

## STUDY ON THE REACTION TO FIRE OF MEDIUM VOLTAGE CABLES SYSTEMS

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### ABSTRACT

*The uncertainty created by the reaction to fire of medium voltage cables and their accessories installed on trays inside galleries and substations has given rise to this joint project by General Cable, Iberdrola and Red Eléctrica de España. A specification is made for a set of fire reaction tests to determine the most appropriate protection to use.*

*The study, focused on the test for vertical fire spread cat. A, was carried out on the following cables systems:*

- MV cables with fireproof barriers included in the design
- MV cables coated with fireproof paint: efficacy of the different coatings applied
- MV cables with clamps or joints: effect of the accessories during the test

*The coatings are ineffective on non-fireproofed cables (type 1) and unnecessary on cables with a high fireproofing level (type 3). The coatings are only effective on cables with a low level of fireproofing (type 2).*

*Of the two types of fireproof coatings used, the intumescent coatings behave much better than the ceramic ones during the fire test, as they swell, partially covering the empty space between cable triads and, therefore, preventing the fire from progressing.*

*In relation to accessories, both clamps and joints burn, spreading the fire along the cables during the test.*

### KEYWORDS

Fire protection; medium voltage cables systems; fireproof coatings; intumescent; ceramic; joints; clamps

### INTRODUCTION

At present there are cables to transport and distribute energy installed in galleries and substations without any kind of fire protection. The report presented in Jicable'07 with the title "Fire hazard of MV/HV cables installed in tunnels" established the catastrophic consequences which can result from a fire should the cables installed not have any type of fire protection [1].

The uncertainty created by the reaction to fire of these cables and their accessories, installed on trays inside galleries and substations, has given rise to this project as a result of a commercial agreement between Grupo General Cable Sistemas, Iberdrola and Red Eléctrica de España.

This study assesses the practical effectiveness of the different fire protection technologies. Different levels of fireproofing inherent in the cable design are considered, in addition to external fire protection systems through the use of fireproof coatings. The influence of the accessories (fastening clamps, joints) on the spread of the fire is also assessed.

The following are the main requirements to be able to carry out the project:

- Analyze which medium voltage cable designs are those most installed in galleries and substations and decide which are going to be the prototypes to test
- Decide on the part of Iberdrola and REE which are the fireproof coatings and accessories to be used on the cables systems during the implementation of the project

### EXPERIMENTAL

#### Cables

The three prototypes of cables used for the study have the same design up to the screen phase (aluminium conductor, XLPE insulation and copper wire screen), but their sheaths are different depending on their degree of fireproofing (from less to more):

- Cable type 1, corresponding to a non-fireproofed cable, with DMZ1 polyethylene sheath, according to standard HD 620-1 (section 4.9.1 and table 4C)
- Cable type 2, corresponding to a cable with a low level of fireproofing, with DMZ2 sheath, according to standard HD 620-1 (section 4.9.1 and table 4C)
- Cable type 3, corresponding to a cable with a high level of fireproofing, with fireproof filling plus DMZ2 sheath, according to standard HD 620-1 (section 4.9.1 and table 4C)

They were tested alone to obtain the reference standards. Cable types 1 and 2 were coated with fireproof paint, as the type 3 cables already pass the test for vertical fire spread according to the assembly of triads described below.

The typology of cables chosen (voltage of 12/20 kV and formation of 1x240 mm<sup>2</sup>) is one of the most sold and installed in medium voltage for galleries and substations.

#### Coatings

The following paints were chosen to coat the cables to be tested:

- Two intumescent coatings of fire protection (I1, I2)
- Three ceramic coatings of fire protection (C1, C2, C3)

The thickness of the paint applied was in all cases that recommended by each manufacturer, a considerable level of variability existing between them.

The fireproof coatings were applied to each cable individually and then were joined in the form of triads to carry out the tests, although this is not the usual procedure in an installation.