AGEING PERFORMANCE OF NEW TYPE OUTDOOR TERMINATION USING COMPOSITE INSULATOR

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ABSTRACT

Recently, composite insulators have been increasingly adopted mainly from the economic viewpoint. A new type outdoor termination consisting of composite insulator, which can be installed horizontally on a steel tower, in order to reduce the construction cost has been developed. The termination has been already applied as commercial use since 2001. Then, in order to evaluate the long-term reliability of the new type termination, we carried out the ageing characteristic evaluation for aged composite insulator. This paper describes the development outline and the results of the ageing characteristic evaluation of the new type termination.

KEYWORDS

Composite insulator, Outdoor termination, SF_6 gas, Ageing performance, silicone rubber

INTRODUCTION

Porcelain insulators have been widely used for outdoor terminations. However, in recent years, so-called composite insulators (also called polymeric insulators), which consist of the FRP (Fiberglass Reinforced Plastic) cylinder and silicone rubber, have been increasingly employed because of their ease of handling.

The Kansai Electric Power and J-Power Systems have jointly developed a new type termination for a XLPE cable (Cross Linked Polyethylene Insulated Vinyl Sheathed Cable) that reduces total weight and allows horizontal installation by using a composite insulator, a cold shrinkable rubber unit and SF_6 gas [1]－[4]. The new type 77kV outdoor terminations has been adopted since May 2001, and total number of terminations for commercial use reached 60 phases in 9 lines. And the terminations for 154 kV XLPE cable have been applied since 2007 [5].

Then, in order to evaluate the long-term reliability of the new type termination, we carried out the ageing characteristic on the 6 years aged composite insulators which were used in the 77kV transmission line [6]. The most serious degradation factor in regard to the electrical performance is the deterioration of water-repellency caused by the irradiation of ultraviolet rays or chemical reaction between the silicone rubber and external contaminants. Therefore we carried out the water repellency test and the electrical performance test in dry and wet condition. Additionally, we evaluated several mechanical performance supposedly affected by the ageing. Consequently, we confirmed that the terminations had sufficient performance.

This paper describes the design of the new type termination and the results of the ageing characteristic evaluation of the new type termination.

STRUCTURE AND FEATURES OF THE CONVENTIONAL-TYPE TERMINATION

Figure 1 shows the basic design of conventional-type termination. A porcelain insulator is used as outer-insulator. A rubber pre-molded insulator and the epoxy resin insulator are used in the main insulation. The inside of the porcelain insulator is filled with silicone oil. The air-space is provided to compensate the change of silicone oil volume due to the seasonal and daily variation of temperature. The air-space is required to be located above the silicone oil where the electric field is weak. Therefore, the installation is limited to being vertical or diagonal (with limits on the angle).

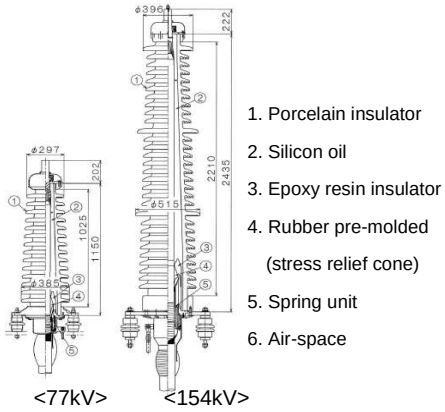

Fig.1: 77/154kV outdoor termination
(Porcelain insulator type)

DEMAND OF NEW-TYPE TERMINATION

As can be seen in Figure 2, the outdoor terminations in 77kV transmission lines which connect overhead lines and XLPE cables are usually installed on the tower. On the other hand, the outdoor terminations in 154kV transmission lines are placed on the ground. In order to convert a tower that was used for only overhead lines into a terminal tower connecting overhead and underground transmission lines by the use of conventional termination, the reconstruction or reinforcement of the tower is required to keep the sufficient clearance and to support the weight of termination. As a result, the tower must be substantially modified or rebuilt.

As can be seen in Table 1, if the termination can be installed horizontally, the problem of the clearance around the termination can be resolved without remodeling the tower. As a result, the substantial cost reduction can be expected.