Abstract:
The development of carefully designed extruded HVDC cables able to meet more than 30 years service operation requires to foresee a lot of aspects, including the long term behaviour of the insulating system. To meet such an objective, manufacturers must set up experiments in order to assess endurance features of the selected systems.

This paper relates a set of tests performed on extruded cable systems (cable and accessories) for DC application, taking aim for conventional HVDC (LCC, line commutated converter) or voltage source converter (VSC) configurations. Attention was paid to withstand and type tests performed according to the latest CIGRE recommendations as well as to evaluation of total electric field distribution directly performed on energised and loaded HVDC trial cables.

All these tests, together with the insulating system characteristics, partly displayed in another paper of this conference, clearly show a strong influence of the insulating system on the cable performances and give directions toward a reliable cable system design depending upon requirements on type of converter.

Keywords: Extruded HVDC cables – cable testing – Space charge – Thermal Step Method on power cables – VSC – LCC.

1. Introduction
The design of HVDC extruded cables is a challenge. The field and space charge distributions over the insulation thickness somehow control the cable behaviour and its life expectancy. These features have never been measured up to now and the cable designer can only rely on models and calculations.

The calculation of the field and space charge distribution in the steady state is a classical problem that has been treated in many publications [1-8]. On the other hand, the transient state has been scarcely considered, see Law [1], McAllister et al [3]. Recently, Aladenize et al. [9] extended the pioneering work of Law to the case of a conductivity that depends upon both temperature and field through a Poole-Frenkel mechanism. This necessary approach needs to be completed and validated with measurement and evaluation of distribution of total electric field in the insulation thickness, thus to assess behaviour of the cable under different testing conditions, notably under expected working ones.