Space charge evolution in composite XLPE HVDC cable insulation during VSC pre-qualification programme

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Typical HVDC projects have a cost that ranges from hundreds to thousands of million GBP. These projects include HVDC generators, cables cost of large portion, and substations. Ensuring that the cable performance, cost of large portion, is maintained over the lifetime of service (40 years) is critical to successful schemes. In the case of land buried cables eXtruded cross Linked PolyEthylene (XLPE) cables can be the preferred type due to their operating temperature of 90°C, as compared to 55°C for the traditional Mass-Impregnated cables (MI). However extruded HVDC power cables are prone to localised electrical charge accumulation that can lead to premature failure. Many of the problems associated with HVDC electrical insulation are associated with the build-up of electrical charge. Such charge accumulation leads to significant distortion of electric field; so that much higher than average electric fields occur in, or on, certain parts of the insulating structures. This can lead to premature ageing or even electrical breakdown and compromise the reliability of a HVDC link. The focus of this paper is to present the results from Alstom Grid's Cable Ageing facility of on-line and simultaneous space-charge monitoring technique that continuously assess the health of composite cable's insulation during Cigre TB 496 VSC prequalification programme [1]. The Cigre VSC prequalification programme is a 360 days at $\pm 1.45U_o$ that it is equivalent of 40 years of service life at three different thermal loading phases. These are Load Cycle (LC), High Load (HL) and Zero Load (ZL). A 200 kV cable with HVDC composite XLPE insulation is subject to a VSC ageing programme according to CIGRE TB 496. On the cable loop an on-line Pulse-Electro-Acoustic (PEA) [2] space charge probe is installed that is capable of monitoring the space charge evolution throughout the length of the ageing programme. The space charge evolution during the first two Load Cycles is presented and discussed.

References

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