BS EN 50288-10-1:2012

BSI Standards Publication

# Multi-element metallic cables used in analogue and digital communication and control -

Part 10-1: Sectional specification for screened cables characterized up to 500 MHz — Horizontal floor and building backbone cables

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This British Standard is the UK implementation of EN 50288-10-1:2012.

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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# Multi-element metallic cables used in analogue and digital communication and control - Part 10-1: Sectional specification for screened cables characterized up to 500 MHz - Horizontal floor and building backbone cables

Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques - Partie 10-1: Spécification intermédiaire pour câbles pour applications jusqu'à 500 MHz - Câbles horizontaux et verticaux de bâtiment

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Übertragung - Teil 10-1: Rahmenspezifikation für Kabel bis 500 MHz - Kabel für den Horizontal- und Steigbereich

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CENELEC

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**



Ref. No. EN 50288-10-1:2012 E

# Contents

## Foreword

This document (EN 50288-10-1:2012) has been prepared by CLC/SC 46XC, "Multicore, multipair and quad data 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) | 2013-11-12 |
| • latest date by which the national standards conflicting with this document have to be withdrawn | (dow) | 2015-11-12 |

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).

The EN 50288 series is divided into the following parts:

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

– EN 50288-2-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 2-1: Sectional specification for screened cables characterised up to 100 MHz — Horizontal and building backbone cables*;

– EN 50288-2-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 2-2: Sectional specification for screened cables characterised up to 100 MHz — Work area and patch cord cables*;

– EN 50288-3-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 3-1: Sectional specification for unscreened cables characterised up to 100 MHz — Horizontal and building backbone cables*;

– EN 50288-3-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 3-2: Sectional specification for unscreened cables characterised up to 100 MHz — Work area and patch cord cables*;

– EN 50288-4-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 4-1: Sectional specification for screened cables characterised up to 600 MHz — Horizontal and building backbone cables*;

– EN 50288-4-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 4-2: Sectional specification for screened cables characterised up to 600 MHz — Work area and patch cord cables*;

– EN 50288-5-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 5-1: Sectional specification for screened cables characterized up to 250 MHz — Horizontal and building backbone cables*;

– EN 50288-5-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 5-2: Sectional specification for screened cables characterized up to 250 MHz — Work area and patch cord cables*;

- EN 50288-6-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 6-1: Sectional specification for unscreened cables characterised up to 250 MHz — Horizontal and building backbone cables*;

- EN 50288-6-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 6-2: Sectional specification for unscreened cables characterised up to 250 MHz — Work area and patch cord cables*;

- 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 50288-8, *Multi-element metallic cables used in analogue and digital communication and control — Part 8: Specification for type 1 cables characterised up to 2 MHz*;

- EN 50288-9-1, *Multi-element metallic cables used in analogue and digital communications and control — Part 9-1: Sectional specification for screened cables characterized from 1 MHz up to 1 000 MHz — Horizontal and building backbone cables*;

- EN 50288-10-1, *Multi-element metallic cables used in analogue and digital communications and control — Part 10-1: Sectional specification for screened cables characterized from 1 MHz up to 500 MHz — Horizontal and building backbone cables* (the present document);

- EN 50288-11-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 11-1: Sectional specification for un-screened cables characterised from 1 MHz up to 500 MHz — Horizontal and building backbone cables*.

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

## 1 Scope

EN 50288-10-1 is a sectional specification for screened cables, characterised from 1 MHz up to 500 MHz, to be used in horizontal and building backbone wiring for Information Technology generic-cabling systems.

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

This sectional specification is to 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 communications systems. These cables are not intended to be used in conjunction with low impedance sources, for example the electrical 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 | *Multi-element metallic cables used in analogue and digital communication and control — Part 1: Generic specification* |
| EN 50289-1-4 | *Communication cables — Specifications for test methods — Part 1-4: Electrical test methods — Insulation resistance* |
| 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 (all parts) | *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 a part of the shielding and grounding system of the cabling system. D.C. 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 annealed copper and comply with the requirements of EN 50288-1, 4.1

The nominal conductor diameter shall be ≥ 0,50 mm and ≤ 0,80 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, 4.4

### 4.5 Screening of cabling elements

Where appropriate, screening of the cabling elements shall be applied in accordance with EN 50288-1, 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, 4.8.

### 4.9 Screening of the cable core

The screening of the cable core shall be applied in accordance with EN 50288-1, 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, 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 d.c. electrical measurements

**Table 1 — Low-frequency and d.c. electrical measurements**

| EN 50288-1 Subclause | Parameter | Requirement |
|---|---|---|
| 5.1.1.1 | Conductor loop resistance | ≤ 19 Ω/100 m. |
| 5.1.1.2 | Conductor resistance unbalance | ≤ 2 % |
| 5.1.1.3 | Dielectric strength conductor/conductor and conductor/screen | 1,0 kV d.c. or 0,7 kV a.c. for 1 min<br>or<br>2,5 kV d.c. or 1,7 kV a.c. 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

**Table 2 — High-frequency electrical and transmission requirements**

| EN 50288-1 Subclause | Parameter | Requirement |
|---|---|---|
| 5.1.2.1 | Velocity of Propagation | Phase Delay ≤ 534 + 36/$\sqrt{f}$ ns/100 m, 1 MHz ≤ $f$ ≤ 500 MHz |
| 5.1.2.2 | Propagation delay difference (skew) | ≤ 45 ns/100 m at 100 MHz |
| 5.1.2.3 | Longitudinal Attenuation [b, c, f] | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 10□ \| 155 \| 200 \| 300 \| 500 \| MHz<br>2,1 \| 3,8 \| 5,9 \| 7,5 \| 8,4 \| 10,5 \| 15,0 \| 19,1 \| 24,1 \| 27,6 \| 34,3 \| 45,3 \| dB/100 m<br>$\alpha \leq 1{,}82\sqrt{f} + 0{,}0091 f + 0{,}25/\sqrt{f}$, 1 MHz ≤ $f$ ≤ 500 MHz |
| 5.1.2.4 | Near End Unbalance Attenuation | Level 1 ≥ 40 - 10 log ($f$) dB, 1 MHz ≤ $f$ ≤ 250 MHz ; 250 MHz ≤ $f$ ≤ 500 MHz<br>Level 2 ≥ 50 -10 log(f) dB, 1 MHz ≤ f ≤ 250 MHz ; 250 MHz ≤ $f$ ≤ 500 MHz |
| 5.1.2.5 | Near-end Crosstalk (NEXT) [b] | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 100 \| 155 \| 200 \| 300 \| 500 \| MHz<br>75,3 \| 66,3 \| 60,3 \| 57,2 \| 55,8 \| 52,9 \| 48,4 \| 45,3 \| 42,4 \| 40,8 \| 38,1 \| 34,8 \| dB<br>≥ 75,3 – 15 log $f$, 1 MHz ≤ $f$ ≤ 500 MHz |
| 5.1.2.6 | Attenuation to crosstalk ratio at the far end [b, d, g] (ACR-F) | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 100 \| 155 \| 200 \| 300 \| 500 \| MHz<br>68,0 \| 56,0 \| 48,0 \| 43,9 \| 42,0 \| 38,1 \| 32,1 \| 28,0 \| 24,2 \| 22,0 \| 18,5 \| 14,0 \| dB<br>≥ 68 - 20 log $f$, 1 MHz ≤ $f$ ≤ 500 MHz<br>values referenced to 100 m |
| 5.1.2.7.1 | Power sum Near-end Crosstalk [b] (PSNEXT) | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 100 \| 155 \| 200 \| 300 \| 500 \| MHz<br>72,3, \| 63,3 \| 57,3 \| 54,2 \| 52,8 \| 49,9 \| 45,4 \| 42,3 \| 39,4 \| 37,8 \| 35,1 \| 31,8 \| dB<br>≥ 72,3 – 15 log $f$ ,1 MHz ≤ $f$ ≤ 500 MHz |
| 5.1.2.7.2 | Power Sum Attenuation to crosstalk ratio at the far end [b, d, g] (PSACR-F) | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 100 \| 155 \| 200 \| 300 \| 500 \| MHz<br>65,0 \| 53,0 \| 45,0 \| 40,9 \| 39,0 \| 35,1 \| 29,1 \| 25,0 \| 21,2 \| 19,0 \| 15,5 \| 11,0 \| dB<br>≥ 65 - 20 log $f$, 1 MHz ≤ $f$ ≤ 500 MHz<br>values referenced to 100 m |
| 5.1.2.7.4 | Power Sum Exogenous Crosstalk PSExNEXT [b, e] | 1 \| 4 \| 10 \| 16 \| 20 \| 31,25 \| 62,5 \| 100 \| 155 \| 200 \| 300 \| 500 \| MHz<br>67,0 \| 67,0 \| 67,0 \| 67,0 \| 67,0 \| 67,0 \| 65,6 \| 62,5 \| 59,6 \| 58,0 \| 55,3 \| 52,0 \| dB<br>≥ 92,5 - 15 log $f$, 1 MHz ≤ $f$ ≤ 500 MHz (67 dB max.)<br>Cable meets requirement by design: values referenced to 100 m. |

**Table 2** *(continued)*

<table>
<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]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td></tr>
<tr><td>67,0</td><td>66,2</td><td>58,2</td><td>54,1</td><td>52,2</td><td>48,3</td><td>42,3</td><td>38,2</td><td>34,4</td><td>32,2</td><td>28,7</td><td>24,2</td><td>dB</td></tr>
</table>
≥ 78,2 - 20 log $f$, 1 MHz ≤ $f$ ≤ 500 MHz (67 dB max.)<br><br>NOTE Cable meets requirement 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>8</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>250</td><td>300</td><td>500</td><td>MHz</td></tr>
<tr><td>23,0</td><td>24,5</td><td>25,0</td><td>25,0</td><td>25,0</td><td>23,6</td><td>21,5</td><td>20,1</td><td>18,8</td><td>17,3</td><td>17,3</td><td>17,3</td><td>dB</td></tr>
</table>
≥ 20 + 5 log ($f$), 4 MHz ≤ $f$ ≤ 10 MHz; 25 dB, 10 MHz ≤ $f$ < 20 MHz;<br>25 - 7 log ($f$/20), 20 MHz < $f$ ≤ 250 MHz: 17,3 dB, 250 MHz ≤ $f$ ≤ 500 MHz
</td></tr>
<tr><td>5.1.2.10</td><td>Coupling attenuation</td><td>Type I<br><br>≥ 85 dB, 30 MHz ≤ $f$ ≤ 100 MHz<br>85 - 20 log ($f$/100 dB), 100 MHz ≤ $f$ ≤ 500 MHz<br><br>Type Ib<br><br>≥ 70 dB, 30 MHz ≤ $f$ ≤ 100 MHz<br>70 - 20 log $f$/100 dB, 100 MHz ≤ $f$ ≤ 500 MHz</td></tr>
<tr><td>5.1.2.11</td><td>Transfer impedance</td><td>Grade 1<br><br>≤ 15 mΩ/m at 1 MHz;<br>≤ 10 mΩ/m at 10 MHz;<br>≤ 30 mΩ/m at 30 MHz;<br>≤ 100 mΩ/m at 100 MHz<br><br>Grade 2<br><br>≤ 50 mΩ/m at 1 MHz;<br>≤ 100 mΩ/m at 10 MHz;<br>≤ 200 mΩ/m at 30 MHz;<br>≤1 000 mΩ/m at 100 MHz</td></tr>
<tr><td colspan="3">NOTE See also Table A.1, proposed table for data cable current, voltage and power ratings.</td></tr>
<tr><td colspan="3">[a] For the measurements the test sample having a round trip loss ≥ 40 dB at any measured frequency shall be used.<br>[b] The values in the table are for information only. The formula given shall be used to determine compliance, rounded to one decimal place.<br>[c] The attenuation shall meet values adjusted for temperature of 0,2 % per degree rise above 20 °C.<br>[d] No measurement of ACR-F and PSACR-F is required when FEXT is above 70 dB.<br>[e] PSExNEXT and PSExACR-F for cables complying with the minimum requirements of this European Standard for transfer impedance and coupling attenuation type Ib and above values need not be measured and are for information only.<br>[f] Values between 1 MHz and 4 MHz are for information only.<br>[g] EL-FEXT has been replaced by ACR-F.</td></tr>
</table>

## 5.3 Mechanical tests

**Table 3 — Mechanical test requirements**

| EN 50288-1 Subclause | Parameter | Requirement |
|---|---|---|
| 5.2.1 | Conductor elongation at break<br>EN 50289-3-2 | ≥ 10 % |
| 5.2.2 | Shrinkage of insulation<br>EN 50289-3-4 | ≤ 5 % |
| 5.2.3 | Crush resistance of the cable<br>EN 50289-3-5 | 1 000 N / 1 min / 100 mm<br>Near end Crosstalk, Return Loss and Characteristic Impedance shall remain within the specified limits. |
| 5.2.4 | Impact resistance of the cable<br>EN 50289-3-6 | 12,5 mm radius / 1 J / 3 impacts at 1 m from the measured end<br>Near end Crosstalk, Return Loss and Characteristic Impedance shall remain within the specified limits. |
| 5.2.5 | Abrasion resistance of the sheath markings<br>EN 50289-3-8 | Marking shall remain legible.<br>10 strokes. Force: 4 N |
| 5.2.6 | Simulated installation testing of the cable | |
| 5.2.6.1 | Simulated installation testing of the cable<br>EN 50289-3-9:2001, Clause 4 | Single Bend<br>4 X diameter / 4 strokes<br>Near end Crosstalk, Return Loss and Characteristic Impedance and Coupling Attenuation (u/c) shall remain within the specified limits. |
| 5.2.6.2 | Simulated installation testing of the cable<br>EN 50289-3-9:2001, Clause 8 | “S” Bend<br>8 X diameter / 100 m / 1 cycle / 120° / 1 m/s<br>Near end Crosstalk, Return Loss and Characteristic Impedance and Coupling Attenuation (u/c) shall remain within the specified limits. |
| 5.2.7 | Tensile performance<br>EN 50289-3-16 combined with 5.2.6 | Load shall be 25 N per pair (i.e. 100 N 4 Pair).<br>Near end Crosstalk, Return Loss and Characteristic Impedance and Coupling Attenuation (u/c) shall remain within the specified limits. |

## 5.4 Environmental tests

**Table 4 — Environmental test requirements**

| EN 50288-1 Subclause | Parameter | Requirement |
|---|---|---|
| 5.3.1 | Cold bend performance of the cable<br>EN 50289-3-9 | Mandrel diameter: 8 X OD,<br>No of turns: 4<br>Temperature: -20 °C ± 2 °C<br>No cracks when examined visually without magnification |
| 5.3.5 | Temperature cycling<br>EN 50289-4-6 | The attenuation shall meet the adjusted values according to note [c] in Table 2 when subjected to 2 temperature cycles between 20 °C and 60 °C. |
| 5.3.6 | Hot shock test | As specified in EN 50290-2-27 |

## 5.5 Fire performance tests

Fire performance tests shall be conducted in accordance with EN 50288-1, 5.4.

# Annex A
(informative)

## Maximum voltage, current and temperature rating for cables used for POE applications

Table A.1 specifies the maximum recommended voltage, current, current density and conductor temperature for cables when used for POE applications. (IEEE 802.3 AN (POE) IEEE 802.3 AF (POE plus)).

**Table A.1 – Maximum recommended voltage, current, current density and conductor temperature for cables when used for POE applications**

| Parameter | Unit | Requirement |
|---|---|---|
| Maximum communication service voltage[a] | V | 100 |
| Maximum current density | A/mm² | 3 |
| Maximum short circuit power density for periods < 1 s | W/mm² | 350 |
| Maximum service power density | W/mm² | 100 |
| Maximum conductor surface temperature in service | °C | 60 |
| [a] 300V for Bell Voltage for some telephone installation is allowed. | | |

**WARNING**:

The maximum voltages, currents and temperatures shown in Table A.1 apply to cables specified in this European Standard which are intended to be used solely for communication technologies. The cables specified in this European Standard are **not intended** for and **must not** be connected to and/or used on the mains utility electricity supply.

# Annex B
(informative)

# Blank Detail Specification

## B.1 General

Annex B is a Blank Detail Specification for screened cables characterised from 1 MHz up to 500 MHz, for industrial or environmental demanding areas, horizontal and building backbone cables. It covers cables to be used in industrial or environmental demanding areas for horizontal and building backbone wiring for information technology generic cabling systems. The numbers shown in B2 and B3 are required information that should be recorded in this annex.

## B.2 Document Details

B.2.1 Name and address of the organisation that has prepared the document.

B.2.2 EN document number, issue number and date of issue.

B.2.3 Address of the organisation from which the document is available.

B.2.4 Related documents.

B.2.5 Any other reference to the cable, national reference, trade name, etc.

B.2.6 A complete description of the cable which shall include:

B.2.6.1 type and number of elements;

B.2.6.2 nominal impedance;

B.2.6.3 screening;

B.2.6.4 application;

B.2.6.5 category, found in EN 50173;

B.2.6.6 other distinguishing performance characteristics.

*EXAMPLE: 4 pair, unscreened twisted pair cable for use in horizontal floor wiring, having a nominal impedance of 100 Ω, meeting the transmission requirements of Category 6, the coupling attenuation requirements of Type III and $M_2$.*

B.2.7 Details of the cable material and construction.

B.2.8 Special requirements for bending radius or operating temperatures.

B.2.9 List of cable characteristics. They are separated into electrical, transmission, mechanical and environmental characteristics.

NOTE 1 The recommended environmental severities are derived from the MICE table requirements of EN 50173-1. These recommendations were made to better reflect the cable behaviour.

NOTE 2 When these severities are noted ‘’na’’ the cable is expected to meet the requirement of the related environment by design without the need to be tested.

NOTE 3 Ingress requirements using particles is not applicable to cable.

NOTE 4 Rapid change of temperature is irrelevant for cables.

NOTE 5 Electromagnetic requirements coming from the MICE table of EN 50173-1 have been dealt with by using the requirements that are given for Transfer impedance, Screening attenuation and coupling attenuation. ESD requirements are considered non-applicable.

## B.3 Generic specification EN 50288-1

B.3.1 Appropriate sub clause references in the generic specification EN 50288-1.

B.3.2 Requirements applicable to this cable. The values entered shall meet as a minimum the requirements of sectional specification EN 50288-10-1.

B.3.3 Comments – Relevant remarks.

**Table B.1 — Blank detail specification for symmetrical pair/quad cables for digital communications**

| Cable construction | EN 50288-10-1:2012 Subclause | Requirements | Comments |
|---|---|---|---|
| | 4.1 | Conductor description | |
| | 4.2 | Insulation description: Maximum diameter | |
| | 4.3 | Elements:<br>(pair or quad) | |
| | 4.4 | Identification of cable elements: | |
| | 4.5 | Screening of the cable element: (screening elements, materials, construction) | |
| | 4.6 | Cable make-up:<br>(number of cable elements, layers, etc) | |
| | 4.7 | Filling compounds: | |
| | 4.8 | Interstitial fillers: | |
| | 4.9 | Screen of the cable core:<br>(screening elements, materials, construction) | |
| | 4.10 | Moisture barriers: | |
| | 4.11 | Protective wrappings: | |
| | 4.12 | Sheath:<br><br>Material Nominal thickness, Colour<br>Maximum overall diameter | |
| | 4.13 | Bedding layers for metallic protection: | |
| | 4.14 | Metallic protection: | |
| | 4.15 | Cable integral suspension strand: | |
| | 4.16 | Oversheath:<br>Material, Nominal thickness, Colour<br>Maximum overall diameter | |
| | 4.17 | Fauna proofing: | |
| | 4.18 | Chemical and/or environmental proofing: | |

**Table B.1** *(continued)*

| Mechanical Parameters | EN 50288-1 Subclause | Requirements | Comments |
|---|---|---|---|
| | 5.2.1 | Conductor elongation at break<br>EN 50289-3-2 | |
| | 5.2.2 | Shrinkage of insulation<br>EN 50289-3-4 | |
| | 5.2.3 | Crush resistance of the cable<br>EN 50289-3-5 | |
| | 5.2.4 | Impact resistance of the cable<br>EN 50289-3-6 | |
| | 5.2.5 | Abrasion resistance of the sheath markings<br>EN 50289-3-8 | |
| | 5.2.6.1 | Simulated installation testing of the cable<br><br>Single bend EN 50289-3-9:2001, Clause 4, procedure 2 | |
| | 5.2.6.2 | Simulated installation testing of the cable<br><br>“S” bend<br>EN 50289-3-9:2001, Clause 8 | |
| | 5.2.7 | Tensile performance<br><br>EN 50289-3-16<br>combined with 5.2.6 of this standard | |

**Table B.1** *(continued)*

| **Electrical Characteristics** | **EN 50288-1 Subclause** | **Requirements** | **Comments** |
|---|---|---|---|
| Electrical Characteristics | 5.1 | all electrical characteristics at<br>(at 20 °C) | |
| Conductor loop resistance | 5.1.1.1 | ≤. …..Ω/km | |
| Conductor resistance unbalance | 5.1.1.2 | ≤. ….. % | |
| (inside pair or quad) | | | |
| Resistance unbalance between pairs | | ≤. ….. % | |
| Dielectric strength | | | |
| Conductor/conductor | 5.1.1.3 | ……..kV | |
| Conductor/screen | 5.1.1.3 | ……..kV | |
| Insulation resistance | | | |
| Conductor/conductor | 5.1.1.4 | … MΩ*km | |
| Conductor/screen | 5.1.1.4 | ≥. … MΩ*km | |
| Mutual capacitance | 5.1.1.5 | ≤. … nF/km | |
| Capacitance unbalance to earth | 5.1.1.6 | ≤. … pF/km | |

**Table B.1** *(continued)*

| | | | |
|---|---|---|---|
| Transmission characteristics<br><br>(at 20°C) | 5.1 | Relevant sectional specification for the office area are set (all electrical characteristics at 20 °C) – only special agreed values are described in following sub clauses | |
| Velocity of propagation | 5.1.2.1 | ≥. …km/s | |
| Propagation delay difference (skew) | 5.1.2.2 | ≤. …ns/100 m at f [MHz] | |
| Longitudinal attenuation | 5.1.2.3 | ≤. …dB/100 m at f [MHz] | |
| Temperature effects | | ≤. … %/ °C | |
| Environmental effects | | ≥. … % | |
| Near-end unbalance attenuation | 5.1.2.4 | ≥. … dB at f [MHz] | |
| Power sum near-end crosstalk (PSNEXT) | 5.1.2.7.1 | ≥. … dB at f [MHz] | |
| Near-end crosstalk (NEXT) | 5.1.2.5 | ≥. … dB at f [MHz] | |
| Power sum equal level far-end crosstalk (PSELFEXT) | 5.1.2.7.2 | ≥. … dB at f [MHz] | |
| Equal level far-end crosstalk (ELFEXT) | 5.1.2.6 | ≥. … dB at f [MHz] | |
| | | …. Ω | |
| Mean characteristic impedance | 5.1.2.8 | ≥. … dB at f [MHz] | |
| Return loss | 5.1.2.9 | ≥. … dB at f [MHz] | |
| Ex Xtalk (ExNEXT, ExACR-F) | | ≥. … dB at f [MHz] | |
| PSExNEXT | 5.1.2.7.4. | ≥. … dB at f [MHz] | |
| PSExACR-F | 5.1.2.7.6. | | |
| Screening characteristics<br>(at 20 °C) | 5.1 | Relevant sectional specification for the office area set (all electrical characteristics at 20 °C) – only special agreed values are described in following sub clauses | |
| Screening attenuation | 5.1.2.12 | ≥ dB, 30 MHz ≤ f ≤ 1000 MHz | |
| Transfer impedance | 5.1.2.11 | ≤ mΩ/m at 1 MHz<br>≤ mΩ/m at 10 MHz<br>≤ mΩ/m at 30 MHz<br>≤ mΩ/m at 100 MHz | |
| Coupling attenuation | 5.1.2.10 | ≥ dB, 30 MHz ≤ f ≥ 100 MHz<br>≥ dB-20log(f/100) dB,<br>100 MHz ≤ f ≥ 1 000 MHz | |

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