IMI: Hybrid and Electric vehicle maintenance

Bosch has been developing hybrid and electric vehicle technologies for more than 30 years. Its training relies on comprehensive know-how in the field of battery, electric drive, and brake management, as well as engine and transmission-shift control.

Under the umbrella term, there are different categories of electric and hybrid vehicles grouped by the design specification of the specific vehicle. Micro and Mild hybrids are assistive technologies. Strong hybrids and electric only vehicles are capable of electric only drive (the driveable range will be determined by the High Voltage battery size and specification). Later hybrids, and of course electric-only vehicles, have the option to plug-in to the mains grid for high voltage battery charging.

Hybrid vehicles use a combination of engine and battery power, with the High Voltage system assisting the engine drive. While early vehicles cannot be recharged using a plug-in approach they still require a high-capacity battery pack which is sized according to the needs of the car. This means that although capable they will only have electric-only drive for a very short distance. Usually the battery will be in use the entire journey being either charged or discharged.

Three main types of plug-in electric vehicle

There are three main types of plug-in electric vehicle; pure electric, range extended electric and plug-in hybrid; all of which can be recharged using a dedicated plug. They have bigger batteries constructed with newer chemical technologies (more efficient and lighter in weight) than previous hybrid vehicles.

Pure electric vehicles are 100% battery-powered, with an average range of around 50 - 250 miles – although products coming to market in the next 12 months should have a longer range.

Range extended electric vehicles have an electric motor driving the wheels, with a combustion engine used as an on-board generator to recharge the

battery on the move. This means the vehicle has an average range of around 300 miles.

A plug-in hybrid's driven wheels are powered by a blend of two power sources (exactly as current hybrid technologies) but with a larger battery that can now be recharged from the mains. This solution gives vehicles a total range of between 500-700 miles.

The high voltage battery packs and electric motors utilised by plug-in electric vehicles mean that technicians will need to adopt a different approach when working on them. Although the vehicle systems are designed to be very safe, the high voltage components can be dangerous if they are not worked on using the correct procedures and equipment.

The battery's impact on components

Across all hybrids and pure electric vehicles there will be a 'standard' Low Voltage electrical system with a 12V low voltage battery, operating in a normal manner providing power for traditional systems such as lighting, windscreen wipers and climate system control. This battery will be charged from the High Voltage system using a DC to DC converter, managed by an ECU. There are also some components that now operate in the High Voltage domain, such as HV electric Air Con Compressors. This requires the use of a sophisticated battery monitoring and management process for both HV and LV systems.

Using hybrid and electrical powertrains has an impact on many other automotive components and systems. This includes auxiliary units, such as electric power steering, braking and ESP. These must be tailored to hybrid and electric vehicles, the system ECU's will coordinate (via a data network) the interaction between the conventional friction brake and the braking effect of the generator. Finally, there are features such as efficient thermal management for the heating and cooling systems in the electric vehicle, or navigation systems that compute the optimum route in terms of fuel efficiency.

The Electric / Hybrid vehicles various control units will measure driver demand (acceleration – load – speed) and deliver power to the motor (or a blend of power with hybrid drivetrains) that is balanced against battery condition and battery load (and emission levels where an internal combustion engine is used) and allowing energy recuperation for HV battery recharge whenever possible within the driving cycle. This will happen while all other functions of vehicle operation and safety interact with the system (Stop - Start for hybrids, ESP, Traction control, Transmission control if used etc).

The energy saved can then be used to increase engine power if the driver so demands or save fuel through a passive boost.

About Bosch Service Training Centre

With four spacious classrooms and a vast workshop area fully equipped with the latest diagnostics and test equipment, the centre runs a variety of courses for technicians looking to sharpen their skills or indeed gain new knowledge and expertise. Training is a core competence for Bosch, and most training involves a mix of practical and theory based learning.

Opened in 2012, the centre is located in Uxbridge within walking distance of Uxbridge Tube station and a plethora of transport options. It has capacity to train 4,500 delegates a year and is a vital part of Bosch's commitment to training in the aftermarket.

Bosch is at the forefront of automotive technology, supplying to both vehicle manufacturers as original equipment and through the aftermarket to motor factors and automotive workshops. Delegates benefit from this experience, being trained by experts in the field who use their experience to better engage with attendees.

For more information on available courses, both at Bosch's Service Training Centre and across the UK, please see here: http://uk-ww.bosch-automotive.com/en/services_support_workshopworld/training/course_finder/course_calendar Alternatively you can contact the onsite team by emailing SAA.Training@uk.bosch.com or calling 01895 816160

What is the scope of Bosch's North American market for EV replacement parts?

Business will be as usual. Everything at electrification including EVs will be handled in the aftermarket just like any other product on conventional vehicles. There are some differences such as the battery having end-of-life at 80% of original depth of discharge, the charger, inverter and electric motor components will have a much higher life expectancy than some of the traditional internal combustion engine components. The reason is that these parts are not exposed to as rough an environment as ICE components are, which include fuel combustion, oil, moving parts and high temperature. Also the fixed gear transmissions for EV are much simpler and should have a higher durability.

Are drivers patronizing aftermarket repair shops and DIY parts stores? Or are most repairs and parts purchased from dealership service centers?

Currently, it seems drivers are more likely to take their hybrids and EVs back to their dealer for service and general maintenance.

Do you recommend that aftermarket repair shops begin purchasing the necessary shop equipment and training to repair EVs?

As with any new technology, aftermarket shops should be prepared to invest in specialized equipment based on the number of vehicles they see. If a shop has never seen a hybrid or EV for service, it wouldn't make sense to invest in equipment and training until it becomes a larger part of the car park in their area. As electric vehicle adoption expands, shops should consider training and equipment options that fit with their needs and the services they expect to perform.

Do you provide EV shop equipment? What are some of the key components needed?

Yes, our automotive aftermarket division provides tools and equipment for high-voltage service. Tools and equipment for hybrid or EV service must be able to safely handle the high-voltage systems within an EV, including the AC system. For starters, an AC recovery, recharge and recycle machine must be tested and rated for high-voltage systems to safely service the system and meet specific SAE standards. Additionally, technicians should wear insulated gloves rated for 1,000V use. Testing the high-voltage systems also requires specialized multi meters capable of reading voltage well above what you'd normally see in an automobile or even a house.

Where do you recommend that EV service managers and technicians obtain the proper training for working on these systems?

There are a number of electric vehicle technician training programs available from respected institutions. We don't favor one over another but do recommend technicians do their research and look for programs that are in some way partnered or affiliated with a vehicle manufacturer or from a trusted, longstanding technician training program.