



## COMMUNICATION CABLES AND BURNING BEHAVIOUR

# INTERNATIONAL REGULATIONS

Different regulations and standards apply depending on the geographic location.

Europe is normally governed by CENELEC (EN), but in practice it is more under the influence of international standards (IEC). Nevertheless, when it comes to safety, national regulations such as NF in France and BS in the United Kingdom often prevail.

In the United States and in Asia, installation rules and the types of products to be used are determined by the American standards (UL).

Whether local or worldwide, co-called fire resistance standards characterize the reaction or resistance to flames of cables. Moreover, from a personal safety point of view, one also needs to take into account the characteristics of the smoke produced by combustion.

The most important matter is to select the right product based on the environment in which it will be installed and on its use or application.

## I. INTERNATIONAL AND EUROPEAN STANDARDS

### Flame propagation

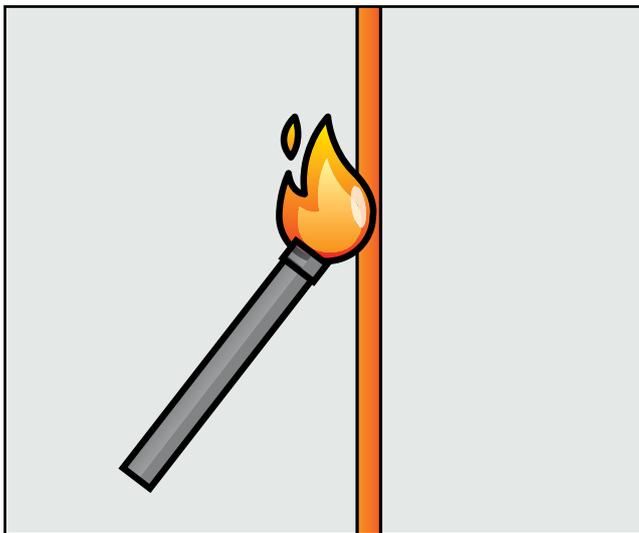
The IEC 60332 standards (Tests on electric cables under fire conditions) are the reference standards regarding the modus operandi for the measurement of the flame retardant properties of cables. There are different categories depending on the degree of flame resistance.

IEC 60332-1 & IEC 60332-2: Flame retardant to a higher or lower degree

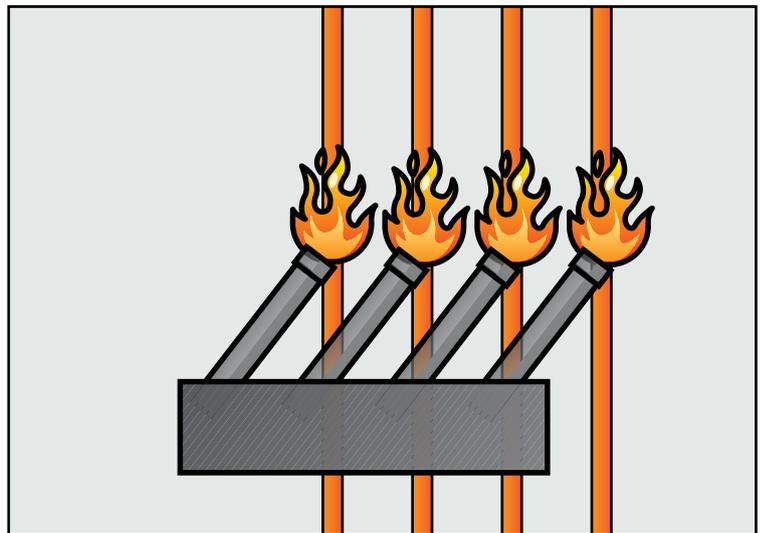
IEC 60332-3: Fire retardant

The simulation protocols are different for each test:

#### IEC 60332-1 Vertical Flame Test



#### 60332-3 Vertical Tray Flame Test



The tests according to IEC 60332-3 comprise 4 test categories (A – B – C – D) according to the volume of combustible material per metre of cable.



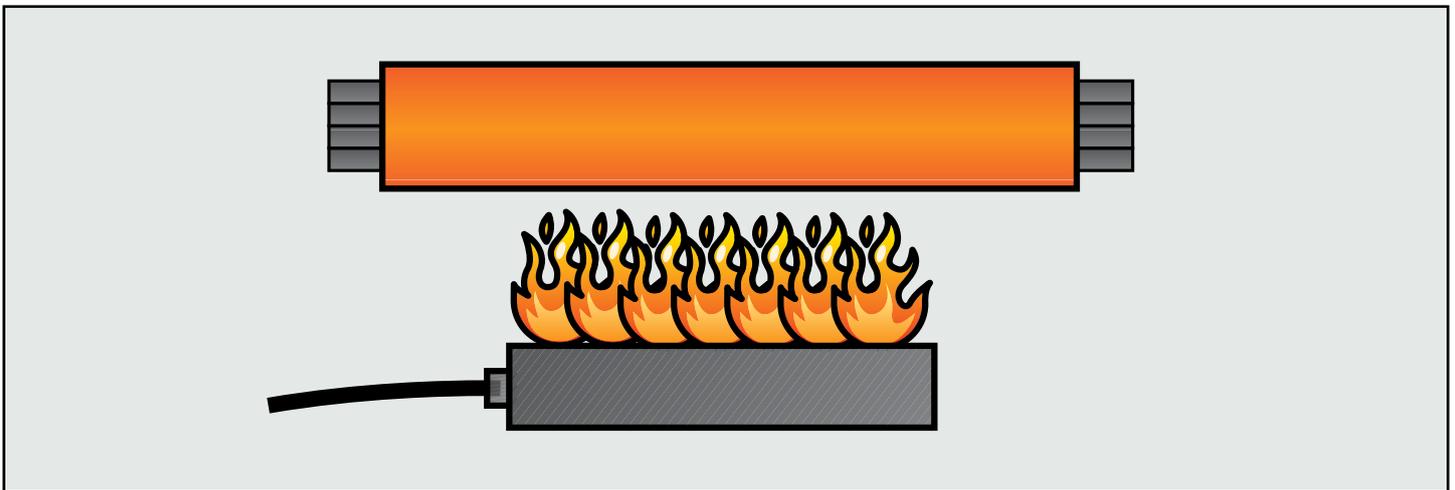
### Fire resistance

Verification of fire resistance is covered by the IEC 60331 standards which exist in different versions depending on the type of cable that needs to be tested.

IEC 60331-11 Apparatus	Fire alone at a flame temperature of at least 750°C
IEC 60331-12 Apparatus	Fire with shock at a flame temperature of at least 830°C
IEC 60331-23 Procedures and requirements	Electric data cables
IEC 60331-25 Procedures and requirements	Optical fibre cables

Contrary to IEC60332 tests, the cables must be resistant and maintain their functional integrity during the test. In this case, the application prevails.

### IEC 60331-21



Cables satisfying the requirements of this type of standard are manufactured using materials such as fibre glass, fire-proofed components with polyolephine, silicone or fluorinated polymers. (IEC 331-23 cable)

### Example:



Polyethylene and silicone rubber insulator

Fibre optic foil to limit heat generation

Jacket in low smoke zero halogen material



### Smoke emission

Basically, two parameters are considered: the toxicity of the combustion gases and the density of the emitted smoke.

The IEC 60754-1 standards (amount of halogenated acid gas) and IEC60754-2 (acidity of gasses emitted during the combustion) make it possible to characterize a cable as Zero Halogen or Halogen Free.

The IEC 61034-1 and 61034-2 standards serve to measure the opacity and thus to determine the Low Smoke characteristic.

All these international standards have an equivalent at European level.

IEC Standard	EN Standard
60331-11	EN50200 and analogous national standards for NF, BS, DIN VDE, UNE...
60331-12	
60331-21	
60331-23	
60331-25	
60331-31	
60332-1	50265-2-1
60332-2	50265-2-2
60332-3	50266-2-1
61034-1	50268-1
61034-2	50268-2
60754-1	50267-2-1
60754-2	50267-2-2



## ASIA, UNITED STATES AND REST OF THE WORLD

In parts of the world where Anglo-Saxon regulation applies, cable types are defined by the American NEC 800 regulation (National Electrical Code) of ANSI/NFPA 70. There are six cables types, each with different fire resistance depending on the application.

**CM** — Indicates cable intended for general use within buildings in accordance with Section 800.154 of the NEC. This cable does not spread flame to the top of the tray in the Vertical-Tray Flame Test in UL 1685, «Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.»

**CMG** — Indicates cable for general use within buildings in accordance with Section 800.154 of the NEC. The damage height of this cable does not exceed 4 ft 11 in. when tested in accordance with the CSA FT4 Vertical-Tray Flame Test in UL 1685.

**CMP** — Indicates cable intended for use within buildings in ducts or plenums or other spaces used for environmental air in accordance with Section 800.154 of the NEC.

**CMR** — Indicates cable intended for use within buildings in vertical shafts in accordance with Section 800.154 (B) of the NEC.

**CMUC** — Indicates cable for under carpet use in accordance with Section 800.154 (E6) of the NEC. This cable complies with the VW-1 Flame Test requirements in ANSI/UL 1581, «Reference Standard for Electrical Wires, Cables, and Flexible Cords.»

**CMX** — Indicates cable intended for use within buildings where the wire or cable is enclosed in raceway or non combustible tubing, or in non concealed spaces where the exposed length of wire or cable does not exceed 10 ft, or in one- or two-family or multifamily dwellings when the cable diameter is less than 0.25 in., in accordance with Section 800.154 of the NEC. Type CMX cable may be marked «Outdoor» to indicate its suitability for installation outdoors on dwellings. This cable complies with the VW-1 Flame Test requirements in ANSI/UL 1581.

### Summary of equivalent UL and IEC tests:

Cable type	UL Test Standard	Equivalent IEC Standard
	UL 1581 §1100 Horizontal-specimen flame test	IEC 60331-2
	UL 1581 §1060 Vertical flame test	IEC 60332-1
CMX	UL 1581 §1080 VW-1 (vertical specimen) flame test	IEC 60332-1
	UL 1581 §1160 UL vertical-tray flame test	IEC 60332-3
	UL 1581 §1164 UL vertical-tray flame test; vertical-tray combustion propagation test	No equivalent
CMR	UL 1666 General Riser test	No equivalent
CM, CMG	UL 1685 Low-smoke, low-flame cable test	No equivalent
CMP	UL 910 General Plenum cable test (Steiner tunnel)	No equivalent



## APPLICATIONS

In Europe, for indoor installations cables composed of non-halogenated compounds (LSZH or HFFR) are the preferred choice as these are less toxic in case of fire. Although not mandatory, their use in public spaces (offices, hospitals, banks) is becoming ever more widespread.

Cheaper PVC-based cables are still in use, notably in residential installations, although their application tends to decline year after year.

Regarding the degree of fire resistance, the right choice will often be dictated by the application:

Fire resistance	Application	Example
IEC 60332-1	Indoor installations in public spaces. Non-critical applications (office applications, IP television, sound systems (non fire)).	IT equipment in an administrative department
		IP television in a hotel
		Multi-site telephony on an industrial estate
IEC 60332-3	Indoor installations in sensitive environments. Applications that are critical to the integrity of the systems (sensors, supervision, video surveillance), for installations with bundled cables.	IP video surveillance at a company
		Profinet Supervision of a production chain
		Access control at an airport
IEC 60331-23 IEC 60331-24	Indoor installations in rooms located within a sensitive environment, where systems must remain operational even in case of fire. System-critical applications (supervision, fire detectors, video surveillance, access control)	Video surveillance of public places during events (sports stadium)
		Central supervision in nuclear installations
		Fire detection through IP sensors in a tunnel