

# Fire Engineering

[Close](#)

## Mid-Voltage/Low-Voltage Automotive Systems

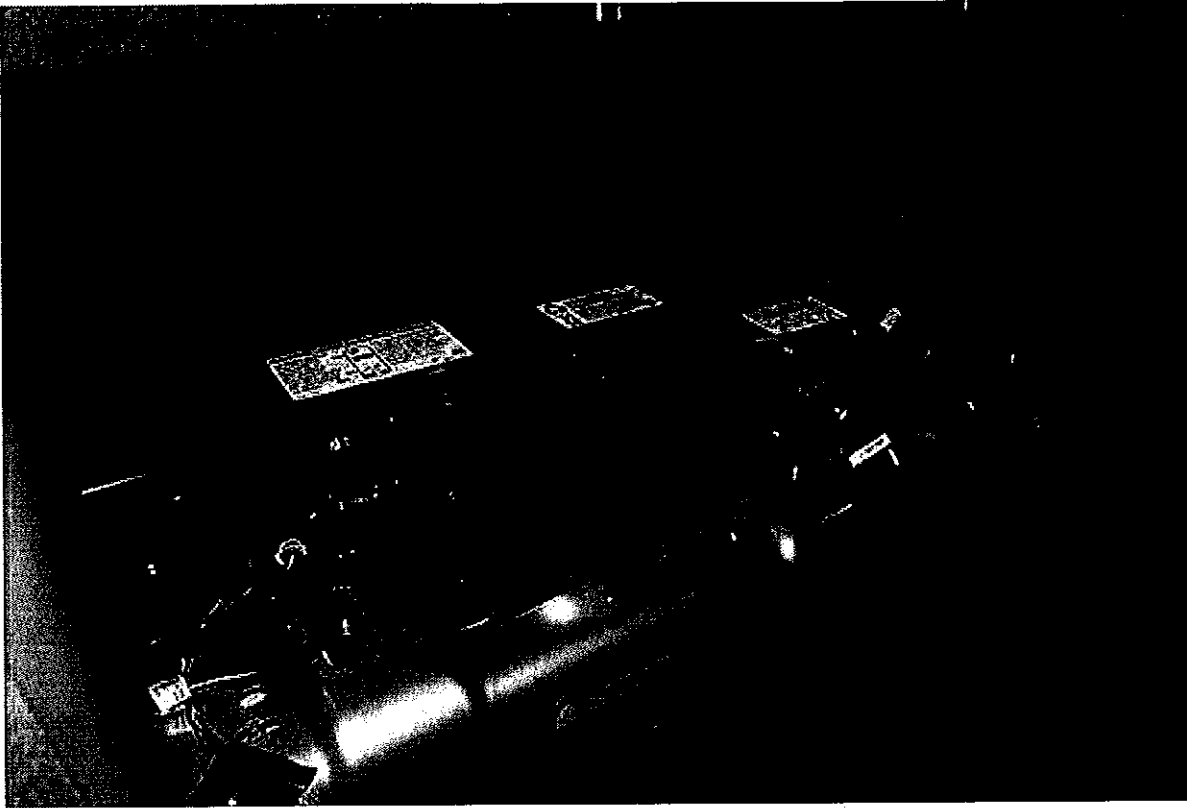
*By Paul Bindon  
Vice-president of MGS TECH*

Automotive electrical systems have been evolving quickly as new technology is integrated in our transportation systems. We have previously discussed high-voltage electrical systems in hybrid vehicles. It is also important to understand other electrical systems and how they may be important during extrication. We will be discussing mid-voltage “hybrids” as well as some key 12-Volt systems found in vehicles today.

Mid-voltage hybrid vehicles were relatively inexpensive alternatives as compared to the hybrid vehicles from Toyota and Honda. This cost savings was accomplished by using a relatively simple technology that allowed the gasoline engine to shut down when the vehicle was slowing down and when it was sitting at a stop light. A large electric motor/generator, located between the engine and transmission, was used to restart the engine very quickly when the throttle pedal was applied. When these vehicles are braking or slowing down, the motor/generator is used to recharge the mid-voltage battery pack. To be able to power a motor large enough to start the engine quickly, a larger battery capacity was required than a standard 12V system could supply. Mid-voltage “hybrids” were equipped with 36-42V battery packs. Early models had three 12V lead-acid batteries that were connected in series to form the required battery voltage. Later models were equipped with newer technology NiMH units. The mid-voltage battery was used exclusively for the “hybrid” system, and are not involved in the operation of other vehicle systems such as SRS (supplemental restraint systems like airbags).

Mid-voltage “hybrid” vehicles use an industry standard color for their wiring. All wires found in mid-voltage “hybrids” that contain the 36-42V electricity are colored **BLUE**. They do not contain a lethal amount of voltage. The blue wire coloring indicates an increased arc hazard. Each mid-voltage “hybrid” was also equipped with a conventional 12V battery which powers all other electrical systems in the vehicle.

Below is an example of the mid-voltage battery pack and blue wiring which indicates a 36-42 volt system. This battery (photo 1), from a 2009 Saturn Aura, is located in the trunk of the vehicle.



(1)

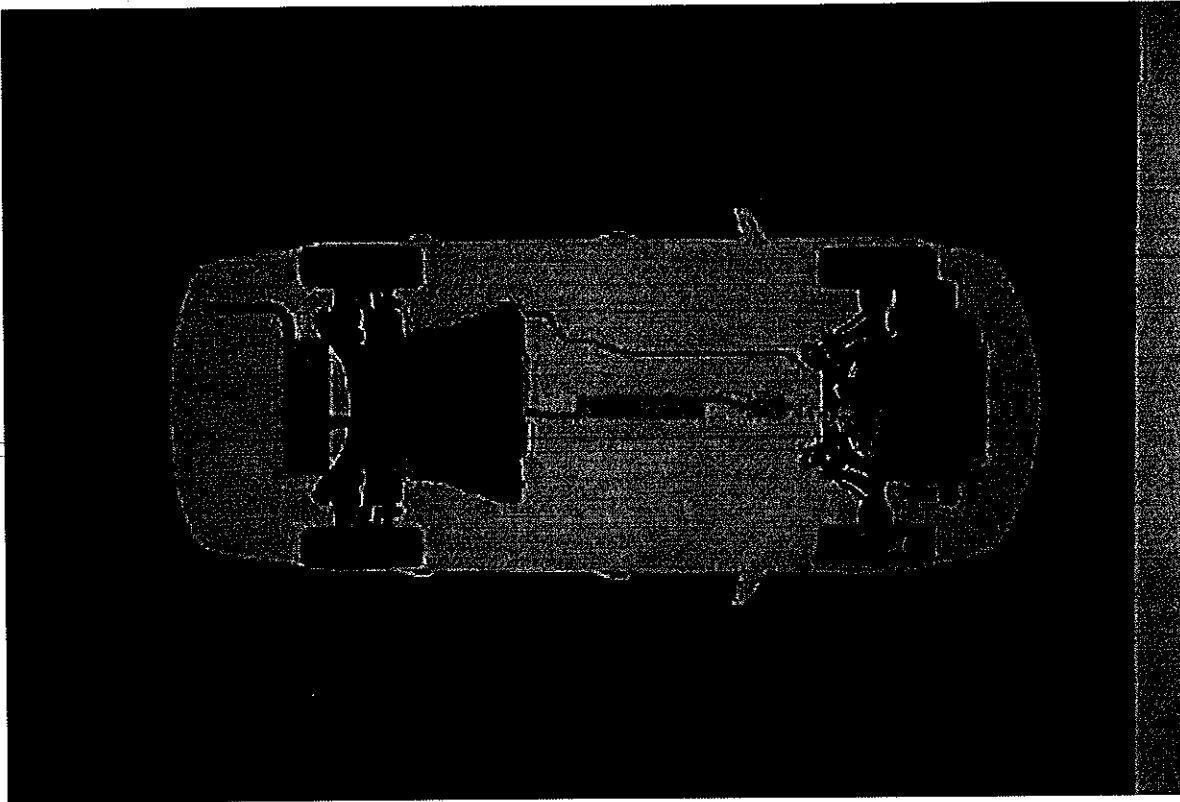
Photo 2 is an example of the 12V-battery location from the same vehicle. Note the blue wiring in the engine area.



(3)

The other possible location for the mid-voltage battery is under the rear seat (truck) or cargo floor (SUV).

Photo 4 contains an overview of system components is shown below for the Saturn Aura sedan.



(4)

Mid-voltage “hybrids” were released from several automotive manufacturers as an attempt to bring to market their own version of eco-friendly vehicles at a time when the public was becoming increasingly aware of their impact on the environment. Although they were marketed as “hybrids,” they do not have some of the key characteristics of a true hybrid.

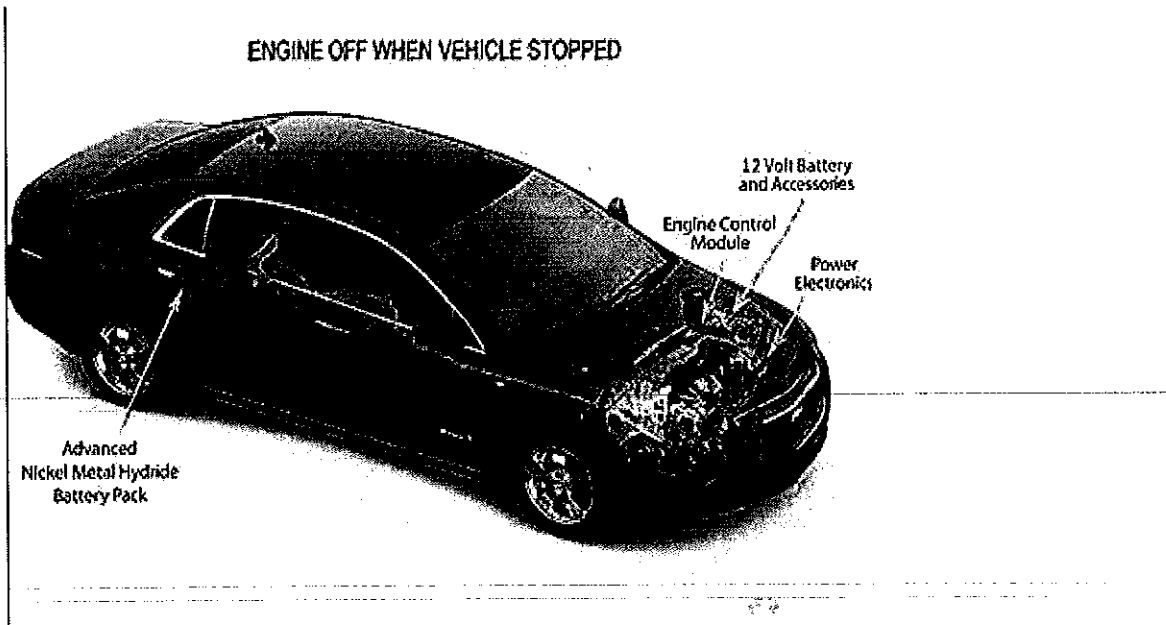
- **They Do Not** contain a high-voltage battery.
- **They Do Not** contain orange high-voltage wires
- **They Do Not** use a high-voltage motor that drives or assists in driving the wheels.

Because of the above listed differences, they are not considered to be true hybrid vehicles by most automotive experts.

The first mid-voltage “hybrid” vehicles were the 2004 model year GM Sierra and Chevrolet Silverado full-size pickup trucks. Marketed as contractor friendly trucks, they were equipped with an 110V AC power outlet in the truck bed. Advertising featured the truck being used as a power base by a contractor to build a home in a remote location. Unfortunately, the available power from the bed power outlet was limited to the point where high-load items such as power saws were unable to be used. Although modest gains in fuel economy and emissions reductions were realized with this technology, production of these trucks was halted after the 2006 model year.

## Chevrolet Silverado Mild Hybrid

Later mid-voltage “hybrids” offered by GM and its related companies were the 2007 Chevrolet Malibu, Saturn, Aura and the Saturn Vue compact sport utility vehicle. These vehicles used the same mid-voltage systems to enhance fuel economy and reduce emissions. A cost premium over the conventionally equipped vehicles made them less desirable to the general public and they were discontinued after the 2009 model year.



(5) Cutaway view of a mid voltage hybrid vehicle.

As with other hybrid vehicles, it is very important to remember that the vehicle is a silent running hazard. Just because the engine is not running, it has the potential to move without warning. It would be embarrassing and potentially dangerous to have to relocate the scene for patient extrication if the vehicle suddenly drives away with one of your team members stabilizing the patient in the vehicle. Normal procedures should be followed for vehicle stabilization before any entry into the vehicle is made.

All computers in vehicles today are run off of the 12-volt system. It is important to remember that disconnecting the 12V battery will prevent the SRS system from operating. This should be a primary goal during vehicle stabilization prior to any extrication procedures being performed.

Mid-voltage “hybrid” vehicles have been discontinued from production for a variety of reasons. They are, however, still to be found on the road today in a large enough number to justify being aware of their technology and how to handle it. Increased arc hazard from the mid-voltage system and the ability to move suddenly when the engine was stopped are the main points to remember.

*Paul Bindon is a research specialist for MGS Tech and an on-site trainer, and has completed extrication training at the Corona-X seminar. He is also an ASE certified master auto technician with more than 23 years experience in the automotive field. He has been employed with Lexus dealerships for the past 16 years; he has received master diagnostic specialist and hybrid certification through factory training in the latest automotive technologies.*

- **More Vehicle Extrication**

---

To access this Article, go to:

**<http://www.fireengineering.com/content/fe/en/articles/2010/10/bidon-mid-volt.html>**

# Fire Engineering

[Close](#)

## On the Line: Positioning the Backup Line

*Article and photos by David DeStefano*

Most fire departments have a policy to ensure that a backup line is stretched to support the first attack line for all fires. This line reinforces the original attack line should the volume of fire increase or the original line suffer a loss of pressure or another problem. The backup line should be at least the same diameter as the first line and at least one length longer. The longer length will prove useful in cases where the backup is put into use laterally from the initial line or immediately above it. In addition, having a longer line at the ready will be helpful if the first engine misjudged the stretch and comes up short of the seat of the fire.

One common issue affecting the first-in engine and the first-in truck is the position of the backup line by a subsequent engine company. As action-oriented people, every firefighter on the fireground would love to be as close as possible to the seat of the fire. However, when assigned the backup line, firefighters must remember their primary function is to be prepared to enter the firefight, not to obstruct it.

Often, the backup line is stretched and held fast directly behind--or even worse--next to, the attack line. Although this may get the backup company closer to the seat of the fire, it may also cause an unnecessary bottleneck at a critical point in the firefight. Members trying to advance the attack line may be inadvertently pushed over and have their line stepped on, making it difficult to advance. The additional firefighters may also create kinks in the line. In addition, truck company firefighters trying to get past the line to conduct a search and find the seat of the fire will have more difficulty trying to get past the additional members bunched together, especially in narrow hallways. Officers and firefighters stretching a backup line must be prepared to place their line in a standby position without creating an obstacle. This can be accomplished with size-up and self-discipline.



*(1) Firefighters on the backup line are shown on the lower stair landing, allowing the attack line room to advance freely. This position allows the backup firefighters the ability to see or hear the progress of the first line and deploy quickly if needed.*

Sizing up the layout of the building as the line is stretched will aid the company officer in choosing the proper position. The backup line should follow the path of the attack line up to a point where it can be held in place close enough to the fire to be rapidly deployed, yet allowing for free movement of the primary line as well as members conducting searches. In most cases, the line is stretched dry for ease of maneuvering. The officer supervising the line may choose to charge it at any point he feels it necessary. Holding fast before the beginning of a narrow hallway or on a lower stair landing often provides the needed room for other companies to operate. In most occupancies, this distance will allow the members on the backup line to get a feel for conditions without putting them directly in the firefight.

The exact staging point for a backup line will vary based on building layout and conditions; the key points for this important position are to stretch the correct diameter and length hose and to position it for effective deployment without competing for space with the attack line or truck members trying to conduct searches. This will also help reduce bottlenecks on stairways and in narrow halls in single and small multidwellings.

*David DeStefano is a 20-year veteran of the North Providence (RI) Fire Department, where he serves as a lieutenant in Ladder Co. 1. He previously served as a lieutenant in Engine 3 and was a firefighter in Ladder 1. He teaches a variety of topics for the Rhode Island Fire Academy. He can be reached at [dmd2334@cox.net](mailto:dmd2334@cox.net).*

- **[Read more of David DeStefano's On the Line column in the Survival Zone!](#)**

---

To access this Article, go to:



**<http://www.fireengineering.com//content/fe/en/articles/2010/10/destefano-backup-line.html>**