

## 2011 Chevrolet Volt

### Collision Awareness Guide



GM Service Technical College provides Collision Repair Guides *free of charge*. Collision Repair Guides can be displayed in a classroom as long as they are represented as GM information and are not modified in any way.

The intent of this guide is to provide the collision repair technician information to properly handle and repair Chevrolet Volt vehicles in the safest manner possible. This guide contains a general description of how the Chevrolet Volt vehicle systems operate, identifies the location of the unique components, fuse blocks, and lifting locations. The guide also describes methods of disabling the high voltage system and identifies cut zone information.



The Chevrolet Volt is a front-wheel drive, four-passenger electric vehicle with extended-range capability. The vehicle is propelled exclusively by electric motors. The Volt uses high voltage energy that is stored in the high voltage battery as its primary power source. However, once the battery capacity is reduced, the gasoline engine drives a generator which produces electricity to power the vehicle.

## High Strength Steel

The Volt has been designed to protect the occupant(s) during a collision. The body structure is nearly 80% high strength steel. The occupant 's are protected from front, rear and side impacts by a structural cage created by the underlying vehicle structural design. The following parts are for formed using ultra high strength steel:

- Door Inner Reinforcement Beams
- Center Pillar Reinforcements
- Windshield Pillar Reinforcements
- Rocker Panel Reinforcements
- Rear Compartment Lower Rails

Additional crumple zones protect the occupant with front, side and rear rails that are designed to crush in a crash.



## Vehicle CUT ZONES

Use caution when cutting in these areas:

- Center tunnel area or the area under the rear seats. The 360 volt battery is installed in this area.
- Roof rails near the lift gate hinge. Side curtain air bag inflators and lift gate hold open struts are located in this area
- Front seat back on the outboard area, contains side air bags.
- B pillar near the rocker, contains the seat belt retractor pretensioner. Note: The outboard area of the front seat lower frame houses an additional seat belt pretensioner.

**WARNING:** Do NOT cut into the vehicle until the 12V electrical system has been disabled. Cutting into the vehicle prior to disconnecting and isolating the 12V electrical energy sources may cause air bag deployment resulting in serious injury.

**Potential damage area to high voltage components.** Side curtain air bags and lift gate hold open struts.



**Potential damage area to high voltage components.** The Volt battery has 360 volt electrical potential at all times. It is inside the center tunnel and under the rear seat area.

## Welding

When Welding GM recommends disconnecting the 12volt battery and removing any modules If welding with-in 12 inches or 300mm of them. GM also recommends disabling the high voltage system if welding with-in 12 inches or 300mm of the high voltage battery



## Paint Baking

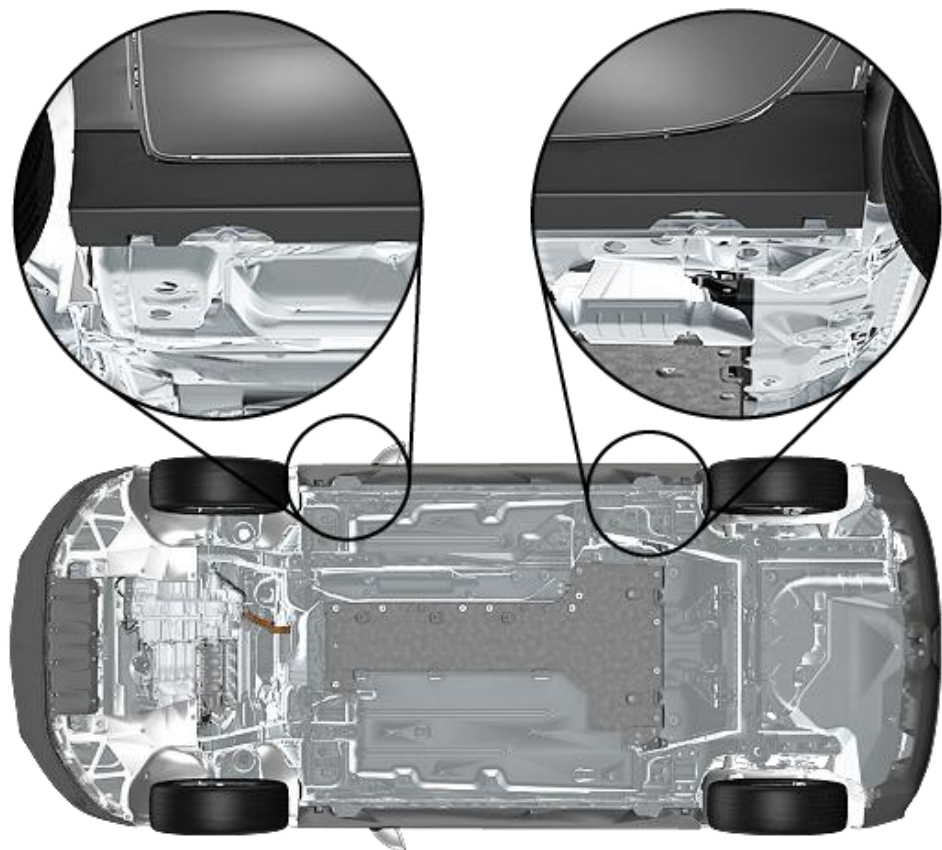
General Motors does not recommend baking the Volt vehicle for more than 40 minutes at 140° Fahrenheit or 60 ° Celsius. Damage to the high voltage battery may occur.



## Lifting and Jacking

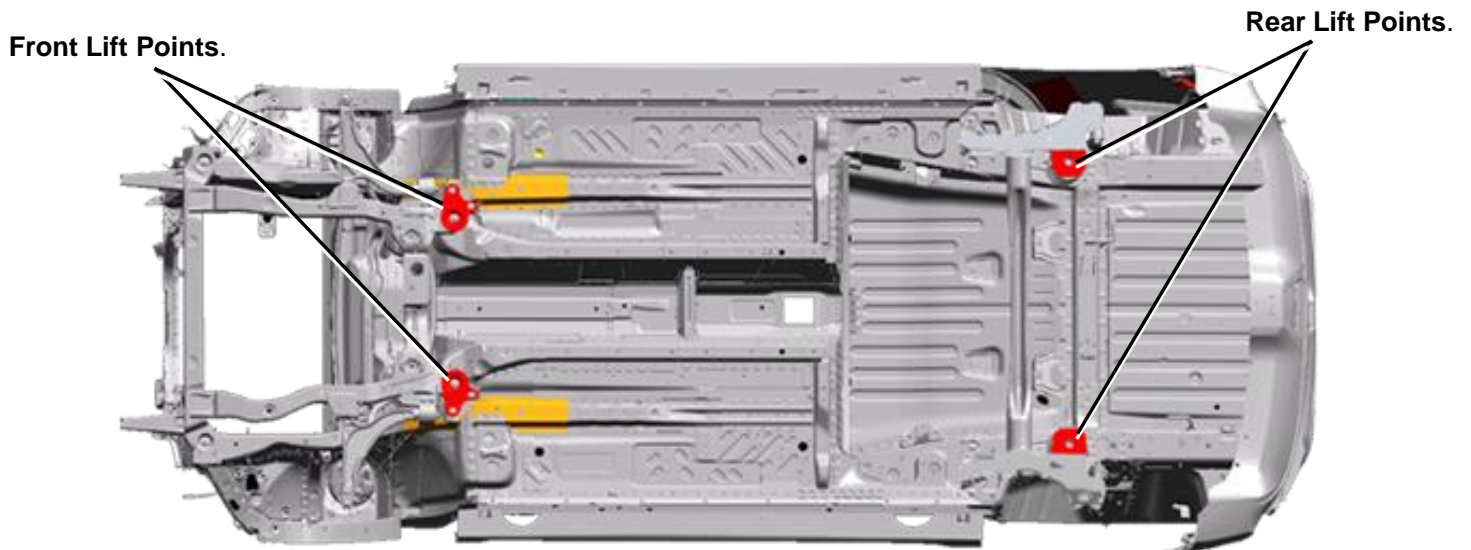
To lift the vehicle on a hoist, use the rocker outer panel weld flanges in each corner of the vehicle.

Note: To avoid damage to the vehicle, the hoist pads **MUST** not contact the rocker panel moldings or the under body air deflectors.



## Lifting and Jacking

The Chevrolet Volt may be lifted using a service jack from a single location. To raise the right-front or left-front of the vehicle, place the service jack pad under the rear mounting bracket of the front cradle. To provide sufficient clearance for certain service jacks, it may be necessary to place ramps under the vehicle's front tires. To lift the rear of the vehicle, place the service jack lift pad under the rear spring support.



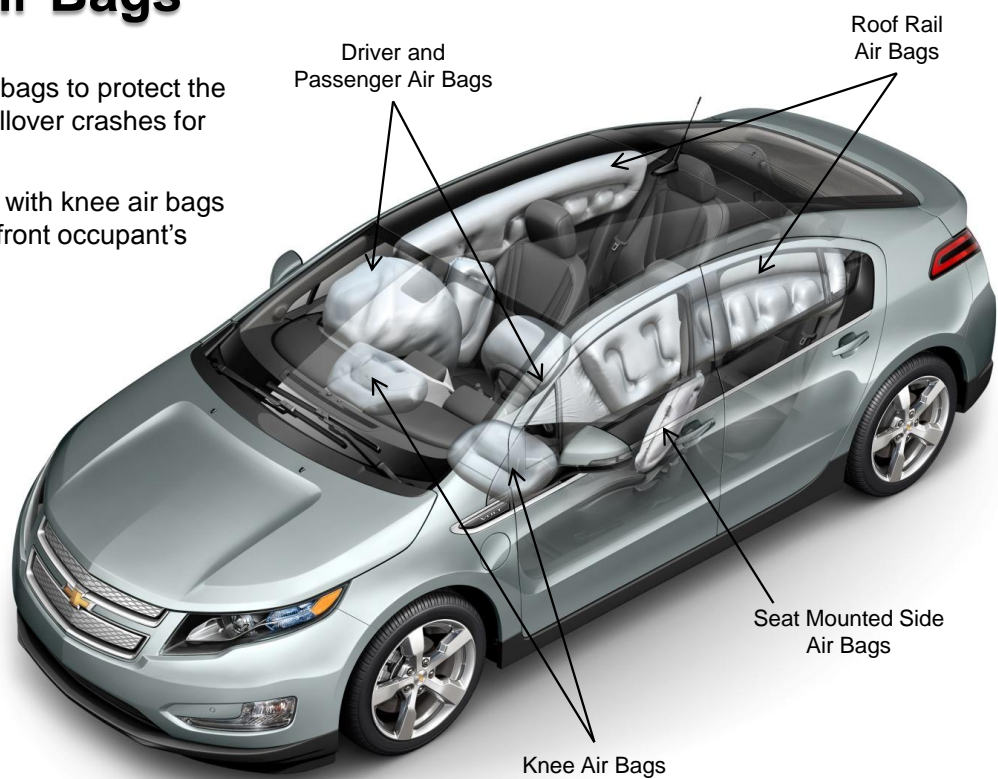


## Chevrolet Volt Air Bags

The Volt is equipped with eight air bags to protect the occupant in front, rear, side and rollover crashes for 360° of protection.

The Volt is one of the few vehicles with knee air bags which helps reduce injuries to the front occupant's legs.

There are dual pretensioner seatbelts that work together with the air bag system to protect the occupant in the event of a crash.



## Air Bag Deployment

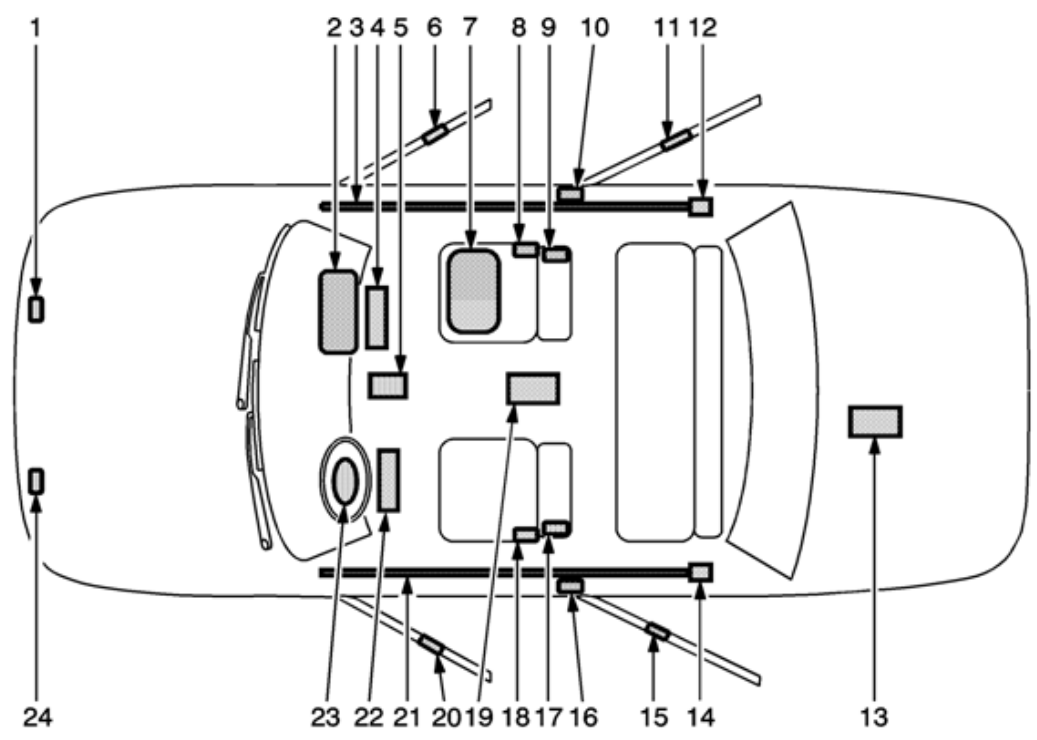
The contactors within the high voltage battery are commanded open whenever one or more airbags deploy. This interrupts the 360 volt electrical system and discontinues current flow through the high voltage cables.

This vehicle is equipped with dual-stage air bags and the appearance of deployed air bags does not ensure all stages of the air bags have deployed.

Therefore, disabling 12 volt power is essential to ensure personal safety even if the airbags in the vehicle appear to have been deployed. After disabling 12 volt power, wait 1 minute to allow any un-deployed air bag reserve energy to dissipate.



# SIR Sensor Locations



## SIR Sensor Locations (cont.)

1. Right Front Impact Sensor--Located under the hood at the front right side of the vehicle
2. Passenger Instrument Panel Air Bag--Located at the top right under the instrument panel
3. Right Roof Rail Air Bag--Located under the headliner, extending from the passenger front pillar to the passenger rear pillar
4. Passenger Knee Air Bag--Located in the instrument panel behind the glove box.
5. Inflatable Restraint Sensing and Diagnostic Module (SDM)--Located underneath the center console
6. Right Front Side Impact Sensor--Located in the right front door
7. Passenger Presence System--Located on the passenger front seat underneath the seat bottom trim
8. Passenger Seat Belt Anchor Pretensioner--Located on the outboard side of the passenger seat
9. Passenger Seat Side Air Bag--Located on the seat back of the passenger seat
10. Passenger Seat Belt Retractor Pretensioner--Located under the passenger side trim near the bottom of the center pillar
11. Right Rear Side Impact Sensor--Located in the right rear door
12. Inflator Module for Right Roof Rail Air Bag--Located behind the headliner above the C-pillar
13. 12 V Battery--Located in the trunk
14. Inflator Module for Left Roof Rail Air Bag--Located behind the headliner above the C-pillar
15. Left Rear Side Impact Sensor--Located in the left rear door
16. Driver Seat Belt Retractor Pretensioner--Located under the driver side trim near the bottom of the center pillar
17. Driver Seat Side Air Bag--Located on the seat back of the driver seat
18. Driver Seat Belt Anchor Pretensioner--Located on the outboard side of the driver seat
19. 300 V Battery--Located in between the driver and passenger seats, underneath the center console
20. Left Front Side Impact Sensor--Located in the left front door
21. Left Roof Rail Air Bag--Located under the headliner, extending from the driver front pillar to the driver rear pillar
22. Driver Knee Air Bag--Located in the instrument panel below the steering wheel
23. Driver Steering Wheel Air Bag--Located on the steering wheel
24. Left Front Impact Sensor--Located under the hood at the front left side of the vehicle

## Air Bag Repairs and Inspections Required After a Collision

**Warning:** Proper operation of the Supplemental Inflatable Restraint (SIR) sensing system requires that any repairs to the vehicle structure return the vehicle structure to the original production configuration. Not properly repairing the vehicle structure could cause non-deployment of the air bag(s) in a frontal collision or deployment of the air bag(s) for conditions less severe than intended.

After any collision, inspect the following components as indicated. If you detect any damage, replace the component. If you detect any damage to the mounting points or mounting hardware, repair the component or replace the hardware as needed.

- The steering column--Inspect the steering column for bending, twisting, buckling or any type of damage.
- The instrument panel knee bolsters and mounting points-
- The instrument panel brackets, braces, etc.
- The seat belts--Perform the seat belt operational and functional checks.
- The instrument panel cross car beam.
- The instrument panel mounting points and brackets.
- The seats and seat mounting points.
- The roof and headliner mounting points.

## Air Bag Repairs and Inspections Required After a Collision (cont.)

After a frontal collision involving air bag deployment, replace the following components.

- Passenger instrument panel air bag, if deployed
- Driver steering wheel air bag
- Inflatable restraint sensing and diagnostic module (SDM)
- Front and/or side impact sensors, impact sensor replacement policy requires replacing sensors in the area of the accident damage
- Driver/Passenger seat side air bag, if deployed
- Seat back cover on if side seat air bag is deployed
- Driver/Passenger seat belt anchor and/or retractor pretensioners
- Steering wheel air bag coil and the coil wiring pigtail—If melted, scorched, or other damaged due to excessive heat.

## Air Bag Repairs and Inspections Required After a Collision (cont.)

After a collision involving driver/passenger side seat air bag deployment, replace the following components.

- Left/right side impact sensors on the side of the impact.
- Left/right roof rail air bag on the side of the impact.
- Inflatable restraint sensing and diagnostic module (SDM), if SDM has DTC B0052 56.
- Inflatable restraint seat belt anchor and/or retractor pretensioner.
- Driver or passenger seat back cushion cover replacement.

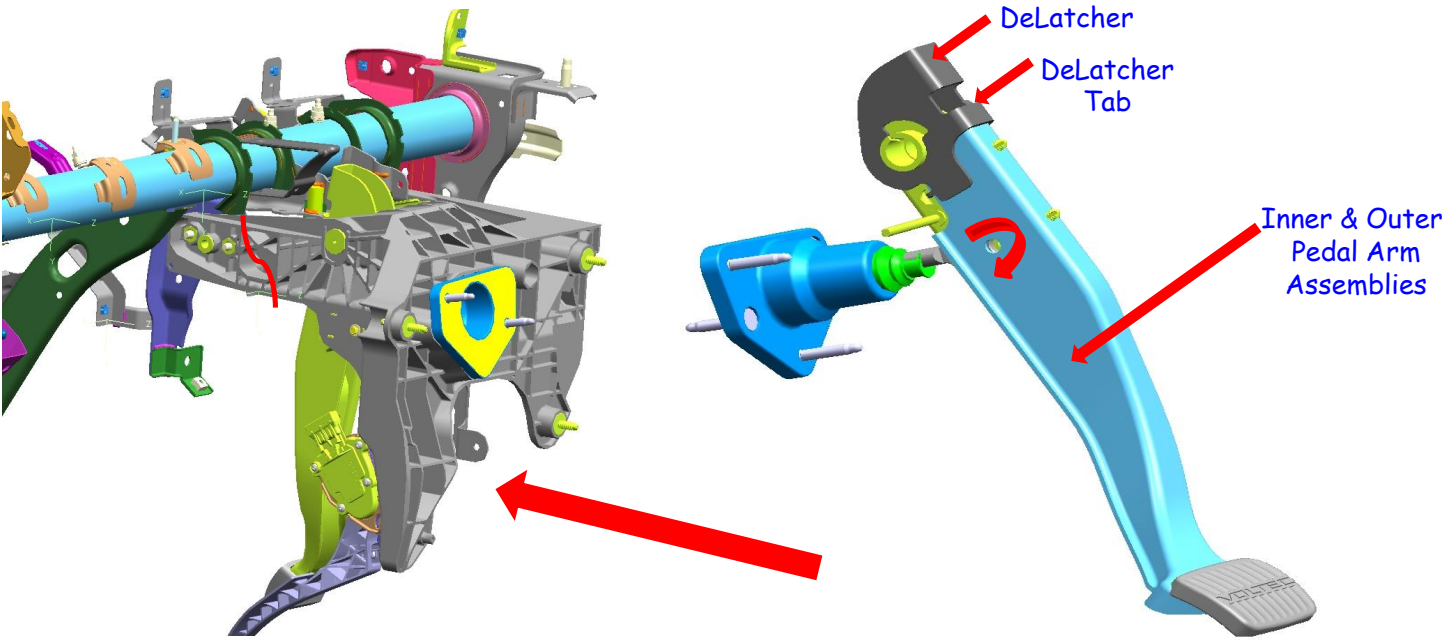
**Warning:** Do not repair or replace the seat stitching or seams in the seat back trim cover with an internal mounted seat side airbag module. Replace the complete seat back trim cover from the OEM. Non-OEM seat stitching may cause improper airbag deployment which could result in personal injury.

Perform additional inspections on the following components.

- The seat cushion frame
- The seat recliner and cover, if equipped
- The seat adjuster
- The seat back frame
- Door trim assembly
- Impacted seat cushion side covers and switches

# Break away Pedals

If a crash is severe enough to damage the dash panel or distort it, it may cause the pedal assembly to disengage. If this occurs the pedal assembly would have to be replaced.

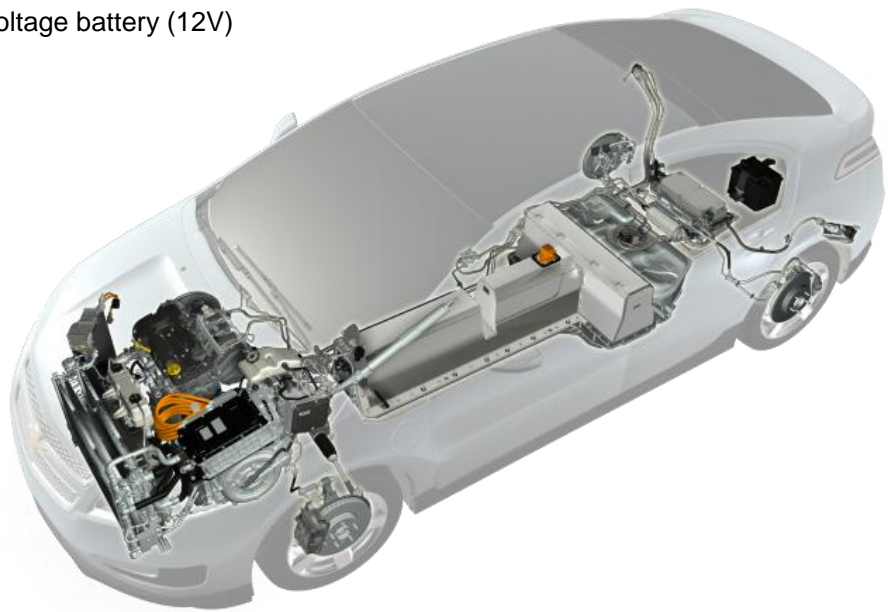




## System Components

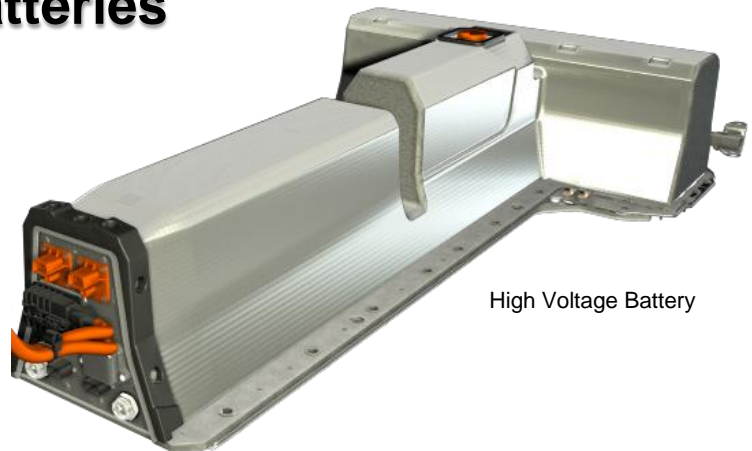
The Chevrolet Volt propulsion system is composed of the following components and systems:

- High voltage battery
- Absorbent Glass Mat (AGM) low voltage battery (12V)
- Power inverter module
- Accessory power module
- High voltage battery charger
- 1.4 Liter Engine
- 4ET50 transmission
- Thermal Management Systems



## High and Low Voltage Batteries

The high voltage battery, also known as the drive motor battery, is a system of many components that operate together to provide the energy required for vehicle propulsion. High voltage contactors, internal to the battery pack, turn on and off to control the output of the high voltage battery.



High Voltage Battery

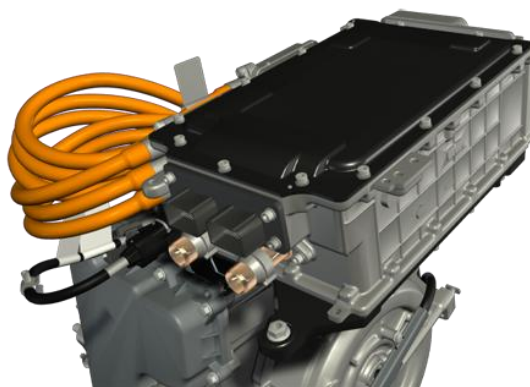
The Chevrolet Volt's low voltage system (12V) utilizes an AGM lead acid battery. The battery is located in the rear compartment underneath the load floor. The low voltage energy is utilized by vehicle modules to control the high voltage battery contactors. Severing the low voltage cables should cause the system to open the contactors. The low voltage (12V) cable cut location is found behind the left rear closeout panel in the rear compartment of the vehicle.



Low Voltage AGM Battery

## Power Electronics

The power inverter module is located on the drivers side of the engine compartment and is mounted on top of the transmission. The module changes the high voltage direct current into 3 phase alternating current. This 3-phase electrical energy is provided to the motors within the transmission for vehicle propulsion.



Power Inverter Module



Accessory Power Module

The accessory power module is located in the rear compartment beneath the load floor. The module replaces the belt-driven generator common to conventional vehicles. The module converts high voltage DC electrical energy into low voltage DC electrical energy to provide the energy needed for the vehicle systems.

## Charging System

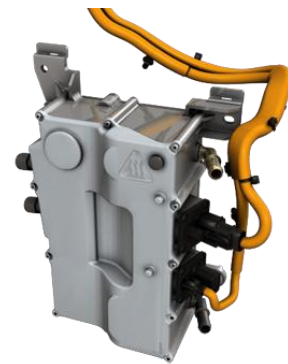
The Chevrolet Volt features an onboard high voltage charging system that recharges the high voltage battery. The system utilizes a unique cord to connect the vehicle to an electrical receptacle. The charger is located behind the passenger headlamp assembly and bumper fascia. The charger converts household AC into DC voltage to charge the onboard battery.

The vehicle charge port provides the interface between the cords, plug, and the charger.

In the event a Volt is involved in an incident while the battery charger is plugged in for charging the battery, remove the charge cord from the car using the charger cord handle at the charge port in the left front fender. If that cannot be accomplished, the electrical power to the charge cord should be terminated at the source.

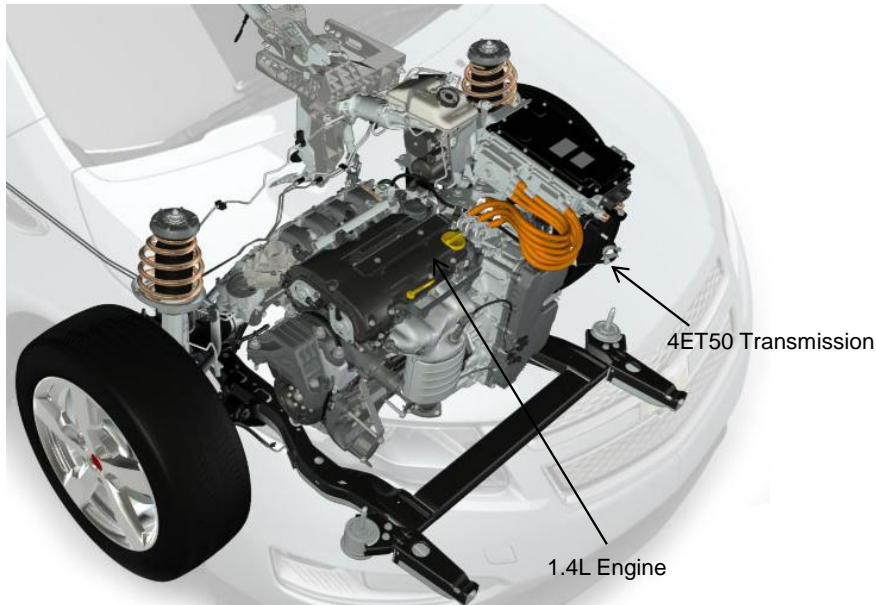


Vehicle Charge Port



High Voltage Charger

## Powertrain



The 4ET50 transmission is a fully automatic, front-wheel drive transaxle, variable-speed, electronic controlled transmission. The transmission contains two electric motor / generators that are utilized to:

- Propel the vehicle
- Generate / recapture energy
- Start the internal combustion engine

The Chevrolet Volt uses an internal combustion 1.4L engine. The engine does not directly propel the vehicle, but operates only to spin the drive motor / generator.



## Thermal Management Systems

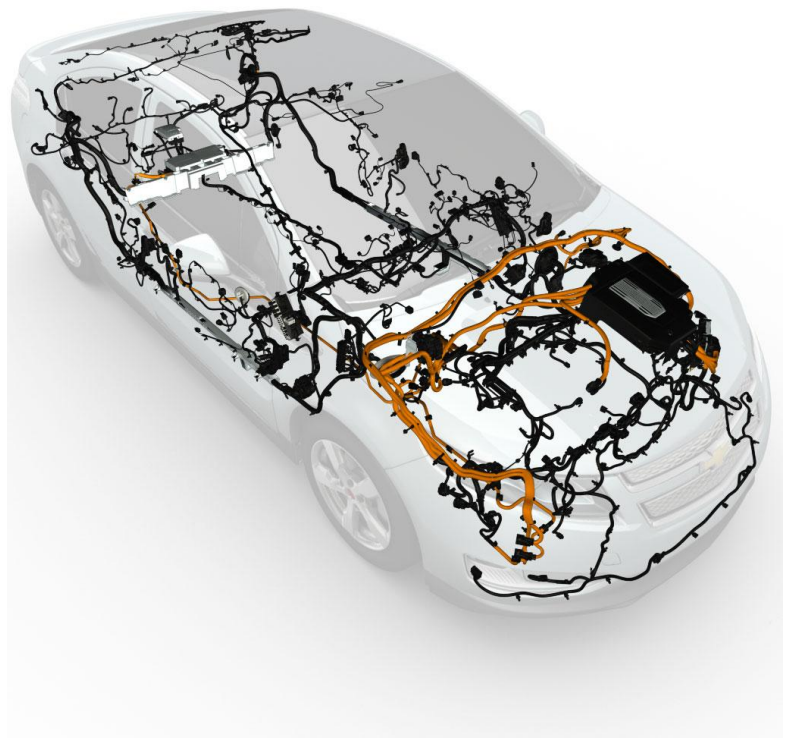


The Vehicle utilizes three separate cooling systems that maintain the proper operating temperature of the components. The components include the drive motor battery, drive motor / generator power inverter module, drive motor battery charger, and engine. The cooling systems require a pre-mixed 50/50 solution of DEX-COOL® coolant and de-ionized water. Tap water should never be used in the cooling system as it will leave deposits and cause corrosion which effects heat sink performance.

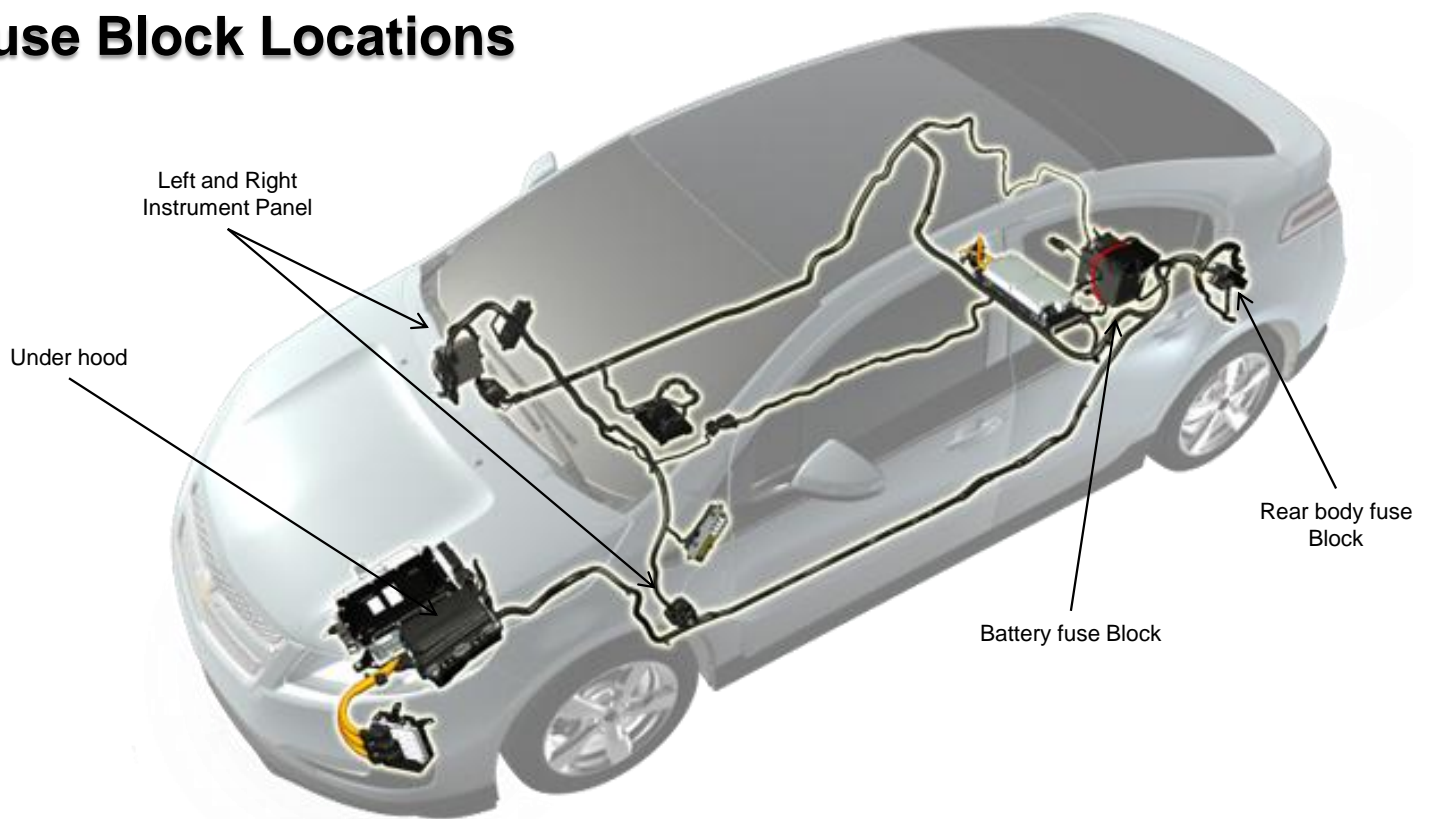
## System Operation

There are two separate electrical systems, low voltage and high voltage. The low voltage system is similar to a conventional vehicle. The high voltage electrical system distributes 360 volts Direct Current (DC) between the high voltage components and 3-phase Alternating Current (AC) to the transmission.

To reduce the risk of severe shock and burns, treat all high voltage cables and connectors as though they are energized until it can be verified that they are not. Full disabling procedures are located in the GM service manual for the vehicle.



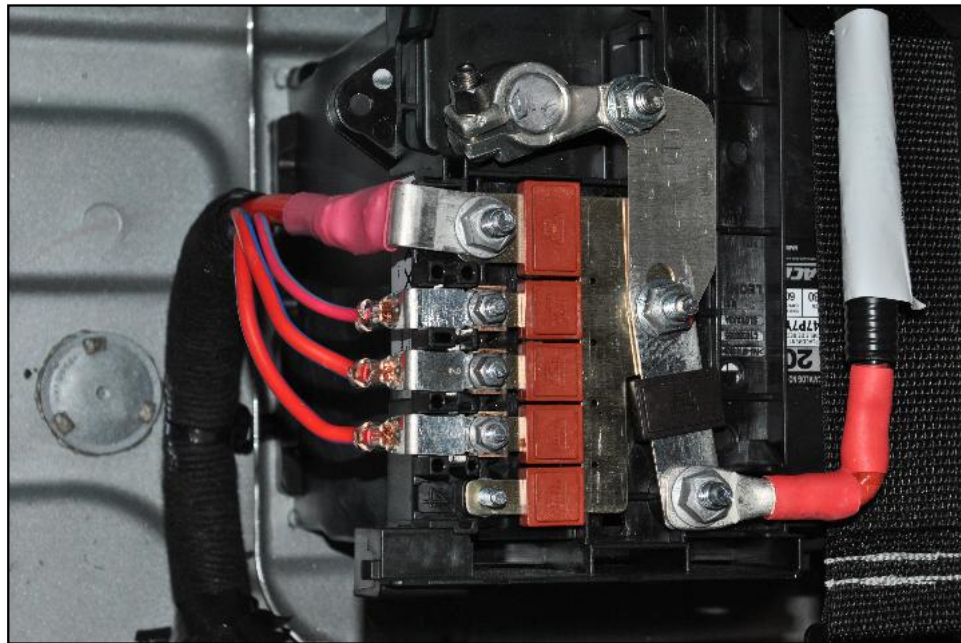
## Fuse Block Locations





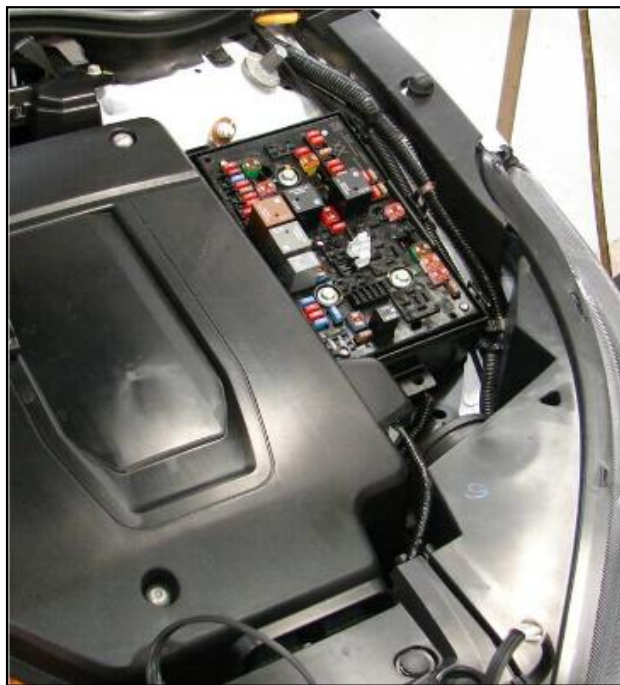
## Battery Fuse Block

The battery fuse block supplies power through the high current fuses to the four electrical fuse blocks which include the underhood, rear body, and left and right instrument panels. The fuse block also connects to the accessory direct current power control module through a 200-amp fuse. The fuse block is located directly on top of the 12 volt battery.



## Underhood

The underhood electrical fuse block supplies fused low voltage electrical power to common non-hybrid underhood components, such as the Engine Control Module (ECM). The fuse block also supplies 12 volt power to hybrid components, such as the drive motor / generator power inverter module, Hybrid Powertrain Control Module 2 (HPCM 2), drive motor battery, and thermal management components. The fuse block is located in the left rear underhood area of the vehicle.



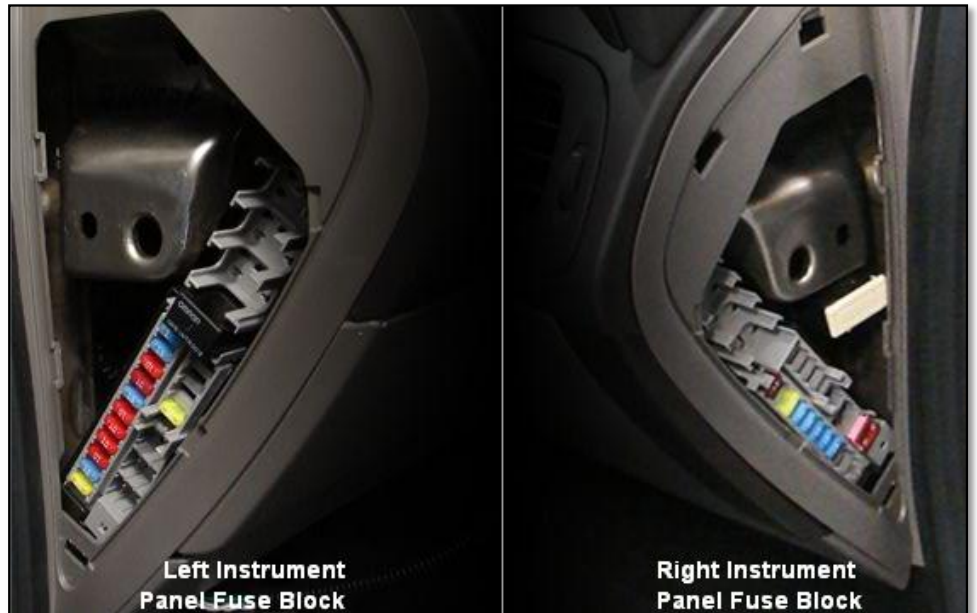
## Rear Body

The rear body fuse block supplies vehicle components, such as the rear defogger, rear hatch release, and fuel pump. The fuse block is located in the left rear quarter panel area.



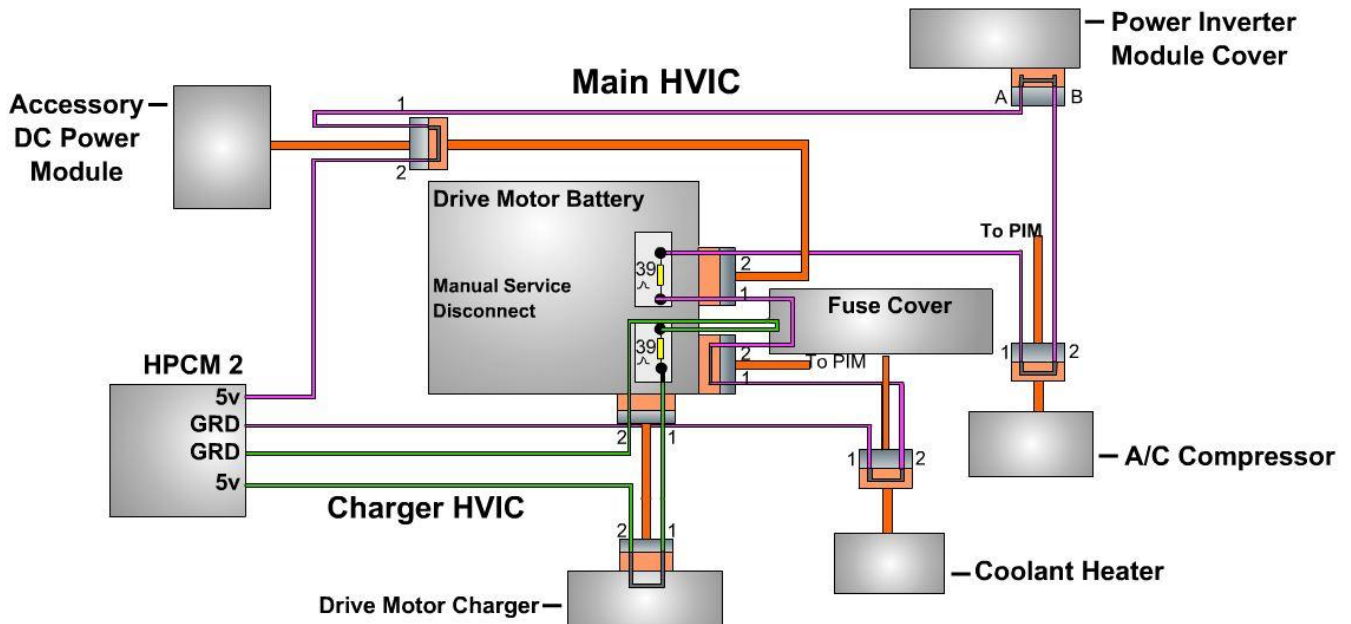
## Left and Right Instrument Panel

The left and right instrument panel fuse blocks supply power to components, such as the body control module, instrument panel cluster, radio, and 12 volt power receptacle. The fuse blocks are located on the left and right side of the instrument panel behind the trim access door.



# High Voltage Interlock Circuit (HVIC) System

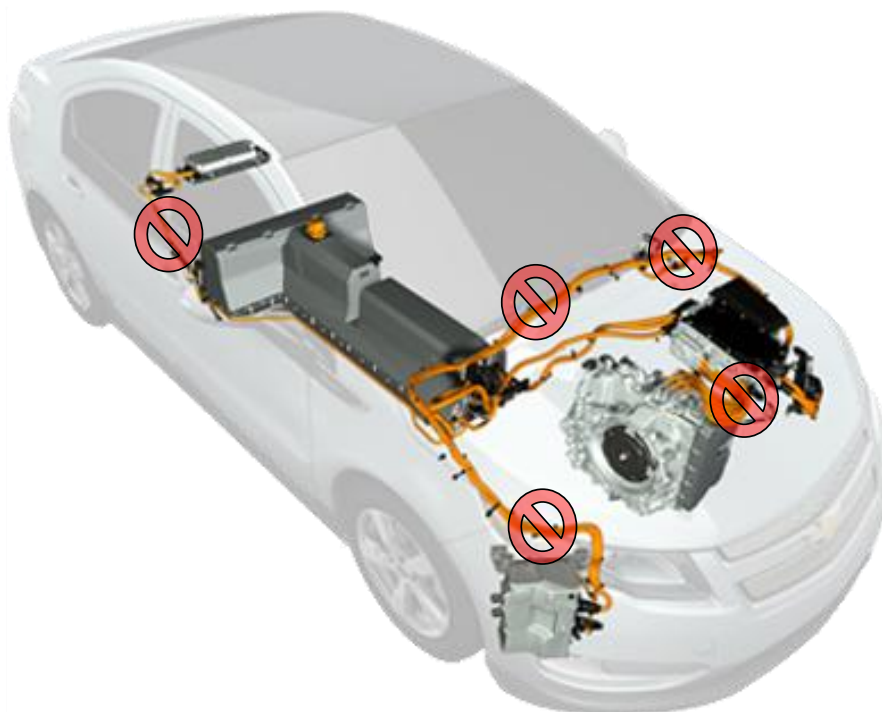
The High Voltage Interlock Circuit (HVIC) is a safety system that monitors access to high voltage components. If the high voltage disable procedure is not properly performed and service is attempted on the high voltage components, the system commands the contactors to open within the drive motor battery. The Chevrolet Volt features two dedicated and separate circuits, the main HVIC and the charger HVIC. The main HVIC monitors the primary high voltage components and cables while the charger HVIC monitors the high voltage charger components and cables.



## High Voltage Cables

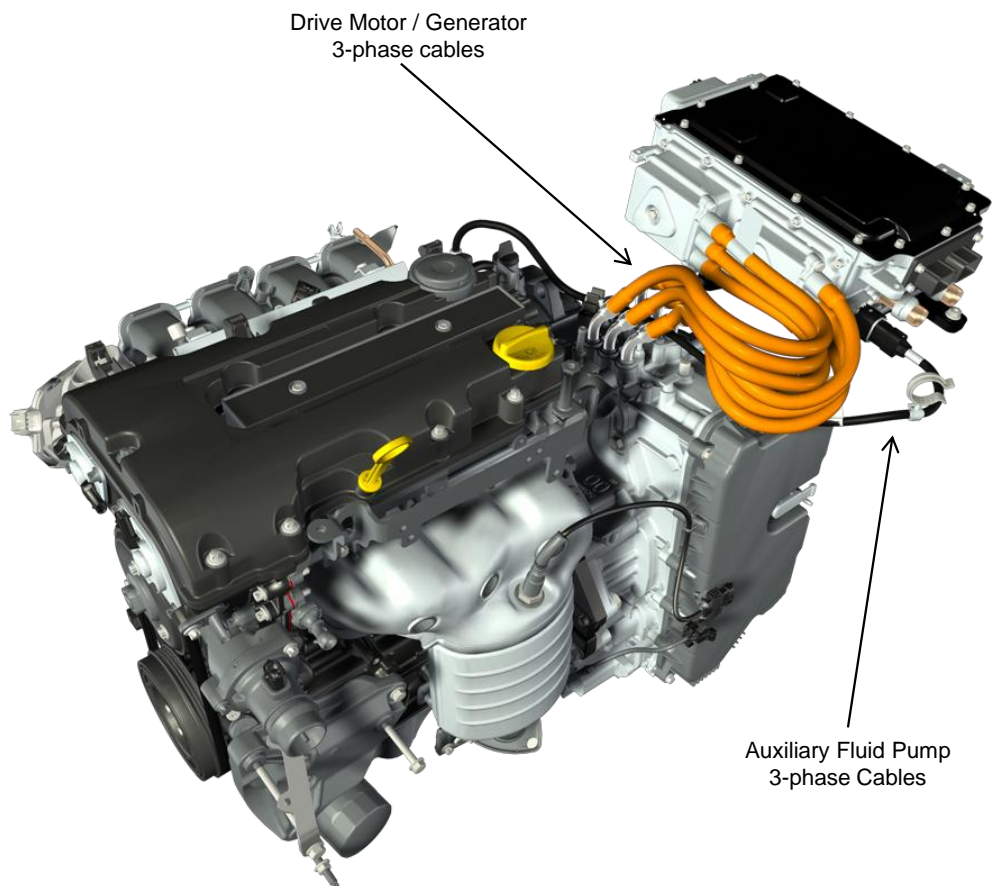
The high voltage cables connect the high voltage components. The cables are orange to identify the potential existence of high voltage. Internal braided shielding reduces electromagnetic interference by dissipating it to chassis ground.

The high voltage cables in the Chevrolet Volt are highly protected and should not be cut. However, performing the disabling procedure prior to work eliminates electrical current flow through the 12 volt system and disables the high voltage electrical system, external to the 360V battery.



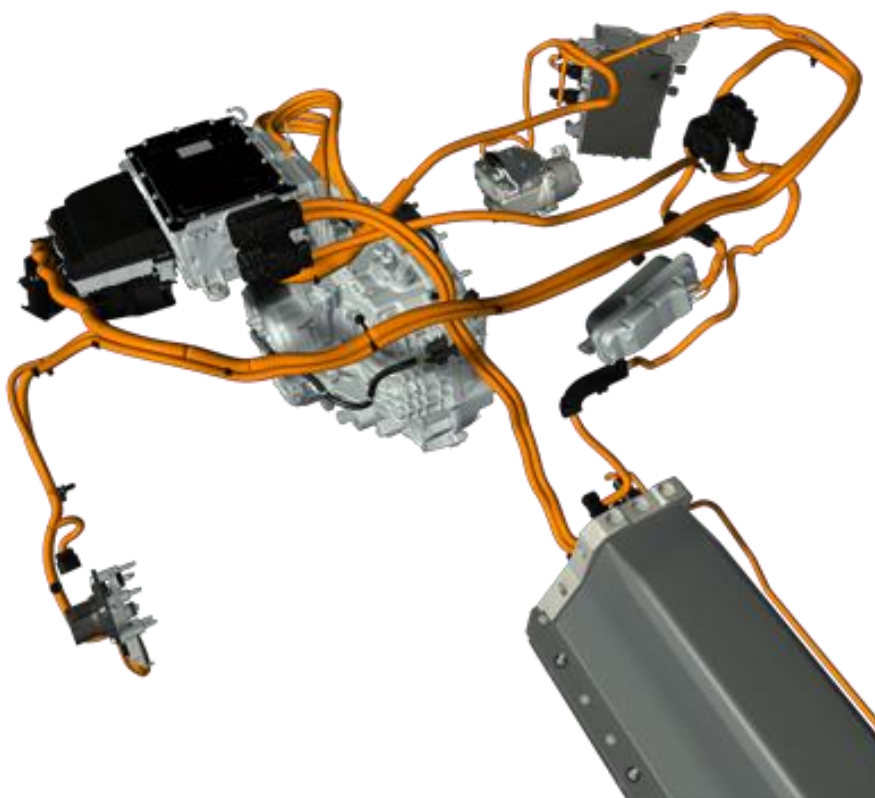
## 3-Phase Cables

There is a set of 3-phase high voltage high current cables connected to each drive motor / generator within the transmission. Each of the cables connects one of the AC phases, U, V, or W to the drive motor coils. Additionally, there is a set of 3-phase high voltage cables connecting the auxiliary fluid pump motor to the drive motor / generator power inverter module



## Direct Current Cables

High voltage positive and negative DC cables are isolated from the vehicle's chassis ground. The cables carry high voltage between the drive motor battery, drive motor / generator power inverter module, accessory direct current power control module, heater coolant heater, AC compressor, and the vehicle's high voltage charging system.





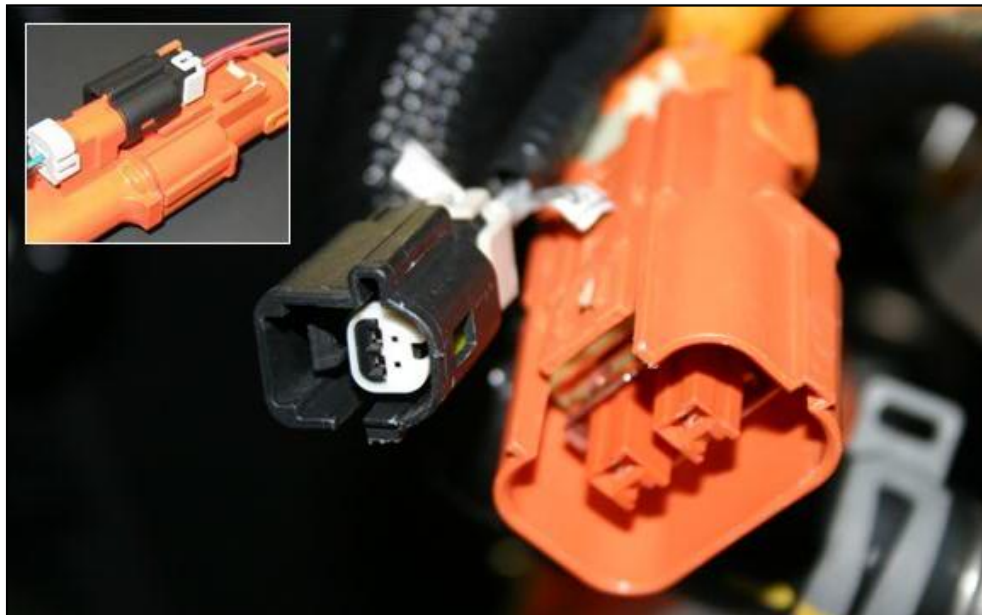
## HPCM 2

The HPCM 2 provides the main and charger circuits with 5 volts and ground. The module monitors each circuit for continuity.



## HVIC Connectors

The HVIC connectors are stacked on each high voltage connector. It is not possible to disconnect the high voltage cable connector before removing the HVIC connector. The design of the connector prevents potential contact with high voltage due to the time required to disassemble the connector. To disconnect the high voltage connector, use a dull pointed pick and press on the white Connector Position Assurance (CPA) tab that is protruding through the hole. Once the CPA is repositioned, disconnect the connector.



## Drive Motor Battery Fuse Cover

The drive motor battery fuse cover is accessible from the front of the battery and contains high voltage. Both the main and charger HVIC loops connect through the fuse cover. If the fuse cover is removed with high voltage turned on, the contactors open to reduce the risk of electrical shock.



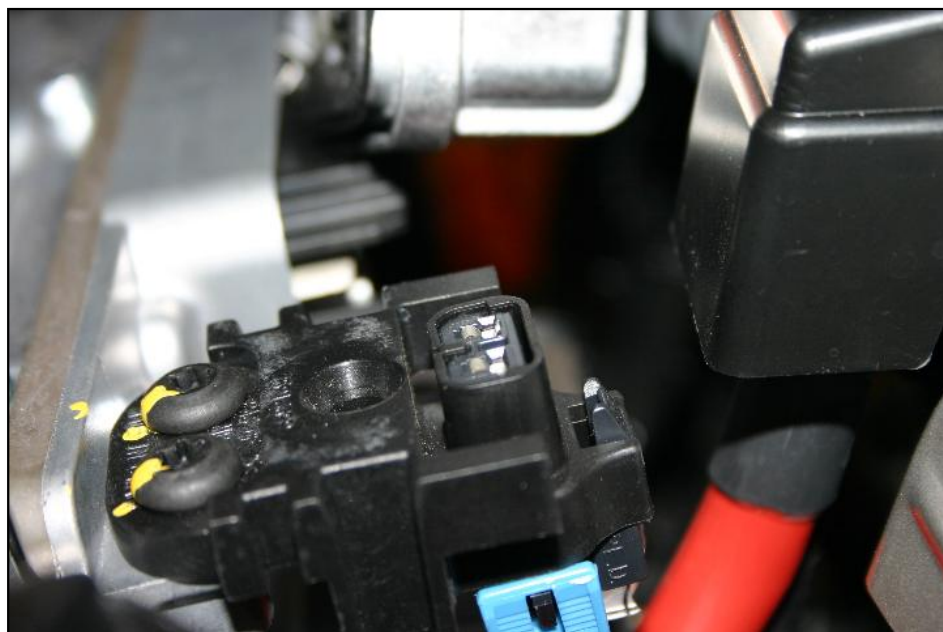
## Manual Service Disconnect

Access to the MSD is from the inside of the vehicle, underneath the center console box. The MSD interrupts the high voltage circuit within the drive motor battery. As the MSD is removed, the design causes both the main and charger HVIC circuits to open prior to high voltage circuit opening.



## Drive Motor / Generator Power Inverter Module Cover

Remove the drive motor / generator power inverter module cover to access the high voltage connectors. The circuit opens when the cover is removed. The system is designed to shut down high voltage by opening the contactors in the amount of time it takes to access the high voltage circuits.



# High Voltage Labels

The Chevrolet Volt features a series of high voltage labels that enable quick identification of potential electrical hazards. The labels are attached on each high voltage component.

The labels are color coded to indicate the potential high voltage state



**EMERGENCY PERSONNEL:**  
To help avoid personal injury in an emergency:  
• Turn ignition to "OFF".  
• Cut all positive cables connected at yellow tape (located behind fuse access panel in rear compartment area).

**PERSONNEL AFFECTÉ AUX URGENCES:**  
Afin d'éviter toute lésion personnelle, effectuer ce qui suit en cas d'urgence:  
• Mettre la clé de contact sur « OFF » (arrêt).  
• Couper tous les câbles positifs connectés au niveau du ruban jaune (situé à l'arrière du panneau d'accès des fusibles dans la zone du compartiment arrière).

**SERVICE PERSONNEL:**  
To help avoid personal injury during vehicle service, disconnect both battery locations (see diagram).

**PERSONNEL AFFECTÉ À L'ENTRETIEN:**  
Afin d'éviter toute lésion personnelle pendant l'entretien du véhicule, déconnecter les deux emplacements de la batterie (voir diagramme).

维修人员:  
为避免在维修车辆时  
引发人身伤害,  
断开两个高压连接位置的连接。  
(如图所示)

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**HIGH VOLTAGE** ALTA TENSÃO  
**HAUTE TENSION** HOCHSPANNUNG  
**高压** فلتنة عالية  
**ALTO VOLTAJE** 고압  
**ВЫСОКОЕ НАПРЯЖЕНИЕ** 高电压

20867289

**HAUTE TENSION** 360 V

**HAUTE TENSION**  
To help avoid burns or electric shock:  
• service by qualified personnel only  
• remove manual disconnect before service.

**HAUTE TENSION**  
Pour éviter les brûlures ou les chocs électriques:  
• Seul le personnel qualifié est autorisé à effectuer l'entretien.  
• Couper l'interrupteur avant de procéder à l'entretien.

**HAUTE TENSION** 360 V

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**HAUTE TENSION** 360 V

# High Voltage Labels

The emergency / service personnel warning label is affixed at the front of the engine compartment and provides specific procedures for emergency personnel.



The high voltage warning labels are orange and indicate a potential shock hazard if high voltage is not properly disabled. The labels are located on all high voltage components with the exception of the high voltage battery which utilizes the danger label.

**EMERGENCY PERSONNEL:**  
To help avoid personal injury in an emergency,  
• Turn ignition to "Off".  
• Cut all positive cables connected at yellow tape (located behind fuse access panel in rear compartment area).

**PERSONNEL AFFECTÉ AUX URGENCES :**  
Afin d'éviter toute lésion personnelle, effectuer ce qui suit en cas d'urgence :  
• Mettre la clé de contact sur « Off » (arrêt).  
• Couper tous les câbles positifs connectés au niveau du ruban jaune (situé à l'arrière du panneau d'accès des fusibles dans la zone du compartiment arrière).

应急人员：  
为避免人身伤害，在出现紧急情况时，  
• 将点火置于“关”的位置。  
• 切断在黄色胶带处 连接 的所有正极线缆（位于后车厢区的 保险丝检修）。

**SERVICE PERSONNEL:**  
To help avoid personal injury during vehicle service, disconnect both battery locations (see diagram).

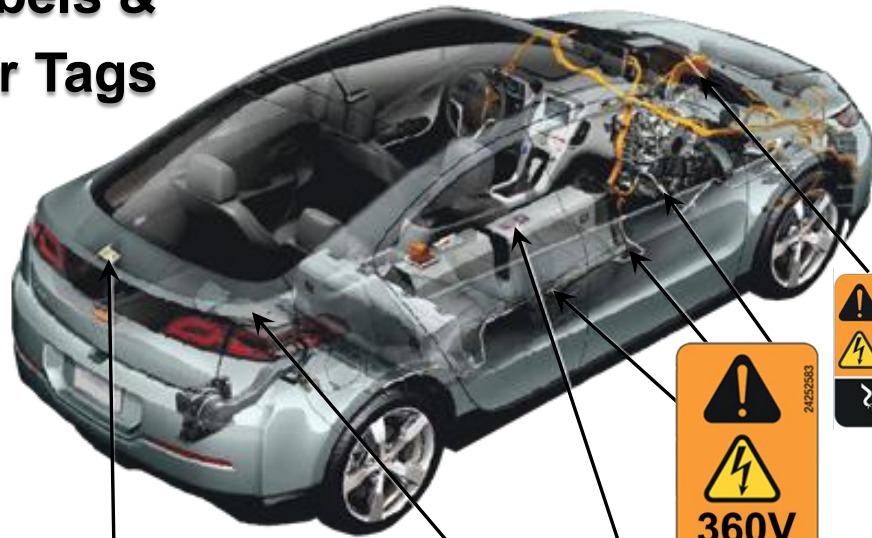
**PERSONNEL AFFECTÉ À L'ENTRETIEN :**  
Afin d'éviter toute lésion personnelle pendant l'entretien du véhicule, déconnecter les deux emplacements de la batterie (voir diagramme).

维修人员：  
为避免在维修车辆时导致人身伤害，断开两个电池连接位置的连接。（如图所示）。



# High Voltage Labels & First Responder Tags

The First Responder cable cut tag is wrapped around the low voltage positive battery cable and is located in the rear compartment behind the fuse panel door. To help ensure that low voltage is not holding the high voltage contactors closed, first responders will cut the cable before an extrication is performed.

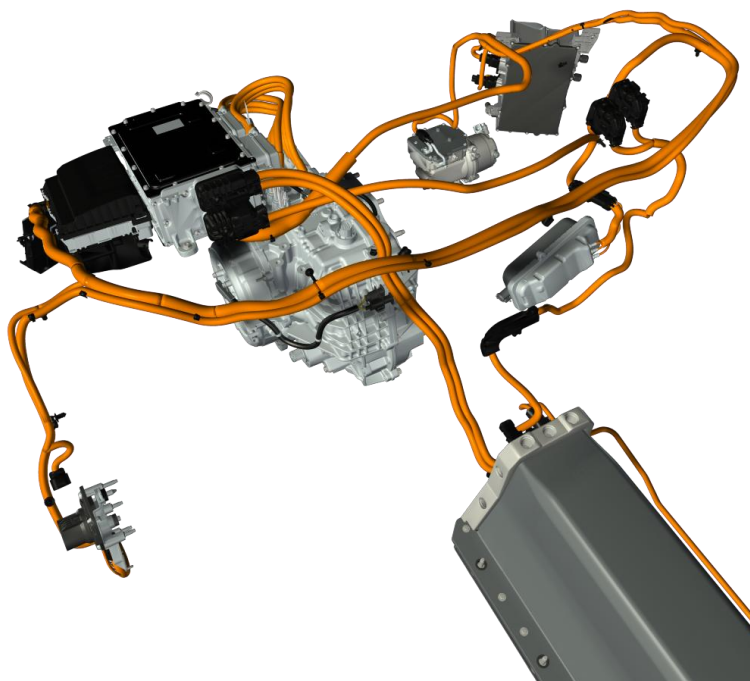




## Inspection

The hybrid powertrain control module 2 will open the high voltage contactor relays and disable the vehicle whenever a SIR deployment occurs.

A complete inspection of the high voltage system and components must be performed in accordance with service information if the vehicle has been involved in a collision. The Crash Event Detected condition will remain active until cleared by the hybrid powertrain control module 2 Clear Secured High Voltage DTCs output control function of the scan tool.



# High Voltage Disabling

Full disabling and removal procedures are located in the GM service manual for the vehicle.

**Danger:** 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.

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

Safety glasses with appropriate side shields when within 15.24 meters (50 feet) of the vehicle, either indoors or outdoors.

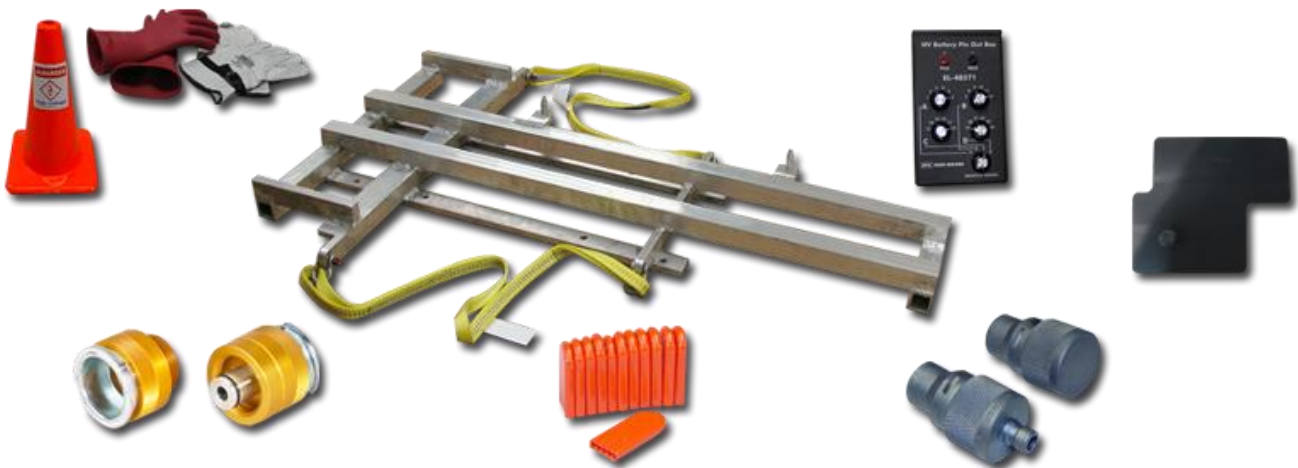
- Certified and up-to-date Class "0" Insulation gloves rated at 1000V with leather protectors.
  - Visually and functionally inspect the gloves before use.
  - Wear the Insulation gloves at all times when working with the high voltage battery assembly, whether the system is energized or not.

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

## HV Battery Removal

The used battery must be removed and returned with a battery assembly lifting fixture (GM Special Tool EL-49976.) This lifting fixture will be attached to the used battery and placed in the shipping cocoon. Each new service battery will come with a battery assembly lifting fixture for use during installation. You will keep this fixture for servicing future battery removals.

**Danger:** The high voltage (HV) battery must be protected when outside of the vehicle. This is why the battery must be immediately placed in the original shipping container (cocoon).



## HV Battery Shipment

Lithium-ion batteries are considered hazardous materials and require special shipping regulations. Lithium-ion batteries are classified as Class 9 hazardous material. Identifications (referred to as UN numbers) exist for the various battery packs based on chemistry and configuration. Refer to the return shipping instructions included with the replacement battery for specific identification needed for transportation.

Make sure that the shipping paperwork is filled out correctly and that the shipment is properly labeled per federal, state, and local laws and regulations. Check to make sure that you are complying with any recordkeeping requirements. . Only certified hazardous material personal should handle hazardous material.

Batteries should be shipped by ground or vessel only. Do not ship batteries for recycling by air.

NOTE: A damaged battery (one that is leaking electrolyte from the battery pack) might need to be shipped differently as a hazardous waste depending on your geographic location. Check your local regulations.

## Handling

### Fire

If battery cells reach high enough temperature, they vent and release electrolyte. Battery electrolyte is flammable. Use copious amounts of water to cool the battery and extinguish the fire. ABC dry chemical extinguisher will not extinguish a battery fire.

### Water

The high voltage battery is sealed and isolated from the vehicle chassis. If the vehicle is immersed in water, you will not be electrocuted by touching the vehicle.

Locate and review the Lithium-Ion Battery Chemistry Material Safety Data Sheet for more information.



## Conclusion

General Motors is committed to making your job as safe as possible.

We are confident the information contained in this guide will prove useful. Always refer to General Motors Service information for additional details and procedures.



GM Service Technical College provides Collision Repair Guides *free of charge*. Collision Repair Guides can be displayed in a classroom as long as they are represented as GM information and are not modified in any way.