

Steep impulse voltage tests on high-voltage equipment

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Abstract

The steep impulse voltage is a special type of high-voltage impulses that are used in testing the integrity of electrical insulation of high-voltage equipment such as high-voltage insulators and stator windings in high-voltage rotating machines. Testing with the steep impulse voltage is usually carried out for the purposes of design verification and quality control of manufactured products in accordance with relevant international standards [1, 2, 3].

Typical peak voltages of the steep impulses range from a few kilovolt to hundreds of kilovolt with a typical rate of rise of the impulse front of 1 ns/kV. The steep front of this type of impulse presents challenges in both their generation and measurement. The paper discusses the measurement systems recently developed at the National Measurement Institute Australia for testing with steep impulses and examples of testing high-voltage equipment. In particular, the paper discusses the techniques and procedures for evaluating the performance of the high-voltage dividers (Figures 1 and 2) used in measuring the steep impulses. The test arrangements, including the generation of the impulses, test procedures used in testing stator windings of a high-voltage motor and high-voltage composite insulators are also presented.

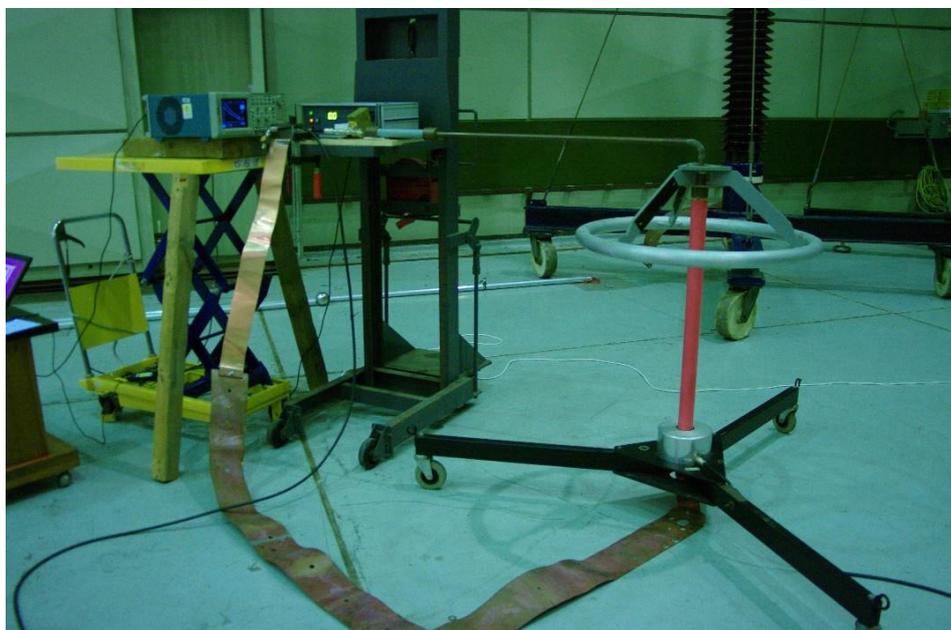


Figure 1 The 350 kV voltage divider for measuring steep impulse voltages



Figure 2 The 2800 kV voltage divider for measuring steep impulse voltages

The paper shows that, while the traditional Marx generators may be configured to generate the steep impulses specified in relevant international standards, it is essential to evaluate the dynamic performance of the measuring systems to ensure the measurement accuracy. The paper concludes that the National Measurement Institute Australia has successfully established the measurement system that can be used in steep impulse testing of high-voltage equipment and for the calibration of other steep impulse measurement systems.

References

- [1] IEC 61211, Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000 V – Impulse puncture testing in air
- [2] IEC 62217, Polymer HV insulators for indoor and outdoor used – General definitions, test methods and acceptance criteria.
- [3] IEC 60034-15, Rotating electrical machines – Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines.