BRITISH STANDARD

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+A2:2013

Coaxial cables –

Part 2-4: Sectional specification for cables used in cabled distribution networks — Indoor drop cables for systems operating at 5 MHz – 3 000 MHz

ICS 33.120.10

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 50117-2-4:2004+A2:2013. It supersedes BS EN 50117-2-4:2004+A1:2008, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CENELEC text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A1 is indicated by [A1⟩ ⟨A1].

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.

A list of organizations represented on this committee can be obtained on request to its secretary.

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EUROPEAN STANDARD **EN 50117-2-4:2004+A2**

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ICS 33.120.10

English version

Coaxial cables
Part 2-4: Sectional specification for cables used in cabled distribution networks — Indoor drop cables for systems operating at 5 MHz - 3 000 MHz

Câbles coaxiaux
Partie 2-4: Spécification intermédiaire pour les câbles utilisés dans les réseaux de distribution câblés – Câbles de raccordement à usage intérieur pour systèmes fonctionnant à 5 MHz - 3 000 MHz

Koaxialkabel
Teil 2-4: Rahmenspezifikation für Kabel für Kabelverteilanlagen - Hausintallationskabel im Bereich von 5 MHz - 3 000 MHz

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This European Standard was prepared by SC 46XA, Coaxial cables, of Technical Committee CENELEC TC 46X, Communication cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50117-2-4 on 2004-09-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2005-09-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2007-09-01

Foreword to amendment A1

This amendment to the European Standard EN 50117-2-4:2004 was prepared by SC 46XA, Coaxial cables, of Technical Committee CENELEC TC 46X, Communication cables.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 50117-2-4:2004 on 2007-12-01.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-12-01
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	2010-12-01

Foreword to amendment A2

This document (EN 50117-2-4:2004/A2:2013) has been prepared by CLC/SC 46XA "Coaxial 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)	2014-07-01
– latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2016-07-01

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.

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

Contents

1 Scope

This European Standard relates to EN 50117-1 and should be read in conjunction with this generic specification.This specification applies to indoor drop cables for use in cabled distribution systems operating at temperature between -40 °C and +70 °C [1)] and at frequencies between 5 MHz and 3 000 MHz and complying with the requirements of EN 50083.

The purpose of this European Standard is to specify the applicable test methods and requirements for the electrical, mechanical, environmental and fire performance of the cables.

2 Normative references

The following referenced documents are indispensable for the application 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 50083 series	Cable networks for television signals, sound signals and interactive services
EN 50117-1	Coaxial cables – Part 1: Generic specification
A2 EN 50117-1:2002/A2:2013	Coaxial cables – Part 1: Generic specification A2
EN 50289-1-6	Communication cables – Specifications for test methods – Part 1-6: Electrical test methods – Electromagnetic performance
EN 50289-3-9	Communication cables – Specifications for test methods – Part 3-9: Mechanical test methods – Bending tests
EN 50290-1-2 [2)]	Communication cables – Part 1-2: Definitions
EN 50290-2-22	Communication cables – Part 2-24: Common design rules and construction – PVC sheathing compounds
EN 50290-2-23	Communication cables – Part 2-23: Common design rules and construction – PE insulation
EN 50290-2-25	Communication cables – Part 2-25: Common design rules and construction – Polypropylene insulation compounds
EN 50290-2-27	Communication cables – Part 2-27: Common design rules and construction – Halogen free flame retardant thermoplastic sheathing compounds
EN 50290-4-1	Communication cables – Part 4-1: General considerations for the use of cables – Environmental conditions and safety aspects
EN 62153-1-1	Metallic telecommunication cable test methods – Part 1-1: Electrical – Measurement of the pulse/step return loss in the frequency domain using the Inverse Discrete Fourier Transformation (IDFT) (IEC 62153-1-1)
IEC 61196-1-115 [2)]	Coaxial communication cables – Part 1-115: Electrical test methods – Test for pulse return loss (regularity of impedance)

3 Definitions

For the purposes of this European Standard, the definitions of EN 50290-1-2 and EN 50117-1 apply.

A1 The definition of a drop coaxial cable is one of use or intended use and application within the network rather than by specific constructional requirements of the cable itself.

3.1
drop cable
coaxial cable which is used to connect from
a) subscriber tap or a directional coupler to a system outlet,
b) subscriber tap to a subscriber splitter,
c) subscriber splitter to a system outlet A1

1) This value is valid for applications without ampacity only.

2) At draft stage.

4 Requirements for cable construction

4.1 General

Designing the cable, consideration should be paid to the maximum admissible current stated in the detail specification. It is assumed that the raise if temperature of the inner conductor when submitted to the maximum current under nominal ambient conditions does not affect the mechanical and electrical properties of the cable (details are under study).

4.2 Inner conductor

The conductor shall meet the requirements of Subclause 4.2 of EN 50117-1, and shall be solid or tube. Individual wires can be plain or metal coated. Dimensions shall be in accordance with the detailed specification.

There shall be no joint made subsequent to the last drawing operation.

4.3 Dielectric

The dielectric material(s) shall be in accordance with Subclause 4.3 of EN 50117-1 and shall consist of polyolefin materials, with EN 50290-2-23 (polyethylene), EN 50290-2-25 (polypropylene) or any relevant part of EN 50290-2-XX. Dimensions shall be in accordance with the detail specification.

Unless otherwise specified, the nominal diameter over the dielectric should be one of the preferred values, namely 2,9 mm, 3,7 mm, 4,8 mm and 7,2 mm.

4.4 Outer conductor or screen

The construction and material of the outer conductor and/or screen shall be meet the requirements of Subclause 4.4 items b), c), f) or g) of EN 50117-1. Where option b) is used, a double braid layer is required.

For braid constructions or helically wound wires, the braid angle shall be between 15° and 45°. The coverage factor shall be greater than or equal to 65 %, or, when the cable is provided with a metal foil, greater than or equal to 25 %. These values are also valid for cables with two bi-directional layers of helically wound wires.

Dimensions shall be in accordance with the detailed specification.

4.5 Filling compounds

Not applicable

4.6 Moisture barriers

Not applicable

4.7 Wrapping layers

Not applicable

4.8 Sheath

Sheath material(s) shall meet the requirements of the EN 50290-2-22 for PVC sheaths or EN 50290-2-27 for halogen free flame retardant materials.

The sheath shall also meet the requirements of Subclause 4.8 of EN 50117-1.

Dimensions shall be in accordance with the detailed specification.

4.9 Metallic protection

Not applicable

4.10 Cable integral suspension strand (Messenger wire)

Not applicable

4.11 Oversheath

Not applicable

4.12 Fauna proofing

Not applicable

4.13 Chemical and/or environmental proofing

Not applicable

4.14 Cable identification

Cable identification shall be in accordance with Subclause 4.14 of EN 50117-1.

4.14.1 Sheath marking

Sheath marking shall be achieved as a non-degradable print containing the following minimum information:

– designation of the cable;
– attenuation value (in dB/100 m at 800 MHz, rounded);
– screening class;
– Euro-class;
– name of supplier.

EXAMPLE EN 50117-2-4 21 < XXX > Class B Euro-class C < YYY >

〈A1〉 NOTE The Construction Products Directive (CPD) will define classes for the fire performance of cables. As long as the CPD is under consideration and fire performance classes (Euroclasses) are not defined, sheath marking with Euroclass is not required. 〈A1〉

4.14.2 Labelling

Unless otherwise specified in the detail specification drums or coils shall be provided with a label with a non-degradable print containing the following minimum information:

– designation of the cable;
– attenuation value (in dB/100 m at 800 MHz, rounded);
– screening class;
– Euro-class;
– name of supplier;
– batch part number;
– length of cable.

EXAMPLE EN 50117-2-4 21 < XXX > Class B Euro-class C < YYY > 03/04 543m

5 Tests for completed cables

When tested in accordance with the requirements of EN 50117-1, the requirements given below shall apply.

5.1 Electrical tests

5.1.1 Low-frequency and D.C. electrical measurements

Table 1 ± Low-frequency and D.C. electrical measurements

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.1.1.1	Conductor resistance	Applicable, value in accordance with the detail specification
5.1.1.2	Dielectric strength	2 kV D.C. or 1,5 kV A.C. for 1 min
5.1.1.3	Insulation resistance	$\geq 10^4$ MΩ x km
5.1.1.4	Mutual capacitance	When required, in accordance with the detail specification
5.1.1.5	Voltage test of sheath	2,5 kV A.C. or 3,75 kV D.C., unless otherwise specified in the relevant detail specification. Test in accordance with EN 50289-1-X [a]
5.1.1.6	Discharge (corona) test	Not applicable
5.1.1.7	Voltage proof	Not applicable
5.1.1.8	Power rating	Not applicable
[a] Test procedure is under consideration by CLC/SC 46XA.		

5.1.2 High-frequency electrical and transmission measurements

Table 2 ± High-frequency electrical and transmission measurements

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.1.2.1	Velocity of propagation	May be specified for information purposes only in the detail specification.
5.1.2.2	Longitudinal attenuation (operational attenuation)	The cable shall comply at any frequency with the formula $a \cdot \sqrt{f} + b \cdot f + c$. In case of copper clad conductor material a term $d / \sqrt{f}$ should be added, to match the curve at low frequencies. The coefficients a, b, c and d shall be given in the relevant detail specification as well as the discrete values at 200 MHz, 800 MHz and 2 400 MHz.
5.1.2.3	Characteristic impedance	75 Ω ± 3 Ω

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

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.1.2.4	Return loss [a]	<u>For cables where $\alpha \leq$ 18 dB/100 m at 800 MHz</u> RL = 23 dB min. from 5 MHz to 30 MHz RL = 23 dB min. from 30 MHz to 470 MHz RL = 20 dB min. from 470 MHz to 1 000 MHz RL = 18 dB min. from 1 000 MHz to 2 000 MHz RL = 16 dB min. from 2 000 MHz to 3 000 MHz <u>For cables where $\alpha >$ 18 dB/100 m at 800 MHz</u> RL = 20 dB min. from 5 MHz to 30 MHz RL = 20 dB min. from 30 MHz to 470 MHz RL = 18 dB min. from 470 MHz to 1 000 MHz RL = 16 dB min. from 1 000 MHz to 2 000 MHz RL = 15 dB min. from 2 000 MHz to 3 000 MHz (α is the longitudinal attenuation) **Measurement accuracy** In case of digital signal processing, the accuracy of the return loss measurement, $\Delta a_{r,f}$ depends on the frequency step Δf in the measured frequency range. The frequency spacing in the measured frequency range is frequency dependent and shall be in accordance with the following equation: $$\Delta f \leq 1{,}4 \cdot \frac{300 \cdot v_r}{868{,}6 \cdot \pi} \cdot a(f) \cdot \sqrt{10^{\frac{\Delta a_{r,f}}{10}} - 1}$$ where a(f) is the attenuation of the cable at the measured frequency point in dB/100 m, Δ_{ar1} is the max. uncertainty of measurement due to frequency spacing; and v_r is the nominal velocity. The measurement inaccuracy $\Delta a_{r,f}$ shall be ≤ 1 dB unless otherwise stated in the relevant detail specification. [b] d
5.1.2.5	Regularity of impedance	Perform on both ends of tested cable Regularity ≥ 40 dB resp ≤ 1 % Test procedure: IEC 61196-1-115, (time domain) or EN 62153-1-1, (transformation from frequency domain into time domain by IDFT). [c]
〖A1〗 5.1.2.6	Transfer impedance	Screening Class A: ≤ 5 mΩ/m from 5 MHz to 30 MHz; Screening Class A+: ≤ 2,5 mΩ/m from 5 MHz to 30 MHz; Screening Class B: ≤ 15 mΩ/m from 5 MHz to 30 MHz; Screening Class C: ≤ 50 mΩ/m from 5 MHz to 30 MHz [d]. Test procedure according to EN 50289-1-6, triaxial method, after completion of the flexure test according to 5.2.9 of this standard. 〖A1〗

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

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
[A1] 5.1.2.7	Screening attenuation	Screening Class A: ≥ 85 dB from 30 MHz to 1 000 MHz; ≥ 75 dB from 1 000 MHz to 2 000 MHz; ≥ 65 dB from 2 000 MHz to 3 000 MHz. Screening Class A+: ≥ 95 dB from 30 MHz to 1 000 MHz; ≥ 85 dB from 1 000 MHz to 2 000 MHz; ≥ 75 dB from 2 000 MHz to 3 000 MHz. Screening Class B: ≥ 75 dB from 30 MHz to 1 000 MHz; ≥ 65 dB from 1 000 MHz to 2 000 MHz; ≥ 55 dB from 2 000 MHz to 3 000 MHz. Screening Class C: ≥ 75 dB from 30 MHz to 1 000 MHz; ≥ 65 dB from 1 000 MHz to 2 000 MHz; ≥ 55 dB from 2 000 MHz to 3 000 MHz[d]. Test procedure according to EN 50289-1-6, triaxial method, after completion of the flexure test according to 5.2.9 of this standard.

[a] In each frequency band, 3 peak return loss values up to 4 dB lower than the stated specified limit are permissible.

[b] A more detailed description of the subject is given in 46XA/Sec104/INF and 46XA/Sec105/INF.

[c] An EN test procedure is under consideration by CLC/SC 46XA.

[d] Screening class C cables are not intended for use in systems operating at frequencies ≤ 30 MHz. [A1]

5.2 Mechanical tests

Table 3 ± Mechanical tests

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.2.1	Conductor elongation at break	Applicable for copper clad steel conductors only
5.2.2	Adhesion of dielectric	Sample length for inner conductor diameters of < 1,6 mm = 25 mm ≥ 1,6 mm = 50 mm. Pressure force F_a [a] required to remove dielectric shall be 0,1 MPa ≤ F_a ≤ 1,0 MPa
5.2.3	Crush resistance of the cable	Load = 700 N, applied for 2 min After a 5 min recovery time, the maximum impedance irregularity shall be less than 1 %, measured with a pulse, having a width of (1 ± 0,1) nsec, (see 5.1.2.5).
5.2.4	Impact resistance of the cable	Under consideration
5.2.5	Abrasion resistance of the sheath	Not applicable
5.2.6	Abrasion resistance of the sheath markings	Procedure, diameter of the needle, force and number of cycles in accordance with the relevant detail specification. Markings shall remain legible.

Table 3 ± Mechanical tests *(continued)*

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.2.7	Simulated installation testing of the cable, (bending under tension).	Procedure according to EN 50289-3-9, Clause 8, procedure 1, 180°, U-bend. Sample length: ≥ 50 m, Length between point A and B: 5 m. Radius of the pulleys: 10 times the outer diameter of the cable under test. Pulling force respectively weight: Max. pulling force according to the detail specification. Number of cycles: One move forward and back. Pulling speed: ≤ 1 m/s. The longitudinal attenuation, the characteristic impedance, and the return loss shall remain within the specified limits.
5.2.8	Tensile performance	Not applicable
5.2.9	Flexure	**Procedure A:** EN 50289-3-9, Subclause 8.3.2, test procedure 2 [b] Radius of the pulleys: 10 times the outer diameter of the cable under test. Pulling force respectively weight: Max. pulling force of the cable under test, according to the detail specification. Number of cycles: One move forward and back. Pulling speed: ≤ 1 m/s. **Procedure B:** EN 50289-3-9, Subclause 4.3.1 Radius of the mandrel: 10 times the outer diameter of the cable under test. Number of cycles: Two, whereas the sample under test shall be turned at 180° along its longitudinal axis during the second turn. Pulling force respectively weight: Max. pulling force of the cable under test, according to the detail specification. Turns per helix: The length of the helix shall at least comply with the length under test of the screening tests according to 5.1.2.6 and 5.1.2.7. The longitudinal attenuation, the characteristic impedance, and the return loss shall remain within the specified limits.
5.2.10	Flexing endurance	Not applicable

[a] The adhesion of the dielectric to the inner conductor, F_a is given in MPa by the following equation: $F_a = \frac{F}{\pi \cdot d \cdot l}$

[b] Contrary to EN 50289-3-9 also the pulleys may be moved from point A to point B, while the cable with the weight is fixed.

5.3 Environmental tests

Table 4 ± Environmental tests

EN 50117-1 Subclause n°	Parameter	Requirements/Remarks
5.3.1	Cold bend performance of the cable	After a storage time of ≥ 24 h samples shall be tested in accordance to EN 50289-3-9, Clause 4, procedure 1 at a temperature as stated in the relevant detail specification. [a] Radius of test mandrel: 10 x outer diameter of the cable under test No. of turns: 3 No. of cycles: 1 No physical damages of conductors, dielectric and sheaths.
5.3.2	Water penetration test	When required, in accordance with the relevant detail specification.
5.3.3	Moisture permeation test	When required, in accordance with the relevant detail specification.
5.3.4	Resistance to solvents and contaminating fluids	When required, in accordance with the relevant detail specification.
5.3.5	Climatic sequence	T_A = -40 °C; T_B = +70 °C; t_1 = 24 h, unless otherwise specified in the detail specification. No. of cycles: 3. Influenced mechanical and electrical characteristics shall be as specified in the relevant detail specification.
5.3.6	Eolian vibration test for aerial cables	When required, in accordance with the relevant detail specification.
5.3.7	Damp heat, steady state	Influenced mechanical and electrical characteristics shall be as specified in the relevant detail specification.
5.3.8	UV resistance	Not applicable
[a] During the bending procedure, the sample under test shall remain in the cold chamber.		

〖A2〗 5.4 Fire performance test methods

Fire performance tests shall be in accordance with EN 50117-1:2002 and EN 50117-1:2002/A2:2013, 5.4. 〖/A2〗

〖A2〗 *Table deleted* 〖/A2〗

6 Cable types

Table 6 indicates typical cable properties for informative purposes for cables with copper inner conductors.

Alternative conductor materials, dimensions and characteristics shall be defined in the detail specification.

Table 6 – Drop cable types – Dimensions and ratings

Characteristic/Type	45 A+/A/B	29 A+/A/B	23 A+/A/B	18 A+/A/B	13 A+/A/B
Nom. diameter [mm]					
over dielectric	2,0	3,0	3,7	4,8	7,2
outer diameter	4,0	4,5	6,0	7,0	10,5
Attenuation max. [dB/100 m]					
@ 200 MHz	21	14	12	9	6
@ 800 MHz	45	29	23	18	13
@ 2 400 MHz	82	52	45	32	25
Attenuation coeff. [a]					
a	1,36	0,94	0,77	0,54	0,39
b	0,006 1	0,002 2	0,002 1	0,002 0	0,001 8
c	0,50	0,50	0,40	0,40	0,30
Screening class	A+/A/B	A+/A/B	A+/A/B	A+/A/B	A+/A/B
Max. D.C. current [b] [A]	0,8	2,1	3,4	6,1	13,2
Euroclass ???					

[a] $a(f)/[dB/100\ m] = a^*\sqrt{f} + b^*f + c$.

[b] Calculated value for aerial installation. 〈A1〉

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