

## Hybrid Shock

As hybrid cars become more common, work on them is moving out of dealerships and into the independent repair facilities. These cars have a hazard not seen with fuel-powered vehicles: high voltage. Touching the body of a wrecked hybrid car won't shock you – the high voltage systems have failsafe mechanisms to prevent that. The high voltage system is isolated from the chassis. And in a crash, sensory devices in the car are supposed to stop the electricity flow. But if you're working on the car, those devices aren't activated. That work can put you at risk of shock. How to prevent that? Turn off the car and disconnect the power.

Wait. It isn't quite that simple. Hybrids don't have noisy, chugging engines. They can appear to be turned off, even if they aren't. And the simple act of disconnecting the power can put you at risk of shock.

Start by turning off the car. Even if you think it's off, double check. Verify it's off – check the dashboard for the Ready light.

Put the key away. Many hybrids have keyless starts, so it doesn't take much more to start the car than having the key nearby and pushing a button. Ensure that can't happen, by putting the key far enough away that it cannot be used to start the car. Twenty feet away is a good safe bet.

If you're changing the oil or replacing a windshield, you don't need to worry about high voltage. If you're doing more extensive work, the high voltage battery needs to be disconnected. But there's a risk of shock or arc flash when you do that, so take some precautions.

Once you've turned the car off, disconnect the 12-volt battery. Then put on a pair of Class 0 rubber insulating gloves (electrician's gloves) with leather overgloves. Follow the service manual's instructions for disconnecting those orange high voltage cables. If the battery has a service plug (Toyotas do), remove that and put it somewhere safe, such as in your pocket. Go take a break – you need to wait about ten minutes before working on the car, so the capacitors can drain.

Whenever you wear electrician's gloves, use leather overgloves with them, to protect them. The insulating gloves can be torn easily, and don't work if they have any holes. The overgloves are required to ensure the rubber gloves stay in good shape.

Check the insulating gloves before each use. Look them over carefully, checking for holes or signs of wear. Do an air leak test. Roll the glove up tightly, starting at the cuff. Then hold it close to your ear. Feel and listen for any leaks. Even a pinhole leak ruins the glove's effectiveness.

Electrician's gloves need to be certified every six months. To do that, send them into a testing laboratory (look here for labs: <http://www.nail4pet.org/laboratories.html>). It isn't expensive – under \$10/pair.

If you need to send a pair of gloves in for recertification, you need to have a spare. We recommend having at least three on hand. That way, you still can have two technicians working on hybrids when one pair of gloves is out for recertification.

If you don't know how to disconnect the high voltage battery, don't work on the vehicle. In fact, stay well away from the high voltage. That circuit is relatively well-protected and clearly identified – it'll be orange. The cables run underneath the body of the car. They're electrically isolated from the body – the chances of the car body being energized are extremely low.

Once you've disconnected the cables and waited for the capacitors to discharge, check the voltage. Again the service manuals will provide guidance. Follow a good electrical work practice – take voltage readings with only your right hand. Keeping your left hand away from the car reduces the change of voltage crossing your heart.

When you're ready to reconnect the battery, put the gloves back on. Connect the 12 volt battery last. Then store your gloves so they'll stay in good condition. Don't fold them, but keep them in the original bag (a canvas pouch will work, too).

Some other cautions about hybrids: don't push them. Put them on rollers or drive them, as pushing them charges the capacitors. In the paint booth, watch the baking temperature. The high voltage battery can't take temperatures above 150°F. And if the battery itself is damaged, watch out for the electrolyte. Unlike a lead acid battery, the high voltage battery uses a caustic electrolyte, which is usually absorbed onto the cell plates. Leaks are uncommon. But in the unlikely event that the cells break open, you could come in contact with the alkaline material. Wear rubber gloves (not your electrician's gloves!) and neutralize any spills with a weak acid, such as boric acid.

If you have questions about this or other safety topics, contact CHESS at 651-481-9787; toll free at 877-481-9787, or [carkey@chess-safety.com](mailto:carkey@chess-safety.com).