BS EN 50290-2-29:2016

BSI Standards Publication

Communication cables

Part 2-29: Common design rules and construction — Crosslinked polyethylene insulation compounds: instrumentation, control and field bus cables

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National foreword

This British Standard is the UK implementation of EN 50290-2-29:2016. It supersedes BS EN 50290-2-29:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/46, Cables, wires and waveguides, radio frequency connectors and accessories for communication and signalling.

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European foreword

This document (EN 50290-2-29:2016) 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".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-07-22
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2019-07-22

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This document supersedes EN 50290-2-29:2002.

1 Scope

This Part 2-29 of EN 50290 gives specific requirements for Crosslinked Polyethylene (XLPE) compounds to be used for the insulation of instrumentation, control and field bus cables. There are several routes used for manufacture of XLPE insulated cables and as a consequence a number of different types of polyethylene compound may be specified. The compounds required for the different manufacturing processes are described (Table 1). The unstabilised materials require antioxidant to be added during the cable extrusion process.

Table 1 — XLPE Materials

Material	Stabilisation	Manufacturing process
PE	None	Base polymer for irradiation/one step silane
PE-S	Yes	Stabilised compound for irradiation/one step silane
SXPE	None	Silane grafted compound or copolymer for two step process
SXPE-S	Yes	Stabilised silane grafted compound or copolymer for two step process

It is essential to read this European Standard in conjunction with Part 2-20 of EN 50290, the product standards EN 50288-7 and EN 61158 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.

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 50288-7, *Multi-element metallic cables used in analogue and digital communication and control — Part 7: Sectional specification for instrumentation and control cables*

EN 60216 (all parts), *Electrical insulating materials — Thermal endurance properties (IEC 60216)*

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 60811-501, *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 60811-502, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 502: Mechanical tests — Shrinkage test for insulations (IEC 60811-502)*

EN 60811-507, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 507: Mechanical tests — Hot set test for cross-linked materials (IEC 60811-507)*

EN 60811-510, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 510: Mechanical tests — Methods specific to polyethylene and polypropylene compounds — Wrapping test after thermal ageing in air (IEC 60811-510)*

EN 61158 (all parts), *Industrial communication networks — Fieldbus specifications (IEC 61158)*

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

EN ISO 1133 (all parts), *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133)*

EN ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics (ISO 1183)*

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 6502, *Rubber — Guide to the use of curemeters*

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. 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.

Specific requirements are shown in Table 2. 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 (Table 3). To achieve the indicated values, the addition of antioxidant and/or catalyst is necessary for materials PE, PES, SXPE & SXPES. 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 Health, Safety and Environmental 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.

Table 2 — Insulation compounds - physical properties of granules

Characteristics[a]		Test method	Unit	Value	Applicability
1	Density[b]	EN ISO 1183	g/cm^3	≤ 0,950	All
2	Melt flow index[c] (190°C/2,16 kg)	EN ISO 1133	g/10 min	D	PE, PE-S, SXPE & SXPE-S
3	Storage stability Retention of melt flow index (190°C/2,16 kg) after storage 1 month at 20°C, RH 50%	EN ISO 1133	%	>TBD[c]	SXPE and SXPE-S
4	Elastograph	ISO 6502	N*m	>0,5[c]	VXPE-S
5	Hardness Shore D (1s)	EN ISO 868	[-]	TBD[d]	All
6	Low temperature brittleness	ISO 974	°C	< -70	All
7	Oxidative Induction Time (200 °C)	EN ISO 11357-6[e]	min	>TBD	PE-S, SXPE-S & VXPE-S

[a] All values of Table 2 shall be provided by the compound supplier, see Clause 3.
[b] Tolerance for the nominal value of a specific compound is +/- 0,003 g/cm³.
[c] Tolerance for the nominal value of a specific compound is +/- 25%.
[d] Tolerance for the nominal value of a specific compound is +/- 3.
[e] Alternative methods which correlate with the antioxidant content are permitted.

Table 3 — Wire insulation properties

	Characteristics	Test method	Unit	Values
1	Maximum rated temperature of cable for which the compound can be used	EN 60216[a]	°C	90
2	Mechanical characteristics	EN 60811-501		
2.1	Before ageing			
2.1.1	Tensile strength- median,min.		MPa	12,5
2.1.2	Elongation at break- median,min		%	250
2.2	Mechanical characteristics after ageing	EN 60811-401 and -501		
2.2.1	Ageing conditions			
2.2.2	- Temperature		°C	135 ± 2
2.2.3	- Duration		H	10 x 24
	Tensile strength			
	- Median, minimum value		MPa	12,5
	Elongation at break			
	- Median, minimum value		%	200
	Retention of Mechanical properties after ageing[b]		%	>75
3	Wrapping after ageing[c]	EN 60811-510		
	- temperature		°C	150 ± 2
	- duration		h	7 x 24
	Result to be obtained			No crack
4	Ageing test on complete cable (compatibility test) [d]	EN 60811-501		
4.1	Before ageing			
4.1.1	Tensile strength- median,min.		MPa	12,5
4.1.2	Elongation at break- median,min.		%	250
4.2	Mechanical characteristics after ageing	EN 60811-401 and -501		
4.2.1	Ageing conditions			
4.2.2	- Temperature		°C	100 ± 2
4.2.3	- Duration		h	7 x 24
	Tensile strength - Median, minimum value		MPa	12,5
	Elongation at break - Median, minimum value		%	200
	Retention of Mechanical properties after ageing[b]		%	>75
5	Hot set	EN 60811-507		
	Test conditions			
	- Temperature		°C	200 ± 2
	- Time under load		min	15
	- Mechanical stress		N/mm^2	0,2
	Results to be obtained			

	- Elongation under load, median, maximum **- Elongation after cooling, median, maximum**		**%** **%**	**175** **15**
6	**Shrinkage** **Test conditions** **- temperature** **- duration** **Result to be obtained, median, max.**	**EN 60811-502**	**°C** **h** **%**	**130 ± 2** **1** **4**

[a] Any procedure based on the Arrhenius principals which can predict 20 000 h life expectancy at the indicated temperature.

[b] In cases where the specified limit is not achieved, the initial mechanical properties (2.1 and 4.1) shall be measured after conditioning of new samples for 24 h at the specified ageing temperature. Additional testing of aged samples is not needed.

[c] Only to be carried out if elongation at break cannot be done

[d] Only to be carried out for cables where the insulation is in direct contact with material (eg. sheath or bedding) containing oils, plasticisers or other extenders which could migrate into the insulation

Bibliography

ASTM D 2084, *Standard Test Method for Rubber Property-Vulcanization Using Oscillating Disk Cure Meter*

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