SLOVENSKI STANDARD
oSIST prEN 50290-2-34:2016

01-maj-2016

Komunikacijski kabli - 2-34. del: Skupna pravila za snovanje in konstruiranje - Polietilenska zmes za oplaščenje zunanjih optičnih kablov

Communication cables - Part 2-34: Common design rules and construction - Polyethylene sheathing compound for outdoor optical fibre cables

Câbles de communication - Partie 2-34: Règles de conception communes et construction - Mélange à base de polyéthylène pour gainage destiné aux câbles extérieurs à fibres optiques

Ta slovenski standard je istoveten z: **prEN 50290-2-34:2016**

ICS:

29.035.20	Plastični in gumeni izolacijski materiali	Plastics and rubber insulating materials
33.120.10	Koaksialni kabli. Valovodi	Coaxial cables. Waveguides

oSIST prEN 50290-2-34:2016 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50290-2-34

March 2016

ICS 29.035.20; 33.120.10

English Version

Communication cables - Part 2-34: Common design rules and construction - Polyethylene sheathing compound for outdoor optical fibre cables

Câbles de communication - Partie 2-34: Règles de conception communes et construction - Mélange à base de polyéthylène pour gainage destiné aux câbles extérieurs à fibres optiques

To be completed

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2016-06-17.

It has been drawn up by CLC/TC 46X.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Project: 24906

Ref. No. prEN 50290-2-34:2016 E

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European foreword

This document (prEN 50290-2-34:2016) has been prepared by a joint working group of the Technical Committees CENELEC TC 46X, "Communication cables", and CENELEC TC 86A, "Optical fibres and optical fibre cables".

This document is currently submitted to the Enquiry.

The following dates are proposed:

• latest date by which the existence of this document has to be announced at national level	(doa)	dor + 6 months
• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

1 Scope

This Part 2-34 of EN 50290 gives specific requirements for polyethylene compounds, as given in Table 1, to be used for low shrinkage sheathing elements of fibre optic cables. All the compounds in this standard are suitable for sheathing cables to be used in outside plant having a maximum operating temperature of 70 °C. In addition, EN 50290-2-34 will give guidance in the selection of polyethylenes for other applications where low sheath retraction is necessary. It is to be read in conjunction with EN 50290-2-20, the product standard EN 60794-3 and other applicable product standards.

Using raw material and type test data as outlined in this standard, the raw material supplier will have sufficient data to demonstrate compliance and warrant that the material is suitable for the specified application.

There are several routes used for manufacture of Polyethylene and as a consequence a number of different types of polyethylene are defined as given in Table 1.

Table 1 – Polyethylene materials (informative)

Abbreviation	Material type	Reactor process	Polymer structure
LDPE[1]	Low density polyethylene	High pressure/ temperature radical reaction	Long chain branched
LLDPE	Linear low density polyethylene	Low pressure/ temperature catalytic reaction	Significant short chain branching
MDPE	Medium density polyethylene	Low pressure/ temperature catalytic reaction	Short chain branched
HDPE	High density polyethylene	Low pressure/ temperature catalytic reaction	Limited short chain branching
1 Upper process capability for density 0,930 g/ml. Normally density range 0,917-0,925 g/ml.			

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60811-401, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven (IEC 60811-401)*

EN 60811-406, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 406: Miscellaneous tests - Resistance to stress cracking of polyethylene and polypropylene compounds (IEC 60811-406)*

EN 60811-407, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 407: Miscellaneous tests - Measurement of mass increase of polyethylene and polypropylene compounds (IEC 60811-407)*

EN 60811-501, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds (IEC 60811-501)*

EN 60811-511, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 511: Mechanical tests - Measurement of the melt flow index of polyethylene compounds (IEC 60811-511)*

EN 60811-512, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 512: Mechanical tests - Methods specific to polyethylene and polypropylene compounds - Tensile strength and elongation at break after conditioning at elevated temperature (IEC 60811-512)*

EN 60811-605, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 605: Physical tests - Measurement of carbon black and/or mineral filler in polyethylene compounds (IEC 60811-605)*

EN 60811-606, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 606: Physical tests - Methods for determining the density (IEC 60811-606)*

EN 60811-607, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 607: Physical tests - Test for the assessment of carbon black dispersion in polyethylene and polypropylene (IEC 60811-607)*

EN 60794-3, *Optical fibre cables - Part 3: Sectional specification - Outdoor cables (IEC 60794-3)*

EN 50290-2-20, *Communication cables - Part 2-20: Common design rules and construction - General*

EN ISO 178, *Plastics - Determination of flexural properties (ISO 178)*

EN ISO 527, *Plastics – Determination of tensile properties (ISO 527)*

EN ISO 868, *Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868)*

EN ISO 11357-6, *Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6)*

ISO 974, *Plastics — Determination of the brittleness temperature by impact*

3 Compound test requirements

The tests are to be carried out on granules or moulded plaques produced from granules of compound. Specific requirements are shown in Table 2. This data shall be provided by the compound supplier. Relevant test methods, requirements and limits shall be included in any supply specification of the compound.

In the case of special applications, additional requirements could be specified.

4 Cable test requirements

The anticipated performance assumes standard cable design and conventional process technology and is specified in Table 3. Using type test data the compound supplier is expected to demonstrate compliance and warrant that the material is suitable for the specified application.

In the case of special applications, additional requirements could be specified.

5 Cable sheath shrinkage

At processing temperatures polyethylene has an amorphous structure with a density (0,800 g/ml – 0,820 g/ml) dependent only on the melt temperature. On cooling to room temperature the polymer will partially crystallise with a resulting increase in density (0,915 g/m – 0,965 g/ml). The potential cable shrinkage is partially a consequence on this change in density.

Shrinkage deformation is a consequence of stress arising from the change in density and volume reduction induced by crystallization as well as the orientation and the stretching of the polymers during extrusion. Provided these stresses can relax within the time constraints of the cooling process the resulting cable sheath will be dimensionally stable. In the case where these stresses cannot relax the sheath will tend to exhibit post manufacture shrinkage as a result of temperature cycling. Stress relaxation characteristics can be determined by melt deformation experiments and the link between the polymer relaxation spectra and cable shrinkage has been reported (see Bibliography). Further guidance on polymer selection is contained in Annex A.

6 Ageing considerations

Natural or coloured polyolefin cable sheaths, containing conventional antioxidant stabilisers degrade rapidly when subjected to natural daylight weathering through photo-catalysed oxidation (actinic degradation). Degradation is manifested by discolouration of the sheath followed immediately by loss of mechanical properties and spontaneous cracking. This ageing process is accelerated in situations where the sheath is physically stressed, for example at sharp bends. Under temperate European climates failure can occur within two years of exposure. Ageing will not only occur on installed cables but also on cables stored externally on drums or reels where the cables have been inadequately protected from solar radiation.

Ultraviolet stabilisation systems shall be incorporated in the natural sheath compound to extend the induction period before the onset of failure in external applications. The best ultraviolet protection is a minimum of 2 % of well dispersed carbon black (see Table 2).

7 Health, safety and environmental (HSE) regulations

The compounds are subject to Health, Safety and Environmental requirements as defined in EN 50290-2-20. Any deviations or compliance failures must be identified by the compound supplier and necessary corrective actions to be undertaken agreed with cable maker.

Table 2 – Polyethylene sheathing compounds - physical properties of granules

Characteristics [1]		Test method	Unit	Types			
				LD	LLD	MD	HD
1	Density [2) 3)]	EN 60811-606	g/cm^3	≤ 0,925	≤ 0,925	> 0,925 ≤ 0,940	> 0,940
2	Melt flow index (190 °C/2,16 kg) [4)]	EN 60811-511		To be reported by the supplier			
3	Flow Rate Ratio (MFR(21,6)/MFR(2,16)) [4)]	EN 60811-511		To be reported by the supplier			
4	Hardness Shore D (1 s)	EN ISO 868	[-]	> 45	> 50	> 54	> 56
5	Low temperature brittleness	ISO 974	°C	< -76	< -76	< -76	< -76
6	Mechanical characteristics	EN 60811-501					
6.1	Tensile strength - median, min.		MPa	10	16	16	18
6.2	Elongation at break - median, min.		%	300	300	300	300
7	Flexural modulus	EN ISO 178					
7.1	Result to be obtained - mean, min.		MPa	200	300	500	750
7.2	Result to be obtained - mean, max.		MPa	300	500	750	-
8	Oxidative Induction Time (200 °C)	EN ISO 11357-6	min.	> 50	> 50	> 50	> 50
9	Measurement of mass increase [5)], max.	EN 60811-407	%	10	9	7	6
10	Stress cracking - (10 % Igepal in water) F0 [6)]	EN 60811-406, method B	h	> 1000	> 1000	> 1000	> 1000
11	Carbon black content [6) 7)]	EN 60811-605	%	2,5 ± 0,5			
12	Carbon black dispersion - agglomerate [6) 7)]	EN 60811-607		Shall not be greater than 3			
13	Carbon black dispersion - appearance [6) 7)]	EN 60811-607		Shall not be worse than photomicrograph B			

1) All values of Table 2 shall be provided by the compound supplier, see clause 3.

2) Value for base polymer. The addition of 2,5 % carbon black will raise the nominal value by 0,012 g/cm³

3) Tolerance for the nominal value of a specific compound is +/- 0,003 g/cm³

4) These characteristics can be used as an indication for different shrinkage behaviour of cable sheaths, see Clause 5 and Annex A.

5) To be measured on a sample cut from a pressed plaque of 0,5 mm. Test specimen according to EN ISO 527 (all parts) is a convenient sample format. The test fluid is petroleum jelly (used as cable core filling material); exposure duration 168 h in fluid at temperature 70 ± 5 °C.

6) For inner sheath and dummy buffer applications non-black PE compounds can be used and items 10, 11, 12 and 13 need not apply, see Clause 6.

7) Not applicable for other colours than black. Non-black PE compounds can be used and items 11, 12 and 13 need not apply, see Clause 6. EN 50289-4-17 contains guidelines for the use of different ultraviolet stabilised products.