Development of an industrial space charge measurement facility for extruded HVDC full scale cables

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When operating, extruded HVDC cables are submitted to various stresses such as voltage ripples from the converters, temperature gradients, polarity reversals and impulses. Overtime, these stresses will trigger space charges accumulations and/or dynamics in the cable dielectric, which will in turn induce electric field distortions. Such electric field distortions within the insulation can accelerate the ageing of the cable system and lead to premature failures.

Space charge measurement methods have been developed and extensively used to study laboratory samples like plates and miniature cables. While the information gathered from laboratory samples help to increase the understanding of the intrinsic behavior of the dielectrics, they do not allow to completely take into consideration synergic effects such as electric fields, by-product, temperature gradients and semi-conductor/dielectric interface on the space charge evolution within the insulation of the cable systems.

In order to seek for the synergic effects on the electric field distortions in the cable insulation, an industrial facility aiming at measuring space charge distributions in extruded HVDC full scale cables by using the thermal step method (see Figure 1 below) has been developed at Nexans High Voltage Competence Center of Calais. In the proposed communication, after a description of the facility, the authors will show, together with a calibration result, some space charge results on an extruded HVDC full scale cable under different poling conditions by varying temperature and applied electric fields.

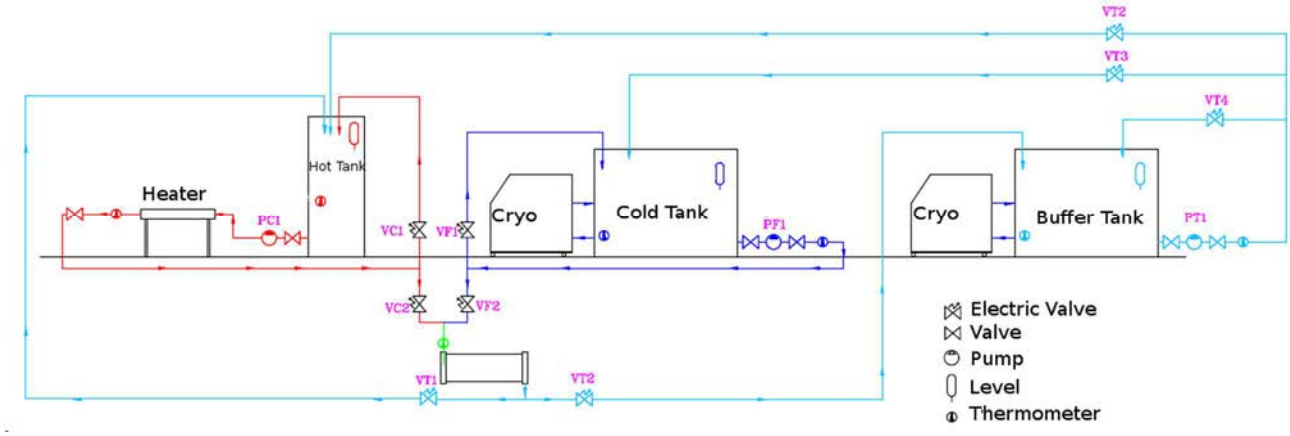

Figure 1: Block diagram of the thermal step method bench adapted to full size cables