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Technical Information For The Collision Industry

PROTECTING GASOLINE/ELECTRIC HYBRID VEHICLE BATTERIES DURING COLLISION REPAIRS

The high-voltage battery pack and control system of a gasoline/electric hybrid vehicle add some special considerations when doing collision repairs. Not only do you need to protect yourself from the high-voltage electrical energy contained in the batteries, but also the batteries and high-voltage electrical systems need to be protected from damage. Recommendations vary, so follow the service information when performing repair procedures on a damaged hybrid vehicle.

DISABLING THE HIGH-VOLTAGE SYSTEM

Disabling the high-voltage system is recommended whenever doing repairs to the vehicle. To avoid potential damage to the high-voltage system, it is important to follow the proper procedure for disabling and for energizing the system once repairs are completed. To protect yourself, remember to always wear rubber insulating lineman's gloves when working on or around the high-voltage battery or other parts of the high voltage system (see Figure 1).

One step common to all current hybrid vehicles is the recommendation to disconnect the 12-volt battery and remove the key from the vehicle as part of the high-voltage system disabling procedure. Some vehicles have a service plug or disconnect switch that is removed from the high-voltage battery as a part of the disabling procedure (see Figure 2). Toyota recommends

keeping the service plug that is removed from the high-voltage battery in your pocket to prevent other technicians from reconnecting it without your knowledge. For the Escape Hybrid, Ford recommends that after the high-voltage service disconnect switch is removed, it be reinserted in the service or shipping position to keep the contacts on the battery free of dirt and other contaminants.

Toyota also warns that attempting to operate the power switch of the vehicle with the high-voltage battery service plug removed may damage the hybrid vehicle control module. Ensure that the high-voltage battery service plug is re-installed before connecting the 12-volt battery. This is actually good advice for any hybrid vehicle. Once you have the high-voltage system disabled, keep the 12-volt battery disconnected and the key out of the vehicle until the system has been properly energized. This will help to ensure that the electronics of the hybrid control system are not damaged.

NIMH BATTERIES AND HEAT

The nickel-metal hydride (NiMH) batteries used in hybrid vehicles are sensitive to excessive heat. The battery can be damaged if its internal temperature gets over 66°C (150°F).

This is something to think about when painting a hybrid vehicle. Ford recommends removing the high-voltage battery



Figure 1 – A pair of rubber insulating lineman's gloves used when working around the high-voltage system parts is being rolled up to check for pinholes before using them.



Figure 2 – The orange service disconnect plug is being removed from the high-voltage battery on a 2002 Toyota Prius.

pack from the Escape Hybrid before placing the vehicle in a spraybooth on the bake cycle. Most of the other vehicle makers don't have specific recommendations about battery removal when baking paint on their hybrid vehicles. Since the high-voltage batteries are generally located in the trunk or passenger compartment area of the vehicle, normal spraybooth baking procedures of 60°C (140°F) for 30 minutes will typically not raise the temperature of the battery to a dangerous level. Be sure to monitor the temperature and restrict the timeframe if a hybrid is placed in a heated spraybooth for refinishing. If any question exists regarding the potential of overheating the battery, consider painting a hybrid vehicle as the last job of the day and letting the finish air dry overnight.

REMOVING A HIGH-VOLTAGE BATTERY

Removing the high-voltage battery also brings up considerations. There's the potential of damage caused by dropping the battery or stripping the fasteners at the terminal connections.

To minimize the possibility of damage, don't remove the battery unless it is called for in a procedure, or completing repairs require the battery to be removed. Unless you're welding closer than 305 millimeters (12 inches) to the battery, simply cover it with a welding blanket after disconnecting the 12-volt battery and disabling the high-voltage system.

If you do need to remove a high-voltage battery, it may require special tools or procedures to complete. Honda has a special battery removal tool that is used for removing the high-voltage battery. Once the tool is connected to the battery module, two technicians are required to lift the battery from the vehicle using the handles on the tool. (see Figure 3). The procedure from Ford for removing the high-voltage battery from the Escape Hybrid uses a lifting crane attached to three specific eyebolt lifting points on the battery assembly case. Toyota recommends that the high-voltage battery only be removed by Toyota-certified technicians trained in hybrid vehicle repair.

SELF-DISCHARGE OF NIMH BATTERIES

Another characteristic of NiMH batteries used in most hybrid vehicles is the high self-discharge rate, which can be as much as 30% per month.

Some hybrids can only have the gasoline engine started by the high-voltage traction motor used in the hybrid drive system. The only way to charge the high-voltage battery is to run the gasoline engine. So on these vehicles, if the state-of-charge of the high-voltage battery is insufficient to start the gasoline engine, the battery cannot be recharged by the facility and may require replacement. To help avoid this, a gasoline/electric hybrid vehicle that sits at the repair facility for extended time periods should have the gasoline engine run every couple of weeks for about 30 minutes if possible. This will help maintain a sufficient charge in the high-voltage battery. Keeping the state of charge in the mid-range helps make these batteries last. Letting the battery state of charge get extremely low shortens the life of the battery and should be avoided.

12-VOLT BATTERY CHARGING

All hybrid vehicles also have a standard 12-volt electrical system to operate lights, radios, and other accessories. The 12-volt system is also used to operate the control modules for the high-voltage system. This means that the 12-volt and high-voltage systems are interconnected. Similar to a conventional vehicle, the 12-volt battery in a gasoline/electric hybrid vehicle has to have a sufficient charge for the vehicle to start.

Recommendations for charging the 12-volt battery on hybrids vary from vehicle to vehicle so check the service information for the vehicle being repaired before charging the battery. Toyota uses a special lead-calcium 12-volt battery in the Prius that must not be fast-charged with a conventional



Figure 3 – The high-voltage battery on a 2001 Honda Insight is being removed using Honda's special battery removal tool.

battery charger. The charging recommendation for the original equipment 2002–2004 Prius battery is to slow charge at no more than 3.5 amps. Replacement batteries and the original equipment 2004–2007 Prius batteries are a larger capacity battery and Toyota recommends charging with a specialized “smart” microprocessor-controlled charger set at the 10-amp position. The 12-volt battery in the Honda Insight is a conventional lead-acid type battery that Honda recommends charging at 40 amps.

Improper charging of the 12-volt battery could damage the battery and possibly the electronics of the high-voltage system if the battery is connected to the cables. A good practice to help ensure that battery charging does not damage the high-voltage system or other electronics on the vehicle is to only charge the battery after both cables have been disconnected and the battery is removed from the vehicle.

CONCLUSION

Hybrid vehicles are becoming more prevalent, and the chance of a collision-damaged hybrid showing up in your facility is very real. Repairing a hybrid vehicle body is no different than repairing a conventional vehicle once the proper precautions are taken to protect yourself from the high-voltage electrical energy. You also need to be aware of the potential of high-voltage battery or high-voltage system damage if proper procedures are not followed.

For comments or suggestions on the Advantage Online, please contact I-CAR Senior Instructional Designer Bob Jansen at bob.jansen@i-car.com.