PERFORMANCE TESTS ON LARGE CONDUCTORS CONNECTORS

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ABSTRACT

This last decade has seen the need to increased power transmission and this has led to the design of large conductor (up to 2500mm²) high voltage XLPE cables systems. The cable conductor connections are used to connect:

- *The cables together, when the cable drum lengths delivered on site are shorter than the entire circuit length.*
- *The cable ends to outdoor devices or cable boxes (GIS).*

The main requirements for a connection are a low resistance and enough mechanical tensile strength to ensure the reliability of the connected cable sections.
The authors describe the development works on large conductor (up to 2500mm²) for VHV XLPE cables systems.

KEYWORDS

Connectors, welding, bolted connector, compression connector,

INTRODUCTION

The High voltage cable systems, are used for power transmission, i.e. to transport current under high voltage. The transport of current is performed by the conductor of the cable, and at accessories a connector is needed to ensure the current flow to another cable (joints), a bar (GIS termination), or an overhead line (outdoor termination). A bad design of connector leads to an overheat at the accessory site. This can lead to the accessory breakdown. This accessory mode of failure is addressed as a common one (due to bad workmanship of a connector) in tutorials [1].
The metal screen of cables has also to transport current: capacitive current, circulation current, …, and especially homopolar short circuit current. Bad transport of the metal screen current can result in the voltage rise of the screen (safety issue) and in the malfunction of the cable system. The authors will address it in this paper.

CONDUCTOR CONNECTORS

Mechanical constraint

During the load cycles in the life of the cable system, conductor expands and shrinks as a function of its temperature. The fixed point, where the core and the sheath do not move relatively, is depending on the laying condition.
Figure 1 shows a joint connection of a 400kV 1600mm² cable installed in rigid condition (pipes + joint aligned with the pipe), after a prequalification test. The prequalification test was successful; the system was submitted to 180cycles at 95C.

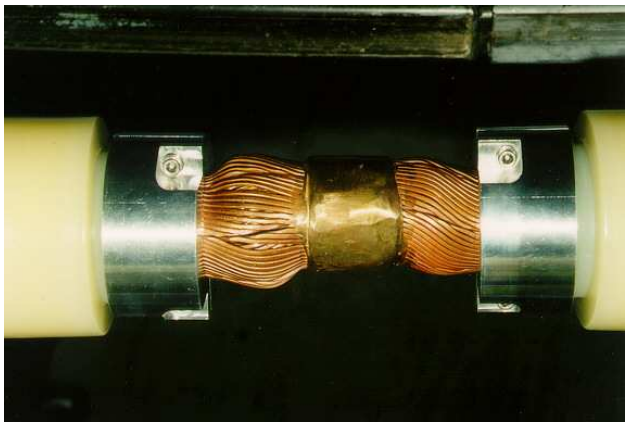

Fig1: conductor connection after 180 load cycles

The risk is a displacement of cable outer semicon stop after the tip of the deflection of the stress cone, which causes a breakdown.

Geometrical constraint

The most demanding geometrical constraint regards the one piece premolded joints. To be screened by the central insert of the joint, the connector must be limited in length (shorter than the insert) and in diameter (smaller than the core diameter over insulation). See figure 2.

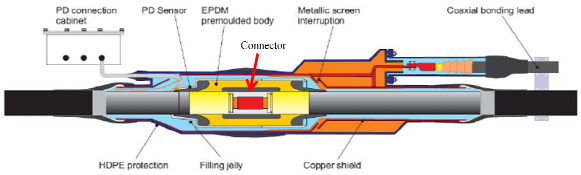

Fig2: geometrical constraint of a connector in a joint

In GIS terminations, the connector must be screened by the metal bell. There is a limitation in length, the diameter can be larger. See figure 3

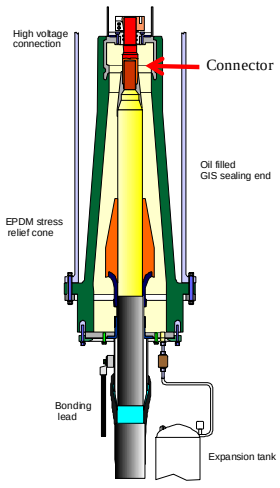

Fig3: geometrical constraint of a connector in a GIS