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An investigation into the effects of floating objects on the electrical breakdown of air insulation under steady state high voltage direct current conditions

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Abstract

In South Africa, live work is routinely performed on high voltage apparatus at various voltages up to 400 kV ac. With regard to HVDC, there are unqualified parameters relating to the development of the safe live work standards, which are currently based on extrapolation of ac and transient voltage test data. Furthermore, it is generally accepted that the mechanism for air breakdown under dc is different when compared between ac and dc voltage.

The air breakdown mechanism under HVDC conditions and the corresponding live work related parameters need to be researched further before live work may be performed. Experimentation using floating objects, has in the past, been used to study parameters related to live working calculations.

This research report presents the results of HVDC air breakdown tests using a 300 mm diameter floating metallic sphere with a 30 mm protrusion, in a point-to-plane configuration with a total gap length ranging between 0.75 m and 1.4 m. Both positive and negative polarity cases were tested. The results indicated that the position of the floating sphere does not significantly affect the flashover-voltage magnitude. There is, however, a definite reduction in the strength of the air gap, between 27 % and 29 %, for the cases tested. Further, the static charge on the floating object did not influence the breakdown voltage. There is also linearity in the air breakdown voltages of simple point-to-plane air gaps. Humidity and temperature also contribute to variations in the breakdown voltage.

Two international publications have been published based on the research presented in this report. These are listed in Appendix D and E, respectively.