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##### New dry outdoor terminations for HV extruded cables

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**Abstract:** The development of a new family of self-standing outdoor terminations of dry design is described. Such outdoor terminations, covering the voltage range from 60 kV to 400 kV, are based on conventional stress cone control, but the insulator is filled on site with an innovative filling material that, after cross linking, becomes a gel like consistency. Electrical tests carried out on the filling material and on full size outdoor terminations have demonstrated that such new design can replace existing outdoor terminations, increasing the reliability of the HV cable systems as the risk of internal fluid leak is eliminated.

Furthermore this design avoids the risk of explosion in case of internal power arc. This concept is also applicable for retrofitting existing fluid filled outdoor terminations.

**Keywords:** Outdoor terminations, filling material, dry-type, explosion-free

#### 1 – INTRODUCTION

Traditionally the self-standing outdoor terminations for extruded HV cables are designed with a porcelain insulator filled with an insulating fluid (oil or SF<sub>6</sub> gas). Even if this design has a very long and positive service record, a certain number of drawbacks can be noted.

First of all the presence of a fluid filler in the insulator requires a carefully made sealing to avoid oil or gas leakage in service, which could lead to electrical breakdown. To reduce the risk of out of service for the HV cable connections, these outdoor terminations are sometimes provided with a monitoring and alarm system that maintains under control the fluid during service. For some types of liquid fillers there are also the risks of fire and of toxic gas emission, as an effect of an internal power arc.

Secondarily also the porcelain insulators have some disadvantages. They are fragile, heavy and in case of

**Résumé:** Le développement d'une nouvelle famille d'extrémités extérieures autoporteuses de type sec est décrit. De telles extrémités extérieures, couvrant la gamme de tension du 60kV au 400kV, sont basées sur un cône déflecteur conventionnel, mais l'isolateur est rempli sur site avec un matériau de remplissage innovant qui, après réticulation, devient un gel consistant. Les essais électriques menés sur le matériau de remplissage et sur des extrémités extérieures de taille réelle ont démontré que de telles extrémités réalisées selon cette nouvelle conception peuvent remplacer les extrémités extérieures existantes, en accroissant la fiabilité des systèmes de câbles Haute Tension car le risque de fuite du liquide interne est éliminé.

De plus cette conception évite le risque d'explosion en cas d'arc interne de puissance. Ce concept est aussi applicable pour le remplacement des extrémités extérieures existantes remplies de fluide.

**Mots clés:** Extrémités extérieures, matériau de remplissage, type sec, anti-explosion

internal failure or external damage due to vandalism, the porcelain could explode.

Furthermore for installation in seismic areas some special precautions are necessary to make the porcelain terminations "earthquake resistant".

To overcome the disadvantages of the traditional fluid filled porcelain termination, a new type of self-standing dry outdoor termination for HV extruded cables has been developed.

The new termination design is based on a conventional stress control, but the insulator is preferably of the composite type and it is filled with an innovative fluid material that after cross-linking becomes a gel-like consistency.

Thus the outdoor termination is totally dry under operation. This new type of outdoor termination, shown in Figure 1, combines the advantages of low cost fluid-filled design and the operational advantages of dry-type design.