

Development of Compact Designed 66/77kV Class XLPE Cable System

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ABSTRACT

There has been big demand to replace 3-core SCFF cables installed in ducts for more than 30 years. From the viewpoint of environmental concern, to prevent the risk of soil contamination by oil, these cables will be replaced by XLPE cables in the coming decades. However, it's difficult to install the same size of XLPE cables in old ducts for SCFF cables, due to the difference in diameters. Therefore, there was an indispensable need to develop new products with the same (or smaller) diameter as that of SCFF cables, and their accessories. Compact 66/77kV XLPE cables and accessories have been designed. These cable systems can be installed into ducts for old SCFF cables, with the same ampacity of existing SCFF cables. Excellent electrical properties have been confirmed according to the requirements of the Japanese domestic standard (JEC-3408).

KEYWORDS

3-core SCFF cables, compact designed XLPE cables, cold shrink joints, outdoor termination, GIS termination.

INTRODUCTION

A lot of SCFF (Self Contained Fluid Filled) cables had been installed in power grids during the period of high economic growth in the 1960s-1970s in Japan. Some of them are still in operation. Figure 1 shows the age distribution of power cables over 66kV in Japan ^[1]. It can be seen in Figure 1 that most cables older than 30 years are SCFF cables. Japanese utilities have much interest in replacing SCFF cables to XLPE cables from the point of view of asset management, easier maintenance and environmental impact relief of unexpected failures.

Most 3-core SCFF underground cables in cities were installed into ducts. In the case of replacing 3-core SCFF cables to triplex type XLPE cables having the same conductor size, the inner diameter of existing ducts is too small for triplex XLPE type cables because the ducts were designed for 3-core SCFF cables which have a smaller diameter than triplex type XLPE cables.

Current state of the art quality control in manufacturing XLPE cables and their accessories has room to design thinner insulation of XLPE cables than the existing insulation for the 66/77kV class. Their review of the performance has led us to design compact type XLPE cables. It is expected to be possible replacing technology ^[6]. This paper describes development activities of compact-designed XLPE cables and their accessories for the 66/77kV class. Some kinds of accessories have been applied to the compact-designed cable systems. Performances of cables and their accessories have been confirmed with long duration loading cycle tests and voltage tests in accordance with standards.

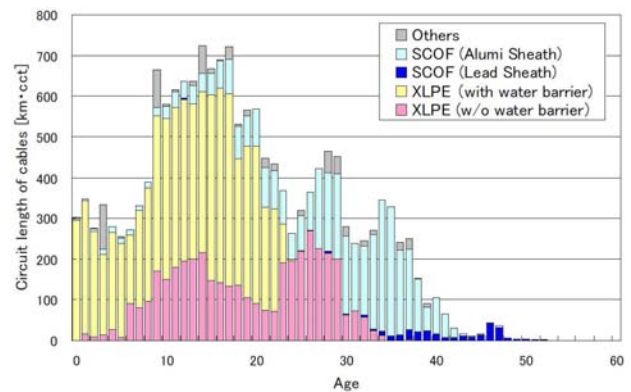


Fig.1 Age distribution of the power cable in Japan ^[1]

FEATURES OF COMPACT DESIGNED XLPE CABLES

There are plenty of 3-core SCFF cables that have been installed in ducts more than 30 years ago. Due to environmental considerations, these cables will be changed to XLPE cables in the coming decades. It is difficult to install the same size of XLPE cable into existing ducts for SCFF cables, due to the difference in diameters.

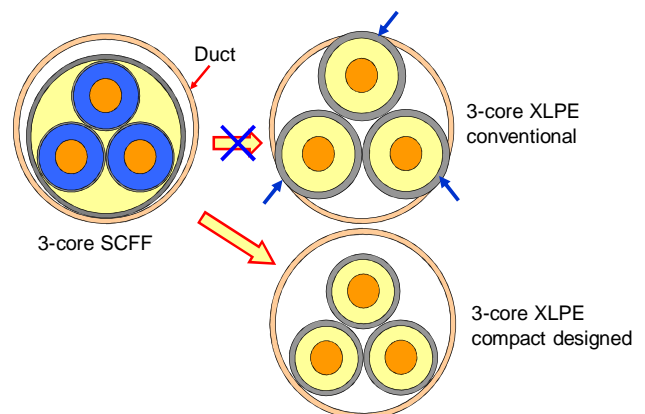


Fig.2 Cable dimensions in duct

The new 3-core XLPE cable has a 10 to 20 % smaller diameter mainly due to reducing of the insulation layer thickness. There are three main features of compact designed XLPE cables.

- ✓ Uses the existing duct lines.
- ✓ Reduces the costs of civil engineering work.
- ✓ Maintains the same ampacity of existing SCFF cables.