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Design of new 150 kV XLPE cable system for the Belgian electrical network

COUNESON P., BRIJS B., Tractebel, Bruxelles, Belgium
ARGAUT P., MARTIN B., SAGEM SA, Montereau, France

Résumé

Le secteur électrique belge a annoncé en novembre 1992 une nouvelle politique d'implantation des réseaux Haute Tension impliquant un recours plus fréquent à des liaisons souterraines de 30 à 220 kV. De nouveaux systèmes de câbles ont été développés pour proposer des solutions plus économiques et plus fiables. A titre d'exemple, ce rapport détaille les composants des liaisons 170 kV et les essais réalisés pour leur validation.

Abstract

The Belgian electrical sector announced in november 1992 a new policy for the implementation of High Voltage networks, leading to a more frequent use of underground cables from 30 to 220 kV levels. New cables systems have been developed to offer more economical and reliable solutions for underground links. As an example the paper details the 170 kV cable system components and the different tests performed for their validation.

1- Introduction

Given the increasing resistance of both the population and the administration responsible for town and country planning to the idea of new overhead line projects, the Belgian electrical sector announced in November 92 a new policy for the implementation of HV networks.
Among its elements, this policy provides that the total length of overhead lines be frozen at its 1992 level, in the 30 to 220 kV range.
This decision had lead to more frequent use of underground cables at these voltage levels.
As an example, taking into account the need of a transmission power rating increasing for these new underground links, a new 170 kV cable system with a transmission capacity of 245 to 290 MVA (continuous rating) was considered. Besides, as the costs of an underground link are significantly higher than an equivalent overhead line, it is of the greatest importance to improve the reliability of the underground systems as much as possible and also to take advantage of the present state-of-art for the highest voltage levels to reduce, by this way, the costs of the HV underground links.
In order to achieve these purposes, different developments were conceived and tested. The most significant ones are described here after.

2- Developments of components, the 170 kV cable system example

One way to reduce the costs of underground cables and, in the meantime, to improve their reliability consists in applying the technical improvements made in the recent developments for the highest voltage (400 and 500 kV) to the HV level.

As an example, a novel 170 kV cable system with a transmission capacity of 245 to 290 MVA was considered and new corresponding components were derived from the present research level of the 400 kV and 500 kV to offer the best technico-economic solution.

2-1- Cable

2-1-1- Basic requirements :

- Permanent transmission capacity : 1050 A in a direct buried trefoil configuration
  (in the following conditions :
  - depth : 3 m;
  - ground temperature : 15 °C;
  - thermal resistivity :
    . natural soil : humid : 1.0 K.m/W
    dried-out : 2.5 K.m/W;
    . special backfill : dried-out : 1.0 K.m/W).
- Maximum peak value of the cyclus : 1180 A
- Short-circuit rating : 38.5 kA / 0.25 s and 100 KA peak
- BIL = 750 kV peak