

# HOW TO...

## How to carry out extrication



*The most important thing to remember when cutting into a hybrid is that the high voltage system may remain powered for up to 10 minutes after the vehicle has been turned off or disabled.*

Due to environmental issues green motoring is becoming more and more popular, and hybrid cars are a common sight on roads around the world.

So how do hybrids affect your rescue operation? What are the risks and what should be considered?

This article hopes to give answers to these questions including an explanation about the different hybrid systems commonly seen, writes

**Remco Niks, Technical Rescue Consultant for Holmatro Rescue Equipment.**



*Remco Niks.*

### **Hybrid technology**

A hybrid is a car with two different ways to drive the vehicle, most of the time with a petrol and an electrical engine. Because the image "green or hybrid" is used as a sales argument nowadays, some manufactures already call their car hybrid when it has a normal fuel engine and a starter engine. Strictly theoretically they are right; the car has two driving options

In order to respond correctly, it is essential to understand what types of hybrid engines are currently on the market. There are

three types in existence at the moment:

- **Micro Hybrid**

A micro hybrid is a car with a normal petrol engine combined with a start-and-stop system. The engine stops when waiting at a traffic light (for example) and automatically starts again – with of course an electrical starter engine – when the driver wants to move again. The car has a normal 12 voltage electrical system like any other car on the road. These cars are, from a rescuer's point of view, no different from vehicles without this system.

- **Mild Hybrid**

A mild hybrid car has the same start-and-stop system, but is extended with an electrical support engine to help the petrol engine move the car. Besides that, there is also a regenerative braking system on board. When this type of vehicle brakes, the energy from the brakes is used to charge the battery again. A good example of this car is the Honda Insight. Besides the normal 12 voltage system, there is a separate electrical circuit for the hybrid drive. Due to the fact that these cars can't be driven completely on electrical power, the system works with a low voltage of 36V. This currency poses no additional risk to rescuers.

- **Full Hybrid**

A full hybrid car has systems similar to the types of vehicles described above, but with these cars it is possible to drive completely on electrical power. To make this possible, a higher voltage is necessary. The most popular full hybrid is still the Toyota Prius. Toyota uses a battery with 201,6 volt DC for the hybrid technique built from 28 modules with 6 cells, 1.2 volt each. New in the 2009 model is a "boost converter"

# on hybrid vehicles

that boosts the available voltage to the electric motor up to 650 volt AC.

Micro Hybrids and Mild Hybrids pose no new risk during extrication compared to any other recently designed car, but what about the Full Hybrids?

While the higher voltage on board might be dangerous in itself, manufacturers have built in various safety systems to remove the risk to rescuers. Normally the 12 volt low voltage circuit uses the metal body of the car as a ground. In this low voltage circuit electricity flows through the vehicle's metal body. Due to the low voltage this is of no risk other than normally the battery is disconnected or at least the car is shut down.

Full Hybrids are also equipped with a high voltage circuit to operate the electrical engine. Unlike the low voltage circuit, this high voltage circuit does not use the vehicle's metal body as a ground. The high voltage battery pack powers the high voltage electrical system with (DC) electricity. Positive and negative (orange) coloured power cables are routed from the battery in the back of the car to the converter under the bonnet. In the high voltage circuit electricity only flows through the high voltage cables. This means that if the positive high voltage wire touches the metal body of the car there is no short circuit. Rescuers shouldn't be afraid to touch or cut the car and electrocute



*The top of a hybrid engine. As the higher voltage might be dangerous in itself, manufacturers have built in various safety systems to remove the risk to responders.*

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## Three-minute interview

### BERT WILLEMS, COMMERCIAL DIRECTOR HOLMATRO RESCUE EQUIPMENT BV

**What was the most significant development of the last five years?**

"From Holmatro's perspective, it is the introduction of CORE Technology (COaxial Rescue Equipment technology), which refers to the hoses, couplers and valves of a rescue system. In other words: the way hydraulic oil is directed from pump to tool and vice versa. A traditional dual hose system consists of a separate pressure and return hose connecting pump and rescue tool. The CORE system consists of a high-pressure inner hose inside a low-pressure outer hose. "I don't think many people will deny this system has revolutionised how extrication is carried out, as it decreases rescue time and makes the whole process safer."

**How do you see the rescue tool market developing?**

"There are still many parts of the world where fire and rescue services have had limited access to rescue tools, and I think the market is still growing, especially in developing countries where they have less facilities in place. We are in close touch with fire and rescue authorities in each country, and the growth of the market is dependent on government budgets."

**Do you see many differences in requirements internationally?**

"We have two production facilities of which one serves the US while the Dutch facility serves the rest of the world. We have found that there are many differences in how extrication is handled all over the world. The rescue scene is set up differently everywhere, and the tools tend to be different as well. You don't just see differences between continents, but within them as well. The average rescue scene in Sweden looks quite different from one in Germany and Holland. There are historical reasons for this, but at the same time it is a given fact, and we have to answer that demand. Therefore we have created an extremely broad and diverse range of rescue tools."

**What do you identify as the main driver for the design of rescue tools?**

"For some time now – and I don't think this will change in the future – new car technology has been driving rescue tool design. Of course urban search and rescue in structural collapse situations is a very important market, which we intend to keep serving in the best possible way, but vehicle extrication will remain the most common application. Cars are becoming increasingly stronger with new car technology, and harder material consisting of more layers. The challenge is to keep up with what the automotive industry develops.

"We have to be ahead of developments in that particular industry, so we are prepared for it. This has been a challenge for many years, and as a company we have invested much time and money. It is absolutely crucial to maintain close contact with car manufacturers.

We are permanently reviewing our cutting technology, and that is why we developed our NCT (New Car Technology) cutters. These cutters are specially designed for modern vehicle constructions.

**What have you got in store for Interschutz?**

"This Interschutz we will have exciting new products on show, and people should come and see this for themselves. Visit us at stand E26 in Hall 2."

themselves, this is not possible. Beside this, the following systems are on board to help keep occupants in the vehicle and emergency responders safe from high voltage electricity:

- A high voltage fuse provides short circuit protection in the

high voltage battery pack.

- Positive and negative high voltage power cables connected to the high voltage battery pack are controlled by 12 Volt normally open relays. When the vehicle is shut off, the relays stop electrical flow from leaving the high voltage battery pack.
- A ground fault monitor continuously monitors for high voltage leakage to the metal body while the vehicle is running.

The most important thing to remember when cutting in a hybrid is that the high voltage system may remain powered for up to 10 minutes after the vehicle is shut off or disabled. To prevent injury or death, avoid touching, cutting or breaching any orange high voltage power cable or other high voltage components.

**Emergency response rescue**

Because all hybrids are recently designed cars the challenges during an extrication are probably much bigger by the fact that it is a modern car. The passive and active safety systems in these kinds of modern cars are a bigger concern than the hybrid technology. All these cars are equipped with the following safety systems, so be aware of their specific risks:

- Airbags (driver, passenger, knee, curtain, seat side).
- Seatbelt pre-tensioners.
- Active head rests.

On arrival, emergency services should follow their standard operating procedures for vehicle incidents. If a hybrid car is involved, it is wise to be extra alert on the following:

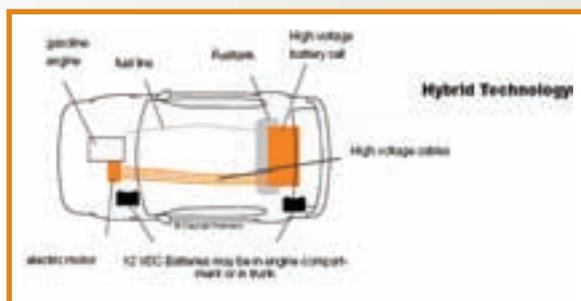
- Never assume a hybrid is shut off because it is silent.
- Always observe the dashboard for indication lights; normally a hybrid is shut off when the instrument cluster lights are out.
- To prevent injury from SRS (airbags) systems or an electrical shock, always shut off and disable the car before starting your operation.

There are several ways to disable a hybrid vehicle. If lights are illuminated in the dashboard, pushing the start/stop (power) button once or turning the key to zero is the easiest way. The vehicle is already shut off if the instrument cluster lights are not illuminated. Do not push the power button; the vehicle may start then! If the smart key is easy accessible always keep it at least five metres away from the vehicle. Do not push any button on this key, because you never know what you may activate by doing this. Try to disconnect the 12 Volt auxiliary battery; if not reachable you could consider removing all the fuses in the fuse box under the hood. If none of the disabling procedures can be performed, proceed with caution. There is no assurance that the systems – Hybrid and SRS – are disabled.

**Note**

Before disconnecting the 12 Volt battery or removing the fuses, it might be necessary to lower the windows, unlock the doors etc. Once the electricity is disconnected power controls will not operate. Vehicle extrication rescue is challenging enough without making it even more complex. As we have discussed above by following a few simple safety tips, extrication rescue on hybrids can be safely achieved without additional specialise tools.

*Hybrid technology provides a new challenge for rescuers.*



**ABOUT THE AUTHOR**

Remco Niks has been the Technical Rescue Consultant at Holmatro Rescue Equipment, based in the Netherlands, since 2009. Before this, he worked in the Dutch fire brigade as Head Officer and was a member of the Dutch USAR team (urban search and rescue). He has a master degree in Crisis & Disaster Management. Remco provides Consultation & Training to emergency services departments around the world. Within the last year he has consulted to no less than 15 different countries in the emergency services field.