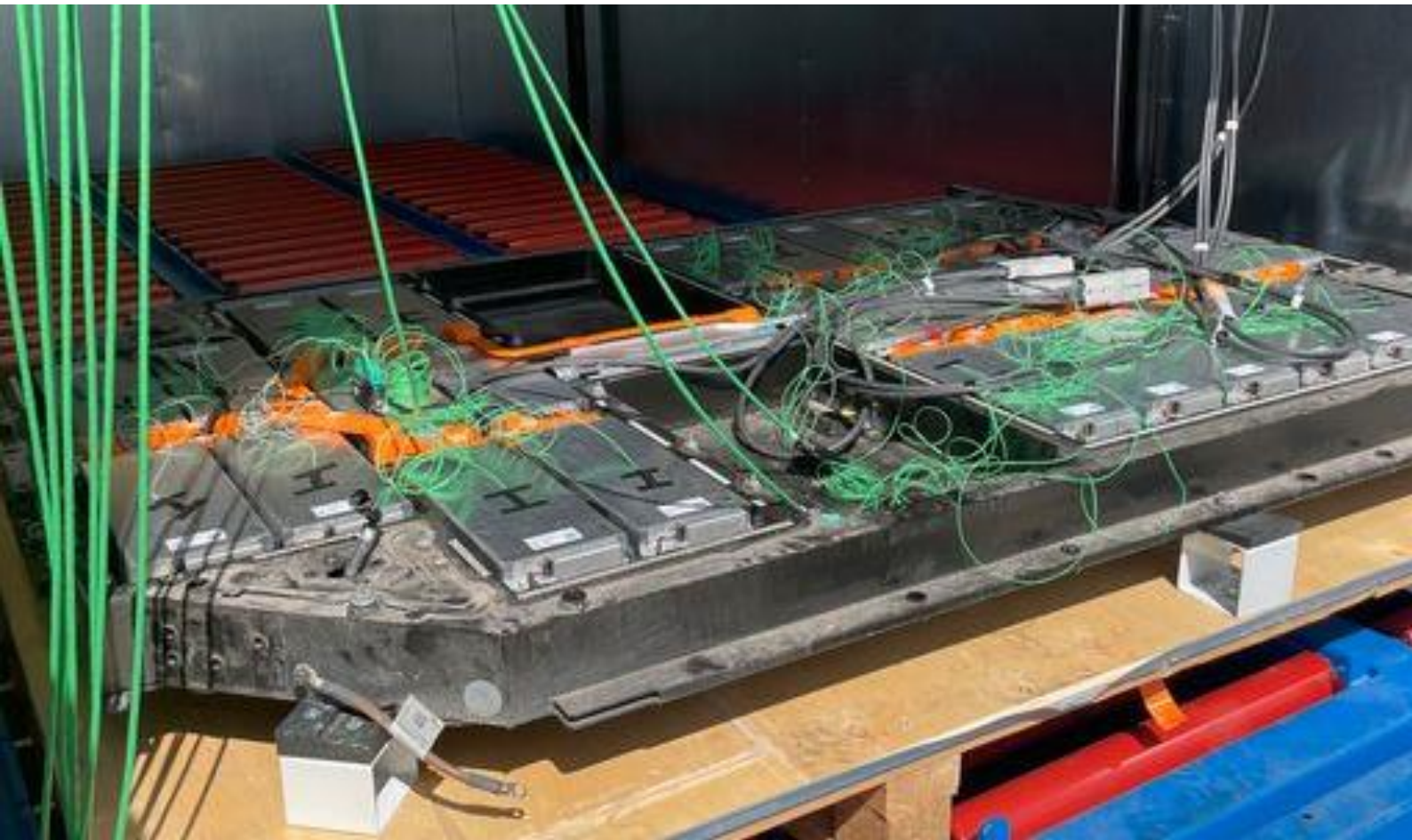


Donsö EV-Battery Reuse and Recycling System

A WireFlow Bifrost Battery Test & Measurement solution for Stena Recycling



The Challenge

The European Parliament is working on an update of the EU's battery directive to ensure that batteries can be repurposed, remanufactured, or recycled at the end of their life. At least 30 million zero-emission electric vehicles are forecast to be on EU roads by 2030 [2]. For electric vehicle batteries and energy storage, the EU will need up to 18 times more lithium and 5 times more cobalt by 2030 compared with the current supply to the whole EU economy [1]. Manufacturers will be required to include information with end-of-life batteries that minimize waste and contribute to the reuse or recycling of their material content. They must also provide information about how automotive batteries should be safely dismantled, transported, and recycled. In addition, they will be obliged to disclose the environmental and health impact of battery contents [3].

The proposed regulation strives to promote a circular economy and reduce environmental and social impacts throughout all stages of the battery lifecycle [1].

This will require new circular partnerships between battery manufacturers and recyclers. Recycling will need to increase, and more recycled materials will be required in the production of new batteries [3].

To meet these requirements and to be prepared for a market with high demands, Stena Recycling is investing in new battery centers and chose to equip them with the WireFlow Donsö system for EV-Battery Recycling.



Figure 1- Stena Recycling Battery Center in Farum Denmark

The Solution

The Donsö system is based on WireFlows Bifrost system for Reuse and Recycling of EV-batteries.

The Donsö system is designed to be versatile and can handle both battery packs as well as modules up to 10 channels simultaneously and independent from each other. The system is prepared to diagnose the health of EV-batteries and in the future determine which 2nd life application they are suitable for or if they need to be completely discharged to recycle the core minerals. When discharging batteries for recycling, we are using WireFlow TotalDischarge™ to ensure there is no energy left in the battery before being sent for recycling.



Figure 2 - A Porsche Taycan battery pack ready to be disassembled.

Flexible

The Donsö system is designed for the capability of running 10 channels simultaneously and independently from each other delivering 6kW per channel. It can handle both battery packs and modules making it a very flexible system. The system is sending energy back to the grid, making it environmentally friendly.

Donsö is prepared for using big data and statistical models when analyzing batteries where the outcome can be used for

- Battery characterization
- Battery state estimation
- Battery remaining life estimation

Scalable

Stena Recycling wanted a solution that could be installed and used in many different working environments. All Battery centers could be designed different, and the system needed to be designed to be scalable in terms of this. The Donsö system is equipped with Bifrost connection nodes that are located as close to the battery packs as possible to minimize cabling. Each Bifrost node is equipped with contactors, shunt, fuses and IOs to control the measurement and reach a high level of safety.



Figure 3 - I/O connection nodes

Safe

Each battery is connected using DC cabling and temperature sensors to the distributed Bifrost node controlled by the central cabinet and operator station. When the operator starts the diagnostic, a series of safety checks are performed. If any of the tests does not pass the criteria's the user is alerted and the process is halted



Figure 4 – Donsö central cabinet

- The system checks that the battery is connected correct and not polarity reversed.
- The contactors in the Bifrost node are activated to connect the battery to the power electronics in the central cabinet.
- The system measures the voltage of the battery and checks that the level is in the expected range.
- The temperature sensors are checked to see that they report valid values.



Figure 4 - One single point of control for all channels at the operator station

During the discharge the system will continuously monitor and log:

- Temperature of the individual sensors
- Temperature diff between the different sensors
- Voltage
- Current
- Power
- Aggregated Power

Since safety is a high priority, the system will stop the discharge if the temperature exceeds the limit, if the delta between the sensors is too high or if the temperature rises more than allowed during a specified time.

Automated and traceable

Stena Recycling sets high priority on automating their processes and Donsö is therefore integrated into their production system making it a seamless part of the entire battery handling process. All tests can be initiated from adjacent systems and the results will be stored into a central database used for traceability and analysis.

To fulfil the battery directive, traceability is of big importance. Everything in the process is logged and saved so they can trace each battery and all the recycled parts.

By using Donsö, Stena Recycling does not only have the capability of discharge EV-batteries for recycling, but they are also ensured they can fulfil the demands given by the EU battery directive.

References

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