A.4.4. Développement de jonctions monoblocs prémoulées pour les câbles HT et THT

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RESUME
Le raccordement des câbles à isolation synthétique à l’aide de jonctions prémoulées monobloc est un concept déjà ancien. Les études relatives à son adaptation aux tensions supérieures à 122 kV et jusqu’au très haut tension sont encore limitées. Nous présentons le développement d’une jonction monobloc EPDM pour le niveau 225 kV, en explicitant le choix du matériau retenu et les principaux paramètres de dimensionnement. Les modélisations nécessaires à la maîtrise complète du développement sont décrites. Nous rapportons les résultats pratiques et enseignements obtenus pendant les essais électriques des jonctions prototypes. L’extension du concept prémoulé monobloc aux niveaux 400 kV et au dela est examiné.

1. Introduction
Polymeric insulated cable is well underway to take over the lead from the conventional oil impregnated paper cable for transport of bulk electric energy at high voltages because of its simpler design and manufacturing process and relatively uncomplicated accessories. Such a cable system is easier to install and virtually maintenance free during its service life. Among the accessories for high voltage polymeric cable system, joint has been the weak link due to its number of components, too much dependence on the skill of the jointers, and long construction time. Commonly used joints are taped joints of different types, however, in recent years other jointing techniques are successfully introduced at least for voltage up to 123 kV. Beyond this voltage, taped joints are still the most prevailing type although new techniques are being evaluated as experiences gained from these installations. Table 1 shows typical jointing methods presently used.

1| Jointing technique and material used for XLPE cables
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Joint type| Voltage (kV)| Jointing material
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Tape (self amalgamating) | 69 - 150 | XLPE, EPR
Tape moulded | 110 - 400 | XLPE, EPR
Field moulded | 110 - 275 | XLPE
Prefabricated-composite | 190 - 275 | epoxy - silicone
- premoulded | 69 - 150 | EPDM, silicone
- premoulded | 225* | EPDM

* System under evaluation

The principle of taped jointing techniques for XLPE cable are spill over from paper cable which require very experienced and skilled jointers, a clean room at the jointing site and a long time consuming process. Other than short time DC test at relatively low voltage after installation these type of joints can not be pre tested before service and thus their quality can not be predetermined. These reasons have lead electric utilities to seek prefabricated joints to improve their service reliability, to shorten jointing time and to reduce the size of cable manhole.

There are several concepts of prefabricated joints and premoulded is one of them. Being simple in concept and construction, a premoulded joint can be pre tested and each step of its manufacturing phases in the factory can be controlled for quality assurance. As other prefabricated types can not be easily manufactured and pretested, one piece premoulded concept is a preferred option for high voltage application.

A premoulded joint requires an elastomeric material that is flexible and electrically, thermally and mechanically compatible to polymeric cables. Among the different types of elastomeric compounds, EPDM and silicone are better suited for premoulded joints and at present both types are used, although the use of EPDM is more widespread. EPDM is a very versatile material and the choice of its ingredients can be closely matched to the requirements. It is compounded and controlled for quality by the joint producer. Whereas silicone, the RTV type that is generally used for cable accessories, comes in two components from large chemical companies where there is a less option for modification. High voltage applications require a careful and objective selection of material on the basis of properties and requirements. When properly formulated, EPDM and possibly silicone would be suitable for EHV joints but considering a) the excellent service records of 132 - 150 kV EPDM joints, b) relatively smaller joint dimensions required for EPDM compared to silicone because of its higher dielectric strength, and c) the means to optimise EPDM ingredients and control of its quality, EPDM is chosen as the material for 225 kV premoulded joint development. Typical properties of EPDM and silicone compounds are noted in table 2.