

Hybrid Vehicles: Today's newest technology produces new risks for automotive service businesses

When hybrid vehicles were first introduced to the U.S market, consumers had only one choice – the Honda Insight. Sales figures reflected the limited options, with only 9,500 units sold in the U.S in 2001.¹

Since then, hybrid sales have increased a staggering 2,955%. In 2009, just over 292,528 units sold in the U.S.² This dramatic jump can be attributed to better fuel economy, environmental awareness, tax incentives, and the “can’t tell” looks of these vehicles. Most major auto manufacturers now offer hybrid models including Ford, Honda, Lexus, and Toyota, with more being planned every year.

So what does this mean for your automotive service business? There are some potentially lethal safety hazards to be aware of when working on a hybrid. With increased sales, the likelihood of a hybrid vehicle rolling into your shop is more likely than ever. Are your technicians prepared and equipped?

What is a Hybrid?

First let's talk about the basics of a hybrid. Hybrid vehicles use two sources of power to increase efficiency and performance by combining traditional gasoline engine technology with an electric motor and battery. The gasoline engine supplies the main power, while the electric motor provides an additional boost.

There are two different types of hybrid engines.³ A parallel hybrid has a fuel tank that supplies gasoline to power the engine and a set of batteries that supplies power to the electric motor. In this type of hybrid, the vehicle starts in full electric mode, and then switches to gasoline mode when the vehicle reaches a certain speed. The electric motor can also work in tandem with the gasoline engine to provide a boost of power when accelerating.

In a series hybrid, the gasoline engine turns a generator, and the generator can either charge the batteries or power an electric motor that drives the transmission. Thus, the gasoline engine never directly powers the vehicle. This type of hybrid does not have a full electric mode. Instead, they use their hybrid battery and electric motor mainly when the vehicle is starting and stopping, or to provide a boost of power when accelerating.

Hybrids also use a technology called “regenerative braking” to help produce electricity. Whenever you step your brakes, you are removing energy from the vehicle. The faster a vehicle is going, the more kinetic energy it has. With regenerative braking, a generator kicks in to capture the kinetic energy being released and store it in the battery for use later. So instead of just using the brakes to stop the vehicle, a hybrid can use its electric motor to act as a generator and charge the battery while the vehicle is slowing down.

Did you know?

- Hybrids should be towed with the drive wheels off the ground, as the drive wheels generate electricity. For this reason, it is also recommended to use dollies when pushing a hybrid around the shop.
- Some hybrids require specific oil, transmission fluid, oil filters, air filters, fuel filters, and other fluids that need maintenance at different intervals.
- Hybrid cars use special tires that are both stiffer and inflated to a higher pressure than conventional tires. The result is less drag than regular tires and improved fuel economy.
- Some hybrid parts need to be handled, stored, and shipped in a specific manner.
- Temperatures of more than 140 degrees in a paint booth can damage the battery.
- Some hybrids require you to disconnect the battery and perform a zero point calibration after a wheel alignment on vehicles equipped with vehicle stability control.

Federal safety regulations

Manufacturers of hybrid vehicles are required to meet all applicable Federal Motor Vehicle Safety Standards (FMVSS) ⁴ set by the National Highway Traffic Safety Administration. Additionally, they must meet FMVSS 305 standards, ⁵ established to protect individuals from being exposed to electrolyte leakage or battery shock in the event a hybrid is involved in an accident.

Safety dangers

So what makes hybrids potentially dangerous for technicians? Hybrid engines are more complicated and use more electrical components than conventional vehicles. One of these components, the high voltage battery, can carry enough electrical current to be lethal.

The threshold at which voltage becomes lethal can be as low as 55 to 60 volts. In addition, hybrids use a dual voltage system – 12 volts for most of the vehicle's electrical systems and high voltage for the drive motor and related systems. It's this high voltage that you need to respect.

Voltage ranges found in today's hybrid batteries vary, with most being well above the lethal threshold. The batteries in the Honda Insight and Civic Hybrid are rated at 144 volts, while the Toyota Prius battery is rated from 201–273 volts, depending on the model year. Voltages can go as high as 300 volts, as found on the Ford Escape Hybrid.

Another factor that presents a potential danger is the fact that some hybrid vehicles are increasingly more difficult to distinguish from their conventional gasoline-powered counterparts. The high voltage cables in most hybrids are color-coded to warn of potential danger; however, some safety experts want hybrid vehicles to have an orange warning label on the sun visor to further distinguish hybrids from gasoline-powered vehicles.

What is important when hybrids are in your shop?

To ensure safety when working on hybrids, technicians should treat them with caution, be aware of the dangers, and refer to the owner's manual or service literature for recommended safety steps.

- **Identify high voltage cables** – High voltage cables in hybrid vehicles are usually color-coded to warn you of their potential danger. On most, the high voltage cables are color-coded ORANGE, as recommended by the Society of Automotive Engineers. Avoid contact with these cables unless the high voltage battery in the back of the vehicle has first been disconnected.
- **Disconnect the battery** – High voltage batteries, cables, capacitors, and other high voltage components should be isolated and disconnected, and if necessary, removed before work begins. Hybrid batteries have a safety switch or other similar mechanism to disconnect the battery from the vehicle's electrical system. The location of the battery disconnect safety switch and the disconnect procedure will vary from one application to another.

Also, it is suggested to wait 15 minutes before working on the vehicle after the battery has been isolated or disconnected. The high voltage capacitors inside the inverter need time to bleed off their stored power.

- **Use safety equipment** – Wear heavy rubber Class 00 rated gloves that can withstand up to 1000 volts. Ordinary latex or neoprene shop gloves are not thick enough and do not provide enough insulation to protect you from a high voltage shock. Gloves should be regularly inspected to make sure they do not have any pin holes, cracks, tears or splits that would allow voltage to find your skin. To check for wear and tear, inflate gloves with air and check for leaks.

In addition, high voltage voltmeters and insulated tools should be used when working on high voltage hybrid components to test whether or not they pose a hazard. Some automotive service shops have a specific “buffer zone” to work on hybrid vehicles.

- **Turn ignition off** – Make sure the ignition is OFF and the key is away from the vehicle before it is serviced or repaired. Make sure the READY light is not on. If the power is on, the hybrid powertrain will still be hot even though the engine may not be running. When stopped, hybrid vehicles revert to electric power and make no noise. Meanwhile, the engine control module continues to monitor the voltage of the hybrid battery, and may automatically restart the engine if the hybrid battery voltage is low and the engine needs to run to recharge it. That could result in a dangerous shock for technicians who happen to be working under the hood, changing the oil or doing anything else that puts them in close proximity to belts, pulleys or high voltage components.

Training & resources

All personnel who may come into contact with hybrids and associated components need to receive specific hybrid vehicle training and should follow manufacturer recommendations. This includes engine technicians, towing professionals, auto body personnel, tire technicians, oil change employees, emergency responders and others.

The good news is that many associations, hybrid manufacturers, and training companies offer hybrid safety training programs in both online and classroom settings – a quick search online will yield many options.

Another excellent resource for hybrid safety training is a hybrid Emergency Responder Guide (ERG). Many hybrid manufacturers have developed ERGs for their models to aid first responders in avoiding dangerous components when responding to an accident involving a hybrid. Below is a list of ERGs prepared by hybrid manufacturers and available online.

- **General Motors** – www.gmstc.com/FirstResponder.aspx
- **Honda** – techinfo.honda.com/rjanisis/pubs/web/Y0716.pdf
- **Ford** – www.motorcraftservice.com/vdirs/retail/default.asp?pageid=free_quickref&gutsid=escape_guide
- **Toyota** – techinfo.toyota.com/techInfoPortal/appmanager/t3/ti;TISESSIONID=HMS521bLjylQpVL190pg92D7GYj02VGtFwJTLXy8hjvkvPxQwdf!814507913?_pageLabel=ti_erg&_nfpb=true
- **Mazda** – www.sceneoftheaccident.org/erg/Mazda%20Tribute%20revision%201.pdf
- **Nissan** – www.nissanusa.com/pdf/techpubs/altima_hybrid/2007/2007_Altima_Hybrid_FRG.pdf

Online Resources

For additional emergency responder guides and training materials, please visit the web sites below. Please note you should always check the manufacturer’s technical responder web site for the most recent emergency responder information for a specific make and model.

www.extrication.com/ERG.htm

www.sceneoftheaccident.org/erg

tkolb.net/tra_sch/CarFires/HybridVehicles/ERG.htm

www.hybridhazards.info/training

www.pocketmobility.com/info/hybrids.html

References

- ¹ www.hybridcar.com/index2.php?option=com_content&do_pdf=1&id=66
- ² www.hybridcars.com/hybrid-sales-dashboard/december-2009-dashboard.html
- ³ www.auto.howstuffworks.com/hybrid-car.htm
- ⁴ www.nhtsa.dot.gov/cars/rules/import/fmvss/index.html
- ⁵ www.nhtsa.gov/DOT/NHTSA/Vehicle%20Safety/Test%20Procedures/Associated%20Files/TP-305-01.pdf

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1400 American Lane, Schaumburg, Illinois 60196-1056
800 382 2150 www.zurichna.com

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