

# CABLE FIRE RATINGS

## CONSTRUCTION PROJECTS REGULATION (CPR) APPLIED TO STRUCTURED CABLING

### WHAT IS THE CPR:

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The Construction Projects Regulation (CPR) is a European law published in 2011, with a classification ratified in 2016, to impose minimum fire performance to products installed permanently in buildings. It covers, among other items, the communications cables fixed in the building, but not the removable items such as patch cords and user cords. Vendors are required to comply since July 1st, 2017 and the fire rating must be identified on the cable packaging along with the European Community (CE) mark. The associated declaration of performance (DoP) must be made available to customers.

The EU regulation enforcing the standard by law is applicable to all European Economic Area (E.E.A.) member states: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom.

It also applies in the countries voluntarily participating to be part of the single market: Iceland, Liechtenstein, Norway and Switzerland. In addition, four other countries are E.U. candidates and in the process of incorporating EU legislation into national law: Montenegro, Macedonia, Serbia and Albania. Finally, Turkey is an associate member, voluntarily following EU regulations.

### WHY DO WE CARE SINCE WE ALREADY HAD LSZH?

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Previously, cables sold in Europe were classified in 2 types depending on their outer jacket:

#### **PVC (Poly Vinyl Chloride):**

A type of plastic that, in case of fire, usually burns very fast and emits large amounts of thick and irritating smoke. Translation: fire spreading quickly, people can't see the exit because of the smoke, and can't breathe because that smoke is burning their lungs.

#### **LSZH (Low Smoke Zero Halogens):**

The "Low Smoke" means that people should be able to still see in case of fire. Fluorine, Chlorine, Bromine, Iodine and Astatine are highly reactive in case of fire and are the principal irritating components of the cable sheaths. The "Zero Halogens" means avoiding them and thus cables are less irritating to the human lungs in case of fire.

The problem is that these terms imply only the type of material of the jacket, but not the conductor isolation material, and do not impose any actual fire resistance of the cable. Some manufacturers chose to comply with certain IEC fire rating tests, but those were insufficient and not mandatory.

A second issue was discovered more recently with less reputable suppliers: non-compliance. Some cables claimed to meet the ratings, but when tested they failed miserably. So, there was a necessity to also introduce a solution to guarantee the rating rather than simply rely on manufacturer claims.

## DETAILS OF THE CPR

The CPR now classifies cables according to the characteristics of flame propagation and heat release, as well as additional characteristics: smoke production, smoke acidity, and flaming particles. Then it also introduces various levels of conformity control over the results. As an example, a CPR classification is written « DCA s2 d2 a1 ». DCA is the Euroclass and « s2 d2 a1 » are additional criteria.

The classification consists of 7 Euroclasses which define the fire reaction performance. Below is a table summarizing the classification:

### Testing and level of control:

		ACA	B1CA	B2CA	CCA	DCA	ECA	FCA
Euro classification	Gross heat of combustion	Yes						
	Flame propagation		Yes	Yes	Yes	Yes	Yes	No
	Heat release		Yes	Yes	Yes	Yes	No	No
Additional Criteria	Smoke production, flaming droplets, smoke acidity		Yes	Yes	Yes	Yes	No	No
Control of compliance	Type Testing by independent lab	Yes	Yes	Yes	Yes	Yes	Yes	No
	Production sampling by certification body	Yes	Yes	Yes	Yes	No	No	No

### Explanation of the Euro Classes:

Euro Class	Reaction to fire	Comments
ACA	Non combustible	It is near-impossible to produce non-combustible communication cable.
B1CA	Various levels of flame propagation and heat release	D <sub>ca</sub> is the lowest cable type with all aspects tested and certified by an independent laboratory. Higher classes offer improved resistance to flame propagation and heat release but their additional criteria could be identical.
B2CA		
CCA		
DCA		
ECA	Minimum flame propagation testing	Heat release is not tested. Additional requirements are not tested, so the spread of fire is controlled, but the evacuation of people is limited due to toxic fumes. This is the first level of cable to require independent testing.
FCA	No testing	Offers absolutely no guarantees. Should be avoided.

## Definitions of the additional Criteria:

These additional criteria are added after the letter of the Euroclass, in order s, d, a. and they allow for more than 200 combinations. For obvious reasons, most will not exist, and only the most useful ones will be used.

It is important to understand that the lowest rating in each type means that the product actually does not meet the requirements.

Smoke Production	Performance	Particles / Droplets	Performance	Smoke acidity	Performance
<b>s1</b>	Very low smoke production	<b>d0</b>	No droplets / flaming particles	<b>a1</b>	Very low smoke acidity
<b>s1a</b>	Very low smoke production & high transmittance	<b>d1</b>	Low droplets / flaming particles	<b>a2</b>	Low smoke acidity
<b>s1b</b>	Very low smoke production & medium transmittance	<b>d2</b>	No performance guaranteed	<b>a3</b>	No performance guaranteed
<b>s2</b>	Average smoke production and propagation				
<b>s3</b>	No performance guaranteed				

The smoke production can impair visibility and restrict people from finding the exit. If the cable is compliant to “s1”, then an additional test of transmittance measure exactly how far a person can see. This factor can be important in fire escape routes, but less in closed rooms where the exit is known.

The acidity is the primary danger in case of evacuation and is the main cause of death, as it seriously impairs breathing. However, it’s only an important factor with large quantities of cables in area where people cannot exit rapidly.

The flaming particles pose two risks: spreading the fire to other areas and burning people nearby. So, when contained inside cable management, this aspect has far lower risk than with apparent cables.

## HOW TO CHOOSE?

The European Union imposes the cables to comply with this classification, but it does not impose any specific requirement. This is the decision of each country and will depend on building types. Some countries have already defined their requirements, but for the others, the advice below can help designers make informed decisions.

If it were possible, all installations would use only the highest fire resistance possible. Unfortunately, there are always trade-offs to obtain an optimal balance between safety, ease of installation and cost.

Euroclass A<sub>ca</sub> will most likely not exist in communication cables.

Euroclass B1<sub>ca</sub> and B2<sub>ca</sub> are generally limited to “protected” emergency exits. These are areas used strictly for emergency and with no burning material inside. The only cables entering this space are to connect fire safety equipment such as fire escape signs or fire detection. Any other cables crossing that space should be enclosed in a fire rated pathway.

Euroclass C<sub>ca</sub> is the first level to require regular product sampling by a certification body, so the cable not only has added cost of manufacturing but also cost of control. This can be justified for high density public areas, or when mandated by law.

Euroclass D<sub>ca</sub>, offers adequate reaction to fire with a certification of compliance from an independent lab. This is the most common cable.

At the bottom of the list, Euroclass F<sub>ca</sub> is not guaranteed for anything, and Euroclass E<sub>ca</sub>, although tested for fire propagation, is not tested for heat or for any additional criteria. These cannot be recommended, although E<sub>ca</sub> could be used where a very limited quantity of cables is installed as these would have a low impact in case of fire.

Then additional criteria must be decided. In Europe, the majority of cables are installed either in the false ceiling, in walls or in closed wall mount containment. This is an important aspect for selecting the right options.

The smoke should be controlled but it's not so critical in most areas since there are already barriers. We can generally see the D<sub>ca</sub> associated with the "s2", and C<sub>ca</sub> and above associated with the "s1" requirement. The "s1a" and "s1b" are generally applied only in very specific contained fire exits and associated to the highest Euroclasses.

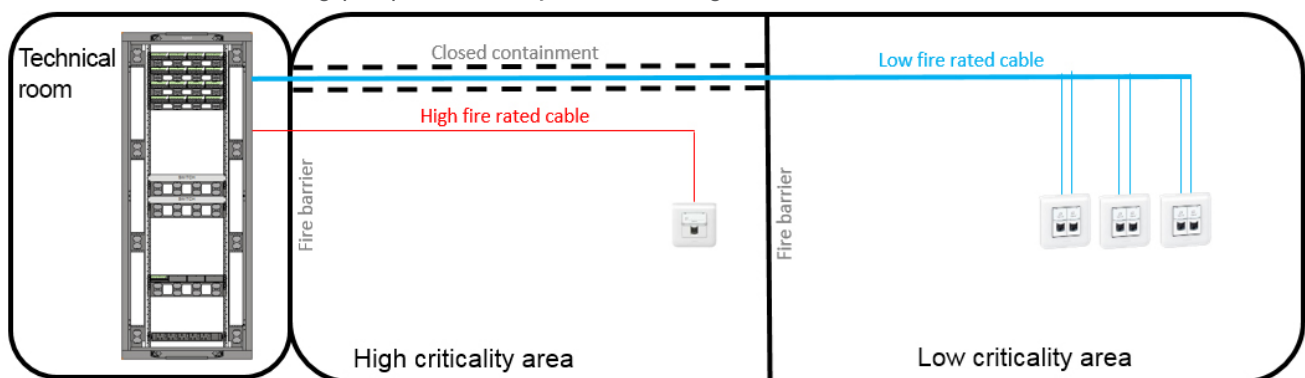
While the cables are not directly inside the user space, the particles have marginal influence on the ability for people to evacuate. These could have an impact in an open containment directly above a main exit corridor where flaming droplets could pose a threat, but in most cases, "d2" is perfectly acceptable. If the cables are crossing a critical area, the simplest is to enclose them in fire resistant containment for that area.

Acidity: it's obvious that a single cable enclosed in a conduit does not have the same effect as a bundle on an open cable tray in a corridor. The general market acceptance is that some acidity is tolerated for low quantity of cables in conduits in residential but is never allowed for any common areas or public buildings. "a1" is the only safe choice if acidity needs to be controlled.

## DESIGN:

The CPR is a European regulation to categorize cables according to their reaction to fire. Each country in the EU can define its own requirements for each type of building based on the classification provided.

In countries where no specification is imposed, it is up to the designers to lead the industry in providing secure installations, allowing people to safely exit building in case of fire.



*Example of compartmentalization to allow use of cable with lower fire rating*

Unlike electrical cables, data cables cannot be spliced, so it's impossible to have a single circuit with various fire ratings according to areas crossed. It could seem simplest to always use the cable with the highest fire rating for the complete installation, but this will have significant impacts on cost and installation methods. The most practical solution is to choose the lowest acceptable rated cable for most of the project, then adapt to specific cases such as containment when crossing a sensitive area or specific cables only for certain needs. A smarter design can improve both costs and safety.

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