

Challenges and feedback on Temporary Overvoltage (TOV) tests from CIGRE TB 852 (853)

HV laboratory test set-up for reproducing TOV wave shapes – challenges and feedback

Generation of Temporary Overvoltage (TOV) wave shapes, as introduced in CIGRE TB 852 (853) have been restricted by laboratory equipment constraints. Today it can be said, that reproduction of TOV wave shapes in a HV laboratory environment on a level of 525 kV is possible, but complex and comes still with open questions and uncertainties. There is today still a lack of expertise in practical implementation, a lack of experience and robustness in test execution and laboratory set-up, as well as there are open questions in reproducibility, measurability, potential secondary effects, etc. So far only very few labs in the world have been able to produce such wave shapes.

TOV recommendations in CIGRE TB 852 (853): implementation, challenges, open questions

In CIGRE TB 852 (853) – Special temporary overvoltage test have been introduced to raise awareness and give a clearance of potential risks as a special study “intended for development purpose”. It is studied as an “exception” and “shall not be considered as design parameters”. There are actually no indication for today's cable systems that the introduced pulse shapes pose a risk.

In CIGRE TB 852 (853) it is stated the TOV test is to “address project specific issues or [is] for engineering information”. This statement is however erroneous and somewhat contradictory in its potential interpretation. It implies the risk that every commercial project considers the TOV being a project specific issue, which needs to be considered a special case and an exception in project qualification. In fact, the TOV appears as a general phenomenon in DC pole-to-ground faults, as a “very slow front temporary overvoltage” on the healthy pole, and a “zero crossing damped temporary overvoltage” on the faulty pole. It has its strongest dependency on the HVDC system layout, rather than project specific parameters. However, general system layout dependence points rather towards a universal technology-based clarification rather than project specific testing. This discrepancy requires further discussion in the insulated cable community in order to avoid unnecessary excessive special test requirements in different commercial projects of the same technology type.

In CIGRE TB 852 (853) the very slow front temporary overvoltage has been introduced with a “limitation on laboratory equipment type” at the time of publication. Those restrictions seem to not be valid any longer. The opportunity should be taken to re-characterize the pulse shape description to the core character of the pulse shape, namely the plateau time and an initial

voltage peak respectively an initial voltage overshoot. Further discussion around characterization of TOV shapes should be taken in the insulated cables community.

In CIGRE TB 852 (853) a chopped TOV has been introduced as some types of (protective) converter operation. There is potential inherent risk to chop a TOV during its plateau time resulting in a damped oscillatory behavior with peak amplitude of both polarities far above 1 p.u. Therefore, certain restrictions need to be discussed in chopping very slow front temporary overvoltages. It is also questioned, whether the right descriptive parameters are used in suggested test curve to the chopped TOV, by neglecting the first oscillation peaks after chopping. Further discussion around the chopped TOV should be take in the insulated cables community.

The introduction of TOV in CIGRE TB 852 (853) has been relevant and appropriate. It was implemented with a lot of technical skills and finesse given the experience and available information around the topic, specifically the laboratory equipment challenges. Today more knowledge and experience have been gained around the topic making further discussions relevant. It is suggested to take those discussions in the insulated cable community and finalize them in running a B1(/B4) Task Force with the target to amend CIGRE TB 852 (853) by the latest knowledge and experience around the topic.