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PRESS BASIC INFORMATION

High-voltage battery project house at the Ingolstadt/Gaimersheim site

Audi is pressing ahead with its electric mobility activities and is launching operation of its new high-voltage battery project house. Located in Gaimersheim, not far from the Ingolstadt plant, more than 100 specialists are working on energy storage devices for electric drives and are looking at all the key aspects – from development and manufacture through to testing the battery systems.

“The new project house is another major step toward electric mobility for our company,” says Michael Dick, Member of the Board of Management for Technical Development. “Here we are building up important development and manufacturing expertise for high-voltage batteries with a view to future model series. At the same time, we are ensuring that they meet Audi’s exacting quality requirements.” Alongside the production of prototypes, future small-series production is another conceivable option, says Dick.

Covering an area of over 3,500 square meters, the high-voltage battery project house is divided up into three main sections: the battery pilot plant facility, a test area, and an office wing with 84 workstations. Construction started two years ago, with occupants able to move into certain areas more than a year ago. The building is now complete.

More than 100 specialists collaborate closely and flexibly in the new project house. They come from various Audi development departments, from Production and the Pre-Series Center. Two doctoral students from the Institute for Power Electronics and Electrical Drives (ISEA) at the RWTH Aachen University supplement the team. Panasonic is an important external partner and is responsible for supplying the battery cells.

Jens Koetz, Head of Networking and Energy Systems, says: “The close cooperation between the specialist areas is a major strength of our approach. It gives rise to smart solutions.” No compromises – that is the maxim when it comes to integrating the large battery systems into the vehicle. Even with an electrically powered Audi, such as the R8 e-tron, the brand strengths such as progressive design or sporty handling are fully retained. To meet these objectives the experts in the individual technology disciplines maintain an ongoing dialog – focusing on the very last millimeter of installation space and the c_d figure right down to the second decimal place.

But Audi starts at an even earlier stage: beginning with the construction of the battery systems. The demands in this respect are enormous and, to a certain extent, conflicting. The battery system in an electric car must be light and compact, yet produce as much energy as possible. It needs to withstand thousands of charging cycles and clock up some 160,000 kilometers without performance being notably impaired over a period of around ten years. Irrespective of the outside temperature, it must always keep within the ideal temperature range – around 25 to 45 degrees Celsius. This calls for sophisticated cooling. And with all these factors, robustness and safety are the top priority.

In the high-voltage battery project house, Audi is working on a solution that fulfills all these tasks in a balanced way without neglecting any of them. “To meet these demands, we need expertise in all key aspects from within our own ranks,” says Ivo Muth, Head of Electrical Systems/Electronics Production: “Our aim is to be in a position to provide everything in-house that moves the vehicle. In the age of electric mobility, the focus of attention is on the high-voltage battery.”

In the battery pilot plant facility, around 70 batteries have been developed to date for the Audi A1 e-tron and the Audi R8 e-tron. At present, prototypes for vehicles such as the Audi A6 L e-tron concept, which the company recently unveiled at the Auto Show in Beijing, are being developed – partly by hand.

One piece of equipment in the battery pilot plant facility checks the prismatic flat cells. Another presses them together to create cell modules. These modules consist of a varying number of cells which are insulated from each other by means of separators.

The next stage, electrical contacting, involves interconnecting the individual cells in the cell modules. Optimized assembly processes produce outstanding contact resistance figures. At the same time, positive bonding techniques are being investigated. At the end of this process step the voltage exceeds the safe limit of 60 volts for the operator. Consequently all employees are suitably qualified to carry out this type of work. Their working area is also separated from the rest of the facility. Cell modules are assembled one on top of the other in several layers to produce the 48 kWh battery for the R8 e-tron. Finally, the employees attach diagnostic wires to the units.

The penultimate work step is final assembly. The housing – made out of carbon fiber-reinforced polymer – is fitted to the battery systems. Once initialized, each battery undergoes a rigorous test cycle on the test system at the end of line.

The test area is located next to the battery pilot plant facility. Here the developers test the batteries at various development stages – as cells, modules, and as complete units. Chambers of varying sizes are used as test benches, which are capable of producing temperatures in a range of –40 to +80 degrees Celsius. Certain chambers can also produce extreme humidity. The three largest test benches are housed in separate containers. With a volume of 6,000 liters they can also accommodate the powerful batteries in the Audi R8 e-tron. Their electrical equipment generates 1 megawatt.

The test-bench runs simulate subsequent operation in the vehicle. Some run over several hours; others over a few months. The components are charged and discharged with direct current, which is obtained from the building's mains supply via a rectifier. Measurement sensors record all the key data – such as temperature, capacity, internal resistance, voltage, and current – and send this data to the control room.

Other equipment supplements the test area. The shaker is a climate chamber in which modules weighing up to 50 kilograms are jolted and shaken. Special test benches are used to test the current transformers in the vehicle and the cooling system. Specialists finally prepare individual battery tests for analysis in the lab. These tests are conducted outside the project house using gas/ion chromatographs and scanning electron microscopes.