Supplemental Restraint System (SRS)

Hybrid vehicles have the same passive safety features that conventional vehicles have, including airbags. Typically when airbags deploy, or the hybrid remote collision sensors activate, the following safety features will automatically occur:

• The hybrid system should shut down.
• The flow path of DC high voltage current from the HV battery pack is interrupted as relays open preventing the electrical flow out from the HV battery pack.
• The gasoline fuel pump shuts down.
• Low voltage power is prevented from flowing to the SRS Electric Control Unit (ECU)/ or airbag computer.

Once the SRS has activated, resulting in the deployment of an airbag, the hybrid system is automatically shut down and will not start up on its own.

Notation

When the Nissan Altima or any Toyota-Lexus hybrid is involved in a crash deploying any SRS airbag, or when the responder shuts OFF the ignition, this essentially accomplishes the same shut down features as utilizing the service plug outlined in the Nissan ERG.

If it is not possible to turn a vehicle off using normal methods, every hybrid ERG provides emergency shut down procedures for the hybrid system. It is important responders consult each make and model ERG for specific emergency shut down procedures.

Performing Extrication

Extrication can be performed using the same methods as a conventional vehicle. Having a hybrid system does not affect the way and manner you perform the following tasks:

• Glass management
• Door displacement or removal
• Roof displacement or removal
• Dashboard displacement

"Hybrid vehicles are safe, and responders should not fear performing tasks normally associated with extrication."

There are NO high voltage cables or components in the normal cut zones or push points in any hybrid vehicle.

If a hybrid was operational and power disconnect was not possible, responders still could safely perform normal extrication for any of the previous mentioned tasks. However, this is unlikely, since a crash that would typically cause the need for extrication would have also activated the automatic hybrid safety features disabling the hybrid system.

Responder Concerns

With all the published manufacturers’ hybrid safety information now available you wouldn’t think there should be any controversy lingering about. Yet hybrids remain a hot topic at the responder round table at conventions.

The big question is why are hybrids so controversial if there is so much information readily available? This author believes it’s due to misinformation, combined by the lack of proper education at the state and local levels.

Issue: The number one concern responders have expressed is the presence of high voltage cables when performing extrication.

Resolve: There are NO high voltage cables located in any of the normal cut zones in any hybrid vehicle.

The high voltage cables are routed under the floor pan, NOT in the roof, pillars or interior side of the occupant cabin. High voltage lines will clearly be indicated, and the actual cables are color coded bright ORANGE, NOT yellow or blue as indicated by misinformed presenters.

If a responder were to transverse through the body (occupant cabin) of a hybrid then you would come in contact with a high voltage cable. But, ask yourself why would you need to make that type of a cut? With over 29 years of service on a career department I have never seen a rescue that required a transverse cut through a vehicle, essentially cutting it in half.

Issue: Can a responder be electrocuted by touching a hybrid vehicle body in a crash?

Resolve: No, a hybrid’s...
high voltage system is isolated from the vehicle’s (low voltage) body ground. The orange colored power cables and connectors are insulated to prevent contact with bare wiring. A separate ground high voltage cable is routed to each component from the battery to complete the circuit (return path).

**Safety Features**

There are safety features on all hybrid vehicles offering both manual and automatic protection. The simplest way to manually disable the high voltage system, is to turn the ignition OFF. This isolates the high voltage battery power from the high voltage power cables.

**Manual Protection**

One of your first objectives at a crash is to secure the ignition by turning the ignition key to the OFF position. If equipped with a smart key/push button start, pushing the power button once will shut the vehicle OFF. Effectively opening the both positive and negative high voltage relays from the high voltage battery pack to the orange high voltage power cables.

Caution: Some hybrids have large capacitors in the traction motor inverter that can store a reserve high voltage charge for up to 10 minutes. Never assume that the high voltage system is completely absent of high voltage current and drained down under any situation. Never touch, cut or breach any high voltage cable or component. Doing so may cause serious burns, shock or electrocution.

**Issue:** Are manufacturers using yellow, blue and orange color coding for high voltage cable identification?

**Resolve:** No. According to the Society of Automotive Engineers (SAE), only the color orange was adopted to identify high voltage cabling. There seems to be a mis-conception, which I believe to be caused by misinterpreting text written in GM’s hybrid and fuel cell vehicle ERGs. GM has volunteered to define low, intermediate and high voltage, in an effort to help responders have a better understanding of the company’s choice of color.

see HYBRID page 34

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Hybrid Vehicle Rescue

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to help responders have a better understanding of the company’s choice of color coding. The following chart is similar to the illustrations depicted in the GM ERGs.

Defining Low, Immediate and High Voltages

Low Voltage DC can be defined as any direct current up to 30 Volts. Low Voltage AC can be defined as any alternating current up to 15 Volts RMS. Intermediate voltage DC can be defined as any direct current from 30 Volts up to 60V. Intermediate voltage AC can be defined as any alternating current from 15 Volts up to 30 Volts RMS. High voltage DC can be defined as any direct current 60V or greater. High voltage AC can be defined as any alternating current 30 Volts RMS or greater.

I think that we sometimes forget because of familiarity that the typical house current is 120V AC, this too is high voltage.

Educating the Responder

Today the responder can be educated in several ways; self taught by reading reference books on hybrid technology, manufacturer’s ERGs, trade periodicals, or receive an information lecture by their local training officer or guest speaker know as a Subject Matter Expert (SME).

Sharing Responsibility

Hybrid vehicles are not a fad. Hybrids are here to stay, at least until replaced by the next generation of innovative vehicles. The automotive industry assumed responsibility to provide relevant information about their products to the emergency services so responders can properly

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train for any emergency situation, safely and efficiently. As subject matter experts (SME)/presenters, we have a responsibility to our audience to present fact, not hearsay or conjecture. The information we present is intended to save lives.

As emergency responders, it’s our responsibility to learn how to cope with new innovations and to maintain that level of training throughout our career. If everyone does their part, responders can safely provide maximum care to the public with minimal risk to themselves, and without fear.

Web Based Resources

- Extrication.Com: http://www.extrication.com
- General Motors Company: http://www.gmstc.com/courses/available_courses.asp

**GM Voltage Classification System**

This illustration depicts Low, Intermediate and High Voltage Cable Identification by color coding.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Low Voltage</th>
<th>Intermediate (Blue)</th>
<th>High Voltage (Orange)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Range</td>
<td>DC ≤ 30V</td>
<td>DC 30-60 V</td>
<td>DC &gt; 60V</td>
</tr>
<tr>
<td></td>
<td>AC ≤ 15V RMS</td>
<td>AC 15-30V RMS</td>
<td>AC &gt; 30V RMS</td>
</tr>
</tbody>
</table>

Note: Presently there are no industry standards to identify intermediate voltage. GM has chosen BLUE for this cable color.

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