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SC D1 – Material and emerging test techniques
PS 1 – Testing, monitoring and diagnostics
Q 1.03 – What special requirements apply to the use of gas-insulated voltage dividers and what frequency range must basically be mapped? In general, the tests for different components of HVDC power transmission seem to differ significantly. Should the test procedures be standardized? The papers also point out the possibility of using these new components for diagnostic and monitoring purposes. What are the possibilities in this area and are there already practical experiences or examples?

Requirements on design and testing of RC voltage dividers for application in HVDC GIS

Within the last ten years, the worldwide development activities on DC GIS have been comprehensively increased knowledge and experience on design requirements, dimensioning principles, and short- and long-term performance. Standardization work has been prepared by CIGRE JWG D1/B3.57 “Dielectric testing of gas-insulated HVDC systems” in TB 842, emphasizing that additional electric and thermo-electric tests must be performed to consider the special aspect of DC voltage in terms of electric field distribution of insulators, influenced by the accumulation of electrical charge carriers and the operation-related inhomogeneous temperature distribution. Hence, especially impulse voltage testing superimposed to DC voltages after long DC pre-stress (reaching DC steady-state) with maximum temperature gradient is of high importance.

Composite voltage testing, as the superposition of DC and impulse voltages discussed in this paper, is currently not defined or described in the relevant standards of low-power instrument transformers. This situation leads to fundamental research activities to investigate the impact of composite voltage testing on RC dividers and their insulation system. Simultaneously, the results and experience gained, can be used for adapting upcoming revisions of the international standard for instrument transformers.

Dimensioning gas-insulated RC dividers for application within DC GIS according to IEC 61869-15, will result in an insufficient design for the expected dielectric requirements during operation. Considering composite voltages according to superimposed impulse voltage test and DC insulation system test as described by CIGRE JWG D1/B3.57, has a significant impact on electrical and mechanical design principles of RC dividers.

The performance of the developed and presented RC divider design has been proven by accuracy measurements, frequency response and composite voltage testing aiming to establish a high precision divider with a bandwidth of up to some ten kHz. Although accuracy in amplitude and waveshape is limited, the RC divider can be used to even measure superimposed lightning impulse voltage. All requirements for the application of the gas-insulated RC divider as part of a DC GIS in HVDC systems have been achieved.