

# Chevrolet Equinox Fuel Cell

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## Emergency Response Guide



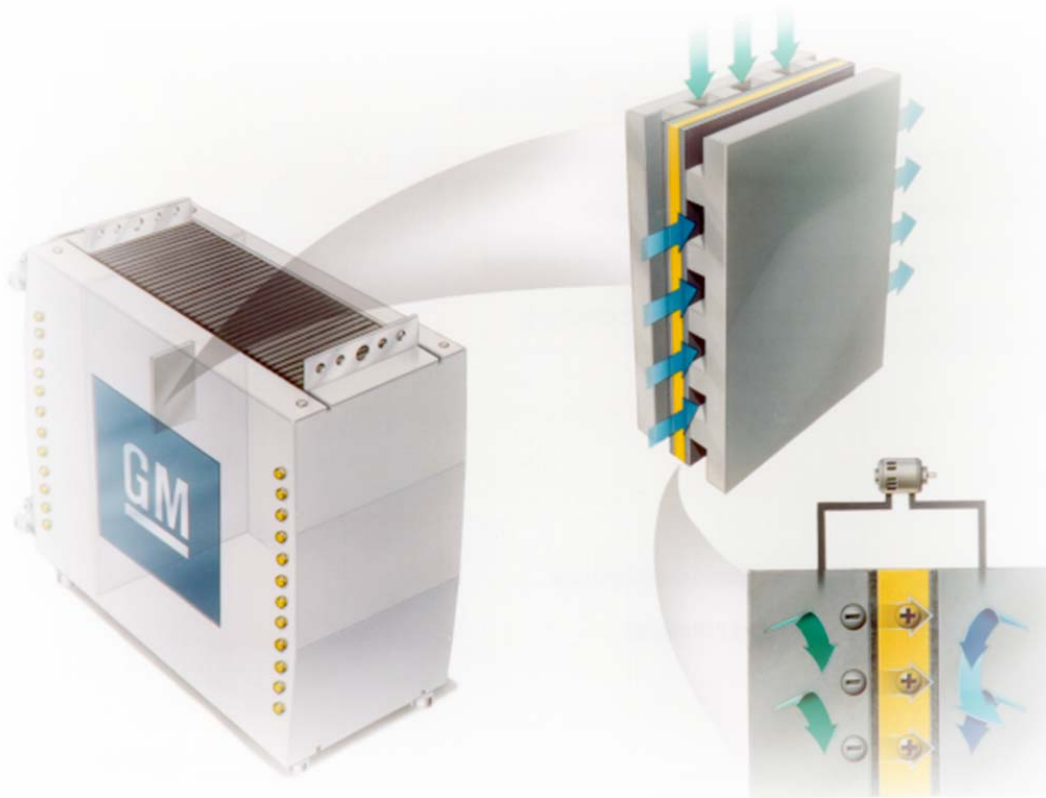


This guide specifically addresses the Chevrolet Equinox Fuel Cell.

While a majority of the systems installed on these vehicles are common to traditional GM vehicles, some components are different and may affect how a rescue procedure is performed.

We will note those differences as well as highlight ways to easily distinguish the Equinox Fuel Cell from its conventional counterparts.

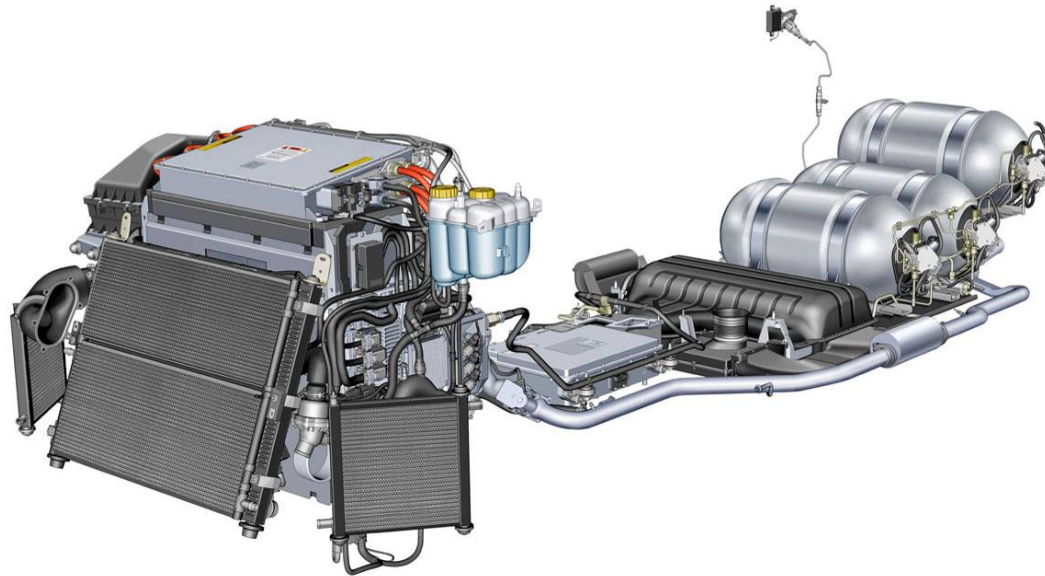
Finally, we will illustrate where the Do NOT Cut Zones exist to help you safely extricate occupants from the Equinox Fuel Cell.



## System Operation

The Equinox Fuel Cell is a hydrogen fuel cell electric vehicle that uses both high voltage and low voltage electrical systems. This vehicle is being initially launched as a controlled market test to compile consumer feedback.

Instead of traditional propulsion through an internal combustion engine, the Equinox Fuel Cell uses electrical output from hundreds of stacked fuel cells, which use hydrogen that is converted to energy for vehicle propulsion. The hydrogen fuel cell system enables the ability to achieve zero emissions. There is an absence of combustion in the Equinox Fuel Cell system.



## Hydrogen Properties

The fuel consumed in an Equinox Fuel Cell is hydrogen gas. Hydrogen rises two times faster than helium, and six times faster than natural gas. Because hydrogen is much lighter than air, it will disperse quickly from an area.

While hydrogen and gasoline have similar characteristics, they also have many differences. Hydrogen and gasoline can both be used as fuel; however, gasoline is a liquid as dispensed, and hydrogen fuel may be dispensed as a gas or liquid. Equinox Fuel Cells are fueled only with gaseous hydrogen.

A difference between hydrogen gas and gasoline is that they autoignite at different temperatures. Autoignition is the temperature at which a substance will spontaneously ignite without an external spark or flame. Depending on octane ratings, gasoline will autoignite between 450°F to 900°F (230°C to 480°C). Hydrogen has an autoignition temperature of 1058°F (570°C) making it less likely to spontaneously ignite.

Hydrogen minimum ignition energy, or the lowest possible energy resulting in the ignition of a flammable mixture by an electrical discharge, is lower than that of gasoline. This means that sparks from static electricity or electrical circuits discharges can more easily ignite hydrogen / air mixtures than gasoline vapor / air mixtures. Hydrogen gas typically burns with a flame that is only visible at night.

## Vehicle Identification

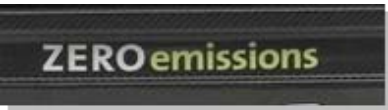
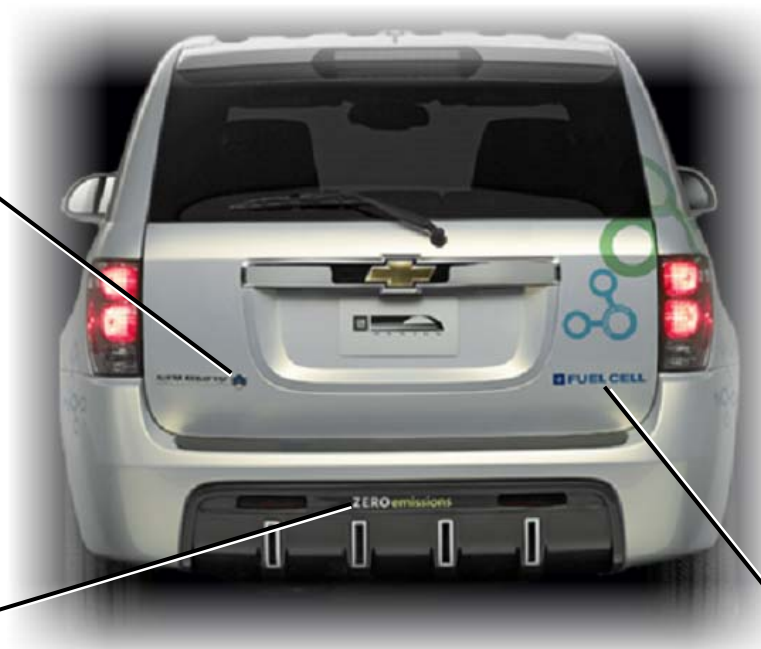
The Equinox Fuel Cell can be identified by the graphics on the vehicle exterior.



Graphics displayed are typical of what you will see on vehicles, but can vary by vehicle.

## Vehicle Identification (cont.)

Special badging is attached to the liftgate.



## Vehicle Identification (cont.)

A special trim cover on the Fuel Cell System, located under the hood, helps to identify an Equinox Fuel Cell.



## Vehicle Identification (cont.)

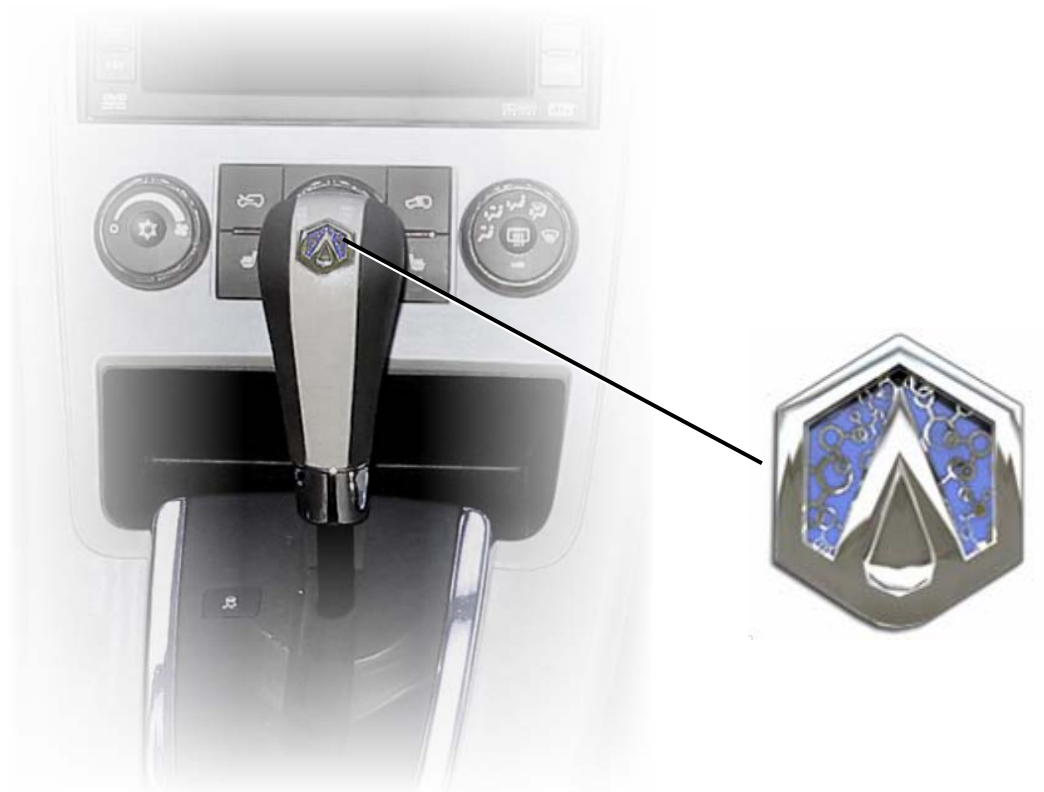
Instead of a tachometer, a power indicator is integrated into the instrument panel.

The power indicator shows the actual power being delivered by the Fuel Cell System in Kilowatts (kW).



## Vehicle Identification (cont.)

The Equinox Fuel Cell shifter is modified to identify a fuel cell vehicle. This modification consists of an emblem signifying a hydrogen vehicle.



## Voltage Classifications

The Equinox Fuel Cell uses a high voltage system, similar to hybrid vehicles, and **MUST** be approached with caution.



## Voltage Classifications (cont.)

Electricity is categorized as either low, intermediate, or high voltage.

- Low voltage – from 0 to 30 volts DC / 0 to 15 volts AC
- Intermediate voltage – from 30 volts to 60 volts DC / 15 volts to 30 volts AC

**NOTE:** Intermediate voltage is not used on this vehicle.

- High voltage – any voltage greater than 60 volts DC / 30 volts AC

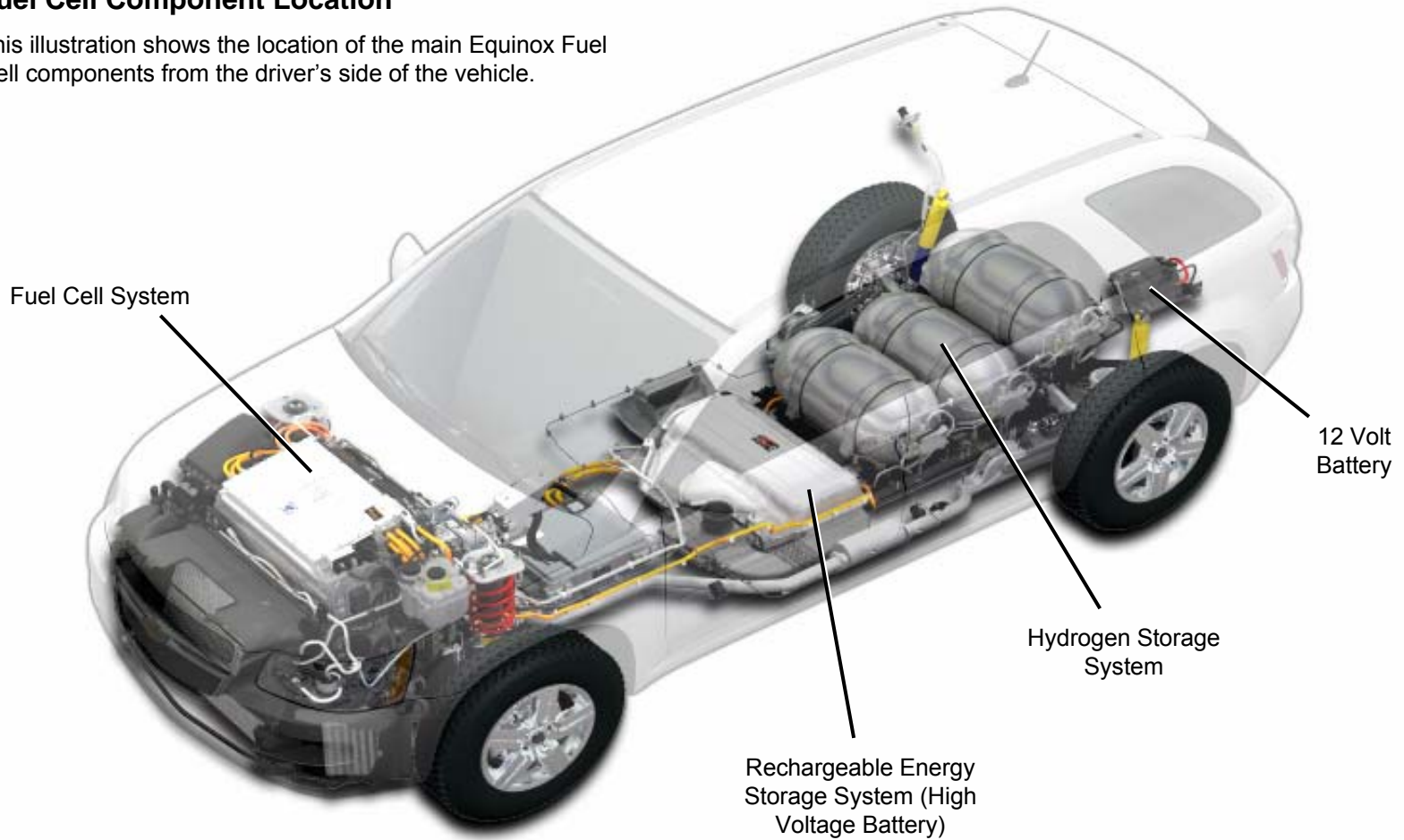
| Classification | Low Voltage                                       | Intermediate Voltage (Blue)                     | High Voltage (Orange)                   |
|----------------|---|---|---|
| Voltage Ranges | DC $\leq$ 30v<br><br>AC $\leq$ 15v <sup>RMS</sup> | DC: 30 - 60v<br><br>AC: 15 - 30v <sup>RMS</sup> | DC > 60v<br><br>AC > 30v <sup>RMS</sup> |

Color coding is used to identify the different levels of voltage. Orange represents high voltage.

Note: Presently there are no industry standards to identify intermediate voltage. GM has chosen BLUE for this cable color. Intermediate voltage is not used on the Equinox Fuel Cell.

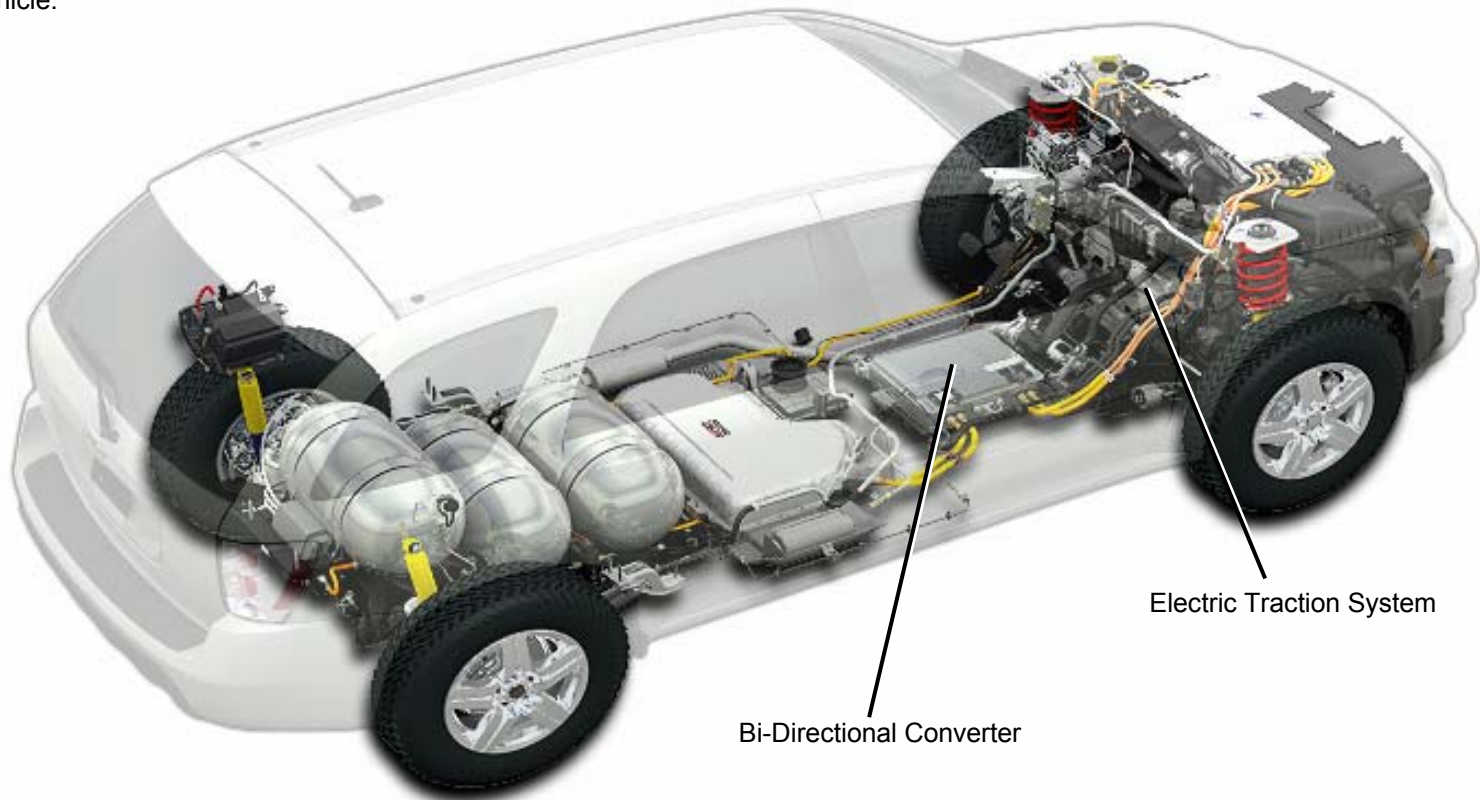
## Fuel Cell Component Location

This illustration shows the location of the main Equinox Fuel Cell components from the driver's side of the vehicle.



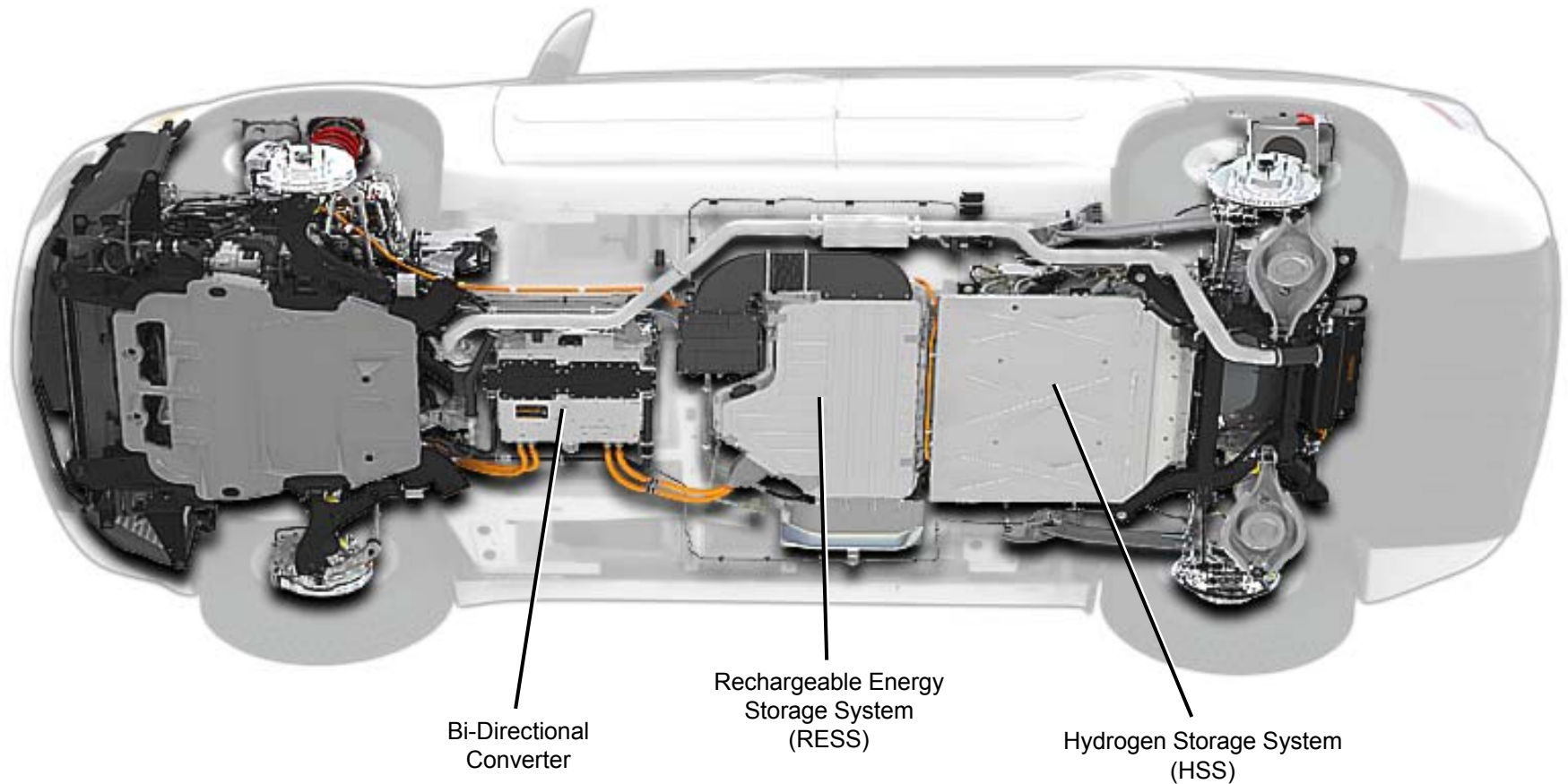
## Fuel Cell Component Location (cont.)

This illustration shows the locations of the main Equinox Fuel Cell components from the passenger side of the vehicle.



## Fuel Cell Component Location (cont.)

This illustration shows the locations of the main Equinox Fuel Cell components from the underside of the vehicle.

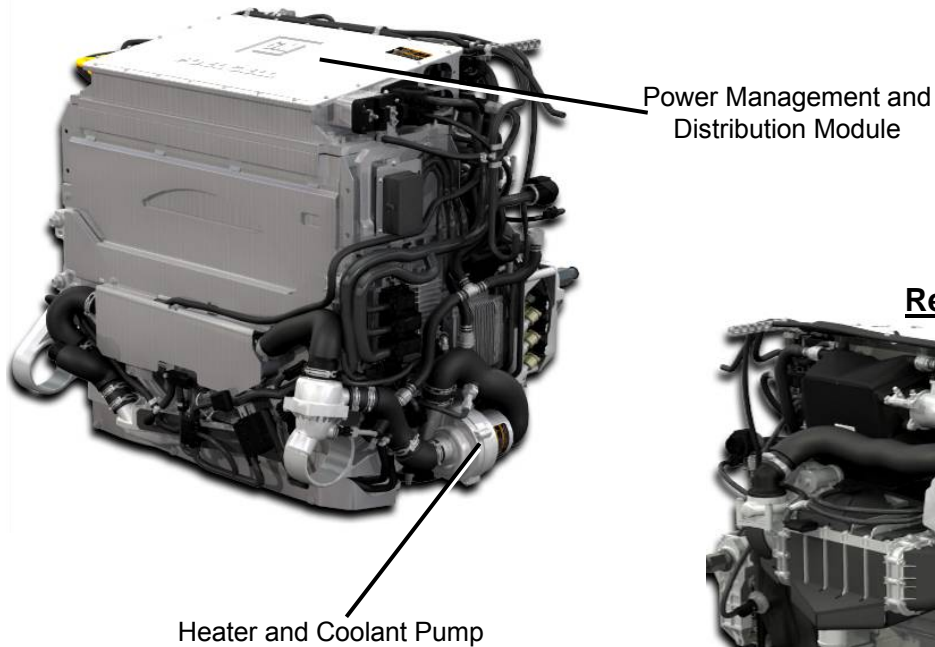


## Fuel Cell Component Operation

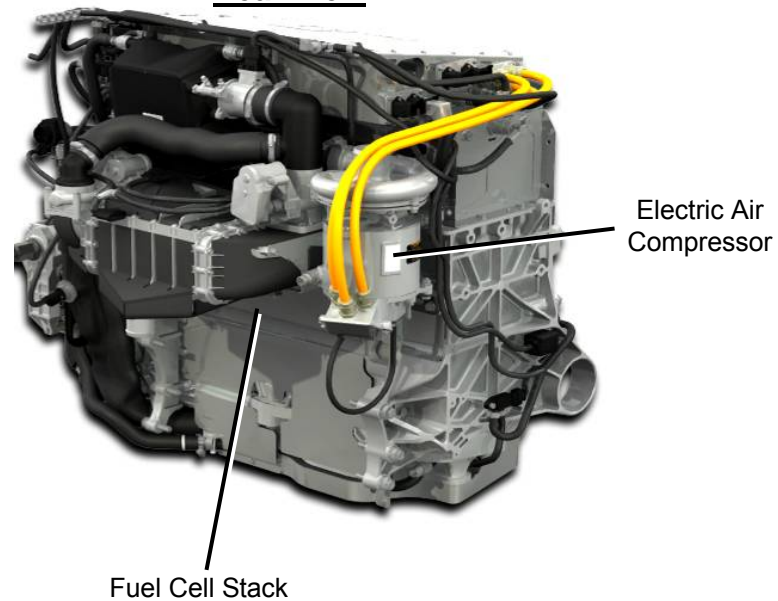
The Fuel Cell System provides power from the Fuel Cell Stack to the high voltage components. The Fuel Cell System contains:

- Fuel Cell Stack
- Power Management and Distribution Module
- Electric Air Compressor
- Heater and Coolant Pump

**Front View**



**Rear View**



## Fuel Cell Component Operation (cont.)

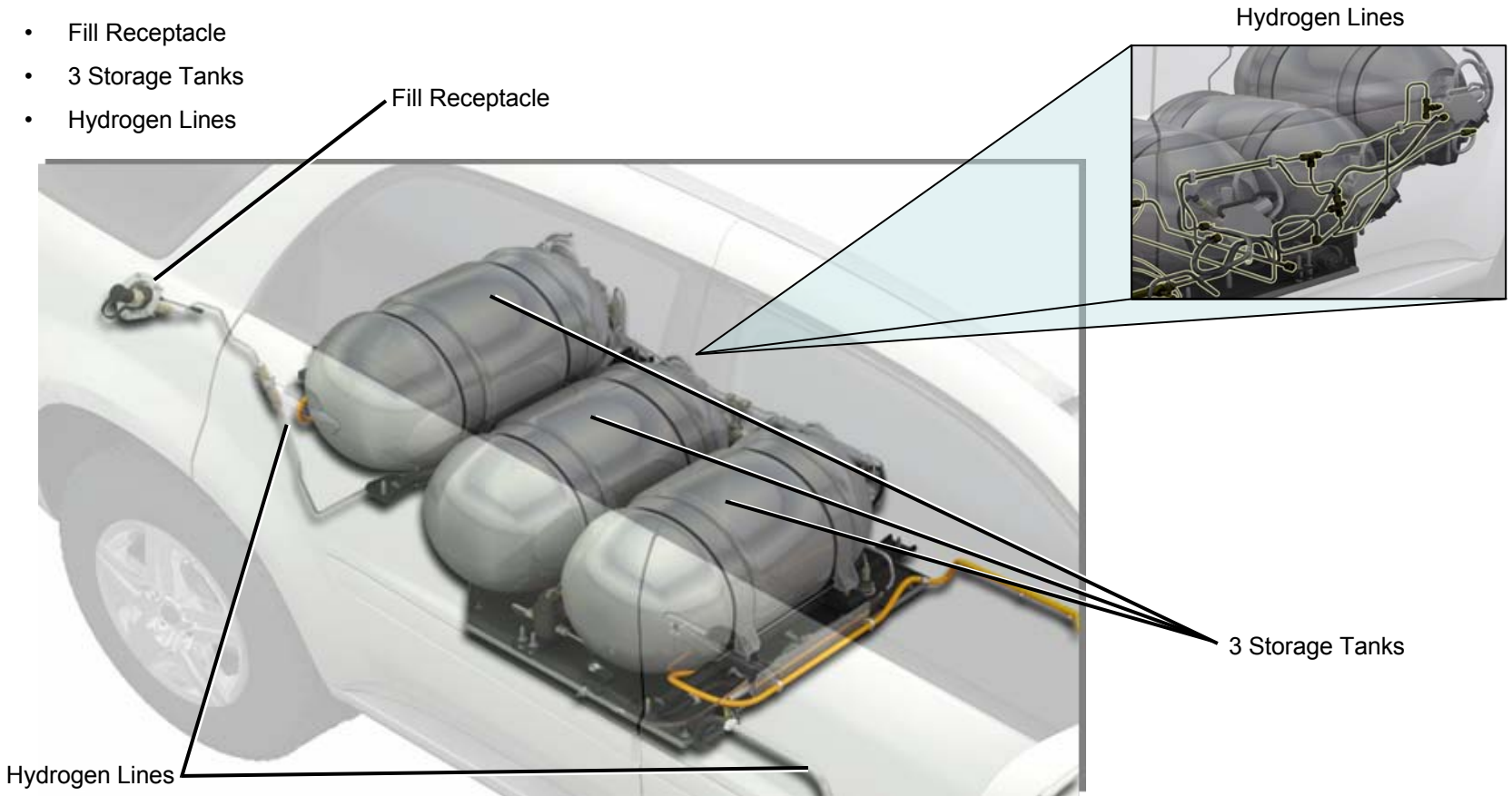
The Rechargeable Energy Storage System (High Voltage Battery) collects energy generated from the Electric Traction and Fuel Cell Systems. The energy is then stored in the high voltage battery for later use.



### Fuel Cell Component Operation (cont.)

The Hydrogen Storage System (HSS), located in the rear underbody area, stores compressed hydrogen for use in the Fuel Cell Stack. The HSS contains:

- Fill Receptacle
- 3 Storage Tanks
- Hydrogen Lines



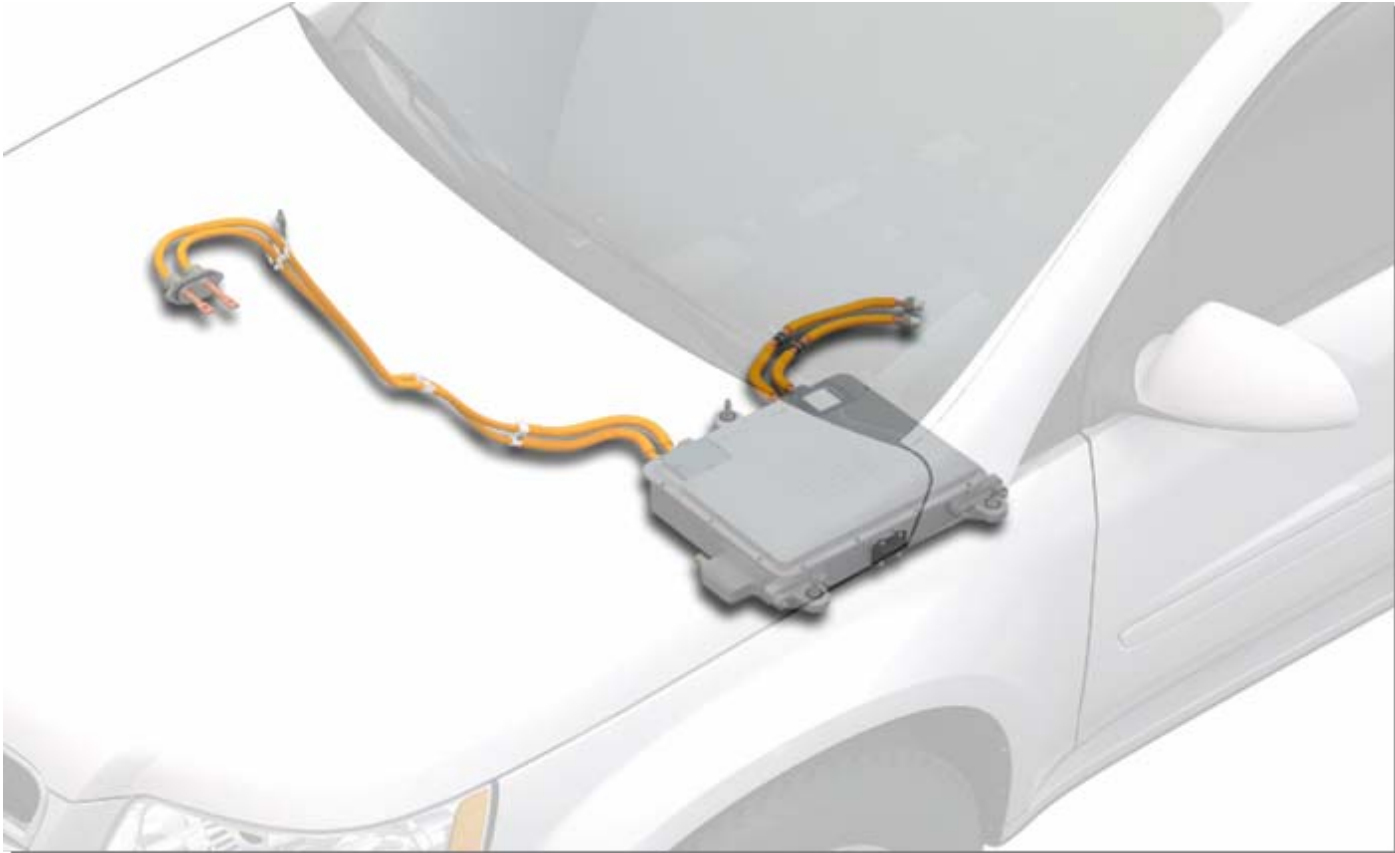
### Fuel Cell Component Operation (cont.)

The 12 Volt Battery is located in the rear of the vehicle, on the driver side, under a trim panel. The 12 Volt Battery powers all accessories when the Equinox Fuel Cell is NOT running.



## Fuel Cell Component Operation (cont.)

The main function of the Bi-Directional Converter is to control the flow of energy between the Fuel Cell Stack and the Rechargeable Energy Storage System.



## Fuel Cell Component Operation (cont.)

The Electric Traction System contains the Power Inverter Module and the Drive Motor. The Drive Motor is the only propulsion motor on the vehicle. It propels the vehicle using power from both the Fuel Cell System and the high voltage battery. The Electric Traction System also provides regenerative energy from deceleration to recharge the High Voltage Battery.

The main function of the Power Inverter Module is to convert direct current (DC) from the Fuel Cell System into 3-phase alternating current (AC) for the Electric Traction System. The Power Inverter Module also converts regenerated energy from the propulsion motor to recharge the high voltage battery.

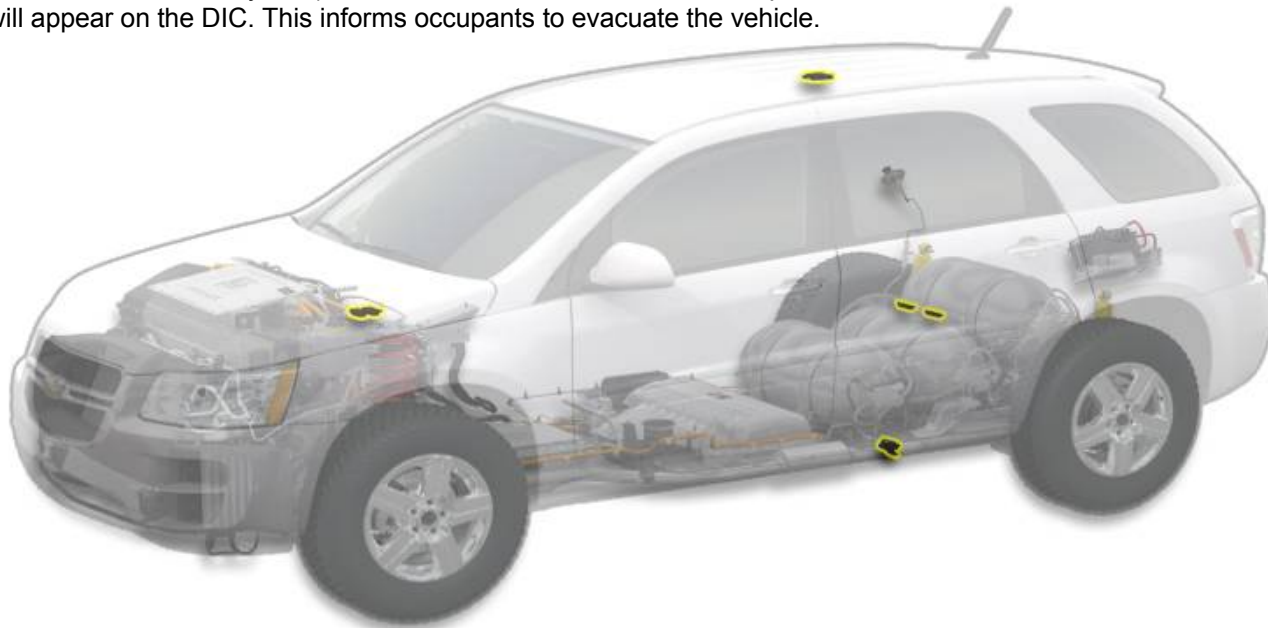


## Hydrogen Sensors

There are a total of 7 hydrogen sensors located on the Equinox Fuel Cell:

- 2 sensors under hood
- 2 sensors mounted above headliner in passenger compartment
- 2 sensors near hydrogen storage tanks
- 1 sensor inside exhaust system

Whenever the propulsion system is ON, these sensors continuously monitor hydrogen concentration in these areas. When hydrogen is detected at a **Warning Level** (above 12% of lower flammability limit), the driver will be alerted by the H2 icon located in the instrument panel cluster and the Drivers Information Center (DIC) will show a "H2 detected" message. If hydrogen is detected at an **Alarm Level** (above 50% of lower flammability limit), the H2 icon will blink, an audible beep will sound, and a "H2 detected – evacuate vehicle" message will appear on the DIC. This informs occupants to evacuate the vehicle.



## Approaching the Vehicle

The Equinox Fuel Cell Hydrogen Storage System is outfitted with Pressure Relief Devices (PRD). These devices are designed to release hydrogen pressure upon a thermal event, such as a vehicle fire, to reduce the risk of a storage tank over pressurization which otherwise may occur. If a loud hissing noise is heard from the rear when approaching or working on the vehicle, it may be that hydrogen is being released from a Pressure Relief Device, which could proceed for up to 1 minute. There are three tanks, each with their own PRD. Each tank can release at a different time, depending on the location of the heat source. While releasing hydrogen will disperse quickly, it is possible that it could ignite and burn if an ignition source is present. These potential occurrences should be considered in timing of an occupant extrication. Pressure relief devices are located underneath the rear section of the vehicle on the driver's side.

Note: Hydrogen gas typically burns with a flame that is only visible at night.

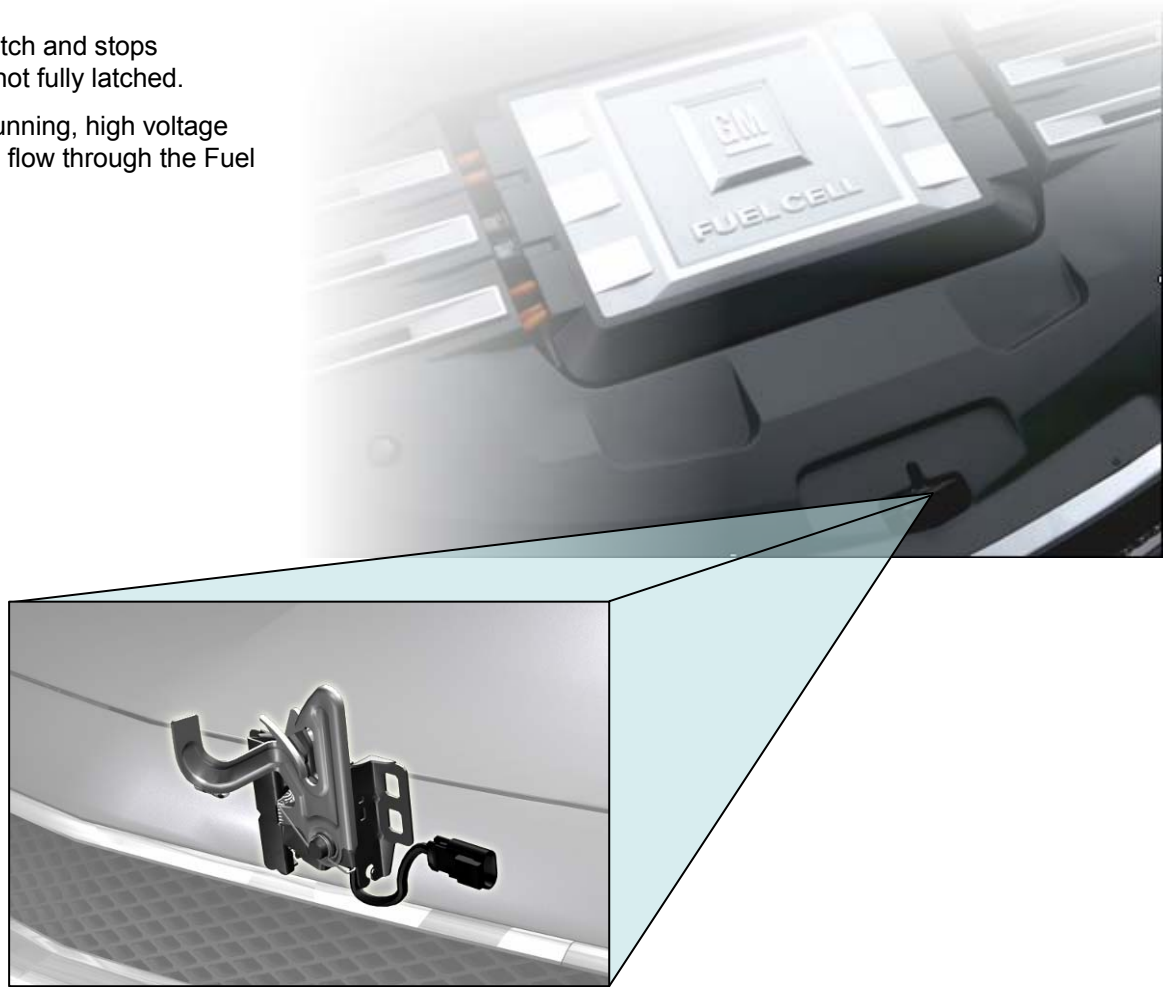


Driver's Side View

## Disabling Propulsion System

A hood switch is mounted near the hood latch and stops hydrogen flow if the hood of the vehicle is not fully latched.

If the hood is opened while the vehicle is running, high voltage current flow will be disabled, and hydrogen flow through the Fuel Cell System will shut down.



## Air Bag Deployment\*

Upon rear impact, or if one or more air bags deploy, contactors inside the high voltage battery are designed to open and hydrogen flow to the propulsion system stops. This causes high voltage to be isolated in the Rechargeable Energy Storage System. Additionally, the hydrogen supply is isolated within the three storage tanks.

To ensure personal safety, it is essential to disable 12 volt power if one or more of the air bags remains undeployed. Refer to the Disabling Power section to review this procedure.



\*For more information on air bags, refer to the Emergency Personnel Information link at [www.gmstc.com](http://www.gmstc.com)



**After disabling 12 volt power, WAIT a minimum of 10 seconds to allow any undeployed air bag reserve energy and high voltage energy to dissipate before cutting into the vehicle.**

## Disabling Power

Perform each of the following steps to disable the 12 volt electrical system. This includes power to the air bag system.

1. Turn the ignition key to the OFF position.
2. Pull the hood release latch. This interrupts the normal Fuel Cell System shutdown procedure, disconnects the high voltage power supply, and stops hydrogen flow to the propulsion system.
3. Remove cover for 12 volt battery and disconnect or cut the 12 volt negative battery cable.
4. WAIT a minimum of 10 seconds to allow any undeployed air bag reserve energy and high voltage energy to dissipate before cutting into the vehicle.

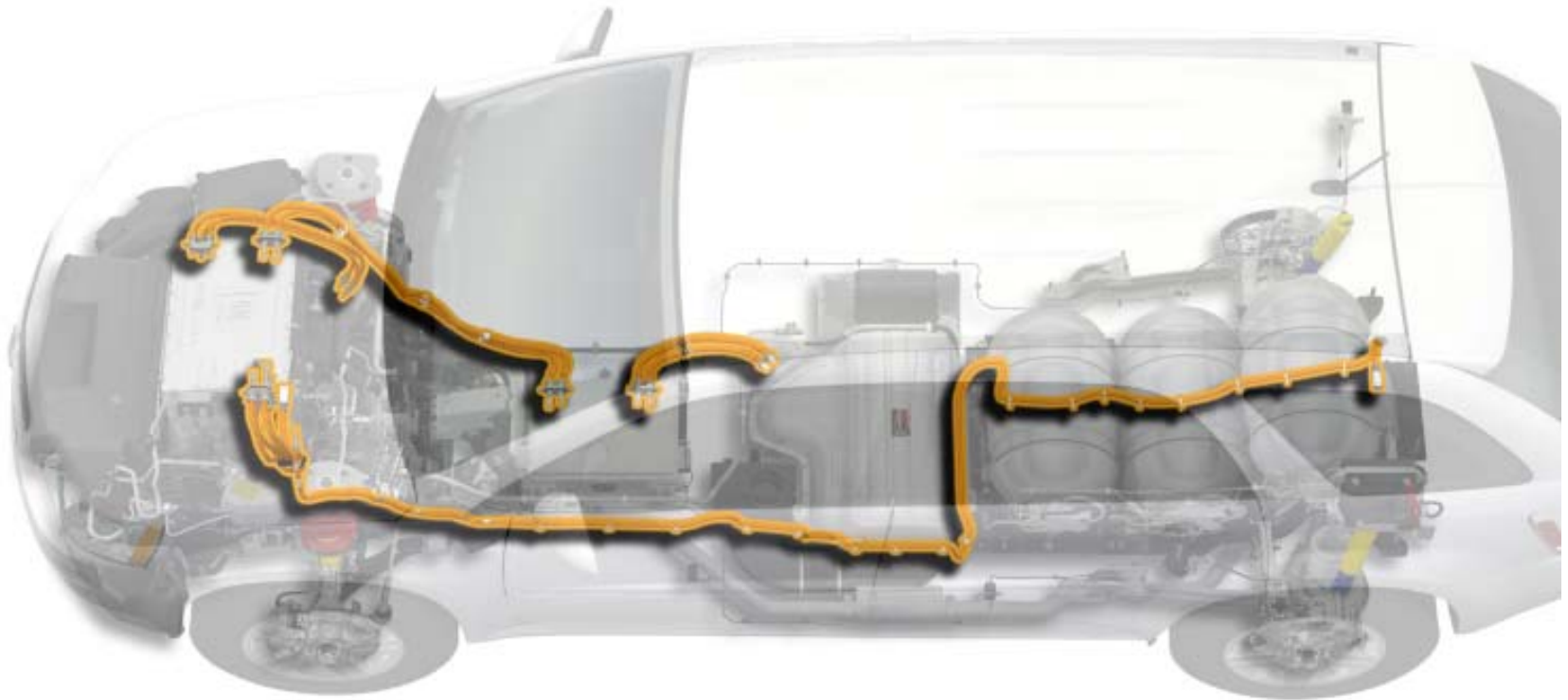


## High Voltage Electrical System

Perform the Disabling Power procedure (explained on the previous page) to eliminate current flow on the 12 volt electrical system. This interrupts high voltage current flow.

**Warning:** Even though high voltage current flow has been interrupted, it is still important to NEVER cut the orange high voltage cables. If the cable is cut, personal injury and/or electrical arc may occur.

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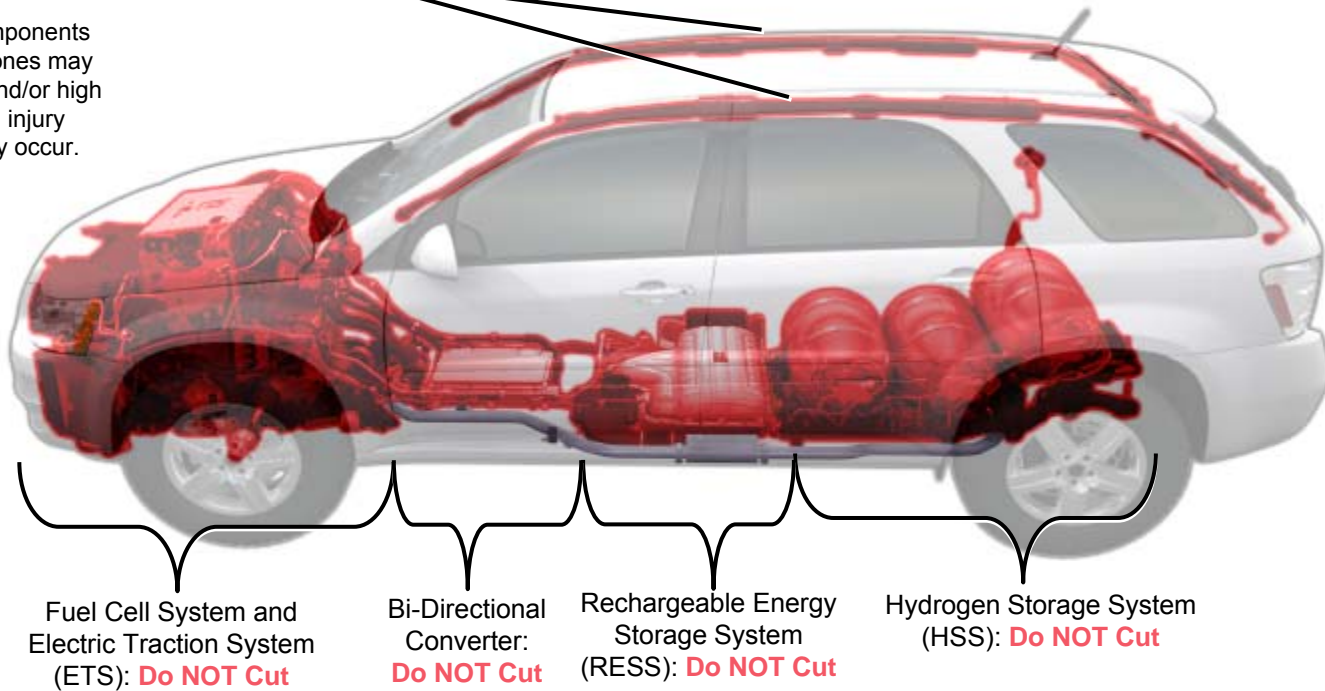


## Do NOT Cut Zones

**Danger: NEVER cut the vehicle until the electrical systems have been deactivated and isolated. Cutting into the vehicle prior to disconnecting and isolating the electrical energy sources may cause personal injury and/or an electrical arc.**

Roof Rail Air Bags

Note: The systems/components identified as No CUT Zones may contain hydrogen fuel and/or high voltage. If cut, personal injury and/or electrical arc may occur.



**NEVER, in any circumstances, cut the following:**

- Underbody of the vehicle inboard of structural rails. The high voltage wiring and hydrogen lines are routed beneath the vehicle. Personal injury and/or electrical arc may occur.
- Roof rails between the windshield pillars and 'sail' panels. The roof rail air bags are present and personal injury may occur.



Note: An Equinox Fuel Cell First Responder **Quick Reference Sheet** is available for download and printing from <http://www.gmstc.com>. Click on the First Responder link and select the Chevrolet Equinox Fuel Cell First Responder Quick Reference Sheet.

## Conclusion

Automotive propulsion technology advancements are changing the way vehicles are being built. Awareness of new technology and changes in vehicle systems will assist First Responders in their job. The information in this Equinox Fuel Cell Emergency Response Guide will help First Responders prepare for rescue situations. In this guide we have made you aware of Equinox Fuel Cell:

- Identification
- Component operation & location
- Potential risks & dangers
- Air bag safety
- Disabling procedures
- Do NOT Cut zones

We are confident this guide will contribute positively toward attaining this goal.

Note: Like many other GM vehicles, the Equinox Fuel Cell is equipped with OnStar, which may notify your area's Public Safety Answering Points ("9-1-1" call center) if a crash occurs.