Qualification of a 220 kV transition joint to connect MI pipe-type cable with extruded single-core cables

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ABSTRACT

This paper introduces a new 220 kV dry transition joint design that was developed to meet the demand of the French transmission system operator. The driving need of this development is the renewal of the Parisian GIS (gas insulated substation) in which pipe-type cables are connected, as well as projects to replace old transition joints for which the creation of vents is not feasible.

This paper highlights the different aspects involved in the assessment of the transition joint design, including all the tests performed as per IEC 62067, CIGRE TB 415 and RTE specification.

KEYWORDS

MI cable, Extruded cable, Cigré TB 415, Transition joint, Type test.

INTRODUCTION

The large number of aged 220 kV pipe type cables based on the technology of impregnated lapped paper dielectric – so called MI (mass-impregnated) cables – present in the French network and especially in Paris and its suburbs pushes the French transmission system operator to assess the possibility to refurbish this technology.

Consequence of this natural ageing process of HV paper-insulated cables and possible corrosion of the steel pipes, the number of oil leaks and failures is gradually increasing in the network.

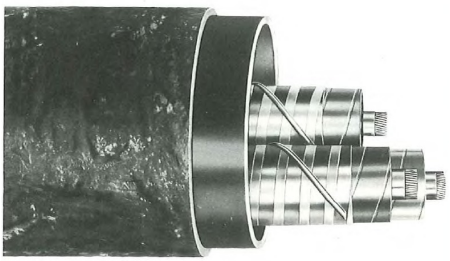
Technical solutions are needed to secure the network, to allow the repair or rerouting works on HV paper-insulated cables without having spare cable of the original design. One possibility consists of connecting old MI cable to new XLPE insulated cable by means of a transition joint for connecting the two-different cable technologies in the shortest possible execution time.

This paper presents the different steps of the assessments as well as the development and qualification test program, which was performed to approve this new dry transition joint design. It highlights

- the conventional and the new design of transition joint used to connect XLPE and MI cables,
- the tests and the qualification of this new dry transition joint.

CONVENTIONAL TRANSITION JOINT DESIGN

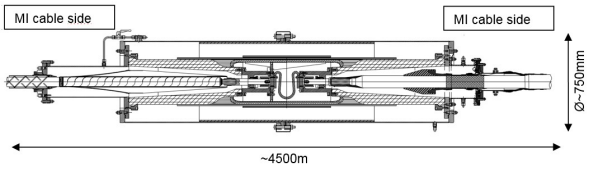
The MI pipe type cable (also called “Oléostatique” in French) are three core external oil-pressurized cables placed in a steel pipe under nominal relative pressure of 15 bar.



Picture 1: High-pressure oil-filled pipe-type cable

After the trifurcations of the three-core cable, single core transition joints are designed to connect the MI cable core to the XLPE insulated cable.

A typical design of a conventional transition joint as shown in picture 2 comprises two oil immersed terminations in a common joint housing. The terminations are in back-to-back arrangement and connected with a short length of busbar. Insulating oil is used to fill the joint housing [1].



Picture 2: Single core transition joint back-to-back design

Issues such as high costs, long installation time and - as safety and environmental aspect - the large oil volume led to the modern redesign of transition joint, which incorporates the main advantage of joints for polymer insulated cables: prefabricated and pretested stress relief bodies for the main insulation of the connection.