



### B.6.3. Comportement des câbles électriques lors d'un incendie

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#### Résumé

L'amélioration du comportement des câbles électriques lors d'un incendie est le résultat des études effectuées par les cabliers depuis plus de vingt ans. Le choix des matériaux ou d'additifs et la mise au point d'essais au feu spécifiques aux câbles, permettent de répondre aux exigences des clients et des prescripteurs.

Quelques exemples de constitution de câbles sont donnés à la fois pour des câbles basse et haute tension, ainsi que des résultats d'essai au feu obtenus sur des câbles PVC et sans halogène.

#### 1 - Foreword

Electrical cable with its linear characteristic and its function as a link has always been a transmission factor of fire from a point to another one, even if it is rarely at the fire origin. Cable makers' objective studying, for more than twenty years, is to reduce fire hazard due to cables.

Which steps have been accomplished today?

1. Reduction of fire propagation
2. Reduction of rate and/or volume of smoke emission
3. Reduction of halogenous materials, to minimize corrosion and toxic hazards.
4. Using of halogen free materials .

These improvement have been identified as a need by our customers in different market sectors.

#### 2 - Combustion and flame retardant treatment

To obtain flame retarded materials, process is well known for a long time : it consists to introduce halogens (chlorine, bromine, fluorine) by using halogenous polymer (polyvinyl chloride, polychloropren, chlorosulfonated polyethylene) or halogenous additives.

Halogenous gases evolved during the combustion of these materials (or products using these materials) react with active sites of free radicals inducing non activation and stopping oxydation reactions.

Two disadvantages are derived from this process :

1. important smoke emission due to the interruption of chain reaction giving by-products like fog of tars or soots without oxydation up to stage of transparent gases,
2. toxic and corrosive gases due to principally halogenous component.

For halogen free materials the flame retardant treatment is obtained by adding hydrated mineral fillers to an halogen free polymer. During fire exposure mineral fillers decompose and evolve their constituting water into steam. The polymer cools and decomposes just a little. Combustion steam dilutes combustion gases which blocks oxygen arrival.

### B.6.3. Behaviour of electric cables under fire conditions

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#### Astract

The improvement in behaviour of electrical cables in case of fire is the result of studies performed by cable manufacturer for more than twenty years. The choice of materials or additives and finalization of specific fire tests for cables allow to meet customers' and prescribers' requirements.

Some examples of cable designs are given for low and high voltage cables, as well as fire test results obtained with halogen free and PVC cables.

The small amount of decomposed polymer induced a large reduction of smoke and halogen absence avoids gases emission.

Although this process is known for a long time, many studies on polymers and fillers were and are necessary to obtain compounds, easy to work in spite of the large amount of these fillers, with good mechanical characteristics.

Our choice is to treat outer, inner and filling sheaths. In some cases we are obliged to treat the insulating materials to improve the cables fire behaviour, but this solution is not possible for HTA (M.V.) cables.

#### 3 - Properties of materials

The compounds designed by our company are based on polyolefins filled with a large quantity of aluminium hydroxide. Studies carried out for twenty years allowed us improvement of mechanical characteristics, U.V. and radiation behaviour of these materials in keeping their performances in relation to the fire behaviour.

Current sheathing materials (thermoplastic or cross linked) have mechanical characteristics comparable with those of PVC (see table 7).

With regard to PVC, halogen free flame retarded materials present three major advantages :

- low smoke emission
- low nuisance and toxicity indexes
- non corrosivity for electrical apparatus and buildings.

Typical values are given in table 8.

#### 4 - Development of cable structures to improved fire performance

There are two main lines of research in the field of fire retardant cables :

- development of specials materials,
- development of cable specifications.