

# POWERFUL AND COMPACT

An innovative solution for GIS testing



“Borkum Riffgrund 2” – an offshore wind turbine located 57 km | 35,4 mi north-west of the German coast, is set to receive two specially developed pieces of gas-insulated switchgear (GIS). OMICRON has worked in close collaboration with Siemens AG Berlin – manufacturers of switchgear and voltage transformers – in order to develop the perfect solution for this challenging project.

## Challenges lead to new solutions

“A powerful and compact system was essential to this project – in fact, that’s what made it possible in the first place,” René Müller tells us in our interview about testing gas-insulated switchgear.

René Müller from Siemens was responsible for testing the GIS system on-site in the port of Rotterdam.

His job was to make sure that the high-voltage tests being done in collaboration with OMICRON were running smoothly.

The two GIS, which were specially developed by Siemens, were transported from Berlin to the wind farm operator in Rotterdam for final inspection. We were actually able to solve a space problem inside of an ▶

offshore wind turbine thanks to a test transformer (Power VT) that was integrated in the GIS system.

#### **On-site testing in difficult locations**

"The greatest challenges in this project in particular were of course the structural conditions," explains René Müller. In this case, it was not possible to use a conventional procedure with an external testing transformer. The lack of space and limited lifting equipment called for a tailor-made solution. The corresponding power unit (Power VT), combined with the OMICRON's CPC 100 and CPC Sync, made it possible to carry out the required tests without the need for structural changes.

#### **Integrated power VT**

When it comes to high-voltage testing, the voltage transformer is operated in reverse. Voltage is supplied to the secondary side (low-voltage side) in order to generate the required test voltage on the primary side. Therefore, the transformer must be able to transmit the energy required to generate the test voltage at the capacitive load – the GIS. In addition, due to the saturation

behavior of the transformer, an increased test frequency (approx. double the nominal frequency) must be selected.

Therefore, it is necessary to use specially adapted voltage transformers for this type of test. In addition to heightening the winding cross-section and altering the winding structure, finding suitable connection options for the high-test currents is also essential. This modification guarantees that the measurement accuracy and long-term stability of the voltage transformer is not affected by the high currents.

Therefore, the new method allows tests to be carried out quickly with fewer personnel. The testing system for the voltage withstand test is connected directly to the voltage transformer that is integrated in the GIS system, which eliminates the need for venting and refilling it with SF6 gas. As the voltage transformer is integrated into the system, it is also easy to repeat tests for maintenance purposes. The specially designed VT (Power VT), which is already integrated in the GIS in the factory, eliminates the need for complex

crane work that would otherwise be necessary for an external testing transformer.

#### **IEC 62271-203-compliant testing**

"Once a system has been commissioned, the final test – dielectric testing of the system – is carried out. The Power VT is used for this high-voltage test," explains René Müller.

With this Power VT, the induced voltage was applied to the primary conductor of this GIS system and the test voltage conformed to the rated voltage of the switchgear. The rated voltage was 170 kV. The test was carried out in line with the relevant IEC 62271-203 standard with a voltage of 270 kV. The 270 kV was applied between a conductor and the system enclosure. The test cycle was specified by the GIS manufacturer. Every GIS manufacturer has its own test cycle for conditioning its systems.

In this system with Power VT, conditioning was carried out in several stages. The first stage took five minutes, followed by a three-minute stage and finally by a one-minute stage. In order to pass the test, there must not be a voltage



«The flexible CPC Sync testing system is a **huge advantage** for testing gas-insulated switchgears.»

**René Müller,**  
Project Manager, Siemens AG

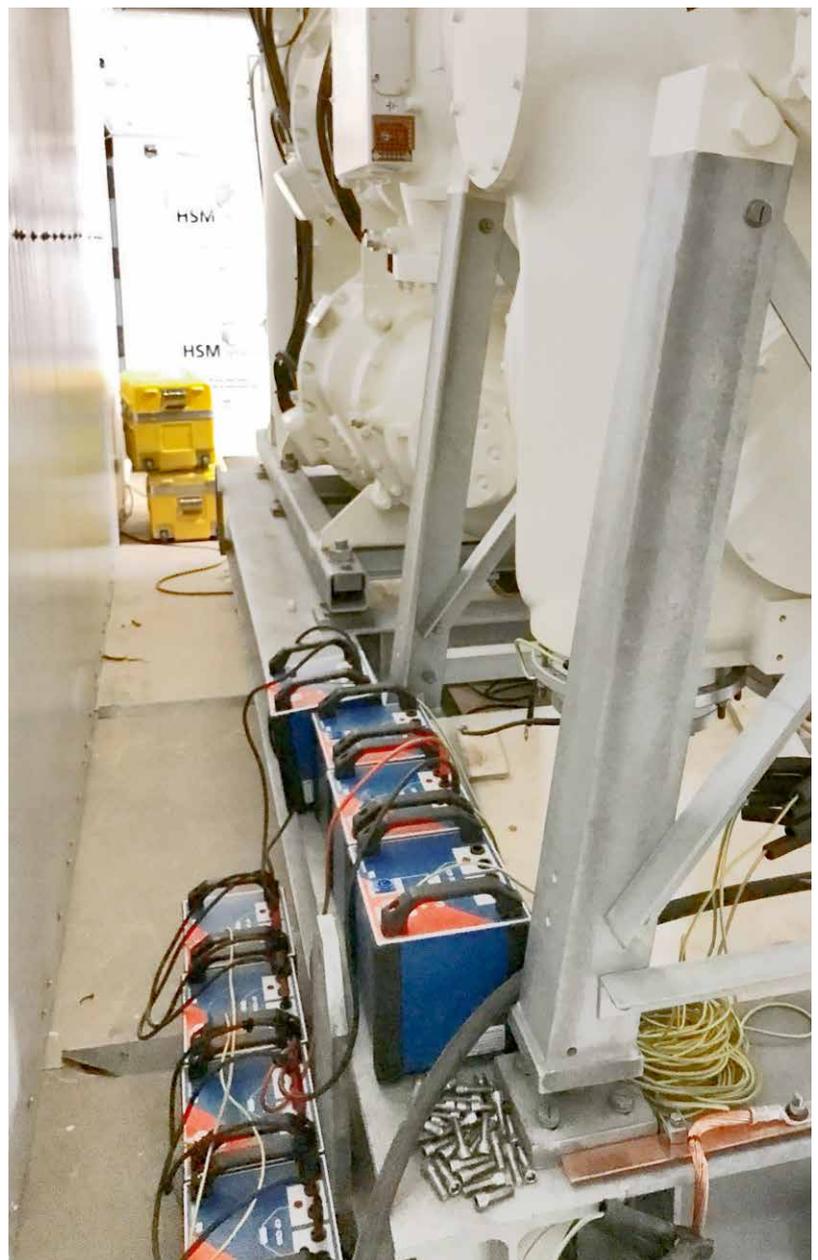
dip and the measurement equipment cannot shutdown.

#### **A flexible and modular testing system**

“The flexible CPC Sync testing system was a huge benefit to this project,” says René Müller. “Essentially, the CPC Sync is a kind of modular system which can be assembled like a set of Legos.” This made the entire setup ideal for on-site testing in demanding locations which are either difficult to access or have limited space – like offshore wind turbines. “Another advantage is that extending the CPC Sync system is cost-effective.”

In certain cases, the power required to generate the test voltage cannot be provided by a single CPC 100. By using the CPC Sync function, up to two additional CPC 100/80s can be added for support and the output power can be increased to up to 15 kVA.

In the case of the GIS system in Rotterdam, a test voltage of up to 270 kV was achieved with the CPC Sync plus two CPC 100/80s with a switchgear capacity of 1,400 pF. Therefore, it was possible to conduct a standard-compliant test at a 170 kV voltage level and the high-voltage tests on the GIS system could also be carried out successfully on site. ■



The CPC Sync system is ideal for field tests in confined spaces.