



## NEW CONCEPT IN CABLES AND ACCESSORIES FOR LOW VOLTAGE UNDERGROUND DISTRIBUTION IN SPAIN



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### ABSTRACT

*The circuits currently used in Low Voltage distribution networks in Spain are composed of four single-core cables of the same cross-section, with aluminium conductor, XLPE insulation and PVC sheath. This study was carried out with the aim of obtaining a cable and accessories which meet the following requirements: maintenance of the single-core design, improvement of the resistance of the cable and accessories to external agents, reduction of the environmental impact, maintenance of the cost, simplification of the assembly, reduction of stocks, safety for live work and highly reliable connections.*

### KEYWORDS

XZ1 oversheath, LV cable, HFFR

### INTRODUCTION

Due to the difficulty in detecting earth faults in the event of damage to the insulation and sheath layers of Low Voltage (LV) networks and the consequent corrosion of the aluminium conductor, a joint study was carried out back in 1995 by the Utilities and some cable manufacturers to determine the optimal design in accordance with a series of variables assessed according to their importance (possibility of detecting defects, cost, ease of installation, etc.) (see Jicable 95 Article B.1.5).

The conclusion then reached was that the cable with Ceander type concentric conductor was the one that offered the greatest advantages and the replacement of single-core cables by the Ceander was therefore considered. After several test installations using the new cable, it was finally rejected due to its higher cost and the greater complexity in the preparation of accessories, the single-core cable being maintained despite its lower level of safety.

The advisability of modifying the design of the LV distribution cable was again raised in 2001, the following requirements being defined:

-Maintain the single-core design to aid the laying and the preparation of accessories.

-Improve the resistance of the cable and accessories to external agents (tearing, abrasion, entry of water, etc.) without compromising the reliability of the cable installation.

-Reduce the environmental impact, eliminating stabilizers with lead and plasticizers.

-Eliminate the emission of halogens in the event of fire and maintain a similar fire-resistance.

-Maintain the cost of the new cable and accessories substantially the same as the previous one.

Suitable accessories for this cable were subsequently designed with the following requirements:

-Simplification of assembly.

-Reduction of stocks.

-Safety of live work.

-Same level of environmental impact as the cable.

-Highly reliable connections.

To obtain these objectives work was basically carried out on developing a new cable, whose characteristics were defined in the standard UNE 211603 5N1, which will replace the previous low voltage RV cable. The main new developments can be found in the new oversheath compound, HFFR (Halogen Free Fire Retardant) material and in the design of new suitable accessories. This new cable will be identified as XZ1.

### RESULTS

#### New HFFR sheath compound

To meet the new requirements the PVC oversheath has been replaced by a HFFR compound. The characteristics of this compound have been defined in the standard UNE 211603 5N1 type DMO1. This new compound, has been developed by is characterized by having a blend of polyolefins fire-proofed with a metallic hydroxide. The blend of polyolefins selected grants the sheath compound greater abrasion resistance properties, better tear resistance and resistance to the entry of water. These improvements allow the cable to be protected against possible damage caused during the laying and installation operations. They moreover reduce the environmental impact on allowing elimination of the use of stabilizers with lead and plasticizers. The fireproofing system chosen maintains the fire resistance and eliminates the emission of halogens in the event of fire. It should be stressed that the new sheath compound also prevents the flame from spreading downwards. Table 1 shows a comparison of the values that the PVC compound and the new HFFR DMO1 compound have to fulfil.