FitTherm

Thermal load profiles and test standards for fittings of high-temperature conductors

The increasing demand for electrical energy and the increasing integration of renewable energies such as wind energy and photovoltaic systems is leading to an increasing load in the German transmission and distribution grid. Network analyses within the Electricity Network Development Plan show that 5,000 km of overhead lines will have to be upgraded in the coming years. The upgrade procedure is based on the so-called NOVA-principle (grid optimization before reinforcement before expansion). The use of High Temperature Low Sag Conductors (HTLS), which can increase thermal transmission performance through the use of innovative materials, is an efficient way of reinforcing the network. This is made possible by a higher continuous operating temperature of over 200 °C compared to conventional conductors. The low thermal elongation causes HTLS not to exceed the sag of conventional aluminium-steel conductors at 80 °C (maximum operating temperature). These properties allow the current carrying capacity to be doubled for the same cross-section compared to standard conductors. This makes HTLS an option for upgrading existing power lines without the need to adjust the mast heights. In particular, this technology can be used to reinforce highly utilised overhead lines with volatile load profiles.

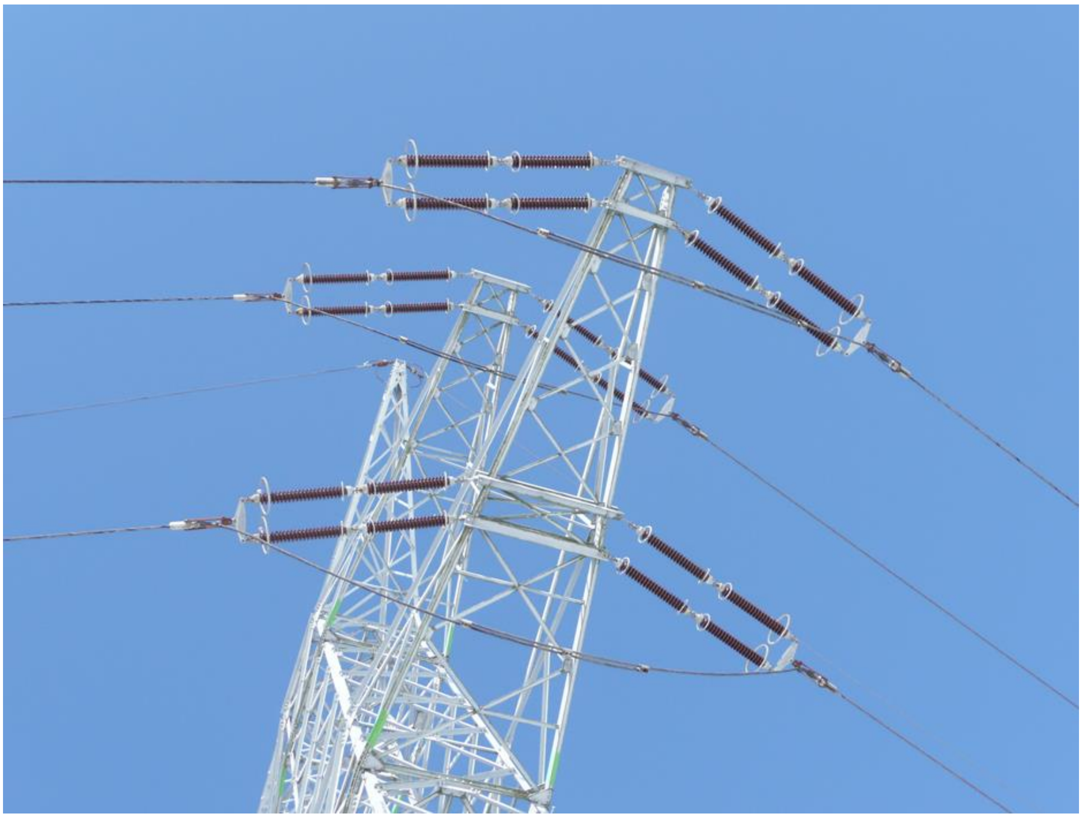

Figure 1: Tensioning pole with wedge type tension clamps on the insulator chains for fixing the conductors

Problem definition and solution approach

The high continuous operating temperatures of the HTLS require high demands on the long-term stability of fittings used for tensioning, carrying and connecting the conductors. Inadmissibly high temperatures lead to loss of material strength and thus to a shortening of the service life. However, the real thermal load of the fittings due to weather conditions and electricity is unknown to a large extent. Therefore, the thermal stress of fittings is evaluated in the BMWi supported project FitTherm. A new approach is taken to determine the real thermal stress of the fittings with the help of statistical analyses of flowing current (e.g. power flow calculations from IFHT and real measurement data of grid operators) and weather data.

Thermal modelling of fittings for high temperature conductors

Thermal modelling of the fittings on the basis of the determined current and weather load should provide information on the thermal behaviour of fittings under these load situations and helps to identify hotspots of the fittings. The developed thermal model is verified in laboratory tests. In the overhead line laboratory of the IFHT it is possible to simulate electrical, mechanical and weather-related loads on the fittings and thus evaluate the models. For example, wind speeds of up to 12 m/s and horizontal tensile forces of up to 50 kN can be adjusted.

Definition of test procedures

With these thermal investigations, requirements for testing the thermal long-term performances of fittings are supposed to be derived. The developed tests will be conducted on prototyped fittings to assess their long-term stability. The prototype will also be designed during this project. Finally, the results will be used to create guidelines for fittings for HTLS. The results will also be presented in international committees (IEC; FNN, Cigré) during the project.

Project information

Partners

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- RWTH Aachen University

Facts

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