SLOVENSKI STANDARD
SIST EN 50288-9-2:2016

01-februar-2016

Večelementni kovinski kabli za analogne in digitalne komunikacije in krmiljenje - 9-2. del: Področna specifikacija za zaslonjene kable z lastnostmi od 1 MHz do 1000 MHz - Kabli za delovna območja in povezovalne vrvice

Multi-element metallic cables used in analogue and digital communication and control - Part 9-2: Sectional specification for screened cables characterized from 1 MHz up to 1 000 MHz - Work area, patch cord and data centre cables

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Übertragung -- Teil 9-2: Rahmenspezifikation für geschirmte Kabel von 1 MHz bis 1 000 MHz - Geräteanschlusskabel, Schaltkabel und Kabel für Rechenzentren

Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques -- Partie 9-2: Spécification intermédiaire pour les câbles écrantés caractérisés de 1 MHz à 1 000 MHz - Câbles de zone de travail, pour cordons de brassage, et pour centres de traitement de données

Ta slovenski standard je istoveten z: EN 50288-9-2:2015

ICS:

33.120.20	Žice in simetrični kabli	Wires and symmetrical cables

SIST EN 50288-9-2:2016 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50288-9-2

September 2015

ICS 33.120.10; 33.120.20

English Version

Multi-element metallic cables used in analogue and digital communication and control - Part 9-2: Sectional specification for screened cables characterized from 1 MHz up to 1 000 MHz for work area, patch cord and data centre applications

Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques - Partie 9-2: Spécification intermédiaire pour les câbles écrantés caractérisés de 1 MHz à 1 000 MHz - Câbles de zone de travail, pour cordons de brassage, et pour centres de traitement de données

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Kommunikation - Teil 9-2: Rahmenspezifikation für geschirmte Kabel von 1 MHz bis 1 000 MHz für Geräteanschlusskabel, Schaltkabel und Anwendungen für Rechenzentren

This European Standard was approved by CENELEC on 2015-08-03. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 50288-9-2:2015 E

Contents

Page

European foreword

This document (EN 50288-9-2:2015) has been prepared by CLC/SC 46XC "Multicore, multipair and quad data communication cables," of CLC/TC 46X, "Communication 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) 2016-08-03
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-08-03

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This Part 9-2 is to be read in conjunction with EN 50288-1.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

1 Scope

This sectional specification covers screened cables, characterised from 1 MHz up to 1 000 MHz, to be used to construct cords for use in cabling specified in the EN 50173 series of standards.

The premises-specific cabling standards of the EN 50173 series reference the D1 requirements of this specification for the cable used within cords of the “reference implementations” of those standards. The alternative D2 requirements of this specification may be used to produce cords for other implementations and applications including the direct connection of equipment in data centres.

This sectional specification contains the electrical, mechanical, transmission and environmental performance characteristics and requirement of the cables when tested in accordance with the referenced test methods.

This sectional specification should be read in conjunction with EN 50288-1, which contains the essential provisions for its application.

The cables covered in this sectional specification are intended to operate with voltages and currents normally encountered in communication systems. These cables are not intended to be used in conjunction with low impedance sources, for example, the electric power supplies of public utility mains.

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

EN 50289-3-2, *Communication cables – Specifications for test methods – Part 3-2: Mechanical test methods – Tensile strength and elongation for conductor*

EN 50289-3-4, *Communication cables – Specifications for test methods – Part 3-4: Mechanical test methods – Tensile strength, elongation and shrinkage of insulation and sheath*

EN 50289-3-5, *Communication cables – Specifications for test methods – Part 3-5: Mechanical test methods – Crush resistance of the cable*

EN 50289-3-6, *Communication cables – Specifications for test methods – Part 3-6: Mechanical test methods – Impact resistance of the cable*

EN 50289-3-8, *Communication cables – Specifications for test methods – Part 3-8: Mechanical test methods – Abrasion resistance of cable sheath markings*

EN 50289-3-9:2001, *Communication cables – Specifications for test methods – Part 3-9: Mechanical test methods – Bending tests*

EN 50289-3-16, *Communication cables – Specifications for test methods – Part 3-16: Mechanical test methods – Cable tensile performance*

EN 50289-4-6, *Communication cables – Specifications for test methods – Part 4-6: Environmental test methods – Temperature cycling*

EN 50290-2 series, *Communication cables – Part 2: Common design rules and construction*

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

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*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1
screening of cable
a cable is considered screened when the cable core is covered by a continuous conductive layer forming part of the shielding and bonding system of the cabling system

Note 1 to entry: DC continuity has to be given and minimum shielding requirements have to be met.

3.2 Symbols and abbreviations

For the purposes of this document, the following abbreviations apply.

EX Exogenous (derived or originating externally)

POE Power Over Ethernet

4 Cable construction

4.1 Conductor

The conductor shall be solid or stranded annealed copper and meet the requirements of EN 50288-1:2013, 4.1

The solid conductor nominal diameter shall be ≥ 0,40 mm and ≤ 0,80 mm.

The stranded conductor shall consist of seven wires each with a nominal diameter of ≥ 0,10 mm to ≤ 0,21 mm.

NOTE Constructions with ‘copper clad’ conductors **do not** meet the requirements.

4.2 Insulation

The insulation shall be of a suitable material in accordance with the appropriate part of the EN 50290-2 series.

4.3 Cabling elements

The cable element shall be a pair or quad.

4.4 Identification of cabling elements

Unless otherwise specified, the colour coding for identification shall be as specified in IEC 60189-2 or EN 60708, as appropriate. The colours shall comply with the requirements given in EN 50288-1:2013, 4.4

4.5 Screening of cabling elements

Screening of the cabling elements shall be applied in accordance with EN 50288-1:2013, 4.5. When a braid is used the minimum braid coverage (for mechanical purposes) shall be 60%. When a foil and braid are used the minimum braid coverage (for mechanical purposes) shall be 30% coverage as defined in EN 50290-2-1

4.6 Cable make-up

The cable elements shall be laid up in concentric layer(s) or units to form the cable core.

4.7 Filling compound

Not applicable.

4.8 Interstitial fillers

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

4.9 Screening of the cable core

The screening of the cable core shall be applied in accordance with EN 50288-1:2013, 4.9. When a braid is used the minimum braid coverage (for mechanical purposes) shall be 60%. When a foil and braid are used, and/or where a foil is used over each cabling element/the core, the minimum braid coverage (for mechanical purposes) shall be 30% as defined in EN 50290-2-1

4.10 Moisture barriers

Not applicable.

4.11 Wrapping layers

Where wrapping layers are used they shall be in accordance with EN 50288-1:2013, 4.11

4.12 Sheath

The sheath shall be of a suitable material in accordance with the appropriate part of the EN 50290-2 series.

5 Test methods and requirements for completed cables

5.1 General

The following tables specify the tests that shall be applied to the completed cable, together with the requirements to demonstrate compliance with this sectional specification.

5.2 Electrical tests

5.2.1 Low-frequency and DC electrical measurements

Table 1 – Low-frequency and DC electrical measurements

EN 50288-1:2013 Sub-clause	Parameter	Requirement
5.1.1.1	Conductor loop resistance	(D1) ≤ 28,0 Ω/100 m (D2) ≤ 34,0 Ω/100 m
5.1.1.2	Conductor resistance unbalance	≤ 2%
	Pair resistance unbalance	≤ 4%
5.1.1.3	Dielectric strength conductor/conductor and conductor/screen	1,0 kV DC or 0,7 kV AC for 1 min or 2,5 kV DC or 1,7 kV AC for 2 s
5.1.1.4	Insulation resistance	≥ 5 000 MΩ.km when tested in accordance with EN 50289-1-4
5.1.1.5	Mutual capacitance	No requirement specified
5.1.1.6	Capacitance unbalance to earth	≤ 1 200 pF/km

5.2.2 High-frequency electrical and transmission measurements and requirements

Table 2 – High-frequency electrical and transmission requirements

<table>
<tr><th>EN 50288-1:2013 Sub-clause</th><th>Parameter</th><th>Requirement</th></tr>
<tr><td>5.1.2.1</td><td>Velocity of Propagation</td><td>Phase delay ≤ 534 + 36/√f ns/100 m, 1 MHz ≤ f ≤ 1 000 MHz</td></tr>
<tr><td>5.1.2.2</td><td>Propagation delay difference (skew)</td><td>≤ 25 ns/100 m at 4 MHz to 1 000 MHz</td></tr>
<tr><td>5.1.2.3</td><td>D1 Longitudinal Attenuation [b, c, f, h, i]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>2,9</td><td>5,5</td><td>8,5</td><td>21,7</td><td>27,8</td><td>35,0</td><td>40,1</td><td>50,0</td><td>58,5</td><td>73,3</td><td>86,3</td><td>98,0</td><td>dB/100 m</td></tr>
</table>
α ≤ 1,5 (1,80√f +0,005f +0,25/√f), 1 MHz ≤ f ≤ 1 000 MHz</td></tr>
<tr><td>5.1.2.3.1</td><td>D2 Longitudinal attenuation [b, c, f, h, i]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>3,6</td><td>6,7</td><td>10,6</td><td>27,6</td><td>35,6</td><td>45,3</td><td>52,3</td><td>65,9</td><td>77,8</td><td>99,0</td><td>117,9</td><td>135,3</td><td>dB/100 m</td></tr>
</table>
α ≤ 3,225√f +0,0333f +0,3/√f, 1 MHz ≤ f ≤ 1000 MHz</td></tr>
<tr><td>5.1.2.4</td><td>Near End Unbalance Attenuation</td><td>Level 1 ≥ 40-10 log f dB, 1 MHz ≤ f ≤ 1 000 MHz
Level 2 ≥ 50-10 log f dB, 1 MHz ≤ f ≤ 1 000 MHz</td></tr>
<tr><td>5.1.2.5</td><td>Near-end Crosstalk (NEXT) [b]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>78,0</td><td>78,0</td><td>78,0</td><td>78,0</td><td>75,4</td><td>72,5</td><td>70,9</td><td>68,2</td><td>66,4</td><td>63,7</td><td>61,9</td><td>60,4</td><td>dB</td></tr>
</table>
≥ 105,4 – 15 log f, 1 MHz ≤ f ≤ 1 000 MHz (78 dB max.)</td></tr>
<tr><td>5.1.2.6</td><td>D1 Attenuation to crosstalk ratio at the far end [b, d, f, g] (ACR-F)</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>78,0</td><td>78,0</td><td>78,0</td><td>69,4</td><td>65,3</td><td>61,5</td><td>59,3</td><td>55,8</td><td>53,3</td><td>49,7</td><td>47,2</td><td>45,3</td><td>dB/100 m</td></tr>
</table>
≥ 105,3 – 20 log f, 1 MHz ≤ f ≤ 1 000 MHz (78 dB max.), values referenced to 100 m</td></tr>
<tr><td>5.1.2.7.1</td><td>Power sum Near-end Crosstalk [b] (PSNEXT)</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>75,0</td><td>75,0</td><td>75,0</td><td>75,0</td><td>72,4</td><td>69,5</td><td>67,9</td><td>65,2</td><td>63,4</td><td>60,7</td><td>58,9</td><td>57,4</td><td>dB</td></tr>
</table>
≥ 102,4 – 15 log f, 1 MHz ≤ f ≤ 1 000 MHz (75 dB max.)</td></tr>
</table>

Table 2 – High-frequency electrical and transmission measurements and requirements *(continued)*

<table>
<tr><th>EN 50288-1:2013 Sub-clause</th><th>Parameter</th><th>Requirement</th></tr>
<tr><td>5.1.2.7.4</td><td>Power Sum Exogenous Crosstalk PSExNEXT [b, e]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>65,8</td><td>64,0</td><td>62,5</td><td>dB</td></tr>
</table>
≥ 107,5 – 15 log f, 1 MHz ≤ f ≤ 1 000 MHz (67 dB max.)

NOTE: ExACR-F removed as only PS is required. Cable meets requirements by design.
</td></tr>
<tr><td>5.1.2.7.6</td><td>Power Sum Attenuation to crosstalk ratio at the far end Exogenous Crosstalk PSExACR-F [b, c, d, e, f]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>67,0</td><td>67,0</td><td>67,0</td><td>57,3</td><td>53,2</td><td>49,4</td><td>47,2</td><td>43,7</td><td>41,2</td><td>37,6</td><td>35,1</td><td>33,2</td><td>dB</td></tr>
</table>
≥ 93,2 – 20 log f, 1 MHz ≤ f ≤ 1 000 MHz (67 dB max.)

NOTE: Cable meets requirements by design.
</td></tr>
<tr><td>5.1.2.8</td><td>Mean Characteristic Impedance</td><td>(100 ± 5) Ω, at 100 MHz</td></tr>
<tr><td>5.1.2.9</td><td>Return loss [a, b, f]</td><td>
<table>
<tr><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>23,0</td><td>25,0</td><td>21,5</td><td>20,1</td><td>18,8</td><td>18,0</td><td>17,3</td><td>17,3</td><td>17,3</td><td>16,1</td><td>15,1</td><td>dB</td></tr>
</table>
≥ 20 + 5 log f, 4 MHz ≤ f ≤ 10 MHz; 25 dB, 10 MHz ≤ f < 20 MHz;
25-7 log (f/20), 20 MHz < f ≤ 250 MHz; 17,3dB 250 MHz ≤ f < 600 MHz;
17,3 – 10 log (f/600), 600 MHz < f ≤ 1 000 MHz
</td></tr>
<tr><td>5.1.2.10</td><td>Coupling Attenuation</td><td>Type I

≥ 85 dB, 30 MHz ≤ f ≤ 100 MHz;
≥ 85-20 log (f/100) dB, 100 MHz ≤ f ≤ 1 000 MHz

Type Ib

≥ 70 dB, 30 MHz ≤ f ≤ 100 MHz;
≥ 70-20 log (f/100) dB, 100 MHz ≤ f ≤ 1 000 MHz</td></tr>
<tr><td>5.1.2.11</td><td>Transfer Impedance</td><td>Grade 1

≤ 15 mΩ/m at 1 MHz;
≤ 10 mΩ/m at 10 MHz;
≤ 30 mΩ/m at 30 MHz;
≤ 100 mΩ/m at 100 MHz

Grade 2

≤ 50 mΩ/m at 1 MHz;
≤ 100 mΩ/m at 10 MHz;
≤ 200 mΩ/m at 30 MHz;
≤ 1 000 mΩ/m at 100 MHz</td></tr>
</table>