



ALTERNATE FUEL TECHNOLOGY

Safe Vehicle Service

Editor's note: In this article, author Bob Rodriguez discusses the real and imaginary dangers of servicing today's vehicles, including AFVs. The information presented should be of special interest for mechanical and collision specialists, custom installers, automotive dismantlers, and emergency responders. This information is intended to stimulate discussion and is not a substitute for qualified professional training.

Automotive technicians voice concerns about their personal safety as they consider working on or around compressed natural gas vehicles (CNGVs), propane vehicles (LPG) or ethanol. Even greater concerns are voiced about servicing hybrid-electric vehicles (HEVs) with their high-voltage batteries. What is interesting is that while these and most all vehicles sold in the US today are safer to drive than just a few years ago, they may not be as safe to work on. No doubt that ABS, active suspension systems, supplemental restraint systems (SRS) and increased crash worthiness have all reduced traffic deaths and injuries. Yet these same safety improvements



"What's wrong with this picture...?" Cutting and spreading apart this fully SRS equipped vehicle could detonate the side air bags, which deploy straight up from inside the door. The rescue tool would likely be propelled straight back into the face of the firefighter, or into the vehicle. At a crash scene this could injure the firefighter or kill victims trapped in the car. Knowing a vehicle's SRS layout and the potential hazards is essential before performing vehicle modifications, collision repairs, dismantling or extrication.

have made diagnosing and servicing today's vehicles more difficult—and in certain cases more hazardous. Knowing the facts will help to relieve the anxiety; in this article we'll discuss some of the potential safety issues in store for automotive technicians, custom equipment installers, collision specialists, dismantlers and rescue personnel.

Alternative Fuel Vehicles (AFVs)

With natural gas and propane-powered vehicles on the road, shop owners will inevitably see them come in

for routine service. To identify these vehicles, look for a diamond-shaped sticker on the back of the vehicle. Some people get nervous being around cars with highly charged compressed gas cylinders on board. (Even I was concerned when I first learned that CNGVs carry 3,600 pounds/sq. inch of compressed gas in cylinders in the trunk or under the car, until an industry expert pointed out that as a SCU-BA diver, I carry a similar tank—on my back!) Most concerns about AFV safety are unfounded; dedicated gaseous (non-gasoline burning) AFVs are safer than those that use gasoline.

CNG tank failures (leaks) are mostly caused by bad judgment by vehicle operators. Industry films document CNG tanks being dropped, shot at, and burned in fires without incident. CNG and compressed hydrogen high-pressure cylinders have been confirmed safe in

vehicle crash tests. In a vehicle fire, pressure relief devices (PRDs) vent cylinders before they get too hot and over-pressurized. Stainless steel fuel lines and fittings are tested to *four times* the normal working pressure, and on-board vehicle shutoff and check valves are required. Because natural gas is lighter than air, in the unlikely event of a leak, NG rises into the atmosphere rather than pooling and spreading along the ground. That said, shops servicing CNG vehicles should comply with local codes and NFPA-52 standards.¹

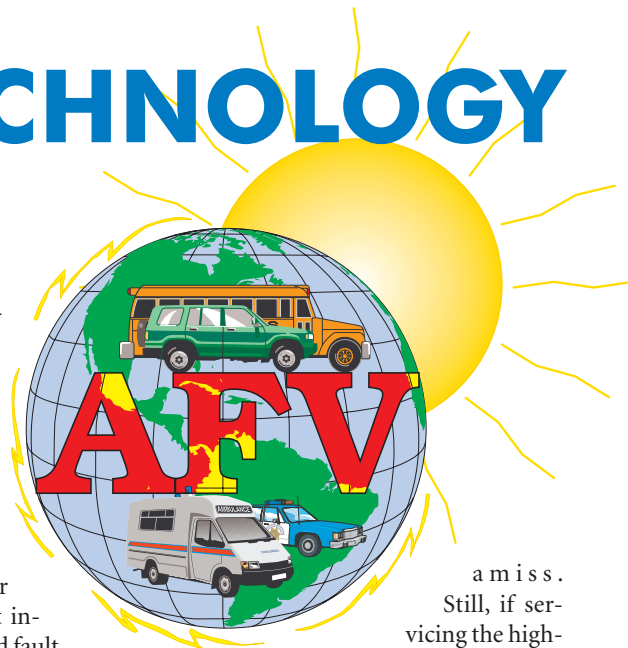
Propane (liquid petroleum gas, or LPG) vehicles store fuel on board at much lower pressures (several hundred pounds) than CNGVs. Here again, systems are designed to be fail-safe. Service personnel should realize, however, that propane is heavier than air and if fuel leaks, the propane will pool and spread much like invisible water. Unsuspecting dangers await service and emergency responders not properly trained with handling propane vehicles and fires. NFPA 58 details the standards for these vehicles.

Ethanol-powered vehicles are essentially like gasoline vehicles. One-hundred percent ethanol (grain alcohol) may not be deadly if ingested, but E85 (85% ethanol) is "denatured" with 15% gasoline for easier cold weather starts and to increase luminosity; ethanol's flame is hard to detect when it's burning under bright light conditions, which makes a vehicle fire hard to detect.

Hybrid Electric Vehicles (HEVs)

Because rumors about hybrid vehicle safety persist, we discussed in a previous *TechNews* article some of the high-voltage safety features used on hybrids. Some people fear being electrocuted while performing even the simplest of service, or if caught in a hybrid vehicle during a flood. In fact, hybrids are safer than most vehicles. Some HEV wiring carries several hundred volts AC or more; any wiring carrying over 50 volts is considered potentially lethal and is identified by orange insulation or wire wrap (reportedly blue for Saturn; yellow for Lexus

vehicles). Additionally, HV wiring is typically shielded to ground and runs along vehicle frame rails for added protection. Even if a hybrid should get hung up on rocks or a guardrail, circuit interlocks and ground fault interrupters isolate and shut down high voltage circuits if anything goes



amiss. Still, if servicing the high-voltage circuits and

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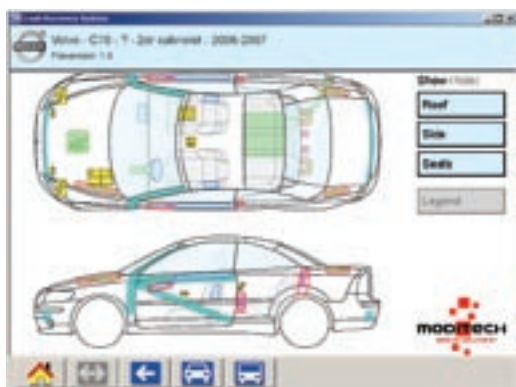
Hazards for Vehicle Service Providers

While far from a comprehensive list, here are a few things vehicle service and rescue personnel should think about.

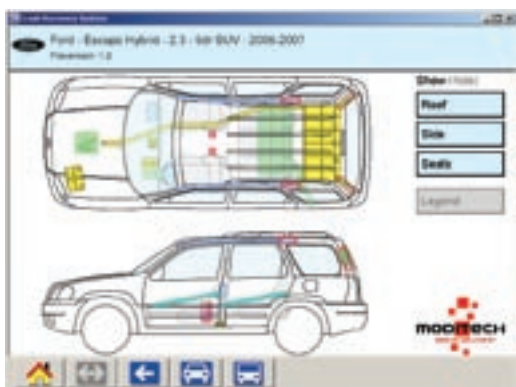
1. Studies show that as vehicles get older, pressurized fuel systems and oil leaks cause vehicle fires. The unsuspecting person who opens a hood to extinguish such a fire may be injured or killed when a gas-charged hood strut overheats as the fire gets added oxygen, explodes and takes off like a rocket. The same can occur with rear-end-crash vehicle fires.
2. Non-metal (plastic) fuel tanks melt at elevated temperatures (over about 400 degrees) and can release gasoline to feed a vehicle fire. Tires burn fiercely and explode forcefully. Magnesium is used in certain vehicle areas (like brake and clutch pedal support brackets) to save vehicle weight, but magnesium burns intensely (a type "D" fire) and poses fire-fighting hazards, especially when hit with water. Reinforced window and door pillars may consist of five or more layers of sheet metal plus a solid metal rod for support, making them almost impossible to cut through; the same goes for some roof rails.
3. Installers of custom interiors must deal with occupant classification systems (OCS) and side curtain airbags. By law, these systems must remain operative. But recyclers and rescue personnel must render these systems *inoperative* when cutting into the front, side or rear pillar—or even the roof rails of a vehicle. Cutting into a high-pressure cylinder containing thousands of pounds of pressure designed to deploy one or more airbags poses great risks. Make sure you know exactly where and what to cut before attempting to forcibly open a crashed vehicle.³
4. If not completely electrically disabled after a crash, SRS systems designed to save lives can detonate as emergency responders work to free crash victims. Dual-stage airbags, back-up SRS battery systems and other safety devices such as seatbelt pretensioners and automatic rollover protection systems are a concern for rescue persons who might otherwise not be aware of them. Airbags deploy with deadly force, so stay clear of all airbags not completely disarmed.
5. A so-called "smart key" used on some vehicles may prove hazardous. After a crash, even with the ignition off, a person approaching the vehicle with the key in his or her pocket may activate the electrical system and cause harm to first responders at work. Emergency response trainers tell us to throw such keys far from the vehicle to avoid an accidental startup of a hybrid's high-voltage system.
6. Even after electrical cables have been cut to disable a hybrid-electric vehicle, it should not be rolled, pushed, or towed. Rotating the wheels could cause electric power to be generated and spark, thus igniting leaking fuel or oil. At an accident scene, chock the wheels of such a vehicle first.
7. The OEMs publish Emergency Response Guides for AFVs and hybrid vehicles. Obtain and study them before attempting any kind of service.

Footnotes:

1. The National Fire Protection Association standards recommend that shops have methane or propane detectors and other safety features installed if servicing gaseous-fueled vehicles. Check also with your local Fire Marshall and county officials for proper adherence to building codes.
2. See earlier ASE TechNews article "Service Hybrids... Safely" at www.ase.com. The article includes a list of hybrid vehicle training providers and sources of vehicle Emergency Response Guides.
3. Cutting into a high-pressure cylinder to extricate a victim is not a good idea. Second batteries in some vehicles keep SRS systems alive even after the main battery cable has been cut. OEMs publish Emergency Response Guides for hybrid vehicles, yet locations of the high voltage shutoff switches are not standardized and may be impossible to get to after a crash. Check out specialized first responder training and information sources on how to locate hazardous areas on a vehicle. Go to www.sceneoftheaccident.org and www.moditech.com for more information.



Supplemental restraints and related components as shown on this Volvo C70 have proven their value in saving lives. Yet such safety features can hinder or be hazardous to vehicle technicians, dismantlers or rescue personnel. At a crash scene, important vehicle information as seen here can be accessed from a special database. Hazardous front and side airbags, gas struts, and explosive tensioners are outlined in red; strengthened pillars and beams in blue-green; electrical objects in yellow, and so forth.



In this image of a Ford Hybrid Escape SUV, the 12 VDC and high voltage batteries (at the rear) are shown in yellow; the curtain airbags in the roof rails in blue. Note also the outlined (in red) tensioner at the seatbelt buckle, and the keyless entry feature (shown in yellow).

(Images courtesy of Moditech: www.moditech.com)

Part of a continuing series on alternate fuel vehicles and advanced vehicle technology; all past articles in this series are available at www.ase.com. If you have comments or questions, contact ASE's Bob Rodriguez at 703-669-6634 or brodriguez@ase.com.

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components on hybrids, be sure to get professional training beforehand.²

Beyond AFVs: Other Vehicle Hazards

When it comes to safety concerns, AFVs and hybrids get our attention. But what safety concerns exist for servicing *any* vehicle, even non-AFVs? Vehicles sold in the US have any number of systems and components designed to protect vehicle occupants, yet ironically, these same systems pose significant safety hazards for vehicle service providers (see sidebar). Installers, service technicians and collision repair specialists, dismantlers—all should get professional training before working on or around SRS systems. “Be prepared” by knowing and understanding the potential

hazards that are present on today’s vehicles.

Emergency responders should attend specialized courses on rescue operations in order to:

- Deactivate safety systems swiftly and accurately to avoid undesirable side effects.
- Work at a safe distance to reduce risks to a minimum.
- Have access to valuable information and avoid delays.
- Avoid environmental damage when working with hazardous materials.

There is a great need to share information about the risks of extinguishing vehicle fires and extricating victims from today’s SRS equipped vehicles.³ What you don’t know could hurt you... or worse.