Background Information

Battery Quick Check: Reliable Evaluation of Traction Batteries

Traction batteries of electric vehicles nowadays mostly consist of lithium-based accumulators such as lithium-ion batteries. Such lithium-ion batteries age: their usable capacity deteriorates over the years. Experts distinguish the aging process between calendrical and cyclical aging.

Calendar aging of batteries

In calendrical aging, various factors such as temperature and state of charge influence the aging process. For example, the "feel-good temperature" of a lithium cell is around 20 degrees Celsius. If the cell is stored permanently at 30 degrees Celsius, for example, it ages about twice as fast as at 20 degrees Celsius. The state of charge also has an influence on calendrical aging. The ideal state of charge to store a lithium battery is around 50 percent of the maximum capacity. Both permanent storage in the maximum state of charge and storage at 0 percent state of charge lead to a shortened service life.

Cyclic aging of batteries

The cyclical aging results from the driving and charging behaviour. A sporty, aggressive driving style with strong acceleration when starting off and rare regenerative braking leads to a higher load on the battery. Frequent fast charging also puts more strain on the battery. On the other hand, anticipatory route planning that already includes charging stops and the optimal type of charging is gentle for battery aging.

Lifetime forecasts are often inaccurate – residual value can hardly be evaluated precisely

Battery aging depends on individual usage behaviour. It is true that electric vehicles themselves provide information on battery status. However, practice shows that the "State of Health" indicated by the vehicle management system often deviates greatly from reality. Accordingly, forecasts about the further service life and performance of a traction battery on this basis are often inaccurate.

So far, this difficulty has usually had a negative impact on the residual value of used battery electric vehicles (BEVs). Since the actual condition of the battery

could not be validly documented, many vehicle evaluators used the worst possible condition of a battery as a basis for determining the residual value. This usually led to losses for the seller (for example, leasing companies in remarketing).

According to TÜV Rheinland and TWAICE, it is not possible to reliably determine how high the respective residual capacity actually is without manufacturer-independent diagnostics of the traction batteries of electric vehicles. A market survey in September 2020 showed that more than 90 percent of electric vehicle users require an independent battery assessment before deciding to buy a used electric vehicle.

Used car market for BEVs picks up speed significantly

The market for BEVs is developing very dynamically. According to the Federal Motor Transport Authority (KBA), the number of new registrations in Germany rose to around 471,000 BEVs in 2022, an increase of 32.2 percent compared to the previous year. The share of newly registered BEVs thus rose to 17.7 percent of the total volume in 2022 and continues to grow. The increasing demand is now also reflected in the used car market: According to the KBA, almost 70,000 transfers of ownership of used BEVs took place in Germany in 2022. This was around 47 percent more than in 2021. By way of comparison, the total number of passenger car conversions fell by a good 14 percent in 2022. Accordingly, a very significant revival of the market for used BEVs can be expected in the coming years.

New service as a market-driven solution

TÜV Rheinland and technology partner TWAICE use the on-board diagnostic system (OBD) with the vehicle's OBD-2 interface to diagnose the battery condition. Qualified workshop personnel or TÜV Rheinland experts read out all relevant data via the interface in around 90 minutes. 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 the battery analysis developed by TWAICE in the TWAICE Cloud.

For each battery type, a variety of battery models are stored in the TWAICE Cloud that represent the behaviour of the battery under different environmental conditions (for example, temperature or state of charge). These models were created with the help of measurements under defined framework conditions in the laboratory. The battery measurement data is sent from the vehicle to the TWAICE Cloud, where

intelligent algorithms estimate various battery parameters and compare the behaviour of the measured traction battery with the stored models. In this way, the aging state of the battery, also known as the State of Health, can be precisely determined.

The Battery Quick Check is an independent status report of the traction battery. Both the data collection process on the vehicle and the data evaluation process using the algorithms developed by TWAICE are certified. The central value of the status report is the battery capacity in percent. Here, the lower limit of 70 percent is a point of reference: if the capacity drops to this value, the vehicle battery can usually no longer be used sensibly. 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 launched on the German market on 31 August 2023. It is the first market-ready service for business customers with which used traction batteries - the most expensive single component in electric vehicles - can be evaluated independently and accurately across manufacturers.

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