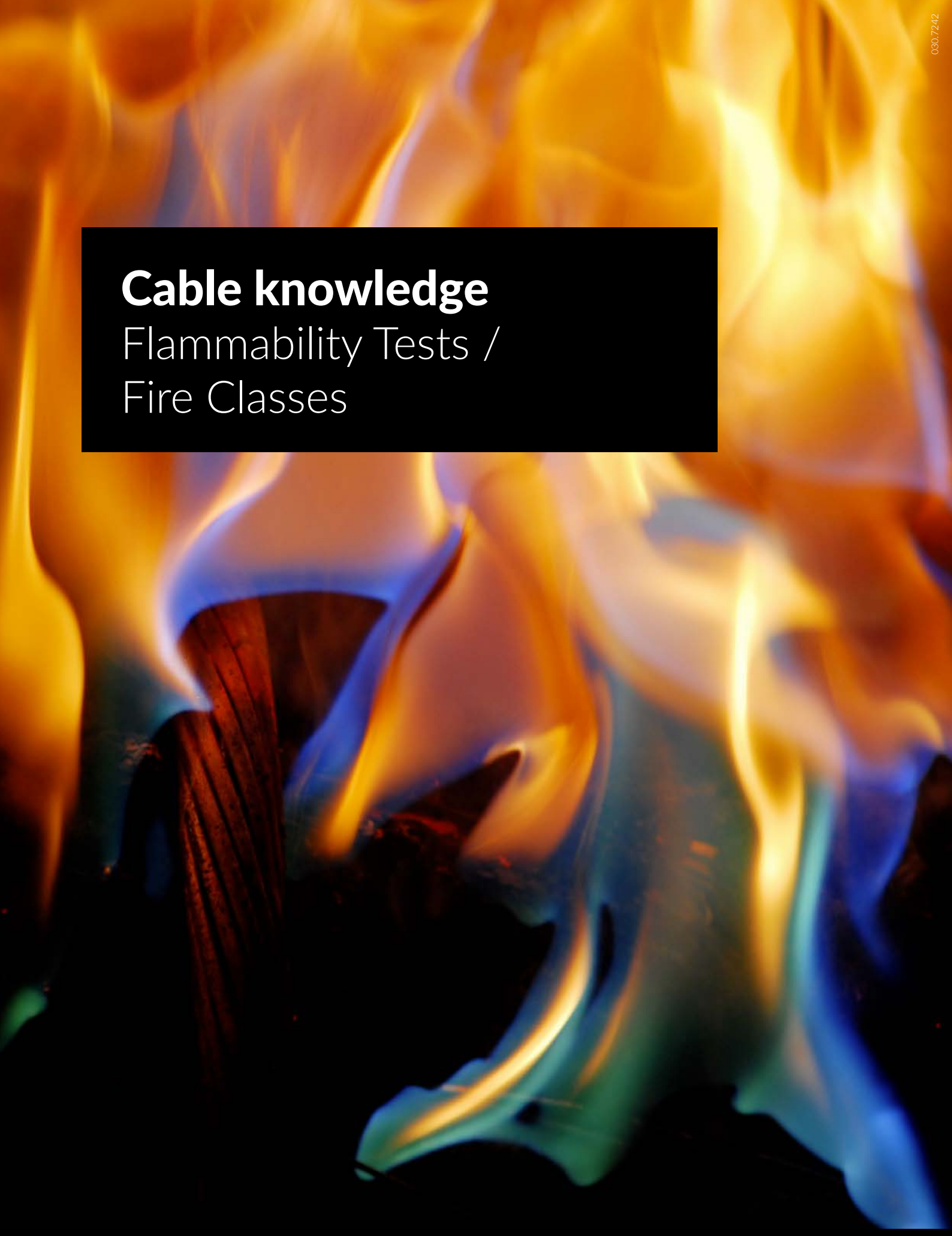


Cable knowledge

Flammability Tests / Fire Classes

Technical Information 2020 – English

R&M

030.7242

Introduction

«Fire properties» is a collective term for various properties that are individually recorded and evaluated in specific tests and provide a statement about how a cable will behave in the event of fire.

A cable with optimum fire properties does not propagate flames, develops little smoke (visibility obstruction for escapees and/or rescue workers), generates no toxic or acidic fire gases and contributes as little calorific value to the fire as possible.

Different test methods test individual or several fire properties. This technical information mainly deals with the international standards for assessing the fire properties of installation cables.

For CPR-Euro, please refer to the ‹Information on the Construction Products Regulation (CPR)› from R&M.

Fire properties

Fire transmission

Fire spreads fastest upwards. Draft and flammable material, on which the fire can continue to ‹feed›, support the fire propagation.

A downward fire spread occurs when burning drops from the burning cable melt away or sparks break out and fall down.

The horizontal fire propagation via the cable depends very much on the fire load (see below) and the flammability.

Thermal load / Calorific value

The calorific value indicates how much energy a material can contribute to a fire.

Examples

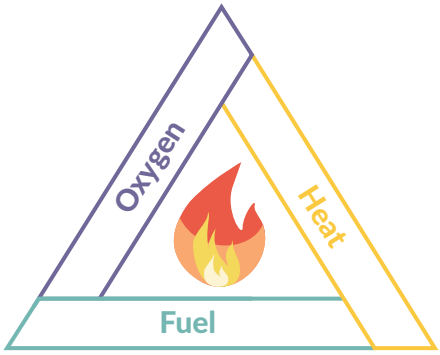
- Polyethylen PE ca. 46 MJ/kg
- Gasoline ca. 44 MJ/kg
- FRLSZH Material ca. 23 MJ/kg
- Wood ca. 17 MJ/kg

The thermal load / calorific value is not a measure for the flammability of a material.

Self-extinguishing

One speaks of self-extinguishing materials if the spread of fire along the cable stops of its own accord as soon as the source of the fire is removed or the cable is no longer directly exposed to flame.

The mechanism underlying the self-extinguishing effect can be easily explained with the fire triangle:



If one of the three elements, oxygen, combustible material or heat (energy) is extracted from a fire, the flame suffocates. In the case of self-extinguishing materials, the heat (energy) of the fire starts a so-called endothermic (endotherm = energy consuming) chemical reaction, that withdraws energy and thus heat from the fire (analogous to extinguishing a fire with water).

A more detailed description of the mechanism can be found at the end of this technical information.

Without sufficient heat (energy) the fire cannot propagate and extinguishes.

Flue gas emission

Flue gas emission impairs in various ways:

- visibility impaired due to heavy smoke development hinders rescue forces in finding persons in need of help
- inhaled toxic fire gases can make it impossible for people to save themselves (fainting)

In general, one speaks of toxic combustion gases. Acidic fire gases are also toxic, but additionally destroy the electronic infrastructure around the fire event.

Test methods

Which test method according to which standard should be cited to classify the installation cable?

Europe knows the classification according to the CPR (Construction Products Regulation), which is a must for all in-house installations.

In contrast to international standards such as IEC, where a test method only determines individual fire parameters, the fire test EN50399 for CPR classification covers a wide range of fire properties.

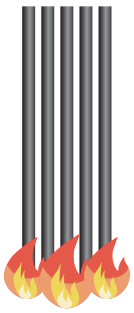
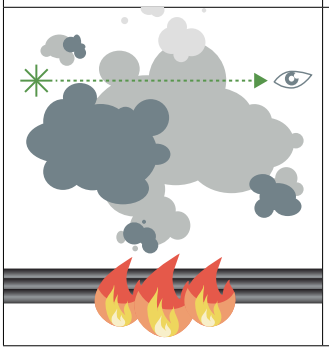
Fire property	CPR	IEC test method
Fire transmission	EN 50399	IEC 60332-1 / -2 IEC 60332-3-xx
Sparks, burning drops		IEC 60332-2
Acidity		IEC 60754-1 / -2
Smoke density		IEC 61034
Thermal load / Calorific value		–

Test methods similar to those described in the IEC standard are also found in other standards.

Although the test methods of different standards show large overlaps, they differ in details such as gas-air mixture in the burner, strength of the air draft, burning time, etc.

Therefore, the statement ‹Result of test method Standard XY = Result of test method Standard AB› is not allowed.

Test descriptions according to IEC

Icon	Test	Application / Compliance criteria
	IEC 60332-1 IEC 60332-2 (Cable 45°) **Execution:** The test specimen is exposed to a defined flame (gas mixture) for 60s. Afterwards the flame is extinguished and observed	**Utilization** The two tests are usually performed with patch cables and installation cables for horizontal cabling. **Criteria** • no dripping of burning material • self-extinguishing of the cable after removing the flame
	IEC 60332-3-xx • -22 (mostly for power cables) • -24 (mostly for data cables) **Execution:** Several cables are fixed side by side on a scaffold and flamed with a defined flame (gas mixture) for up to 30 minutes.	**Utilization** The test is usually used for installation cables for use in riser zones. **Criteria** • no dripping of burning material • max. burning height must not be exceeded • self-extinguishing of the cable after removing the flame
	IEC 61034-2 **Execution:** A defined quantity of cable is flamed in a closed room. During this process, the formation of smoke (visual inspection) is measured optically.	**Utilization** For installation cables or pre-assembled cables **Criteria** • Assessment of the visual impairment (complicating rescue operations) **Additional criteria (further IEC tests)** • Smoke toxicity • Corrosiveness of the smoke

Thermal load

The thermal load is a calculated quantity. It indicates how much energy a cable can release in a full fire.

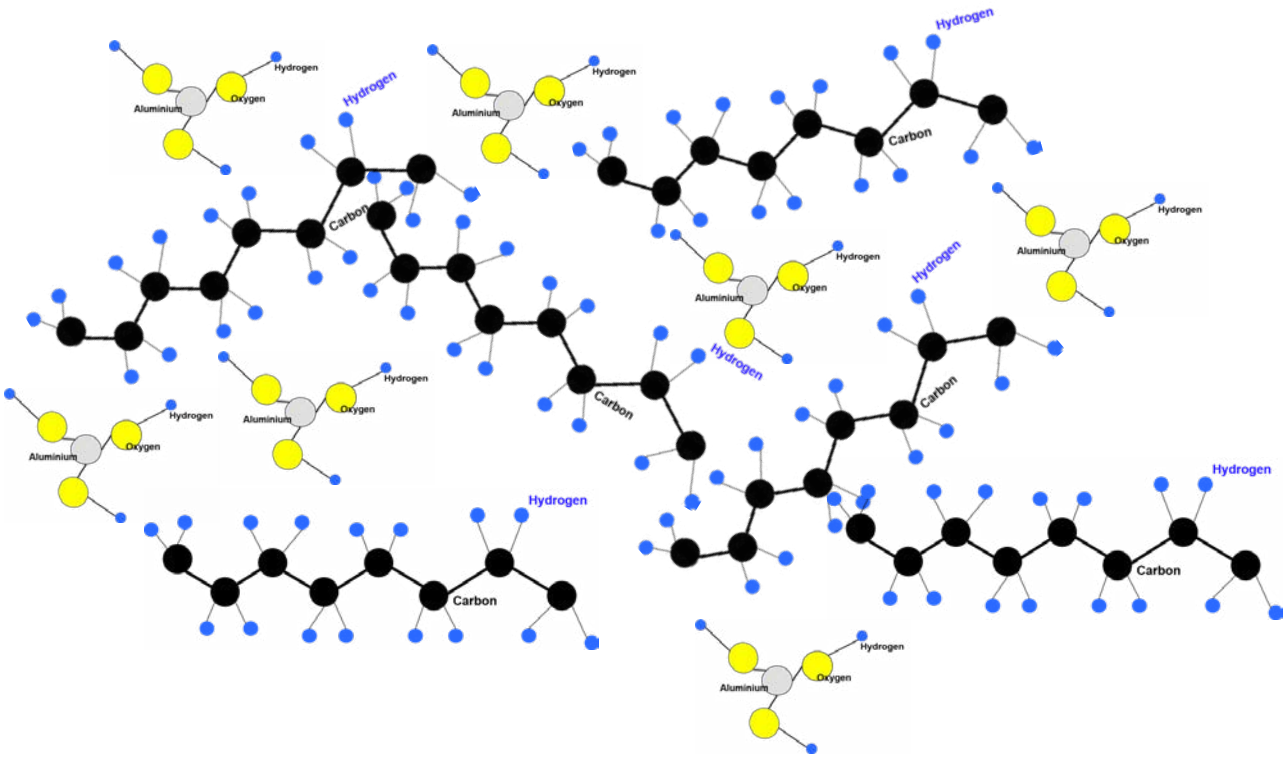
The higher the thermal load, the greater the contribution of a burning cable to fire containment.

EN 50399, which is prescribed for the Euro classification CPR, determines, among other properties, the heat emission, which is related to the fire load.

Mechano self-extinguishing cables

In public buildings, self-extinguishing cables are a must. The self-extinguishing effect is achieved either by the plastic itself (e.g. PVC) or by adding additives to the plastic, e.g. FRLSZH or LSZH.

The self-extinguishing effect is shown in this example using the additive aluminium hydroxide Al(OH)3 in all LSZH materials showed.



The basic plastic, polyethylene PE, is mixed with the additive. The additive decomposes when energy is supplied (fire) and withdraws energy from the system (burning plastic), which is necessary for the propagation of the chemical reaction (fire).

$$2Al(OH)_3 + energy \Longrightarrow Al_2O_3 + 3H_2O$$

The advantage of aluminium hydroxide and similar additives is that they are halogen-free, which is required for installation cables in public buildings in addition to their self-extinguishing properties. Furthermore, the smoke development of LSZH materials is also significantly lower than that of halogen-containing plastics or plastics with halogen-based additives.

Additives such as aluminium hydroxide must be added in high proportions (> 25 %) and thus have a negative effect on the mechanical properties of the base material. Thus, halogen-containing additives are also used, which are already effective in lower proportions (< 10 %) and thus have less influence on the original material properties. Plastics with halogen-containing additives are often declared as ‹halogen-free›. According to the standard, materials with a halogen content of less than 2.5 % may be declared ‹halogen-free›.

R&M range of self-extinguishing installation cables

R&M does not use any halogenated plastics (such as PVC) or halogen-containing additives in its assortment to achieve self-extinguishing cable constructions.

Universal standard FO cables achieve at best a CPR classification of Dca. The new FiRis cable range achieves a CPR classification of B2ca depending on the cable construction.