

ON-SITE TESTING FOR WIND-POWER TRANSFORMERS

Text: Stefan Bergmann | Photos: Dr. Uwe Kaltenborn, Holger Schütze

In recent years, the wind energy capacity has grown enormously. Already more than 198 TW were installed in 2014, by the end of 2017 this number rose to almost 540 TW. As in other countries, wind power in Germany is a key factor in energy production, forming the second largest part of generated energy[1].

Wind turbines are designed for 20 years of operation, and set up in remote and often hard-to-reach areas, where they run unattended. The equipment is subject to a high level of risk, as it is impossible to react quickly in case of a failure. Regular tests reduce the risk of a system breakdown and ensure that it runs safely during its service life. These tests take place every 2 to 4 years.

The transformer is a critical part of a wind turbine. It is installed out of the tower or inside the nacelle. In the nacelle, the transformer has to withstand harsh ambient conditions. It is exposed to frequent load changes and a high number of switching cycles, as well as mechanical vibrations over long periods and an increased risk of lightning strikes. This places extreme stress on the insulation of the transformer winding, and increases the risk of mechanical damage. It is rather impossible to fix a broken transformer winding on-site; the transformer usually needs to be replaced.

On site, wind-power transformers are inspected visually, and a defect in the insulation is visible only at the outer edge of the winding, usually only at an advanced stage. Regular partial discharge (PD) mea-

surements have thus become a recognized way to detect and evaluate possible damage to the insulation. Without these, it would be impossible to plan repairs in a workable means.

PD-measurements need a standardized test voltage generated by special voltage sources. Suitable sources provide the required output and are easily integrated into the on-site maintenance plan. Being compact enough to fit into the small nacelle, it is also crucial to be transportable by local means of transport and to be simple to set up and to operate.

For the specific demands of a wind turbine, HIGHVOLT's new WV 18-18/1.4 forms a powerful source for induced voltage tests on transformers up to 10 MVA. The source is combined with conventional PD-measuring systems, so that PD can be detected. All components fit into compact boxes and are lifted through the maintenance hatch into the nacelle.

It takes an hour to set up the devices and carry out the tests with a minimal effect on the maintenance schedule. The WV 18-18/1.4 achieves a PD level of up to 10 pC and can be used on both wind power- and distribution transformers.

The discussion about the continued operation of existing wind turbines is increasing and regular PD measurements will become even more important in the future. The WV 18-18/1.4 can be used especially in the nacelle and enables reliable on-site diagnostics on the transformer during the regular tests of the wind turbine.



[1] German Wind Energy Association (www.wind-energie.de)