Background information

Battery Quick Check: Reliable Evaluation of Traction Batteries

Traction batteries in today's electric vehicles consist predominantly of lithium-based batteries such as lithium-ion batteries. As lithium-ion batteries age, the usable capacity of the batteries deteriorates over time. Experts differentiate the aging process according to calendrical and cyclical aging.

Calendrical aging of batteries

With calendrical aging, various factors such as temperature and state of charge influence the aging process. The "comfortable temperature" of a lithium cell is approximately 20 degrees Celsius. If, for example, the cell is stored for a long period at 30 degrees Celsius, it will age around twice as quickly as it will at 20 degrees Celsius. The state of charge also affects calendrical aging. The ideal state of charge at which to store a lithium battery is around 50 percent of its maximum capacity. Both long-term storage at the maximum state of charge and storage at a 0 percent state of charge will decrease the service life of the battery.

Cyclical aging of batteries

Cyclical aging is based on vehicle handling and charging behavior. A sporty, aggressive style of driving that involves accelerating rapidly when driving off and minimal regenerative braking increases the load on the battery. The frequent use of quick charging also places greater stress on the battery. A more foresighted driving style, on the other hand, has a positive impact on battery aging – meaning that the optimum charging method can be scheduled in advance, for example.

Forecasts to determine service life are often inaccurate

It is clear that the aging of a battery depends on individual usage. Electric vehicles do provide information on the state of the battery. In practice, however, the "State of Health" presented by the battery management system often differs significantly from reality. As a result, forecasts to determine the remaining service life and performance of a traction battery are often inaccurate. TÜV Rheinland and TWAICE are convinced that it is not possible to reliably determine the actual remaining capacity of the traction batteries in electric vehicles without carrying out manufacturer-independent diagnostics.

Current as of March 2022

New service as a market-driven solution

The market for battery electric vehicles (BEVs) is developing extremely dynamically. This is also being gradually reflected in the used-car market – albeit at a low level: In 2019, as many as 11,000 used BEVs changed hands according to the figures of the German Federal Motor Transport Authority; in 2020, this figure had already risen to more than 19,000. And in 2021, just under 356,000 BEVs were newly registered. With this in mind, the used BEV market is expected to expand considerably over the coming years.

To diagnose the state of the battery, TÜV Rheinland and its technology partner TWAICE use the vehicle's On-Board Diagnostics (OBD) system with the OBD2 interface. Qualified workshop personnel or technical experts from TÜV Rheinland can read out all of the relevant data via this interface in less than an hour. This includes values such as current, voltage, the internal resistance of the battery, and the temperature of cells, modules, and the entire pack. The battery data is then processed by means of the battery analysis developed by TWAICE. Battery models that map the behavior of the battery under various environmental conditions (e.g. temperature, state of charge) for every battery type are stored in the TWAICE cloud. These models are created on the basis of measurements under defined boundary conditions. The measured battery data is sent from the vehicle to the TWAICE cloud. In the cloud, intelligent algorithms are used to assess the various battery parameters, and the behavior of the vehicle battery in question is compared with the stored models. This enables the degree of aging of the battery to be determined.

The Battery Quick Check provides an independent status report on the traction battery that is certified by TÜV Rheinland. Both the process of collecting data from the vehicle and the process of evaluating the data by means of the algorithms developed by TWAICE are certified. The most important value provided by the status report is the capacity of the battery as a percentage. A value of 80 percent serves as a guide value here: If the capacity drops to this value, the battery can no longer be used efficiently in the vehicle. The closer the capacity is to 100 percent, on the other hand, the higher the residual value of the battery. The new Battery Quick Check service will be available on the German market from fall 2022. This will be the first market-ready service for business customers that will enable used traction batteries – the most expensive individual component in an electric vehicle – to be evaluated independently and regardless of manufacturer.

Current as of March 2022