TELDOR
Cables & Systems Ltd.

Selecting the optimal cable design for use in foreseen Fire Conditions

Cables are constructed from a variety of materials, some of which are organic materials which are flammable. When ignited, cables may act as a propagating media for flames and when burning may release toxic gas and smoke to the surroundings.

Dense smoke and toxic fumes may prevent the safe evacuation of people, reducing visibility as well as prohibiting communication with people and equipment in affected areas, which might damage electronic equipment as well. In fact, smoke inhalation is a more common health hazard than the fire itself.

In environments with a high level of oxygen and air movement such as air-conditioned spaces which transfer air from point A to point B, the cable may act as a flame and smoke catalyst — spreading smoke, toxic gases, and the fire itself to the entire premises — somewhat similar to a fire spreading through a very dry forest.

Ranking Cable Properties for performance Under Fire Conditions

The main hazards during a fire may be exacerbated by a few factors: smoke inhalation, smoke toxicity, smoke density, the speed at which the fire spreads, and the fire itself. Each factor must be addressed to meet the needs of the specific installation, application, or regulation.

There are four key factors to consider when looking at the cable properties and performance during fire:

Flame spread

A flame normally starts in a single spot. Cable properties and the environmental conditions will determine the speed the flames spread to the entire premises, which may substantially affect the spread and strength of fire to other parts of the premises and increase potential damage.

Smoke Emissions

Smoke is emitted when the cable materials are burned; smoke density is determined by the chemical composition of the materials. Dense smoke is a severe health hazard due to smoke inhalation and often limits visibility and hampers evacuation.

Toxic fumes

When some cable materials burn, such as jacketing and insulation materials, toxic fumes are released. In some cases, depending on the chemical composition of those materials, the smoke may contain halogenated materials and might be very corrosive and toxic — all of which represent severe health hazards.

Fire resistance/circuit integrity

Fire-resistant/circuit integrity indicate the cable's ability to continue to operate in a desired manner for a defined period under specific fire conditions.

Ranking Table

When ranking fire hazards, priorities are dependent on the type of installation, the number of people at the facility, the applicable requirements of applicable standards, the hazardous or sensitive nature of equipment located there, and whether it's a residential or commercial building such as hospitals, schools, airports, etc.

In a high-rise building for example, the priority is to allow everyone to exit safely. In buildings and other premises when there is a lot of electronic equipment, smoke corrosivity and toxicity must be addressed as well as the regulatory standards that must be complied with.

Ranking	Evacuate personnel	Protect critical equipment	General facilities
A	Flammability	Flammability	Flammability
B	Smoke emission	Corrosive gas element	Release of heat / spread of flames
C	Release of heat / spread of flames	Release of heat / spread of flames	Smoke emission
D	Toxic fire emission	Smoke emission	Corrosive fire effluent
E	Corrosive gas emission	Toxic fire emission	Toxic fire emission

*Ranking is from highest to lowest; A being the highest. Category A is of the highest importance; installers decide on the ranking based on the installation/application. For mission critical applications, fire resistance capabilities are a must and the appropriate jacketing materials must be considered before any other criteria.

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Definition of Cable Types

Currently, the cable industry categorizes cables as follows:

FR

Flame retardant cables (FR)

LSZH

Low Smoke Zero Halogen (LSZH)

LSF

Low Smoke Fume (LSF)

FI

Fire-resistant cables (FI)

Flame retardant cables (FR) – Such as PVC, HFFR and others

Flame retardant cables are tested and classified per the amount of flame (fire) propagation and their ability to retain fire expansion. The flame propagation properties are influenced by factors such as the cable's jacket material; internal insulation materials; cable structure; type of armor; shield and braiding materials; installation methods (vertical or horizontal); number of cables in the cable trays (singles or bundles);
the amount of oxygen and air exchange in the ducts and ambient temperatures.

Common standards for flame-retardant cables are IEC 60332-3, IEC 60332-1, UL1666, CMX, CMR, CMP and the European CPR framework.

Due to their relatively low cost and standardization, flame retardant cables are widely used and specified. Irrespective of whether the cables are installed in single wire or bundles, and regardless of the smoke toxicity, flame spread will be retarded, and the fire will be confined to a limited area.

Low Smoke and Zero Halogen (LSZH, LSOH) and Halogen Free flame Retardant (HFFR)

LSZH cables are both low smoke and halogen free, which means they have low corrosivity, acidity and toxicity — emitting less smoke and/or toxic fumes which may injure people and damage equipment. LSZH cables outperform PVC cables in terms of low corrosivity and low smoke emission properties, whilst maintaining the same properties in respect of flame retardancy.

HFFR are Halogen free Flame retardant materials, however, they are not necessarily considered low smoke since their smoke emission properties are greater than LSZH.

Low Smoke Fume (LSF/LTx)

LSF cables are flame retardant and LSLH (low smoke low halogen), thanks to their low halogen properties and low toxicity of the smoke. These cables are designed to reduce the spread of flame, toxic gases, and smoke during a fire. They are often manufactured from special grade PVC compounds.

Fire-resistant cables

Fire-resistant cables are designed for mission critical installations. The cables should maintain functional circuit integrity and continue transmitting power, communication, and/or signals for a pre-defined period (between 30 to 180 minutes) under specific conditions. Because individual conductors are wrapped with a layer of fire resistance material, it prevents phase-to-phase and even phase-to-earth contact even if the insulation is burned. These cables should deliver consistent performance for the designated time whilst subjected to fire, heat and water, mechanical shock, or all of the above. Also applicable for intrinsically safe and hazardous locations defined as Zone 0 to Zone 2 on board ships or in some industrial applications.

By using combinations of different materials, cables can be designed to minimize the damage caused by fire until systems can be shut down and people are evacuated to safety. It is imperative to ensure continued operation and transmission capabilities in order to guarantee safety, maintain the ability to send commands, receive data, and operate equipment in order to prevent or reduce damage to the bare minimum.

FIRE RESISTANCE STANDARDS COMPLIANCE!

It is important to note that the current fire resistance standards do not specify data transmission capability under fire. These parameters should be tested and verified. For example, cables designated for Cat. 6 may operate as Cat. 5 under fire.

To ensure that a fire-resistant cable delivers the required performance, documentation should be provided on the testing procedures, which demonstrates cable performance is compliant with the requirements of the relevant applications.

Standards and Certifications of Cable Performance under Fire Conditions

It is essential that cables meet stringent standards to ensure the safety of human life as well as property both on land and in marine environments. Compliance with national, regional, and international specifications and standards is mandatory.

There are a wide variety of standards and certifications for flame retardant, fire-resistant cables issued by different certifying bodies which may vary from country to country.

Cable classifications and standards differ from country to country. EU standards differ to US standards in that the US standard prioritizes flame spread and smoke, whereas the EU standard places equal weight on flame spread, smoke, and toxic fumes.

International electrotechnical Commission (IEC)

The IEC categorizes the fire performance of the cables into various classes.
The IEC Standard for Flame Retardancy assesses the flame propagation for single wires (IEC-60332-1, IEC 60332-2, IEC 60332-3) and bundled cables (IEC 60332-3).

The IEC 60332-1-2 flammability test requires a single cable to be vertically fixed and exposed to a Bunsen burner at a 45° angle for 60 (≤ 25mm) to 120 seconds (25<D≤50mm).
The temperature is determined by the setting on the burner. The damage to the cable must end at least 50mm below the fixing clamp; the cable must be self-extinguishing.

The IEC 60332-3 flammability test requires cables to be fixed on a ladder, close together or at distance, depending on the type of fire. The temperature is determined by the specified volume of propane and air. The duration ranges up to 20 minutes, depending on the cable category. The fire damage may be visible up to a maximum of 2.5m from the bottom of the burner to the top.

EU Construction Product Regulations (CPR) Framework

EU's fire protection categories for cables is classified in 7 classes according to their flame spread and heat release.

Fca	Eca	Dca	Cca	B2ca	B1ca	Aca
Flammable	**Basic Performance**			**Higher Performance**		
	Products where a small flame attack does not cause large flame spread	Products that show a fire performance approximately like wood. Products show a continuous flame spread, a moderate fire growth rate, and a moderate heat release rate	Products that do not give a continuous flame spread, show a limited fire growth rate, and show a limited heat release rate	Products that are combustible but show very little burning	Products that are combustible but show very little burning	Level of highest performance corresponding to products that practically cannot burnW

In the CPR framework, three additional classification levels have been established regarding the below:

The amount of smoke emitted

The flaming droplets release by the cable during combustion

The acidity of the smoke

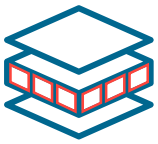
The additional classifications only applies to cables ranging from B1ca to Dca.

US Fire Ratings

Broadly speaking, the National Electric Code (NEC) establishes the cable fire rating guidelines. Typical ratings include:

Plenum (CMP) Cables

refers to any enclosed area that facilitates environmental air handling, such as an air conditioning duct. These cables must conform to stringent testing for flammability and smoke emission.



Riser (CMR) Cables

refers to cables that rise between floors, which may penetrate floors or walls. These cables are subjected to a high level of flame spread tests, because fire tends to climb up.

General Purpose (CM) Cables

refers to cables that may be used anywhere plenum and riser cables are not permitted.

Residential (CMX) Cables

refers to cables used in residential homes.

Low Smoke Zero Halogen (LSZH) Cables

these cables are widely used in enclosed areas with minimal ventilation or in areas containing sensitive equipment. It is not an NEC rating, but indicates the jacketing and insulation type.

UL Certification

UL cables must conform with five testing standards:

• CMP (Plenum Flame Test/ Steiner Tunnel Test) • CMR (Riser Flame Test)
• CM (Vertical Tray Flame Test) • CMG (Vertical Tray Flame Test)
• CMX (Vertical Wire Flame Test)

Intrinsically safe locations such as engine rooms, Zones 1 to Zone 0 and other installations

Cables installed in hazardous locations such engine rooms on board marine vessels or explosion proof areas are defined by a class system such as Class I, Divisions 1 and 2, Zone 2 to Zone 0.

The cables need to maintain cable integrity and enable safe operation, allowing the gradual shutdown of chemical processes in petrochemical plants and other hazardous areas. It is important that sparks are not generated because of cable construction.

Cable Fire Resistance Level Classification

	Continued Operation Fire-Resistant Cable Duration	Applications
FE30	Fire rated 30 minutes (0.5 hours)	FE30 cables are suitable for mission-critical applications where the circuit must remain functional for up to 30 minutes.
FE60	Fire rated 60 minutes (1 hour)	FE60 cables are used in mission-critical applications such as emergency lighting, where circuit operation in the event of fire is required for up to one hour.
FE120	Fire rated 120 minutes (2 hours)	FE120 cables are designed for installations that require longer circuit integrity, for example, to enable longer evacuation periods.
FE180	Fire rated 180 minutes (3 hours)	FE180 cables are designed for installations that require longer circuit integrity, for example, to enable longer evacuation periods

Setting the Gold Standard in Flame Retardant and Fire-Resistant Cables

At TELDOR, we believe that the right combination of knowledge, expertise, and cable material composition may make all the difference when it matters most and when time is of the essence. During these scenarios, data and cable integrity is essential to protecting lives and property, and for this reason, cable specifications and selection becomes a critical factor for both common as well as mission-critical applications.

For over 50 years, we have been supplying a wide range of flame retardant and fire-resistant cables – in fact, we offer the largest portfolio in the industry. We have the expertise and capabilities to design standards/commodity as well as custom-made cables for standard or unique customer requirements and environments.

Our major product lines:

Computer, LAN and Data Transmission cables

Fiber-Optic cables

BUS and Industrial Ethernet cables

LV Power and Lighting cables

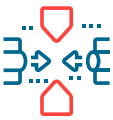
High-frequency Coaxial cables

Electronic and Control cables

Microphone and Audio-frequency cables

Custom-made, Composite and Hybrid cables

Instrumentation, Thermocouple and Process Control cables



Telephone, Switchboard and outside plant (OSP) Telecommunications cables

Teldor is able to provide customers with all-inclusive engineering, consulting as well as design engineering services concerning the following cable properties for fire-resistant cables

Basic elements

fiber-optic and metallic conductor

Data, electronic, instrumentations, fiber-optic, composite and hybrid

Shielding

braid or foil individual and/or overall shielding

Armoring

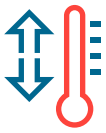
served steel wire, stainless steel and bronze braid, corrugated steel tape and many more

Resistance to chemicals

oil, fuel, MUD and chemical spray

Corrosion

resistance to corrosive environments



Temperatures

resistance to high and low temperatures including cold bend and impact according CSA 22.2.

Teldor's fire-resistant cables secure continued high-speed data transfer, enabling data transmission under direct fire, continued high transfer rate, and guaranteeing safe shutdown. Our product portfolio also includes fire-resistant cables for instrumentation and control, low voltage, and a variety of optical and hybrid cables that ensure secure operations and circuit integrity for a wide range of applications and installations. These include offshore applications such as oil platforms and living quarters, FPSOs, tankers, FLNGs, commercial vessels, and cruise ships; onshore applications such as power plants and petrochemical plants; and airports, tunnels, trains, hospitals and various other civil structures.

The cables are especially designed using flame-retardant, low smoke, and zero-halogen jacketing materials meeting international standards and complying with directives for installations in corrosive, explosive, and hazardous environments.

We are committed to quality. Our cables are rigorously tested and certified by leading classification societies to meet international standards. Our cables are officially verified by several independent third-party testing labs according to the ISO/IEC 11801-1, EN-50173, ANSI/TIA/EIA 568 and other standards.

Our fire-resistant cables meet the stringent IEC 60331 flame test Standards series, and provide high speed data transmission and circuit integrity in mission-critical application for durations of 30, 60, 90 & 180 minutes. Cables for marine applications are Type-approved by leading classification societies such as DNV-GL, ABS, LR, and RMRS. Our cables not only meet but exceed the designed performance during emergency and mission-critical situations.

We're here to help you find the right cable for your specific installation needs. Contact us to discuss your specific project or application's requirements.

Contact us

Teldor fire resistant brochure

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