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» The Last Mile – End-of-Line Test for Batteries

Quality assurance in industrial production processes is becoming more and more important. An increasing number of battery production lines, inter alia motivated by political goals, are also causing higher expenses in quality control processes. Therefore End-of-Line tests are essential.

German engineering still attracts worldwide attention. Since Carl Benz invented the first modern automobile in 1886, Germany has been known as a 'car nation'. However, technical progress in automotive sectors is not always a matter of expertise. The German government, for example, has the plan to put one million electric vehicles (PEV, PHEV) on the road by 2020, meanwhile Norway is regulating the exclusive use of emission-free cars by law from 2025 onwards.

Political decisions are, at least, affecting the industrial developments on a large scale. OEMs have to implement governmental goals by spending money, time and resources on research and development. This causes intensive competition through which the investment in production lines for battery cells, modules and high-voltage batteries increases.

Currently, the vast majority of cell production lines are located in China, Korea and Japan and held by four global players. This is likely to remain this way, except for high-voltage batteries. Investments in the local European market promote new battery factories in Poland, Hungary, Austria and Belgium, which eliminate transportation expenses and keep the production and testing know-how safe – all in all an ecologically and economically valuable decision for European OEMs.

It is all about quantity

Before starting a production process, many questions are asked. Which cell chemistry offers the best performance? How can risks be excluded? Even during the manufacturing process, the product research and development continue. Regardless of improvement, the production

rate is the most important feature for manufacturers. It is influenced by different parameters like the degree of automation or the fragmentation of production processes in the intermediate stages. For example, the production capacity of 50,000 batteries p.a. means one battery every ten minutes 24/7 a year. At first it seems it is no big deal but bearing in mind the ambitious goal of the German government by 2020, a much higher output is required.

In contrast, the incoming goods inspection of cells and modules only needs a few seconds, whereas the quality assurance is a rate-determining step in an End-of-Line (EOL) test station as it takes several minutes and acts as a kind of bottleneck.

The End-of-Line test can be divided into four general stages:

- Test cabin injection, label scanning and contacting of high-voltage and low-voltage cables
- Battery management system (BMS) communication and residual bus simulation via CAN
- High-voltage tests and performance tests
- Assessment of the delivery conditions and removal to the line

A leakage test of the cooling system or the shell is an additional stage and often carried out before the electrical tests.

You will find what you are looking for

Define consistent criteria and parameters by law

Despite an extensive quality control, incidents cannot be completely avoided. During the last few months, reports on burning battery-powered electric vehicles and devices have been published in the global press damaging the image of electric mobility or applications. Furthermore, the trust in risk assessments of safety precautions suffers and creates a negative picture. Unfortunately, the most dangerous potential lays in the smallest part of a high-voltage battery – the single cell within a module. Normally, the cell supplier is encouraged to test and assess the product quality before the cells leave the factory. Nevertheless, nobody is talking about burnt or failed conventional combustion vehicles (CEV), even if similar incidents occur. The general acceptance of CEVs is much higher and causes a major disadvantage for trendsetting technologies.

By the way, the EOL test as quality control is extensive. Besides the regular load on/load off cycle, the measurement of voltages or internal resistance of the battery, it is a much more complex process. Even the electric power test is just a small part of the comprehensive test procedure where a wide data exchange between the battery and the test station produces an extensive data flow. At least, failures do only occur if the test procedure detects them.

Maybe is no option

Inside a battery, a safety feature called battery management system (BMS) takes care of important information like voltage and current limit or state of charge (SOC). Furthermore, the BMS communicates with peripheral devices, regulates the engine power demand and operates precautionary in critical events like performance by crash. All these functions have to be checked by an EOL test station in order to fulfill safety regulations. Therefore, extensive knowledge is required to ensure seamless communication with the BMS via CAN interface and to perform a residual bus simulation. Especially the different protocols or codes, used by battery types and suppliers to run such tests, need comprehensive expertise to meet the challenge.

In addition, the handling of high-voltage energy storages requires special safety precautions for the battery and the worker as well (ISO 12100, ISO 13849). First, the insulation resistance is measured several times during the manufacturing process to avoid short circuits between modules and the shell. During the pulse power test, the battery is stressed with a maximum charge/discharge current pulse in order to check its functionality and to calculate the internal battery resistance. At least, all these tests just assess if the item passes or fails a certain process. The more important part is to define consistent criteria and parameters by law that have to be complied with by manufacturers. Maybe as result is no option for an End-of-Line test.

FuelCon's Evaluator EOL is designed to comply with all these criteria by exactly satisfying customers' needs. Accurate measurements, high reliability, effective standards and occupational safety are as mandatory as the integration of customized test procedures. «

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