

Danfoss Editron converter being used on first hydrogen-powered train to run on the UK's mainline

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Mainline testing has begun for HydroFLEX, the first hydrogen-powered train to run on the UK's mainline. Danfoss Editron has supplied a converter, which is connected to the train's fuel cell provided by Ballard Power Systems.

The HydroFLEX project is a crucial milestone in the development of a zero-carbon emission propulsion system that could help to decarbonize the UK's rail industry. The UK government plans to remove diesel-powered trains from the country's rail network by 2040.

Developed by leading UK rolling stock owner Porterbrook and the University of Birmingham's Centre for Railway Research and Education, HydroFLEX features a hydrogen powerpack retrofitted onto a Class 319 train, transforming it into a Class 799, the first hydrogen powered train on Britain's railway. This approach will enable the train to run on conventional electrified routes as well as independently under hydrogen power, allowing it to operate on non-electrified parts of the UK's rail network.

HydroFLEX can store up to 20kg of hydrogen in four fuel tanks, which is lowered in pressure by a regulator before being combined with oxygen to create 100kW of electricity via Ballard Power Systems' FCveloCity-HD fuel cell module. The train also features two lithium-ion battery packs to store the electrical energy generated, an electrical traction control system and electric motors.

Ballard Power Systems has connected a Danfoss Editron DC/DC converter to its fuel cell module, enabling it to charge the train's batteries. The converter, which is extremely compact and weighs only 15kg, is robustly designed for operation in highly cyclical loads and is capable of withstanding high levels of mechanical vibrations and shocks. A Danfoss Editron choke pack is also included in the HydroFLEX system, which enables the DC/DC converter and inductor unit to be flexibly positioned and allows energy to be transferred between two different voltage levels.

Jesper Moos, Danfoss Editron's Lead Engineer for the HydroFLEX project, said: "It's fantastic to be involved in the development and testing of the UK's first hydrogen train, which we hope will be the first clean energy passenger train operating on the UK's rail network. Our converter has been specifically designed to withstand high levels of mechanical vibrations and shocks, as well as to manage the highly cyclical loads found in heavy-duty machines such as trains."

Jesper Thomsen, President and CEO of Ballard Power Systems Europe A/S, commented: "Danfoss Editron's DC/DC converter was the best fit for our technical requirements currently available on the market, while its low cost and short lead time for production also proved very beneficial. The HydroFLEX project, along with our work on fuel cell rail programmes in Germany and China, shows that momentum is rapidly building in the development and deployment of heavy-duty motive fuel cell solutions for both intercity trains and trams."

Mary Grant, CEO of Porterbrook, added: "Porterbrook is committed to innovation and the delivery of a carbon neutral and sustainable railway. The mainline testing of HydroFLEX achieves another important milestone on this journey. I'm also delighted to be able to announce our intention to start producing HydroFLEX trains, creating the world's first electric and hydrogen powered bi-mode rolling stock, as well as generating significant opportunities for the UK supply chain."

Photo credit: HydroFLEX, the University of Birmingham and Porterbrook

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