



A DEVELOPMENT OF UNDERGROUND DISTRIBUTION CABLE FOR WATER BLOCKING AND REDUCING PROTRUSIONS



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ABSTRACT

The root causes of underground distribution medium voltage cable faults are water penetration into insulation layer(water tree) and focused stress on semi-conductive layers(protrusion). Accordingly, it is needed to improve the water blocking performance of jacket material and the structure of power cables for extending lifetime and preventing failures. We uses nonflame LLDPE compound instead of conventional PVC(polyvinyl chloride) as a outer jacket material. And the jacket structure was also changed from embedding to encapsulating structure. We also use supersmooth class semi-conductive compound as a conductive screen. The insulation screen semi-conductive compound was not changed. The newly developed cables have better AC breakdown voltage after aging tests. This cable has been installed in Korean distribution system from late 2006.

KEYWORDS

Cable, PE jacket, Waterproof, Encapsulating Structure

INTRODUCTION

The XLPE insulation of URD(underground residential distribution) cables are became common. 22.9 kV CNCV W model is the most widely used in Korea. Before 1998 CNCV cable was installed, conductor of which cable was not waterproofed. However waterproofing of conductor could not decrease cable fault rate.

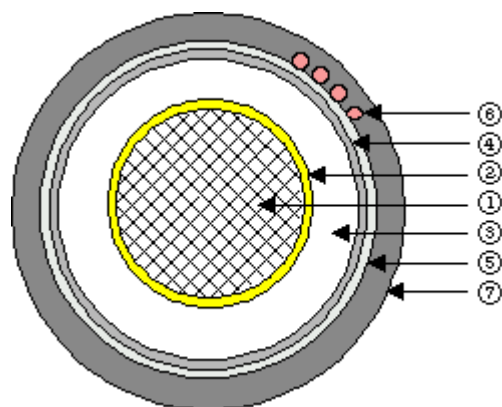
The most common causes of cable fault in Korea can be divided into two categories except digging damage. The first cause is water penetration into insulation into insulation, and the second is irregularities of interfaces between insulation and semi-conducting screens.

PVC outer jacket material is not preventive to water penetration. It is need to find best solution in order to enhance waterproof performance of underground cables.

The conductor screen and insulation screen are for relaxation of electrical stress from high voltages. However sometimes these semi-conducting layers have protrusions then electrical stresses are concentrated to these local defects. These protrusions were the cause of early fault of cables. These defects of semi-conducting layers cannot be completely prevented in the production process with conventional semi-conducting compounds. We have to use new semi-conducting compounds having higher smoothness.

STRATEGES FOR DESIGN OF NEW URD CABLE

We reviewed our CNCV-W model cable, laminated structure cable and encapsulating structure cables. Laminated structure cables have the best waterproof performance but not perfect at the junction point and we have to consider the electrical behaviour of neutral conductor, long term behaviour of overlapped parts, exfoliation of bended area. So we decided to apply encapsulating structure for new design.



No	Major Components	Materials
1	Conductor	Concentric Lay Stranded Copper Conductor (with water penetration impediment sealant)
2	Conductor Shield	Super Smooth Semiconducting Compound
3	Insulation	Tree retardant Crosslinked Polyethylene Compound
4	Insulation Shield	Black Semiconducting Thermosetting Compound
5	Water Blocking Tape	Semiconducting Water Blocking Tape
6	Concentric Neutral Conductor	Round annealed Copper Wires (Encapsulated)
7	Outer Jacket	Non-flame Polyethylene

Figure 1: Structure of TR CNCV W Cable

Insulation is need to tree retardant characteristics because of containing moisture in the production process and moisture ingress through outer jacket during field operation. So we decided to apply TR XLPE compound