



SLOVENSKI STANDARD

oSIST prEN 50288-7:2021

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Večelementni kovinski kabli za analogne in digitalne komunikacije in krmiljenje - 7. del: Področna specifikacija za instrumentne in krmilne kable

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

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Übertragung -
Teil 7: Rahmenspezifikation für Instrumenten- und Kontrollkabel

Câbles métalliques à éléments multiples utilisés pour les transmissions et les
commandes analogiques et numériques - Partie 7: Spécification intermédiaire pour les
câbles d'instrumentation et de contrôle

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Will supersede EN 50288-7:2005 and all of its
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English Version

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

Câbles métalliques à éléments multiples utilisés pour les
transmissions et les commandes analogiques et
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Mehradrige metallische Daten- und Kontrollkabel für
analoge und digitale Übertragung - Teil 7:
Rahmenspezifikation für Instrumenten- und Kontrollkabel

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2021-02-26.

It has been drawn up by CLC/SC 46XC.

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.

This draft European Standard was established by CENELEC in three official versions (English, French, German).
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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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 50288-7:2020) has been prepared by SC46XC, “Multicore, multipair and quad data communication cables”, of Technical Committee CENELEC TC 46X, “Communication 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)

This document will supersede EN 50288-7:2005 and all of its amendments and corrigenda (if any).

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

This document is to be read in conjunction with EN 50288-1, which contains the essential provisions for its application.

LVD additions highlighted

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1 Scope

This document covers multi-element cables suitable for connecting instruments and control systems for analogue or digital signal transmission used in industrial processes carried out in commercial and industrial premises including cables that could be specified for use in *Automated Infrastructure Management* applications. They could be screened and optionally incorporate armouring and/or moisture or environmental protection layers.

The cables are expected to have a mechanically robust construction and electrical transmission handling properties. The electrical, mechanical, transmission and environmental performance characteristics of the cables, related to their reference test methods are detailed in this specification.

Cables covered by this document have maximum rated voltages of 300 V or 500 V a.c.

Multi-element cables for use in analogue, digital and control circuits are not designed to be used for power supply or to be connected directly to mains electricity supply or other low impedance sources.

NOTE These cables are expected to be installed in accordance with the applicable local and national regulations.

According to Annex 1 of mandate M/443 EN, depending upon the installation and application these cables might not necessarily fall under the regulation of EN 50575.

Cables intended to have circuit integrity in a fire are covered by this document.

There could be occasions when cables are required to have higher operating temperature ratings than those provided by using materials specified by the EN 50290 series. Suitable alternative materials are under consideration.

2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10218-1, *Steel wire and wire products - General - Part 1: Test methods*

EN 10244-2, *Steel wire and wire products - Non-ferrous metallic coatings on steel wire - Part 2: Zinc or zinc alloy coatings*

EN 10257-1, *Zinc or zinc alloy coated non-alloy steel wire for armouring either power cables or telecommunication cables - Part 1: Land cables*

EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 50288-1:2013, *Multi-element metallic cables used in analogue and digital communication and control - Part 1: Generic specification*

EN 50289 (series), *Communication cables — Specifications for test methods*

EN 50290 (series), *Communication cables*

EN 50307, *Lead and lead alloys - Lead and lead alloy sheaths and sleeves of electric cables*

EN 50362, *Method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits*

EN 60228, *Conductors of insulated cables (IEC 60228)*

EN 60332-1-2, *Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame (IEC 60332-1-2)*

EN 60332-3, (series), *Tests on electric and optical fibre cables under fire conditions (IEC 60332-3 series)*

EN 60584-1, *Thermocouples - Part 1: EMF specifications and tolerances (IEC 60584-1)*

EN 60584-3, *Thermocouples - Part 3: Extension and compensating cables - Tolerances and identification system (IEC 60584-3)*

EN 60708, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath (IEC 60708)*

EN 60754-1, *Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content (IEC 60754-1)*

EN 60754-2, *Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity (IEC 60754-2)*

EN 60811-201, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 201: General tests - Measurement of insulation thickness (IEC 60811-201)*

EN 60811-202, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 202: General tests - Measurement of thickness of non-metallic sheath (IEC 60811-202)*

EN 61034-2, *Measurement of smoke density of cables burning under defined conditions - Part 2: Test procedure and requirements (IEC 61034-2)*

IEC 60189-2, *Low-frequency cables and wires with PVC insulation and PVC sheath — Part 2: Cables in pairs, triples, quads and quintuples for inside installations*

IEC 60331-1, *Tests for electric cables under fire conditions — Circuit integrity — Part 1: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm*

IEC 60331-2, *Tests for electric cables under fire conditions — Circuit integrity — Part 2: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20mm*

IEC 60331-21, *Tests for electric cables under fire conditions — Circuit integrity — Part 21: Procedures and requirements — Cables of rated voltage up to and including 0,6/1,0 kV*

3 Definitions, symbols and abbreviations

For the purposes of this document, the terms and definitions given in EN 50288-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Cable construction

4.1 Conductor

Conductors shall be solid, stranded or flexible plain or metal coated copper in accordance with Class 1, 2 or 5 of EN 60228 in the range of 0,5 mm² to 2,5 mm². For multi-core cables the maximum conductor resistance shall be as EN 60228, and for finished multi-pair, multi-triple and multi-quad cables the maximum resistance of EN 60228 shall be increased by 2 %.

Conductor joints shall be as EN 50288-1.

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Stranded and flexible conductors shall consist of wires circular in cross section assembled, without insulation between them, by concentric stranding or by bunching.

Conductors for thermocouple extension and compensating cables as described in Annex D shall be solid, stranded or flexible. The materials shall comply with EN 60584-3.

When the installed length of cable results in a high conductor resistance, larger conductor sizes can be used.

Additional conductor wrapping of mineral tape(s) may be applied for circuit integrity in a fire. The thickness of such mineral tape(s) shall not be included in the thickness of the insulation.

Designing the cable, consideration should be paid to the maximum admissible current stated in the detail specification. It is assumed that the raise of temperature of the inner conductor when submitted to the maximum current under nominal ambient conditions does not affect the mechanical properties of the cable. i.e. the temperature rise due to the current is below the continuous maximum permitted temperature of the dielectric and the sheath material.

All cables covered by this document may be subjected to voltages greater than 50 V AC or 75 V DC according to the relevant sectional or detail specification.

In this case, care and attention shall be paid to the requirements of the “Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2014/35/EU)” by the sectional or detail specification. Relevant sectional or detail specifications shall include a respective Annex ZZ.

However, cables covered by this document are not intended for direct connection to the mains electricity supply or other low impedance sources.

4.2 Insulation

The insulating material shall be selected from those listed below. It shall be applied to comply with the requirements of EN 50288-1.

| | | |
|---------------------------------------|---|---|
| PVC | | EN 50290-2-21 |
| Polyethylene | https://standards.iteh.ai/catalog/standards/sist/2ff6c81f-024d-44cc-81c-7a7a20e1475f/osist-pren-50288-7-2021 | EN 50290-2-23 |
| Polypropylene | | EN 50290-2-25 |
| Halogen free flame retardant compound | | EN 50290-2-26 |
| Cross-linked polyethylene | | EN 50290-2-29 |
| Silicone rubber insulation | | Material specification is under consideration |

The minimum thickness at any point of the insulation shall not be less than the value given in Table 1, for the specified voltage rating, and the concentricity shall not fall below 75 % when measured using the procedure in Annex A.

There could be occasions when cables are required to have higher operating temperature ratings than those provided by using materials specified by the EN 50290 series. Suitable alternative materials are under consideration.

Table 1 — Minimum insulation thickness

| Conductor size mm ² | Minimum thickness mm | | |
|-----------------------------------|-------------------------|-------|-------|
| | Voltage rating | | |
| | | 300 V | 500 V |
| 0,5 | | 0,26 | 0,44 |
| 0,75 | | 0,26 | 0,44 |
| 1,0 | | 0,26 | 0,44 |

| Conductor size mm ² | Minimum thickness mm | | |
|-----------------------------------|-------------------------|-------|-------|
| | Voltage rating | | |
| | | 300 V | 500 V |
| 1,3 | | 0,35 | 0,44 |
| 1,5 | | 0,35 | 0,44 |
| 2,5 | | - | 0,53 |

4.3 Cable elements

Cable elements shall be in accordance with EN 50288-1:2013, 4.3.

The lay length of a pair, triple or quad shall not exceed 100 mm for cables with conductor cross-section $\leq 1,5 \text{ mm}^2$, nor 150 mm for cables with conductor cross-section $2,5 \text{ mm}^2$.

4.4 Identification of cabling elements

Unless otherwise specified e.g. by means of numbered cores or tapes, the coding for identification shall be as given in IEC 60189-2 or EN 60708, as appropriate. The colours shall meet the requirements of EN 50288-1:2013, 4.4.

Coloured or numbered non-hygroscopic binder tapes may be applied over screened cabling elements (see 4.5) as identification.

4.5 Screening of cabling elements (standards.iteh.ai)

When screening of individual cable elements is specified, it shall be selected from those listed below and applied in accordance with EN 50288-1:2013, 4.5: <https://standards.iteh.ai/catalog/standards/sist/2ff6c81f-024d-44cc-8ff7-7a7a20e14751/osist-pr-en-50288-7-2021>

- a plain or coated metal braid with a minimum filling factor of 0,6 when calculated in accordance with Annex B;
- a combination of a foil, and a plain or coated metal braid with a minimum filling factor of 0,3 when calculated in accordance with Annex B. The use of a drain wire is optional when this type of screen is applied;
- a foil applied with a minimum overlap of 20 % and with a drain wire in direct contact with the metallic side of the foil.

Metal braid wire diameters are given in Table B.1.

4.6 Cable make-up

The cable elements shall be assembled together in concentric layers or in unit construction to form the cable core.

The cable core assembly shall be protected by wrappings of non-hygroscopic tape.

Successive layers may be separated from each other by interlayer binders of non-hygroscopic tape.

4.7 Longitudinal watertight filling

When a longitudinal watertight filling is specified, it shall be selected from the methods given in EN 50288-1:2013, 4.7.

4.8 Interstitial fillers

When fillers are used they shall meet the requirements of EN 50288-1:2013, 4.8.

4.9 Screening of the cable core

The cable core shall be protected with a protective layer as described in 4.11 or 4.13 when it is covered with a screen.

When screening of the cable core is specified, it shall be selected from those listed below, and applied in accordance with EN 50288-1:2013, 4.9:

- a) a plain or coated metal braid with a minimum filling factor of 0,6 when calculated in accordance with Annex B;
- b) a combination of a foil, and a plain or coated metal braid with a minimum filling factor of 0,3 when calculated in accordance with Annex B. The use of a drain wire is optional when this type of screen is applied;
- c) a foil applied with a minimum overlap of 20 % and with a drain wire in direct contact with the metallic side of the foil.

Metal braid wire diameters are given in Table B.1.

Screening over the cable core may also be in the form of a laminated sheath (moisture barrier as 4.10 or multi-layer sheath as 4.18. b).

4.10 Moisture barriers

When a moisture barrier is specified it shall be applied to meet the requirements of EN 50288-1:2013, 4.10 for a laminated sheath, consisting of a longitudinal overlapped metallic tape, bonded within the overlapping and to the inner surface of an extruded sheath. The tape shall be coated on one or two sides where in the case of one side coating a tinned copper drain wire shall be applied in direct contact with the metallic surface of the tape. The thickness of the metallic part of the tape shall be at least 0,15 mm.

4.11 Protective wrappings

A wrapping layer may be applied under a sheath.

A wrapping layer may be applied under a metallic protection layer.

The wrapping layer shall be of a material compatible with the cable components with which it is in contact.

4.12 Inner sheath

When an additional inner sheath is applied under a metallic sheath (4.14) and may be applied under a lead sheath (4.18), it shall be selected from the materials listed below. It shall comply with the requirements of EN 50288-1:

- a) PVC to EN 50290-2-22;
- b) Polyethylene to EN 50290-2-24;
- c) Halogen free flame retardant compound to EN 50290-2-27.

The nominal thickness shall be calculated in accordance with Table C.1.

The nominal thickness (ISR_t) shall be calculated in accordance with the following formula:

$$ISR_t = 0,04 \times D + 0,7 \text{ mm (min 0,8 mm)}$$

The minimum thickness at any point shall not fall below the nominal value by more than 15 % + 0,1 mm.

There could be occasions when cables are required to have higher operating temperature ratings than those provided by using materials specified by the EN 50290 series. Suitable alternative materials are under consideration.

4.13 Bedding layers

A bedding layer shall be applied between a lead sheath and a metallic protection. This layer may be extruded (materials as in 4.12) or comprise helically applied tape or tapes.

The bedding layer shall be extruded when gland diameter requirements are specified.

The nominal thickness shall be calculated in accordance with Table C.5, where the diameter under the bedding layer (F_L) is calculated in accordance with Table C.1.

There could be occasions when cables are required to have higher operating temperature ratings than those provided by using materials specified by the EN 50290 series. Suitable alternative materials are under consideration.

4.14 Metallic protection

Metallic protection, when specified, shall be in accordance with EN 50288-1:2013, 4.14.

When round or flat galvanised steel wires are used, the minimum thickness shall be 0,80 mm (see Annex C). Flat galvanised steel wire may only be applied to cables where the diameter under the armour, calculated in accordance with Annex C, is > 15 mm.

The round steel wires of single wire armour shall comply with the requirements of EN 10257-1 and EN 10218-1. The coating of the wires shall comply with the requirements of EN 10244-2.

When a single or double layer of steel or brass tapes is used, the minimum thickness of tape shall be 0,20 mm for steel and 0,075 mm for brass.

When a metal braid is specified the minimum wire diameter shall be 0,30 mm. The minimum filling factor shall be 0,57 when calculated as Annex B.

Metal braid wire diameters are given in Annex C.

4.15 Integral suspension strand

Not applicable.

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4.16 Outer sheathing

The outer sheathing material shall be appropriate to the operating environment and may be selected from the materials listed below. It shall be applied in accordance with EN 50288-1:2013, 4.16:

- a) PVC to EN 50290-2-22;
- b) Polyethylene to EN 50290-2-24;
- c) Halogen free flame retardant compound to EN 50290-2-27.

The nominal thickness (S_{Rt}) shall be calculated in accordance with the following formulae:

- a) without metallic protection $S_{Rt} = 0,04 \times D + 0,7$ mm (min 0,8 mm)
- b) with metallic protection $S_{Rt} = 0,028 \times D + 1,1$ mm (min 1,3 mm)

where D is the diameter under the outer sheath calculated in accordance with Table C.1.

For cables without metallic protection, the minimum thickness at a point shall not fall below the nominal value by more than 15 % + 0,1 mm. The minimum average thickness, rounded to 0,1 mm, shall not be less than nominal thickness.

For cables with metallic protection (4.14), the minimum thickness at any point shall not fall below the nominal value by more than 20 % + 0,2 mm