

## PROPERTIES OF SHEATHING MATERIALS FOR OPTICAL FIBER CABLES

### GENERAL

Below features show a general approach to plastic materials used for fiber optic Cable sheathing and jacketing in the world market.

But, these do not cover all materials used for fiber optic cables jacketing and there are other plastic materials in addition to these below indicated ones .

Depending on the innovations and developments as a result of technological improvements etc. , more materials are started to use in related field.

This below table is a type of simple guidance acc. to the best of our today's knowledge and it is based on typical values.

Given information is limited with characteristics of FOC jacketing materials but properties/ resistivity of cables can not be derived from it

Material	Polyolefine flame retardant	Polyvinyl Chloride	Polyethylene		Polyurethane flame retardant	Polyurethane	Polyamide
Abbreviation	LSZH / LSOH	PVC	LD PE	MD/ HD PE	PUR / TPU	PUR / TPU	PA
DIN VDE Code	H	Y	2Y	2Y	11Y	11Y	4Y

### Combustion Properties

Halogen free	yes	no	yes	yes	yes	yes	yes
Flame retardant	yes	yes	no	yes	no	no	no
Smoke emission	low	strong	medium	medium	strong	strong	strong
Corrosive fumes	low	high	no	low	low	no	no

### Mechanical Properties

Abrasion Resist.	low	medium	medium	good	good	good	good
Flexibility	high	high	medium	low	high	high	low
Hardness	medium	soft	medium	high	soft	soft	hard

### Environmental Resistance

Oil / fuel*	good / satisfactory**	satisfactory	good / satisfactory	satisfactory	good	good
Water	good / satisfactory**	good	very good	satisfactory	good	satisfactory
Weathering ***	good	good	very good	good	very good	good

\* Resistivity of various types of jacketing plastics has to be verified against specific types of oils and fuels

\*\* Based on requested cable structure, various types of LSZH materials are used for FOC sheathing having different properties than Each other

\*\*\* Black color for all types of plastic jacketing materials offers the best UV resistance but UV resistivity does not depend on solely color of plastic material used as UV resistive additives are used also for plastic jacketing materials independently color of the jacket etc.

## SHEATHING MATERIALS

### MDPE, BLACK

This is the Standard sheathing material for cables for outdoor use. The material is UV stabilised with using  $2.5 \pm 0.5$  % carbon black. It has excellent weathering resistance.

The MDPE has very good physical properties such as: good abrasion resistance, high hardness, low dielectric constant and outstanding oxidation resistance.

Compared with HDPE, the MDPE has better resistance to stress cracking. Compared to LDPE the MDPE has a higher strength.

The MDPE meets the requirements of various international standards:

- ISO 1872-PE, KGC, 40-G200, C
- ASTM D1248-84: Type II, Class C, Cat 5
- BS 6234 3C
- The MDPE fullfills the requirements of IEC 708-1 (test according to IEC 811)

### LDPE, BLACK

This is the alternative PE material for cables for outdoor use. The material is UV stabilised using  $2.5 \pm 0.5$  % carbon black and have very good weathering resistance.

The LDPE meets the requirements of various international standards:

- ISO 1872-PE, KCHL, 18-D003
- ANSI C 8.35
- ASTM D1248-84: Type I, Class C, Cat 5, grade J3, E5
- BS 6234 03C, TS1
- DIN VDE 0207 type 2YM2
- NF C 32-060
- The LDPE fullfills the requirements of IEC 708-1 (test according to IEC 811)

### MDPE, COLOURED

The coloured MDPE is used for outdoor cables where the end user requires a cable sheath of other colours than black.

The material is UV stabilised for good weathering stability.

Standard sheath colours are: Black, orange, red, green, blue and aqua .Other colours according to IEC 304 or sample are possible.

The natural base material meets the requirements of various international standards:

- ISO 1872-PE, KNH, 27-D003
- ASTM D 1248 Type II, Class A, Cat 5 Grade E4,E5
- DIN VDE 0207 2Y11, 2Y13.
- NF C 32-060
- BS 6234: type 03

### STANDARD MULTIPURPOSE LSZH

Standard LSZH (Low Smoke Zero Halogen) material is produced from polyolefin's and is filled with flame-retardants in the form of aluminium or magnesium hydroxide.

This sheathing compound is used for indoor as well as multipurpose cables. They are commonly used for tight coating of fibers to produce tight buffered optical fiber cables which are mainly used for indoor riser and plenum applications.

Standard sheath colours are: Black, orange, red, green, blue and aqua .Other colours according to IEC 304 or sample are possible.

The LSZH material meets the requirements of various international standards as described in the following pages

### Cables made with LSOH IEC 60332-1 complied materials for sheathing

Low Smoke Zero Halogen material is produced from PE- copolymers and silicon elastomer with chalk as fire retardant filler.

This sheathing compound is used for cables that are installed as indoor/outdoor cables, due to its very low water absorption.

The cables made with this compound can be used outdoor installation in ducts (also flooded with water) as well as for direct burial.

Sheathing material is UV stabilized using a selected type of hindered amine light stabilizer (HALS). Thus a long lifetime even in the open air is assured.

Cables made with this material is selfextinguishing and fullfills IEC 60332-1.

The material fullfills the requirements of:

- EN 50290-2-27:2002
- VDE0207 Teil 24(HM5)

### Cables made with LSOH IEC 60332-3C complied material for sheathing

Sheathing material is a high performance state-of-the-art LSZH (Low Smoke Zero Halogen) material.

Primarily is used where a very high resistance towards fire is needed.

While this material implement improvements well known multi purpose concept regarding performance in case of fire,the resistance towards the outdoor environment is retained: Material is UV resistant, and water resistant.

The UV resistance is achieved using a selected type of hindered amine light stabilizer (HALS). Thus a long lifetime even in open air is assured.

Material is non- toxic, non-corrosive and do not contain any halogens that could cause damage to equipment or the environments.

Further in case of fire it generates only extremely low amount of smoke.

Material fullfills all relevant international and national standards for this class of sheathing material, among them:

- EN 50290-2-27:2002
- VDE 0207 part 24, type HM2
- BS 7655 6.1 type LTS1 and LTS2

Cables made with this sheathing material is selfextinguishing and generally fullfills IEC 60332-3C.

### PA ( Polyamide ) 12

A PA12 outer jacket is used optionally on top of a black MDPE sheath. This jacket gives the cable a hard, smooth surface.

The hardness is >71 (Shore D according to DIN 53505 and ISO R868).

The PA12 jacket adds a number of features to the cable: The cable gets improved rodent protection properties. The friction between cable and a PE duct is reduced with approximately 50%.

The PA12 jacket has a good chemical resistance towards certain chemicals:

At moderate temperatures the material is resistant without appreciable swelling to water, dilute and concentrated alkalis, edible, lubricating and diesel oils, aliphatic hydrocarbons, esters, ketones and ethers.

At room temperature, the material is resistant to dilute organic acids and to very dilute mineral acids. Standard colour for the PA12 jacket is orange and black.

### PP ( Polypropylene )

A PP outer jacket is used optionally on top of a black MDPE sheath. This jacket gives the cable a hard surface.

The PP jacket adds a number of features to the cable: The cable gets improved rodent protection properties. The friction between cable and a PE duct is somewhat reduced. The outer PP jacket is 0,5 mm thick. Standard colour for the PP jacket is orange.

## ALUMINIUM TAPE AS MOISTURE BARRIER

Aluminium moisture barrier in the form of a folded tape is mainly used for telecom trunk lines. The aluminium tape is adhesively bonded to the outer jacket, which is made of LDPE or MDPE. This type of jacket is often called a 'LAP' sheath '.

The aluminium moisture barrier fullfills the requirements of:

- IEC 708-1
- IEC 794-3
- EN 187 100
- DIN/VDE 888-3 (DIN/VDE 816-1) (together with a black LDPE jacket.)

The nominal thickness of the aluminium tape is 0.20 mm. There is a polymer film on both sides of the aluminium tape.

The nominal thickness of the polymer film is 0.05 mm. The adhesion between aluminium tape and the polyethylene sheath is fullfilling the requirements of IEC 708-1.

The tape is folded with an overlap. As Standard the aluminium tape is surrounded by a LDPE or a MDPE jacket.

## ARAMID YARNS FOR REINFORCEMENT

Aramid yarns are used as strength member for cables with tight buffered fibres, some cables with semi tight fibres and for UNI loose tube cables.

Aramid yarns are also used in loose tube cables with central strength member as additional tensile reinforcement.

There are no international or national standards for Aramid yarns. The most common trade names for Aramid yarns are Twaron™ and Kevlar™.

The tensile strength requirement for the cable determines the amount of Aramid yarn to be used.

They are not so effectively used for protection against rodents but wovnen rowings are used sometimes for ballistic protection and against rodent attacks.

Water swellable alternatives are possible to achieve water resistivity in fiber optic dry core cables if requested .

## GLASS YARNS FOR REINFORCEMENT AND RODENT PROTECTION

Glass yarns in the form of rovings are used as alternative strength member for UNI tube cables. Glass yarns are also used in loose tube cables with central strength member as additional tensile reinforcement.

Thick layers of glaziers have appeared to be a good rodent protection scheme, however not as effective as steel armouring.

Water swellable ones are also possible to achieve water resistivity in the Cable core if preferred.

They provide strenght to the Cable to achieve high crush and impact test values. But, due to their structure ,they increase the Cable outer diameter