Space charge Evolution in XLPE HVDC cable with Thermal-Step-Method and Pulse-Electro-Acoustic

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2020 is the target date of the EU commission to reduce by 20% the carbon emission as well as having 20% of electricity supply using renewable energy. 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 70°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 could 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 two complementary, state-of-the-art, on-line and simultaneous space-charge monitoring techniques that continuously assess the health of the cable's insulation during CIGRE TB 496 VSC prequalification programme [1]. The VSC prequalification programme is a 360 days at ±1.45 U_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 grade XLPE insulation is subject to a VSC ageing programme according to CIGRE TB 496. On the same cable loop two on-line space charge probes are installed that are capable of monitoring the space charge evolution throughout the length of the ageing programme. One of the probes is the Thermal-Step-Method (TSM) [2] and the other probe is the Pulse-Electro-Acoustic (PEA) technique [3]. The space charge evolution during the first two Load Cycles is presented and discussed.

References

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