Special Edition 'Safety First'

Hybrid Vehicle Safety Precautions

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With higher fuel prices, sales of Hybrid vehicles have really increased and are now on the road. It is only a matter of time before we will see these vehicles and their owners in our centers looking for service. One very important thing all Hybrid vehicles have in common is that they operate on very high voltages. Depending on the manufacturer, these high voltage electrical systems will operate on anywhere between 150 and 350 volts. Voltages this high can kill or seriously injure you if you come in contact with them the wrong way. You should not attempt any repairs on these high voltage electrical circuits without the proper OEM level training

There are many potential dangers involved when servicing other systems on these vehicles. The most obvious is accidentally damaging the insulation or shorting a high voltage cable. All of the high voltage circuits on any Hybrid vehicle are identified by orange colored cables. Avoid coming in contact with them if at all possible. Some GM vehicles also incorporate a 42 volt electrical system. These are identified by blue cables. Although not as dangerous as the higher voltage system, you should take caution around these as well. One big danger that you may not realize is that with the ignition key in the on position, the vehicle's internal combustion engine can start without warning. Some models, such as Toyota, can start even without the key in the ignition. Another concern is that it is possible for the motor generators to generate electricity just by pushing the vehicle into the shop. Because of these and other various safety concerns associated with servicing these vehicles you should always disable the high voltage electrical circuit before performing any repairs.

The procedure for disabling the high voltage electrical system is very similar with most manufactures. We will give a general overview in this publication; however, you **must consult** the proper service publications for the vehicle you are working on for the exact procedure to follow. AllData and the various vehicle manufactures web sites provide the technical and cautionary information on how to disable the high voltage electrical circuits. You can access the OEM web sites easily through the National Automotive Service Task Force web site at www.nastf.org. In some instances you will find two options for procedures to disable the high voltage electrical circuit. We recommend performing a **complete** system disable which mandates removing the battery service plug. This procedure is as follows:

To disable the high voltage electrical circuit requires utilizing a pair of high voltage insulated gloves. These are available through Graingers, SPX/OTC tools, Snap-on and several other sources.

Before each use, it is important to check the integrity of the glove's surface. To do this, blow air into the glove and fold the base of the glove over to seal the air inside. Next, slowly roll the base of the glove toward the fingers. If the glove holds pressure the insulating properties are intact. If the glove loses pressure do not use it. High voltage electricity can find its way through the hole and back to your body.

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Once you have secured the proper tools and equipment you are ready to disable a Hybrid vehicle's high voltage electrical circuit. Remember to **always consult** the vehicle manufactures service information for vehicle specific procedures and component locations. The typical procedures are as follows:

1. Start by turning off the ignition key and removing it.
   - On Toyota vehicles equipped with smart key turn the smart key system off. See Toyota information for how to do this. Also with the smart key system you must keep the ignition key at least 15 feet away from the vehicle.
   - For any system, it is a good idea to keep the ignition key away from the vehicle and locked up to avoid anyone turning it on by accident.
2. Disconnect the negative (-) terminal of the 12-volt auxiliary battery.
3. Check and put on your insulated gloves.
4. Consult vehicle specific service information to locate the battery service plug and how to remove it. The plug will be located near or on the high voltage battery pack. This plug is what actually disconnects the battery pack from the rest of the circuit.
5. Wearing your insulated gloves remove the battery service plug. Put it in your pocket or away from the vehicle and locked up to avoid anyone reinstalling it by accident.
6. Wait at least 15 minutes before making any repairs. This will allow any capacitors in the circuit to discharge.

Even after 15 minutes have passed the following safety precautions **must be** observed.

- Do not wear any metal objects.
- Before touching a high voltage cable or any other cable that you cannot identify, use a voltmeter to confirm the voltage in the cable is 12V or less.
- After removing the battery service plug cover the connector using rubber or vinyl tape.
- After removing a high voltage cable, be sure to cover the terminal using rubber or vinyl tape.
- Use insulated tools when available.
- Do not leave tools or parts inside the cabin.
- Always torque any high voltage cable connections.

Other Safety Notes:
Starting the Hybrid

1. Make sure the parking brake is engaged and the shift lever is in the park (P) position.
   - Unlike conventional vehicles, the gasoline engine will typically only start when the shift lever is in the P position and will not start in the neutral (N) position.
2. While pressing the brake pedal, turn the ignition switch to the START position and release - a READY Indicator light (ready-to-drive indica tor light) equipped in some vehicles, Auto Stop Indicator lamp or equivalent in other vehicles, flashes.
   - If the outside air temperature is low, the indicator light may flash longer than usual.
3. Once the system determines the vehicle is ready to be driven, the indicator light illuminates steadily and the buzzer emits a beep.
   - After the gasoline engine warms up, it stops automatically, provided that the air condi tioning compressor does not need to oper ate and the high-voltage battery pack is sufficiently charged.

4. While pressing on the brake pedal, release the parking brake and move the shift lever to the drive (D) position (the vehicle will move forward just like a conventional vehicle with an automatic transmission).
5. Gradually release the brake and slowly depress the accelerator to start moving.

When starting at extremely slow speeds, the gasoline engine may remain OFF to conserve fuel while the electric motor drives the vehicle, so don't rely on the sound of the engine to determine if the vehicle is ready to be driven. In addition, if the gasoline engine remains OFF during initial takeoff, it will automatically start up when the car reaches approximately 15 mph during acceleration.

As you can see it is pretty simple to be safe in and around Hybrid Vehicles. Always make sure you follow the vehicle manufacturer's specific procedures and wear your insulated gloves while working around the electrical systems. Taking a few minutes in the beginning to understand what it is your dealing with, can save your life.

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