

Halogen-free Optical Fibre Cables for Outdoor and/or Indoor Use

Introduction

Since the first cables used for communication networks (telephony etc.), there have been two different cable constructions:

1. Cables for outdoor installation, such as between subscribers and telephone exchanges, and between the exchanges themselves.
2. Cables for indoor use such as those installed inside the telephone exchanges.

With the introduction of plastics, most conventional communication cables for outdoor use (including direct burial) were provided with UV-resistant polyethylene (PE) jackets, while cables for indoor use had Flame Retardant, PVC jackets. PE and PVC materials for jackets of communication cables have now been standardised internationally, the main standard in Europe being EN 50290-2-27.

Polyethylene is a very good sheathing material for outdoor use, but it is not flame-retardant. In other words it does contribute to the spread of fire.

PVC is physically an appropriate jacketing material with a high degree of flame-retardancy, but in the event of fire, it generates black smoke, and poisonous and corrosive gas. Such emissions are harmful not only to electrical components, but can also cause death.

Due to the smoke emission and toxic gas set free when PVC burns, halogen-free (FRNC/LSNH) sheathing compounds have become more and more specified and available. These were initially used only for indoor cables, as the first halogen-free compounds were found not to be particularly suitable for outdoor use.

In the early 1990's, Belden Europe redesigned all their Indoor Optical Fibre Cable and replaced the PVC jackets with halogen-free (FRNC/LSNH) jackets. In the second phase of this program, halogen-free compounds for outdoor use were also selected and added to Beldens programme of Outdoor Optical Fibre Cables. This range of fibre cables is therefore suitable for use both indoors and outdoors (the Belden Universal range).

Halogenfree Optical Fibre Cables

What does halogen-free mean? Chemically seen, Polyethylene (PE) is halogen-free, but that is not the meaning of "halogen-free" in this respect. The definition of "halogen-free" for Belden halogen-free Optical Fibre Cables is:

Flame-Retardant, Non Corrosive, Low Smoke, No Halogen (FRNC/LSNH) according to the following standards:

Flame-Retardancy	IEC 60332-1 or 2 / IEC 60332-3
Non-Halogen	
Corrosivity:	IEC 60754-2 (HD 602, BS 6425.2)
Toxicity:	NES 713 (HD 605, BS 6425.1)
Low Smoke:	ASTM E662

Physical Characteristics

In 1994, CENELEC, the European Committee for Electrotechnical Standardisation published a harmonised specification covering halogen-free, flame-retardant, thermoplastic sheathing compounds for use in the construction of communication cables. This specification has been given the designation HD 624 Part 7 and was embedded in 2002 in EN 50290-2-27.

These compounds are particularly interesting for outdoor use, where their high and low temperature performances show that the material is eminently suitable for use in environments with widely varying conditions.

Characteristic	EN 50290-2-27	Belden
After ageing for 7 days, 100C:		
Tensile Strength variation, max	± 30 %	± 15 %
Elongation of Break variation, median	100 %	160 %
Heat Shock (130C, 1 h)	No cracks	No cracks
Cold Bend (-15C)	No cracks	No cracks
Cold Elongation (-25C)	≥ 20 %	≥ 50 %

Water Absorption

All plastic materials are porous to varying degrees. The general category of thermoplastic materials commonly used in cable constructions will to some extent absorb water, and certainly do not act as a complete water block. Only materials like metals or glass can provide a true “hermetic” seal. Plastic materials are generally characterized with parameters such as water absorption, and absorption of other common solvents such as oils, gasoline and kerosene.

Since halogen-free materials are filled with relatively high amounts of flame-retardant powderous additives they will be more sensitive to absorption of water.

A critical selection in the available range of FRNC compounds is necessary to guarantee a maximum water absorption according to IEC 811-1-3. This test gives the amount of water measured in mg/cm² that will be absorbed by test samples soaked in water for 14 days at 70C.

The table below shows a comparison of values for water absorption given for the most common sheathing materials:

Material	Max. Water Absorption after 14 days, 70C in mg/cm ²
PE	0.2
PVC	5
FRNC/LSNH	0.2 - 8

Most communication cables, based on twisted pairs or quads are sensitive to the ingress of moisture. For instance, moisture in the core of telecom cables will ruin the transmission properties immediately. This is different for optical fibre cables buried directly or indirectly (in ducts), where the fibres are generally well protected against long-term contact with water, this being necessary for the guarantee of the lifetime performance of the fibres. Consequently, water absorption is not that important as long as the FRNC/LSNH sheath remain undamaged during the lifetime of the cable.

UV Resistance

Cables for outdoor use must be resistant to sunlight (UV resistant). The UV resistance is measured according to ISO 4892-2 meth.2. In this test, the material is exposed to 340nm UV-light during 500 hrs. After exposure, the variation in mechanical properties (tensile strength, elongation at break) is determined. A maximum decrease in mechanical properties of 25% is generally accepted.

The Belden halogen-free cables for Outdoor and Universal (Indoor/Outdoor) use are UV-resistant according to ISO 4892-2.

Applications

The UV resistant FRNC/LSNH sheathing compounds, suitable for Outdoor and Indoor use, are used in all Belden Universal Optical Fibre Cables.

The FRNC/LSNH sheathing compounds, suitable for Indoor use only are used in all Belden Indoor Optical Fibre Cables.

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