Qualification of a 150kV Transition joint for connecting external gas pressure three-core cable with extruded single-core cables

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ABSTRACT

Transition joints for connecting two different cable types are becoming more and more common in the HV and EHV power cable systems. These joints require special attention during assembly and type testing. This paper highlights the aspects involved in the design, assembly and type testing of a 87/150 (170)kV transition joint between a three core External Gas-pressure Cable ('EGC') and three single core extruded cables.

KEYWORDS

External Gas Pressure cable, Extruded cable, Cigré technical Brochure TB415, Transition joint, Type Testing.

INTRODUCTION

Around the world the backbone of underground electricity transmission has been borne by fluid filled cable, generally operating between 33kV and 400kV, some of which are still in service since the 1930's [1]. For new connections, fluid filled technology has largely been superseded by XLPE type cables because the use of extruded cable systems for transmission and distribution circuits is ever increasing at the expense of LPOF (Low Pressure Oil Filled) and MI (Mass Impregnated) cables. Furthermore the number of manufacturers of these LPOF and MI cables is decreasing and therefore the availability of such cables for repair works or re-routing is limited and it is going to be even rarer in the future. However, most utilities and transmission operators have significant quantities of fluid filled systems within their networks and will continue to maintain them for many years [2]. Consequently, it is becoming more and more common to introduce a length of extruded cable into a paper insulated cable circuit, requiring transition joints for the connection of the two cable types.

For the TenneT (Dutch TSO) project: 'Zomerbed Verlaging Kampen', Prysmian was requested to deliver and joint new 150kV extruded cables to the existing External Gas-pressure Cable (EGC) with aid of a new type of transition joint for the replacement of part of the 110kV EGC connection: "Zwolle-Kampen Wit". One of the requirements within this project was to typetest the transition joint prior to the installation, and for strategic, reasons TenneT required this type test to be performed at 87/150/170kV (U_0 /U / U_{max}) level, rather than 64/110/123kV level.

For the design, development and qualification of this new transition joint at 150kV level, Cigré TB 415 'test procedures for HV transition joints' was followed [3].

This paper highlights:

- The basic design of the transition joint.
  By using state of the art technology, the transition joint was based on pre-fabricated components, allowing factory testing of these components. Furthermore the use of auxiliary equipment for this joint was eliminated, resulting in a smaller joint bay, lower joint weight and reduction of the installed equipment on site.
- The electrical test setup for type testing.
  The testing of a three core EGC and three single core extruded cables require special attention for the heating of the conductor. Also the determination of the maximum conductor temperature during the test in hot conditions is discussed.
- The test of outer protection for the transition joint.
  Because of the dimensions of the joint, a special water tank was constructed to test the outer protection of this transition joint.
- The installation and commissioning test on site.

The joint was successfully tested, installed and commissioned and is now in service since august 2014.

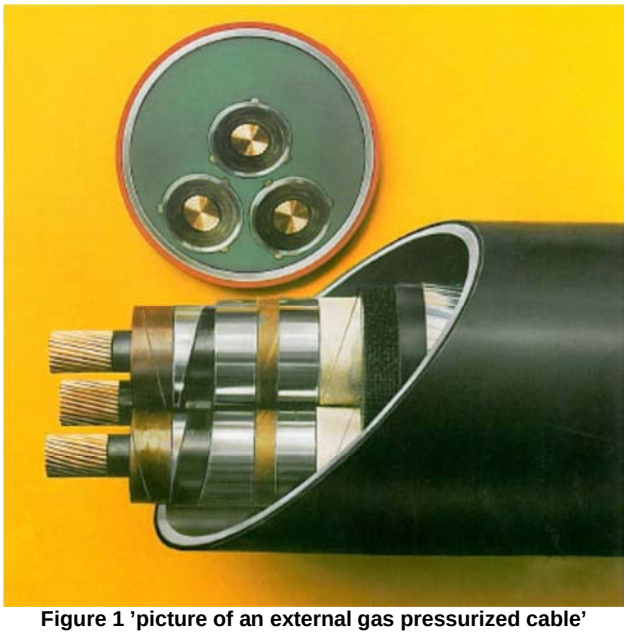

Figure 1 'picture of an external gas pressurized cable'