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Hybrid Models Around Us Today

by Matt Stroud and Paul Bindon

Hybrid vehicles are becoming more and more common on the road today. Is the commuter bus next to you in traffic a hybrid? In some cities, it certainly is. The car in front of you may look like a normal car, but in some cases it's the hybrid version that uses the exact same body style. Identifying hybrid models is not as straightforward as it may seem. Hybrid vehicles pose new challenges to first responders, who must be prepared to understand vehicle technology when responding to motor vehicle accidents (MVAs) and vehicle extrication situations. In our last article, we outlined what a hybrid is. Here, we will discuss the different types of hybrid systems and models on the road today. Auto manufacturers have produced several types of hybrid vehicles to date. Understanding the differences in these vehicles will help you to make critical decisions in the field, saving valuable time when injuries are involved.

Hybrid vehicles operate on several battery voltages and have several drive types. They range from "Mild" hybrids (36-volt systems) up to the heavy truck and bus systems (800-volt systems). The similarities and differences in these systems are outlined below.

Mid-Voltage Hybrid

General Motors initially introduced Mid-voltage hybrids in its Chevrolet Silverado and GMC Sierra pickups in 2004. These trucks obtained improved fuel economy by using start/stop technology to shut off the engine during deceleration/regenerative braking and when the vehicle was stopped. Some reduction in emissions is also achieved as compared with their conventional counterparts. The number of models increased in 2007 with the Chevrolet Malibu and the Saturn Aura. In 2008, a small Saturn SUV, called the Vue Greenline, was introduced.

Mid-voltage Hybrids use three batteries connected in a series to produce 36 to 42 volts. This voltage allows the use of a powerful starter motor/generator that is built into the transmission. Mid-voltage hybrids use blue wires to indicate wiring that contains 36 to 42 volts. The voltage contained in these systems presents an increased arc hazard, but does not contain a lethal amount of voltage. These systems, therefore, do not pose the same hazards as full hybrid vehicles. You can handle mid-voltage hybrids as conventional vehicles when performing power-down procedures. Note that mid-voltage hybrids, like all hybrids, contain a separate 12-volt system which powers all conventional systems, including supplemental restraint systems (SRS), HID headlights, power windows, etc. Mid-voltage hybrids do not contain a high-voltage battery, orange wires, or a high-voltage motor that drives the wheels.

Considered by some to be “mild hybrids," these vehicles do not offer the fuel economy improvements or emissions reductions that are possible with higher-voltage systems. They also do not offset the added cost of the hybrid system over its outwardly identical conventional counterpart.

Full Hybrid

Full hybrid vehicles can use electric motors to drive the vehicle wheels directly or to assist in driving the wheels through a conventional transmission. They differ from mid-voltage hybrids in that they use battery packs that contain from 100 to 800 volts. Not only do full hybrid vehicles use start/stop technology, they also allow the vehicle to store energy that would normally be lost during braking, by generating power that is stored in the high-voltage battery. Significant increases in fuel economy and emissions reduction are possible by using these higher-voltage systems. Since the voltage in these systems is more than 60 volts, the automotive industry standard orange wires are used wherever high voltage may be present. All full hybrid vehicles contain a high-voltage battery, orange wires, and a high-voltage motor(s).

FULL-HYBRID TECHNOLOGIES

Currently, three types of technologies are used in full hybrid vehicles: Series Hybrid, Parallel Hybrid, and Series/Parallel Hybrid.

Series Hybrid

Series Hybrids, a type of full hybrid vehicle, do not have a direct connection between the engine and the wheels. The engine drives a generator which provides electric power for the battery (power storage) or the electric motor (driving the wheels). Examples of this type of hybrid include the Chevy Volt, full-size transit buses produced by New Flyer & Gillig, and heavy trucks produced by International, Kenworth, and others. Increases in fuel economy and emission reduction are possible by using the engine at its most efficient speed, shutting off the engine when decelerating or at a stop, and by charging the batteries

during regenerative braking.

Parallel Hybrid

Parallel Hybrids, a type of full-hybrid vehicle, use electric motors to assist the engine in driving the wheels through a conventional transmission. The electric motor is between the engine and the transmission. Honda pioneered this technology with the “Integrated Motor Assist” system that was first provided in the 2000 Honda Insight. The Mercedes S400 also uses a motor-assist system to help drive a conventional type transmission. These systems use start/stop technology, motor-assisted motion, and regenerative braking to increase efficiency.

Series/Parallel Hybrid

Series/Parallel Hybrids, the most common type of full Hybrid vehicle, can use the electric motor alone or in combination with the engine to drive the wheels. The drive motor also charges the battery during braking. The engine can also power a generator to produce power for motor use or storage in the high-voltage battery. A/C voltage is used in most vehicles to increase the efficiency of the motor(s). These systems use start/stop strategy, regenerative braking, and the most efficient engine operation speed to significantly reduce fuel use and emissions.

Lexus

GS 450h 2007 –

RX400h 2006–2008

RX450h 2010 –

288V NiMH battery

AC current traction motor

2 motors used on RX 4WD models

LS600h 2008 –

HS250h 2010 –

Ford/Mercury/Mazda

DC current traction motor

330V NiMH battery

Escape, Mariner, Tribute
2WD or 4WD
2007–

AC current traction motor

275V NiMH battery

Fusion 2010 –

Milan 2010 –

As you can see, hybrid vehicles vary greatly with different drive types and voltages. Understanding the differences between Mid-Voltage Hybrids and Full-Hybrid vehicles will help first responders effectively evaluate the MVA scene and take appropriate action.

Please send comments and questions through our contact page at www.mgstech.net.

Matt Stroud is a 23-year veteran of Toyota Motor Corporation, a Toyota-certified master diagnostic technician and an ASE certified master diagnostic technician, with 10 years certified in hybrid technology. Matt has completed multiple

extrication courses, giving him a strong knowledge base of fire tactics and terminologies. Because of heavy demand from the fire service, Matt founded MGS TECH in 2007 with the goal to teach firefighters/EMS personnel how to safely manage hybrid and new technology vehicle incidents.

Paul Bindon joined MGS Tech in 2008 as a research specialist and on-site trainer and has completed extrication training at the Corona-X seminar. Paul is also an ASE Certified master auto technician with over 23 years experience in the automotive field. He has been employed with Lexus dealerships for the last 16 years, receiving both master diagnostic specialist and hybrid certification through factory training in the latest automotive technologies.

Matt and Paul perform all their own research on new technology vehicles in order to publish MGS TECH's Hybrid Safety Guide (HRG) and teach the hybrid safety course to firefighters around the country, including a class at the 2010 FDIC in Indianapolis, Indiana.

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