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Development of sheath-interrupter for EHV cables

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Résumé

Nous avons commencé â mettre au point un interrupter â gaine permettant d'effectuer des liaisons croisées â n'importe quel point du câble â la place de seulement des jontions d'isolement.

Les principaux problémes dans les travaux de mises au point d'interrupteurs â gaine sont de conserver la température de l'interrupteur â gaine au-dessous du niveau admissible et de maintenir une performance de contournement suffisante entre les gaines métalliques interrompues. Notre article examine les procédures de base pour un interrupteur â gaine modéle 77kV permettant de résoudre les problémes ci dessus et la mise au point d'un interrupteur â gaine pour une installation de 154kV.

Abstract

We began developing a sheath-interrupter, which enables to make up cross-bonding at any positions of cables instead of insulation joints.

The main problems in the development of sheath-interrupters are maintaining the temperature of the sheath-interrupter below the permissible level and maintaining sufficient flash-over performance between the interrupted metal sheaths.

Our paper discusses the basic procedures for 77kV model sheath-interrupters that solve the above problems and the development of a sheath-interrupter for a 154kV line.

1. Introduction

A cross-bonding system as a grounding method of metal sheaths in an underground transmission line is generally used, with which outer metal sheath is bonded to another sheath of different phase at an insulation joint. Adoption of the system enables great reduction of sheath loss and securing induced voltage in a metal sheath at certain level, thus the system is applied for the most of EHV underground transmission lines.

Recently, on the other hand, it became possible to extrude long length XLPE cables with the advanced cable manufacturing technologies, and such long cables are required for both reliability and economic reasons. However, there are some problems in using long cables; for example, adoption of longer length cables will be resulted in unallowably high induced voltages in metal sheaths at joint positions, and besides in case of relocation of cable lines new cables and joints will be required purposely to make reasonable cross-bonding system.

Hence, we started to develop a new structure, called "sheath-interrupter," which enables to make cross-bonding at any positions of cables without insulation joints.

2. Structure and application form of sheath-interrupter

The sheath-interrupter is made up by partial longitudinal removal of the metal sheath of cables and covered with protective tubes, filled with the waterproof compound. It has an exterior like a conventional insulation joint.

The sheath-interrupter is considered to have two types of structure depending on different protective tube structures as shown in Fig. 1. One is a type which has a combined structure of copper tubes and an insulator which is widely used in an insulation joint (Type Ⅰ), and another type has the protective tube in itself made of insulating material (Type Ⅱ).

In order to make cross-bonding by using insulation joints, a length 3L between the grounding positions is divided into three sections and they are connected by 2 insulation joints so that the single cable length is L. When sheath-interrupters are used, a cable length of 3L is first set, and sheath interrupters are installed at 2 places in each phase instead of insulation joints to construct cross-bonding. (See Fig. 2)

Since the cable core including the outer semi-conducting layer basically remains intact in a sheath interrupter, the installation of a sheath-interrupter is easier than that of a joint, as well as contributing to the reduction of installation time and cost. Furthermore, it is possible to cope with the changes in the range of cross-bonding caused by altering existing line compositions if a sheath interrupter has a sectional structure.