform GDS2 Scan Tool Procedure Unsuccessful steps as required

ONLY if GDS2 Scan Tool Procedure was UNSUCCESSFUL, confirm steps completed below

High Voltage Components you wish to Disable	**GDS2 Scan Tool Procedure Unsuccessful Steps that must be completed**	**Steps Completed**	
• General Vehicle Servicing around or near but not directly at high voltage components • T6 Power Inverter Module and connectors • T12 Transmission and connectors • A4 Hybrid/EV Battery Pack – external • 300V cables A4 Hybrid/EV Battery Pack to T24 Battery Charger – DC	Steps 1–19	NO	YES
K1 14V Power Module	Steps 1–24*	NO	YES
T18 Battery Charger	Steps 1–24*	NO	YES
300V cable - T24 Battery Charger - DC to K1 14V Power Module and T18 Battery Charger	Steps 1–24*	NO	YES
K10 Heater	Steps 1–24*	NO	YES
300V cable - T24 Battery Charger - DC to K10 Heater	Steps 1–24*	NO	YES
G1 A/C Compressor	Steps 1–24*	NO	YES
300V cable - T24 Battery Charger - DC to G1 A/C Compressor	Steps 1–24*	NO	YES
E54 Heater	Steps 1–24*	NO	YES
300V cable - T24 Battery Charger - DC to E54 Heater	Steps 1–24*	NO	YES
T24 Battery Charger - DC	Steps 1–24*	NO	YES

*Perform testing at each component as applicable

Technician:

VIN:

License Plate:

GDS2 Scan Tool Procedure Unsuccessful

Note: If the GDS2 Scan Tool Procedure was unsuccessful, follow the steps below as applicable.

1. Remove all keyless entry transmitters from the vehicle and secure in a place outside the vehicle.
2. Attempt to start the vehicle with the Ignition Mode Switch.

⇒ **If the vehicle enters Propulsion System Active mode or the engine starts**

Locate and remove all keyless entry transmitters from within the vehicle and return to the beginning of the GDS2 Scan Tool Procedure Unsuccessful procedure.

⇓ **If the vehicle did not enter Propulsion System Active mode and the engine did not start**

Note: The 12 V battery must be disconnected to ensure proper test results.

Note: You must ensure Battery Maintenance Mode is not active before disconnecting the 12V battery.

3. Disconnect the 12 V battery. Refer to Battery Negative Cable Disconnection and Connection.
4. Remove the S15 Manual Service Disconnect. Refer to Drive Motor Battery High Voltage Manual Disconnect Lever Replacement. Place the S15 Manual Service Disconnect in a secure place outside the vehicle. Cover the exposed high voltage opening with UL® listed, or equivalent, insulation tape rated at a minimum of 600 V.

Note: 5 min must elapse before removing any high voltage connectors. Removal of non high voltage components is allowed during this wait time.

5. Wait 5 min before continuing, to allow the high voltage capacitors to discharge.

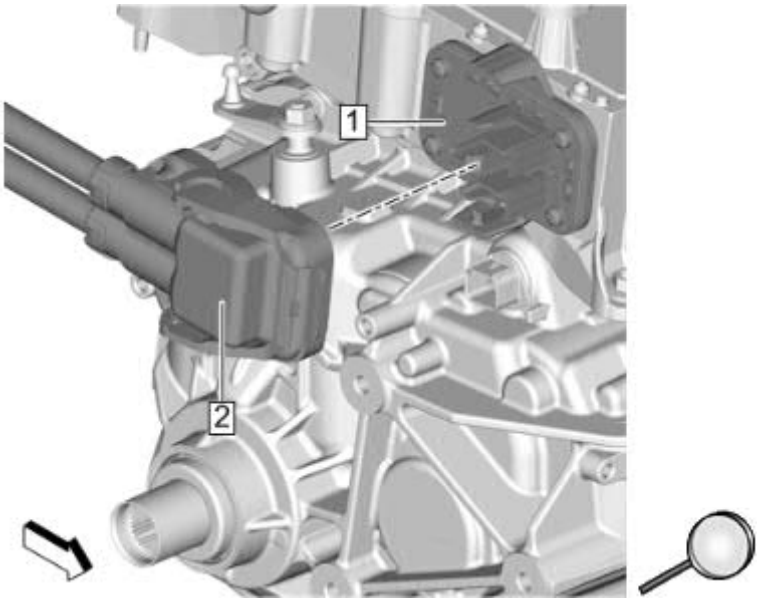
Note: A 9 V DC battery or the vehicles 12 V battery can be used to test the DMM.

6. Verify the test DMM by measuring a known good 9 to 12 V battery.

⇒ **If the DMM does not properly measure the test battery**

Repair or replace the DMM and repeat all voltage measurements.

⇓ **If the DMM properly measures the test battery**



Note:

- Wear your High Voltage Insulation gloves until you have determined that a high voltage exposure risk is no longer present.

- Inspect the High Voltage DC connection seal for deformation or damage. Inspect the High Voltage DC connector for seal residue or debris. Always replace damaged seals and clean seal remnants from the connector with a non-marring tool.

7. Disconnect the T24 Battery Charger – DC high voltage harness connector (2) at the T6 Power Inverter Module.

   Note: 5 min must have elapsed since removing the S15 Manual Service Disconnect before continuing to allow the high voltage capacitors to discharge and ensure proper test results.

8. Verify the voltage measures less than 3 V at the T6 Power Inverter Module connector (1) at the following points:
   - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
   - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
   - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

Leave the DMM connected to the terminals until the voltage drops below 3 V to allow the high voltage capacitors to discharge. Continue to the next step once the voltage is below 3 V.

⇓ **If less than 3 V**

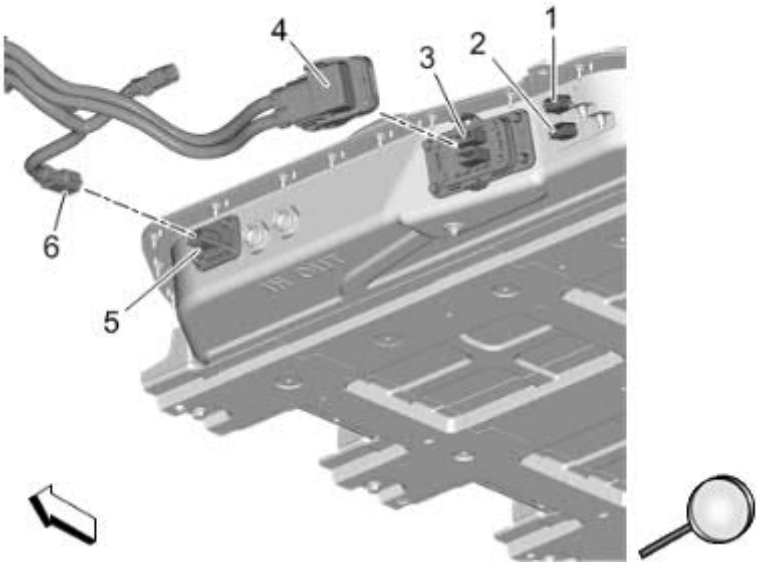
9. Verify the voltage measures less than 3 V at the HV DC harness connector (2) to the T6 Power Inverter Module at the following points:
   - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
   - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
   - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

There is a stuck closed contactor and a loss of isolation within the A4 Hybrid/EV Battery Pack. Refer to Hybrid/EV Battery Voltage Present.

⇓ **If less than 3 V**

10. Raise the vehicle and remove the underbody forward air deflector.



11. Disconnect the low voltage harness connectors (1, 2) at the A4 Hybrid/EV Battery Pack.
12. Disconnect the T18 Battery Charger harness connector (6) at the A4 Hybrid/EV Battery Pack.
13. Verify the voltage measures less than 3 V at the A4 Hybrid/EV Battery Pack connector (5) at the following points:

- High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
- High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
- High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

There is a stuck closed contactor and a loss of isolation within the A4 Hybrid/EV Battery Pack. Refer to Hybrid/EV Battery Voltage Present.

⇓ **If less than 3 V**

14. Verify the voltage measures less than 3V at the T18 Battery Charger harness connector (6) at the following points:
    - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

Leave the DMM connected to the terminals until the voltage drops below 3 V to allow the high voltage capacitors to discharge. Continue to the next step once the voltage is below 3 V.

⇓ **If less than 3 V**

15. Disconnect the T24 Battery Charger - DC connector (4) at the A4 Hybrid/EV Battery Pack.
16. Verify the voltage measures less than 3 V at the T24 Battery Charger - DC harness connector (4) at the following points:
    - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

Leave the DMM connected to the terminals until the voltage drops below 3 V to allow the high voltage capacitors to discharge. Continue to the next step once the voltage is below 3 V.

⇓ **If less than 3 V**

17. Verify the voltage measures less than 3 V at the A4 Hybrid/EV Battery Pack connector (3) at the following points:
    - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

There is a stuck closed contactor and a loss of isolation within the A4 Hybrid/EV Battery Pack. Refer to Hybrid/EV Battery Voltage Present.

⇓ **If less than 3 V**

Note: Discard any 300 V Battery Positive and Negative cable connector seal that may be deformed or damaged. Replace any seal that is deformed, missing, or damaged.

Note: A 9 V DC battery or the vehicles 12 V battery can be used to test the DMM.

18. Verify the test DMM by measuring a known good 9 to 12 V battery.

⇒ **If the DMM does not properly measure the test battery**

Repair or replace the DMM and repeat all voltage measurements.

⇓ **If the DMM properly measures the test battery**

19. The high voltage connectors at the A4 Hybrid/EV battery pack are now discharged. You may perform A4 Hybrid/EV battery pack removal and exit the High Voltage Disabling procedure at this time but you MUST continue if additional high voltage component service is required.

⇒ **If you do not need to perform additional high voltage component service**

HV Disable for T6 power inverter module, T12 Transmission and A4 Hybrid battery pack is complete.

⇓ **If you need to perform additional high voltage component service**

20. Disconnect the high voltage connector(s) at the component(s) to be serviced.
21. Verify the voltage measures less than 3 V at the Module-side connector at the following points:
    - High voltage DC (−360 V) negative terminal B to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A to vehicle chassis ground.
    - High voltage DC (+360 V) positive terminal A and high voltage DC (−360 V) negative terminal B.

⇒ **If 3 V or greater**

Leave the DMM connected to the terminals until the voltage drops below 3 V to allow the high voltage capacitors to discharge. Continue to the next step once the voltage is below 3 V.

⇓ **If less than 3 V**

22. Repeat the previous step at all high voltage module connectors for any additional high voltage components requiring service.
23. Verify the test DMM by measuring a known good 9 to 12 V battery.

⇒ **If the DMM does not properly measure the test battery**

Repair or replace the DMM and repeat all voltage measurements.

⇓ **If the DMM properly measures the test battery**

24. High voltage is disabled/discharged at all TESTED modules.