

Chevrolet Equinox Fuel Cell

Emergency Response Guide

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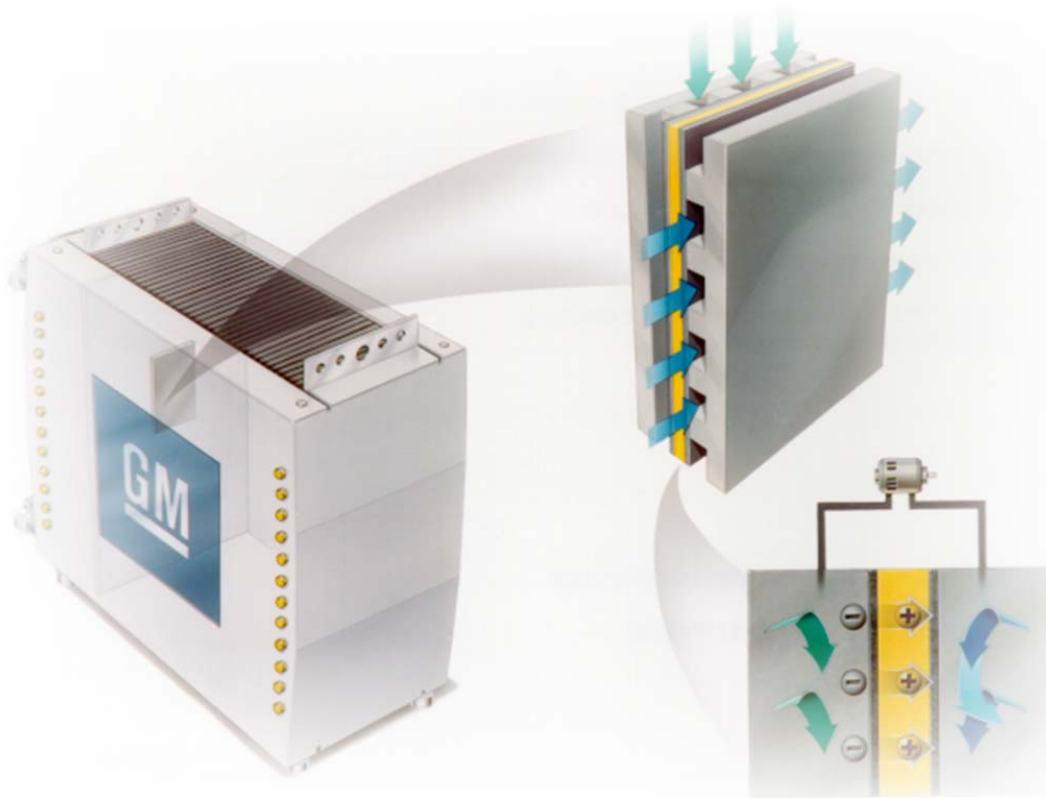


This guide specifically addresses the Chevrolet Equinox Fuel Cell.

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.

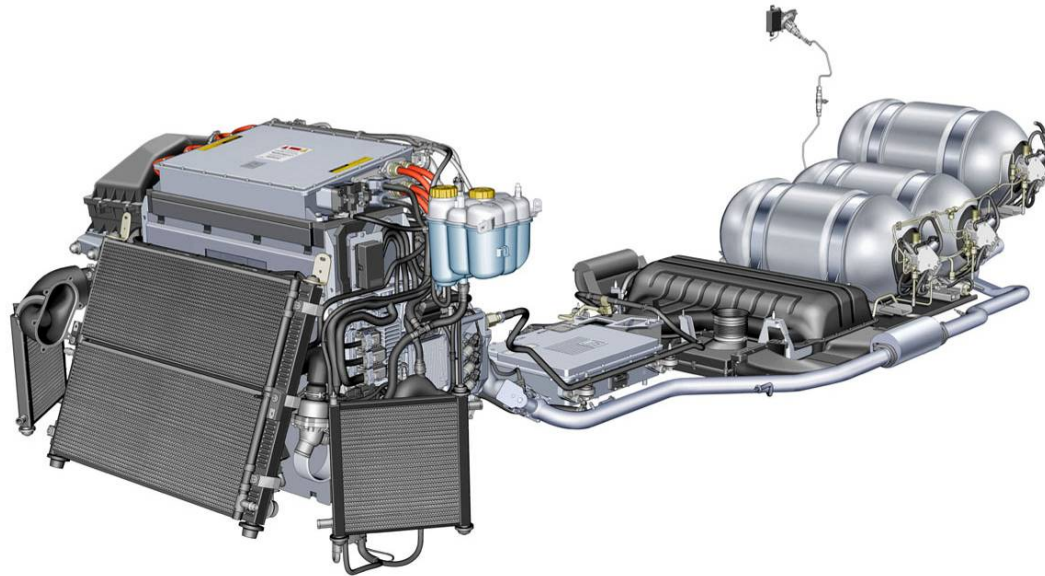
Finally, we will illustrate where the Do NOT Cut Zones exist to help you safely extricate occupants from the Equinox Fuel Cell.



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 Equinox fuel cell is a zero emission vehicle. It does not have a conventional internal combustion engine.



Hydrogen Properties

The fuel consumed in an Equinox Fuel Cell is hydrogen gas. Hydrogen rises two times faster than helium, and nearly 10 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 and badging on the vehicle exterior.



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

Vehicle Identification (cont.)

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



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

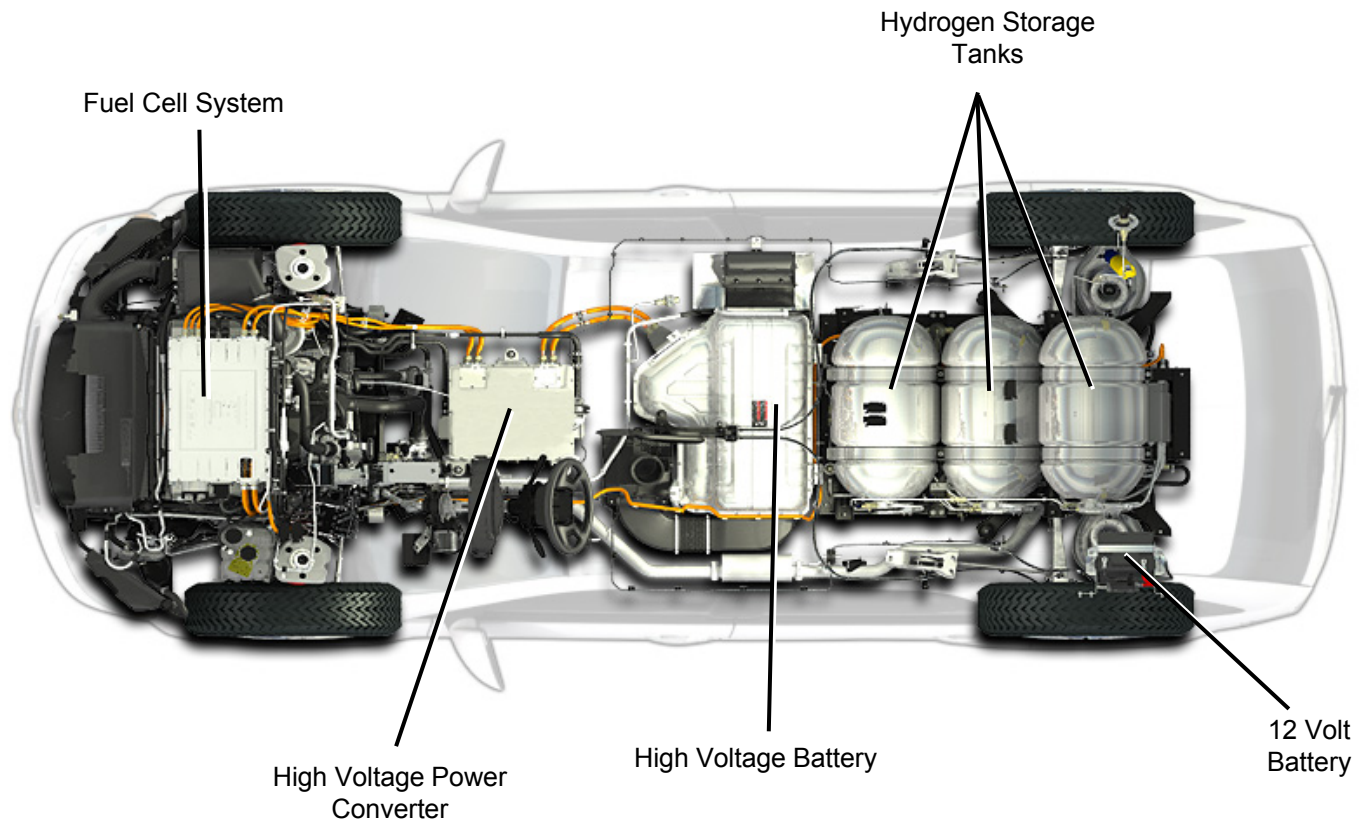
Color coding is used to identify the wiring with different levels of voltage. Orange represents high voltage.

Classification	Low Voltage (No color code)	Intermediate Voltage (Blue)	High Voltage (Orange)
Voltage Ranges	DC \leq 30v AC \leq 15v ^{RMS}	DC: 30 - 60v AC: 15 - 30v ^{RMS}	DC > 60v AC > 30v ^{RMS}

Note: Intermediate voltage is not used on this vehicle. Only low voltage and high voltage are used on the Equinox Fuel Cell.

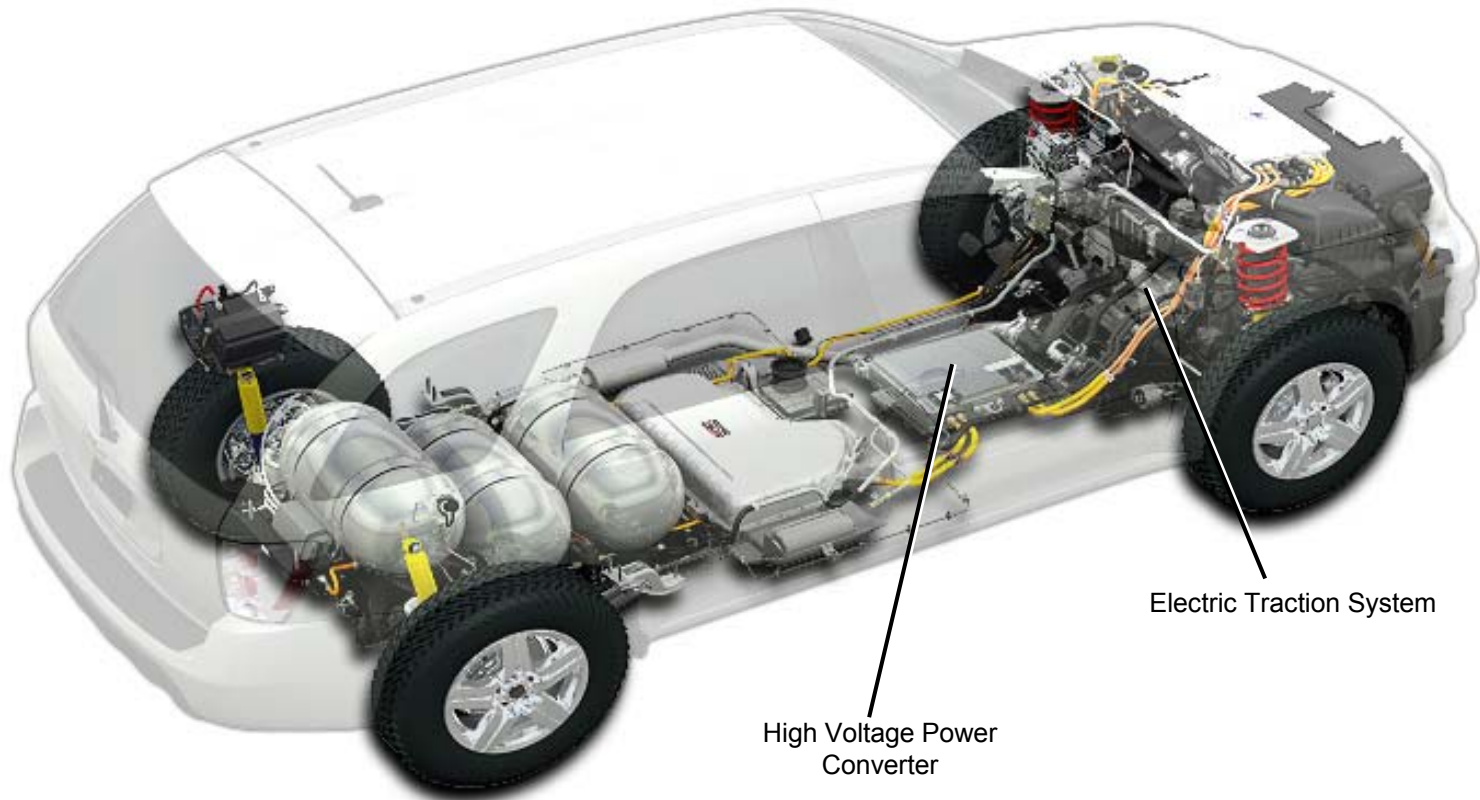
Equinox Fuel Cell Component Location

This illustration shows the location of the main Equinox Fuel Cell components from a top view of the vehicle.



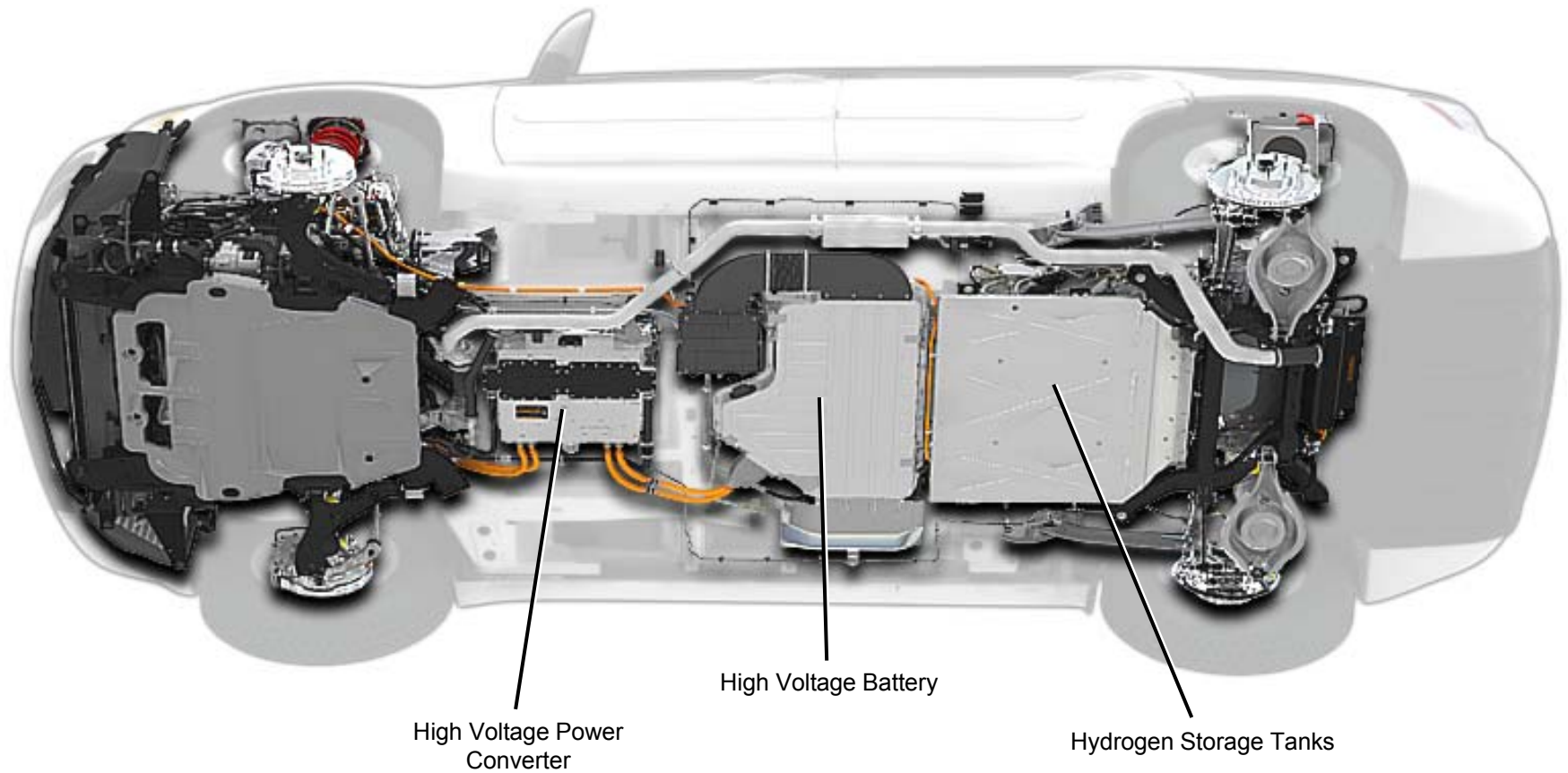
Equinox Fuel Cell Component Location (cont.)

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



Equinox Fuel Cell Component Location (cont.)

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

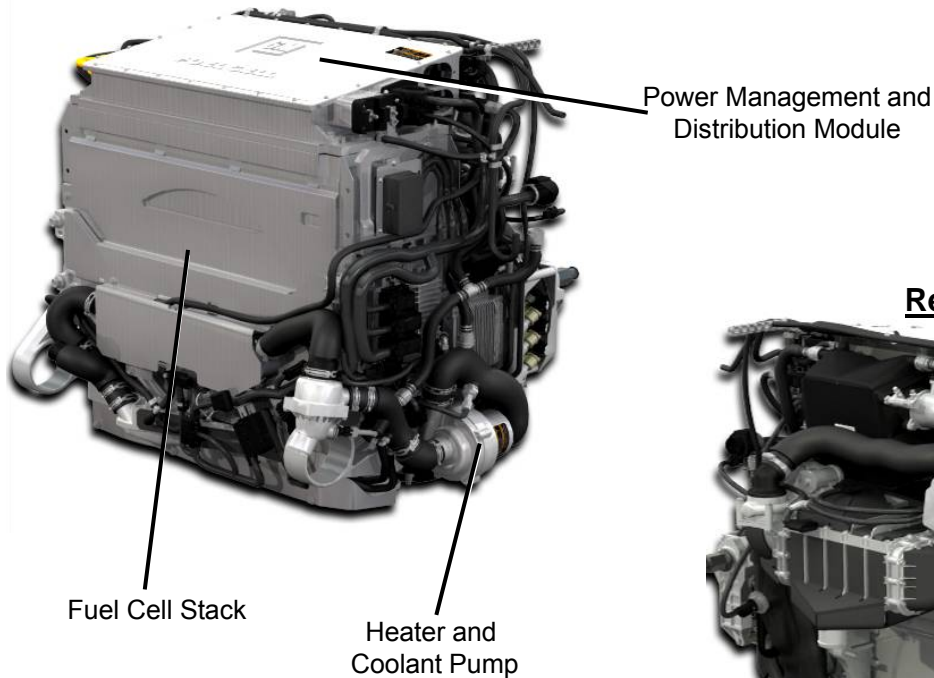


Equinox Fuel Cell Components

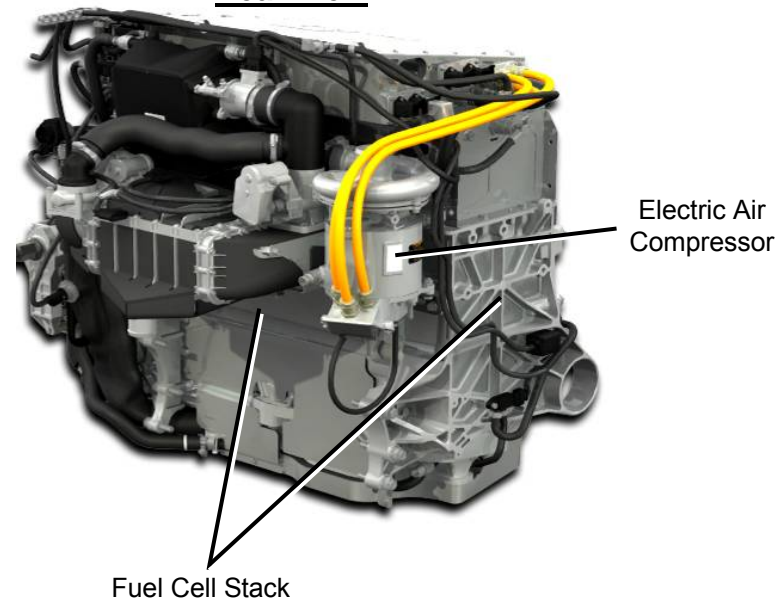
The Fuel Cell System provides power from the Fuel Cell Stack to the high voltage components. The Fuel Cell System contains:

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

Front View

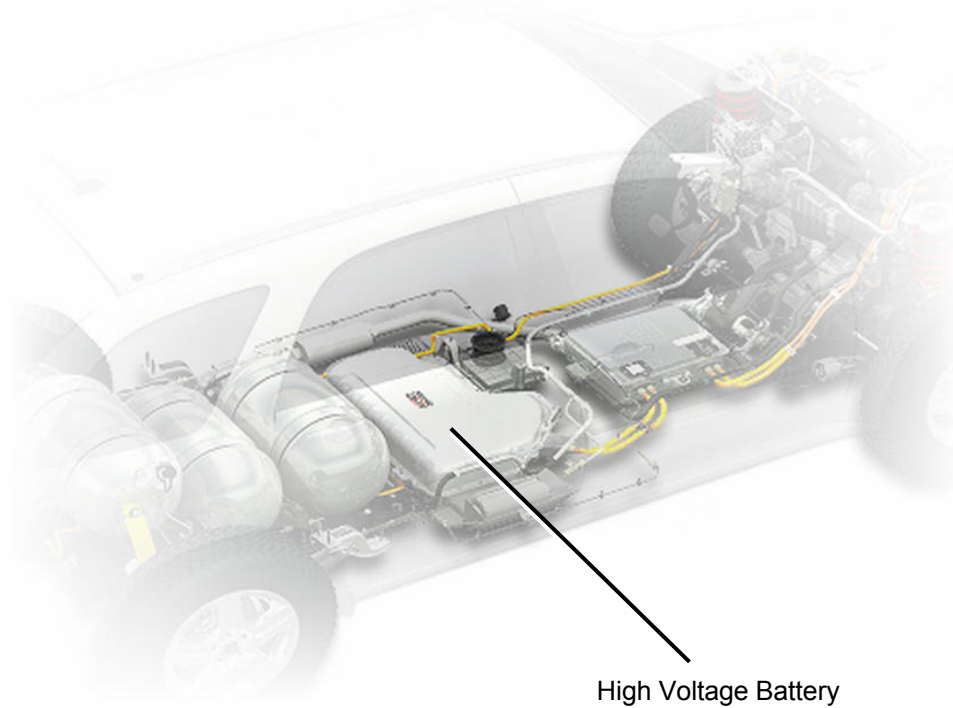


Rear View



Equinox Fuel Cell Components (cont.)

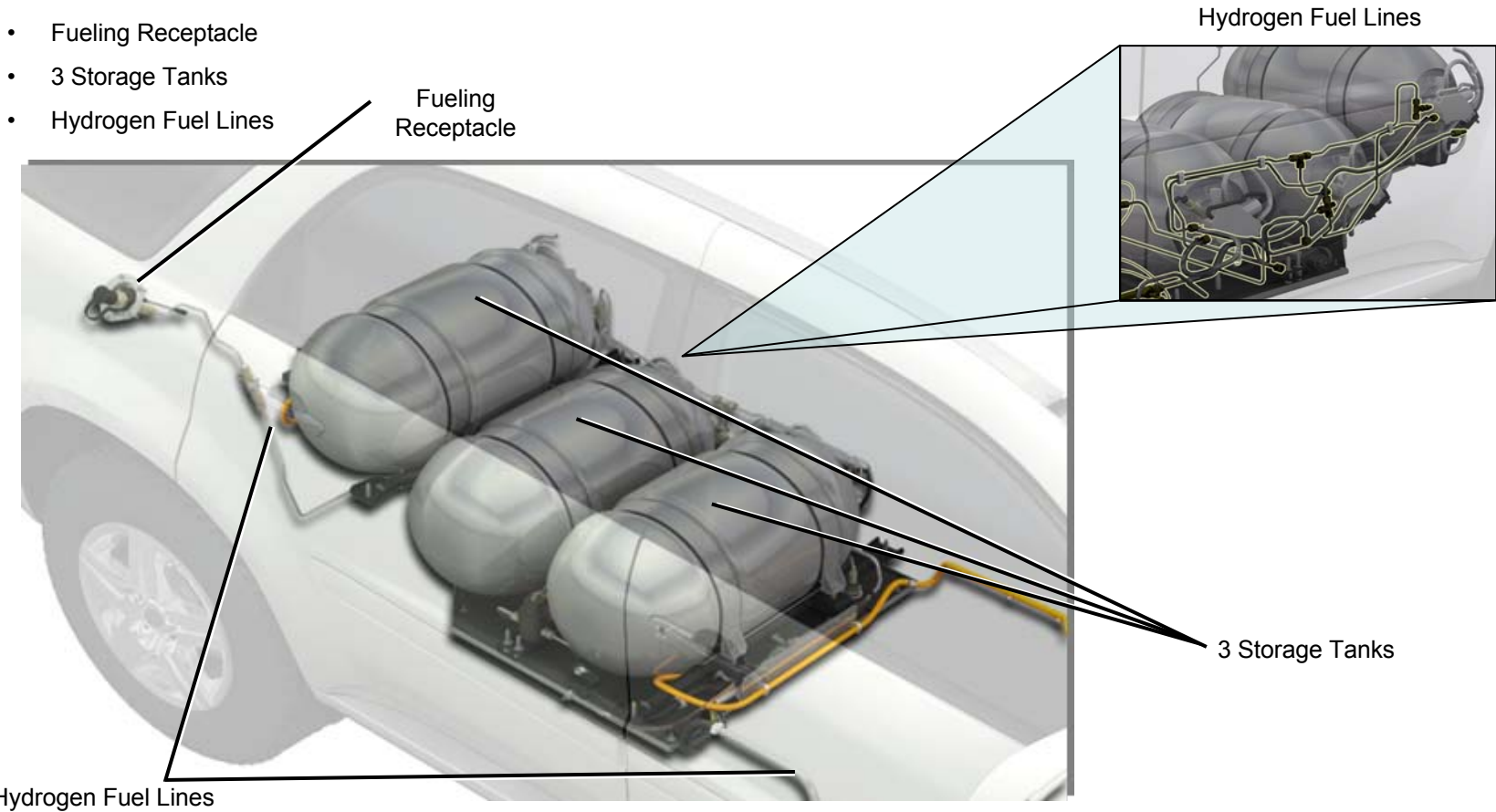
The High Voltage Battery stores energy generated from braking and/or the Fuel Cell System.



Equinox Fuel Cell Components (cont.)

The Hydrogen Storage System, located in the rear underbody area, stores compressed hydrogen for use in the Fuel Cell Stack. This system consists of:

- Fueling Receptacle
- 3 Storage Tanks
- Hydrogen Fuel Lines



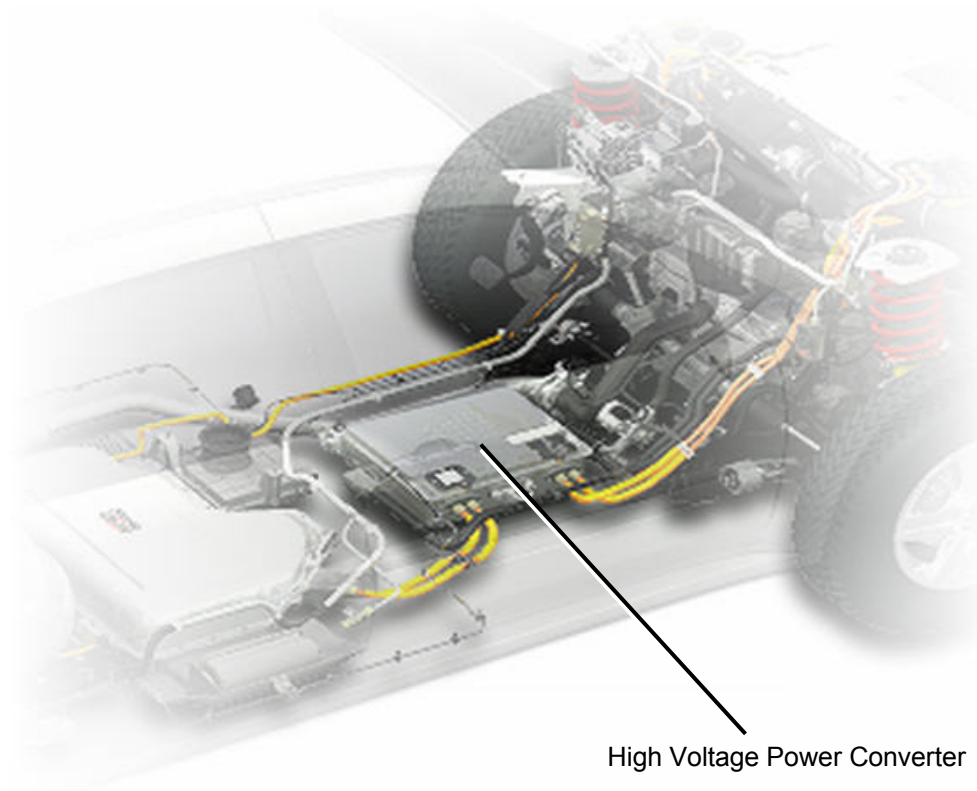
Equinox Fuel Cell Components (cont.)

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.



Equinox Fuel Cell Components (cont.)

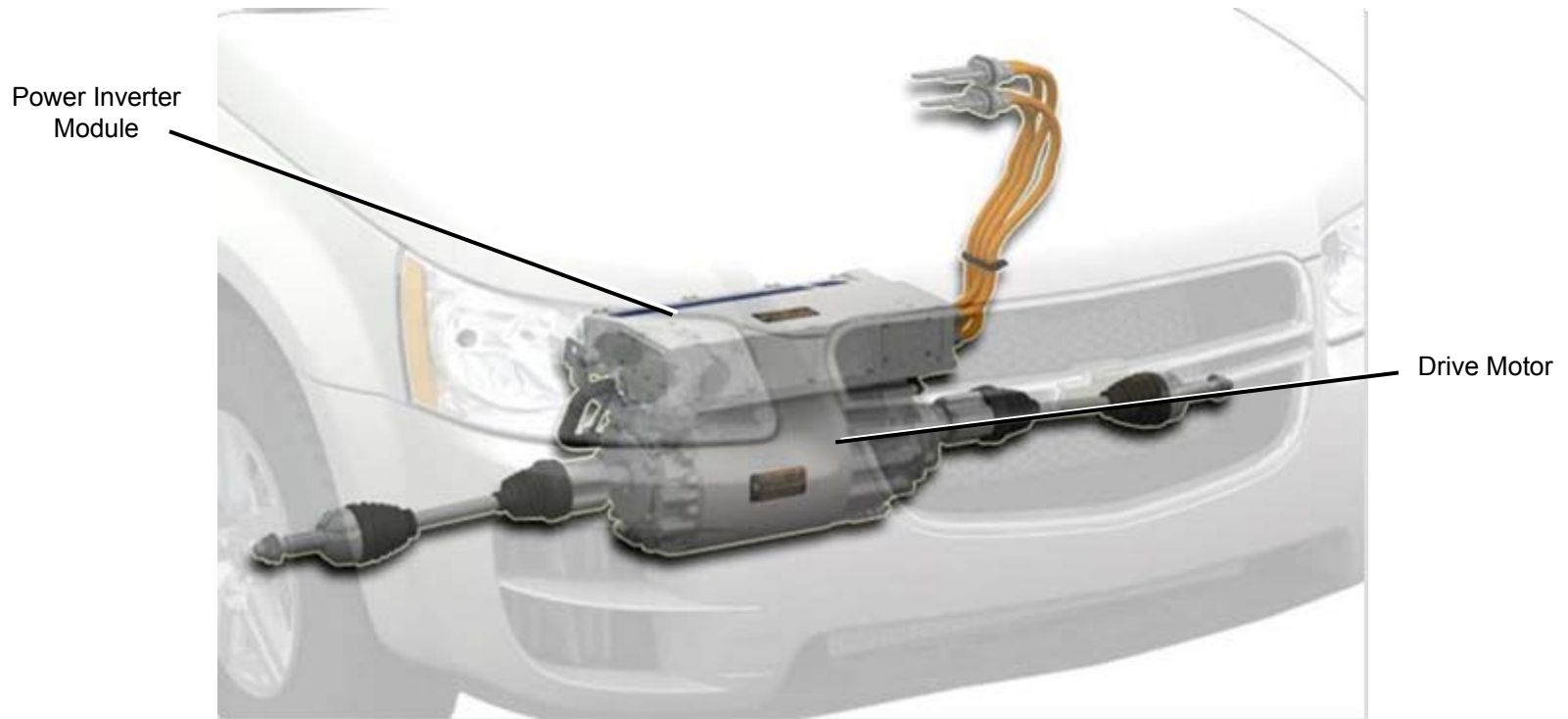
The main function of the High Voltage Power Converter is to control the flow of energy between the Fuel Cell Stack and the High Voltage Battery.



Equinox Fuel Cell Components (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 alternating current (AC), captured from braking by the drive motor, into DC power that recharges 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

During fueling and when the ignition is ON, hydrogen sensors are active.

If hydrogen is detected, the H₂ icon on the instrument panel lights, an audible beep will continuously sound, and a “HYDROGEN DETECTED” message will appear (as shown below). The hydrogen flow to the fuel cell will be shut off, and the vehicle will have reduced power from the battery to move to the roadside.

If hydrogen does not dissipate within 60 seconds, the HYDROGEN IS DETECTED EVACUATE VEHICLE” message will appear.



H₂ Icon

Approaching the Vehicle

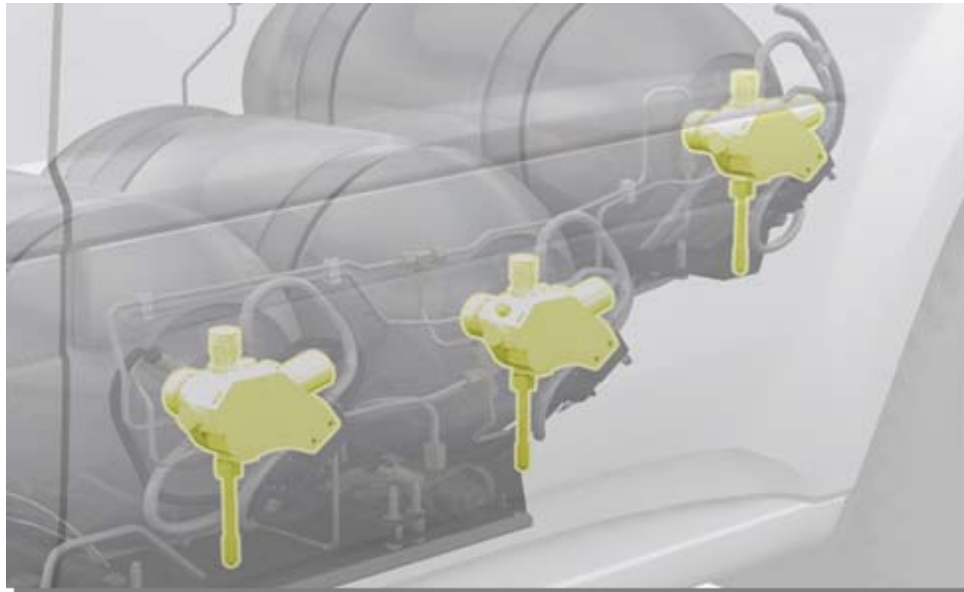
The Equinox Fuel Cell has a Pressure Relief Device (PRD) on each of the three hydrogen storage tanks. PRDs open when exposed to fire to vent hydrogen and prevent over-pressurization. A loud hissing noise is emitted from the rear during a hydrogen release.

The tanks release hydrogen independently depending on their exposure to fire. Release by different tanks can be separated by several minutes. All of the tanks may not release if they are not similarly exposed to fire. A release of one tank may last several minutes. The venting hydrogen will disperse quickly. It will likely ignite and burn if a fire or ignition source is present.

These potential occurrences should be considered in timing an occupant extraction. PRDs are located underneath the rear driver's side of the vehicle.

The fire fighter should use common fire fighting strategies for managing a vehicle fire, which includes extinguishing a vehicle fire.

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

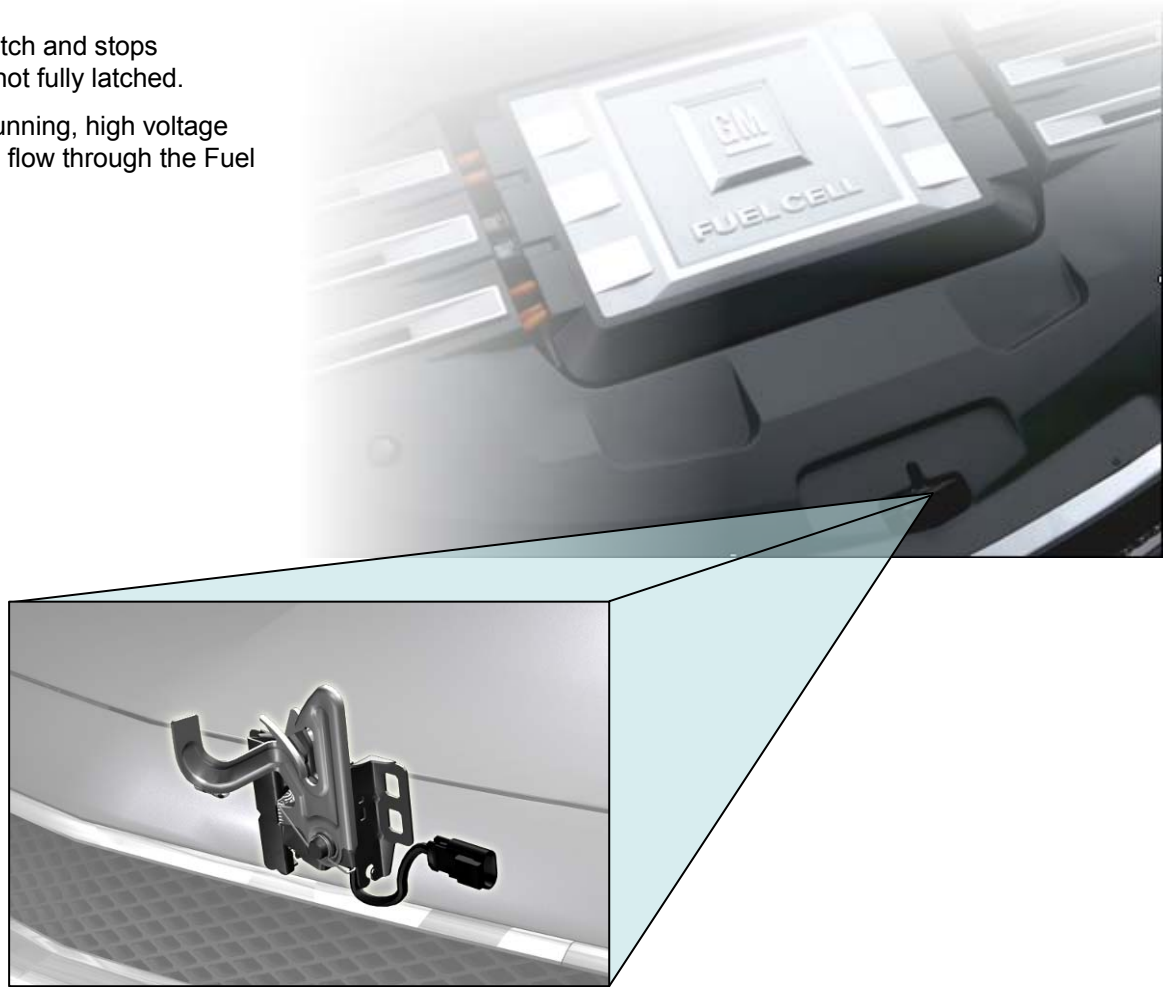


Driver's Side View

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 open to isolate high voltage within the High Voltage Battery. In addition, the automatic shut off valves on the hydrogen tanks close to stop the flow of hydrogen fuel out of the 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



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 High and Low Voltage electrical systems. 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 the 12 volt battery cover 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

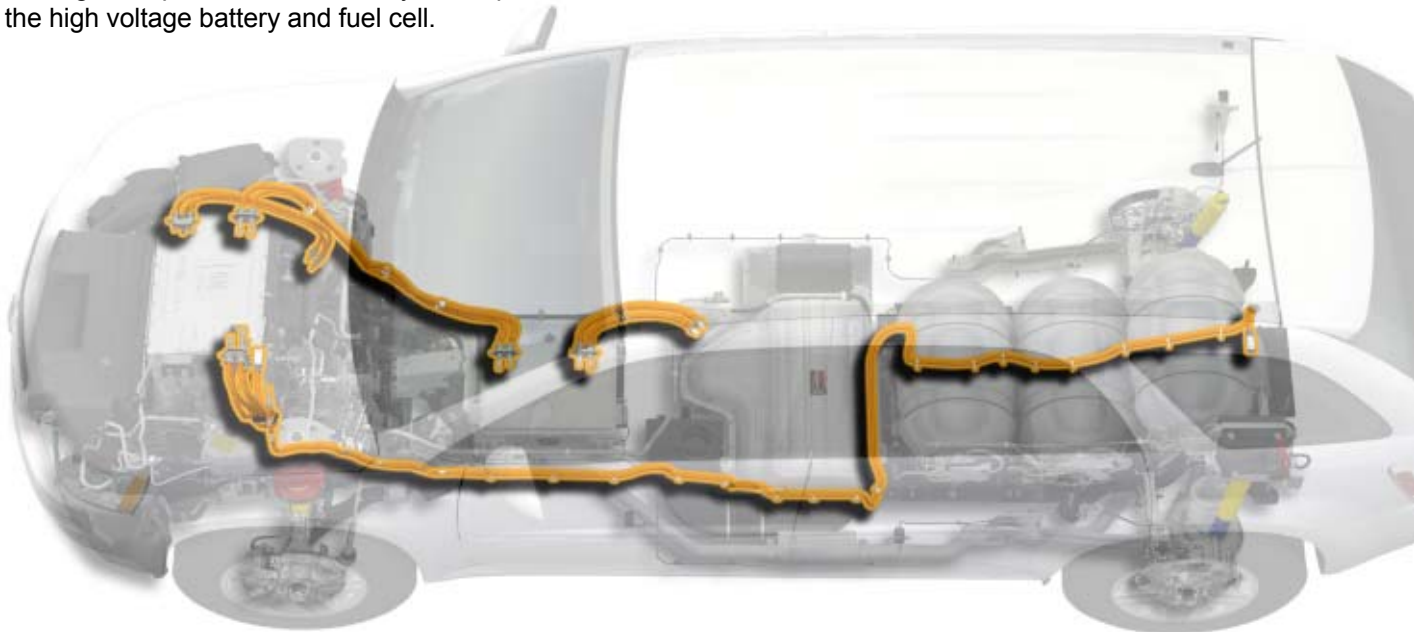
There are three sources of high voltage power on the vehicle: the battery, the fuel cell and the regenerative braking system (the Electric Drive Motor). Regenerative power is not generated when the vehicle has stopped moving.

The high voltage is shut off immediately when an air bag deploys, the hood is opened or the rear crash sensor is activated. When the ignition is turned OFF, the fuel cell shuts down and its high voltage power dissipates within minutes.

Disconnecting the 12 volt battery removes power from undeployed air bags and provides a secondary interruption of power from the high voltage battery and fuel cell.

WARNING: Even though high voltage current flow stops when the power is interrupted, Do NOT cut the orange high voltage cables and/or the High Voltage Power Converter.

If an orange cable and/or the High Voltage Power Converter is cut, residual static charge may cause an electrical arc discharge and/or personal injury.



Do NOT Cut Zones

DANGER: Do NOT cut the orange high voltage cables. Cutting these cables can result in serious injury or death.

Caution: No matter what disable method you perform, Do NOT cut the high voltage cables.



No Cut Zones

- Hydrogen Tanks
- Engine Compartment
- Beneath the Passenger Cabin Floor

Note: Disconnect the 12v Battery prior to cutting the rear roof pillar and allow any undeployed airbag reserve energy to dissipate.

WARNING: Do NOT cut the fuel lines – cutting fuel lines will release hydrogen in the fuel lines.



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GM Licensing Program Headquarters
5775 Enterprise Ct
Warren, MI 48092
Attn: Licensing Coordinator

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.

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.