

# PROPERTIES AND TEST SPECIFICATIONS

## BEHAVIOUR UNDER FIRE CONDITIONS

The flammability of cables and wires is judged in accordance with a variety of standards.

**Flame resistance** acc. to

- DIN VDE 0482 part 332-1
- EN 60332-1
- IEC 60332 part 1

Flame resistance describes the ability of a cable to resist flame propagation. This ability is demonstrated by testing the flammability.

The test is conducted on single cores or cables vertically secured and exposed to a standard test flame for a specified time period of 60 seconds.

The test is considered to be passed where flaming of the specimen ceases of its own accord within a determined length of time.

**Flame retardant acc. to**

- DIN VDE 0482 part 332-2
- EN 60332-3
- IEC 60332 part 3

Contrary to flame resistance, a cable is designated as flame-retardant if it is capable of retarding flame propagation after a flaming period of 20 minutes. For this practice-oriented test a cable bunch attached to a vertically arranged ladder is used. The test is considered to be passed where flaming of the specimens ceases of its own accord after a flaming period of 20 minutes.

## CORROSIVE GASES

Combustion gases developing during fire are very problematic. They can be extremely toxic and very dangerous for people and animals. In combination with extinguishing water these combustion gases also generate aggressive reaction products (acids), which can cause serious damage to facilities and buildings.

The test for **corrosiveness of combustion gases** is conducted acc. to

- DIN VDE 0482 part 267
- EN 50267
- EN 60754

The pH-value and conductivity are to be determined in order to judge the corrosiveness of developing gases. This test also allows the detection of very small amounts of halogen-free components. The combustion of synthetic materials, e.g. PVC, causes dense smoke development and a drastic deterioration of visibility conditions. As a consequence, escape routes may be impassable, and the work and rescue efforts of fire brigades more difficult.

The **density of smoke** developing under fire conditions is judged acc. to

- DIN VDE 0482 Part 1034
- IEC 61034

This test method allows smoke density measurement of burning cables under practice-oriented conditions. The smoke density of various materials is determined by means of comparative testing. A photometric system equipped with a light source (100W) and a selenium photocell records the light obscuration caused by developing smoke.



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## INSULATION INTEGRITY

Many conventional cables malfunction due to melting of synthetic materials under fire conditions. As a consequence, short circuits cause downtime of necessary equipment. Applicable constructive measures and the use of appropriate materials can help maintain the insulation integrity of a cable for a certain time period. Testing is conducted acc. to

- DIN VDE 0472 Part 814
- DIN VDE 0482 Part 200
- EN 50200

This test method determines the insulation integrity of cables and insulated wires under direct fire exposure. Cables tested in accordance with this standard are marked with **FE 180** behind the abbreviated construction designation, whereas **FE** is the abbreviation for fire exposure, not for functional endurance.

The specimen of a single cable is secured above the burner in a horizontal position and connected to a voltage source (power cables and insulated wires are tested at 400 V, telecommunication cables and wires at 110 V). Metallic screens are connected together and earthed.

The burner is ignited, and the flame is adjusted to a temperature of at least 750°C by means of a temperature sensor. The energised specimen is then lowered into the flame, and a timer is started. Unless otherwise specified in the relevant product specifications, the test period shall be 180 minutes.

The test is considered to be passed where no short circuit or current flow interruption occurs within the scheduled duration.

## FUNCTIONAL ENDURANCE

The test of insulation integrity **FE** should not be mistaken for the test of **functional endurance E acc. to DIN 4102-12**. In this case an entire cable system is tested instead of a single cable. Cable systems are cables and wires (power cables and lines, installation cables for telecommunication and information processing systems) together with their corresponding connection elements, cable trays and mountings.

The necessity of functional endurance is required by law, which, among other things, stipulates a functional endurance of at least 30 minutes (E 30) for

- fire alarm systems
- security lighting and
- passenger lift systems

Furthermore, functional endurance over a period of 90 minutes is required for

- extinguishing water pumps
- ventilation systems
- smoke outlets and
- fire brigade lifts

The test is generally conducted by an officially recognised testing centre. The test stand is to be in accordance with DIN 4102 Part 2 and must have a minimum length of 3 metres. The test temperature follows the standard temperature-time curve.

Several test specimens from each cable construction with integrated functional endurance are to be tested, namely

- power cables  
2 specimens 4 x 1.5 and 2 specimens 4 x 50 or greater
- telecommunication cables  
2 specimens of the smallest permissible number of cores or pairs

The test specimens are to be suspended using practical means, applied to supporting structures provided for this purpose or attached directly to the ceiling or wall. The test voltage is to be 400 V for power cables and 110 V for telecommunication cables.

Functional endurance is proven where no short circuit or current flow interruption occurs in the cable system throughout the fire test. The following classes are distinguished depending on the measured duration of functional endurance:

- E30 > 30 minutes
- E60 > 60 minutes
- E90 > 90 minutes

