

### COMPOSITE DC AC VOLTAGES

Growing interest in parallel routing of AC and DC circuits on the same towers of what are referred to as ‘hybrid overhead lines’ could cause both AC and DC voltage components (known as composite voltages) to appear on line insulators. Up to now, knowledge about insulator performance under such composite voltage stress is still relatively limited, as reported in CIGRE paper D1-112 during 2016 General Session.

The problem becomes more complex still in the case of converter transformer bushings.

The steady state voltage at bushings and on post insulators as well as other connected apparatus results as a combination of DC and different harmonics (as shown by the examples in Figure 1).

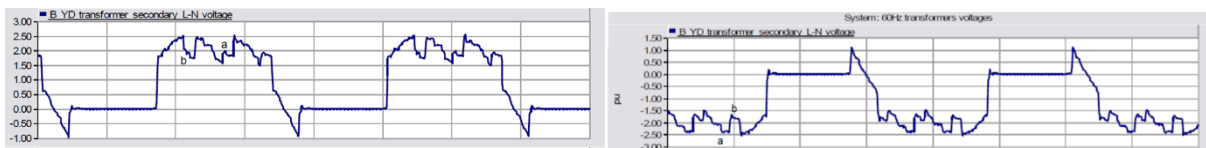


Fig. 1 Examples of the steady state voltages on the converter transformer bushings.

Since the insulator pollution performance is very different under AC and DC it is very important to define the equivalent voltage stress to be taken as the basis for design.

Results of tests on short composite insulator samples by applying different proportions of AC and DC voltages have indicated that the flashover voltage under the mixed voltage (AC+DC) is higher than the value expected under pure AC across a wide range of DC/AC values /see Figure 2) [1]. Thus, the conclusion of the paper was that the insulator performance could be adequately verified by AC tests only in a wide range of AC/DC voltages.

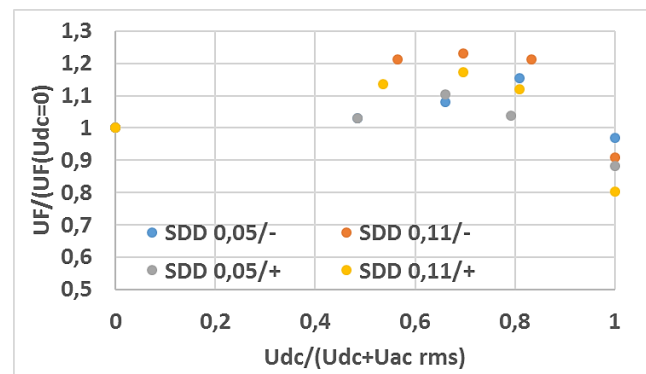


Figure 2 – Pollution tests on a small composite insulator sample (10 cm length) with SDD=0,05 and 0,11 mg/cm<sup>2</sup> with positive and negative polarity

However, since the available results are very limited and the limited information is relative to short insulators and to a specific test circuit, additional investigation on larger and more representative samples and with more representative stress conditions is recommended to verify the above assumption.

[1] A. Wagner, J. Knauel, R. Puffer, J.M. Seifert, M. Brückner, B. Rusek, S. Steevens, K. Kleinekorte “Performance of Polymeric Insulators In Hybrid AC/DC Overhead Lines under Polluted Conditions” CIGRE 2016 paper D1-112

