

Coaxial cables used in cabled distribution networks

Part 1. Generic specification

The European Standard EN 50117-1 : 1995 together with its amendments A1 : 1995 and A2 : 1997 has the status of a British Standard

ICS 33.120.10

Committees responsible for this British Standard

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- AEA Technology
- British Approvals Service for Cables
- British Broadcasting Corporation
- British Cable Makers Confederation
- British Railways Board
- British Telecommunications plc
- Cable Communications Association
- Confederation of Aerial Industries
- ERA Technology Ltd
- Federation of the Electronics Industry
- London Underground Ltd
- Ministry of Defence
- Society of Cable Television Engineers

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National foreword

This British Standard has been prepared under the direction of Technical Committee EPL/46/1 and is the English language version of EN 50117-1 : 1995, *Coaxial cables used in cabled distribution networks*, incorporating Amendments A1 : 1995 and A2 : 1997 published by the European Committee for Electrotechnical Standardization (CENELEC).

Cross-references

Publication referred to	Corresponding British Standard
EN 60068-1 : 1994	BS EN 60068 <i>Environmental testing</i> Part 1 : 1995 <i>General and guidance</i>
EN 60068-2-1 : 1993	Part 2 <i>Test methods</i> Section 1 : 1993 <i>Tests A. Cold</i>
HD 323.2.3 S2 : 1987	BS 2011 <i>Environmental testing</i> Part 2.1 <i>Tests</i> Part 2.1 Ca : 1977 <i>Test Ca. Damp heat, steady state</i>
HD 323.2.38 S1 : 1988	Part 2.1 Z/AD : 1977 <i>Tests Z/AD. Composite temperature/humidity cyclic test</i>
HD 134	BS 3041 <i>Radio-frequency connectors</i>
HD 402 S2	BS 6746C : 1993 <i>Colour chart for insulation and sheath of electric cables</i>
HD 405.3 S1	BS 4066 <i>Tests on electric cables under fire conditions</i> Part 3 : 1994 <i>Tests on bunched wires or cables</i>
HD 602 S1	BS 6425 <i>Test on gases evolved during the combustion of materials from cables</i> Part 2 : 1993 <i>Determination of degree of acidity (corrosivity) of gases by measuring PH and conductivity</i>

Compliance with a British Standard does not of itself confer immunity from legal obligations.

ICS 33.120.10

Descriptors: Coaxial cables, cabled distribution networks

English version

Coaxial cables used in cabled distribution networks

Part 1: Generic specification

(includes amendment A1 : 1995 and A2 : 1997)

Câbles coaxiaux pour réseaux câblés de
distribution
Partie 1: Spécification générique
(inclut l'amendement A1 : 1995 et A2 : 1997)

Koaxialkabel für Kabelverteilanlagen
Teil 1: Fachgrundspezifikation
(enthält Änderung A1 : 1995 und A2 : 1997)

This European Standard was approved by CENELEC on 1994-12-06; amendment A1 was approved by CENELEC on 1995-11-28; amendment A2 was approved by CENELEC on 1996-12-09. 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 Central Secretariat or to any CENELEC member.

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CENELEC

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

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

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

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50117-1 on 1994-12-06

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) 1995-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1995-12-01

Foreword of amendment A1

This amendment A1 to the European Standard EN 50117-1 : 1995 was prepared by SC 46XA, Coaxial cables, of Technical Committee TC 46X, Communication cables.

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- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1996-12-01

Foreword of amendment A2

This amendment 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 A2 to EN 50117-1 : 1995 on 1996-12-09.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-12-01

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1 Scope

This standard establishes the requirements and applicable tests for coaxial cables with characteristic impedance of 75 Ω used in CATV networks.

This standard takes into account the IEC 96 requirements. The relating cables are recommended for use with connectors according to IEC 169.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments)

NOTE. When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 28	1925	<i>International standard of resistance for copper</i>	—	—
IEC 50	Series	<i>International Electrotechnical Vocabulary</i>	—	—
IEC 68-1	1988	<i>Environmental testing</i> Part 1: <i>General and guidance</i>	EN 60068-1 ¹⁾	1994
IEC 68-2-1	1990	Part 2: <i>Tests</i> — <i>Test A: Cold</i>	EN 60068-2-1	1993
IEC 68-2-3	1969	<i>Test Ca: Damp heat</i>	HD 323.2.3 S2 ²⁾	1987
IEC 68-2-38	1974	<i>Test Z/AD: Composite temperature/humidity cyclic test</i>	HD 323.2.38 S1	1988
IEC 96	series	<i>Radio frequency cables</i>	—	—
IEC 169	series	<i>Radio frequency connectors</i>	HD 134 EN 60169	series series
IEC 304	1982	<i>Standard colours for insulation for low frequency cables and wires</i>	HD 402 S2	1984
IEC 332-1	1993 ³⁾	<i>Test on electric cables under fire conditions</i> — Part 1: <i>Tests on a single vertical insulated wire or cable</i>	—	—
IEC 332-3	1992	Part 3: <i>Test on bunched wires or cables</i>	HD 405.3 S1	1993
IEC 754-1	1994	<i>Test on gases evolved during combustion of electric cables</i> Part 1: <i>Determination of the amount of halogen acid gas evolved during the combustion of polymeric materials taken from cables</i>	—	—
IEC 754-2 (mod)	1991	Part 2: <i>Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity</i>	HD 602 S1	1992
IEC 811-1-1	1993	<i>Common test methods for insulating and sheathing materials of electric cables</i> Part 1: <i>Methods for general application</i> Section 1: <i>Measurement of thickness and overall dimensions — Tests for determining the mechanical properties</i>	EN 60811-1-1	1995
IEC 811-1-2	1985	Section 2: <i>Thermal ageing methods</i>	EN 60811-1-2 ⁴⁾	1995
IEC 811-1-4	1985	Section 4: <i>Tests at low temperature</i>	EN 60811-1-4 ⁵⁾	1995
IEC 811-3-1	1985	Part 3: <i>Methods specific to PVC compounds</i> Section 1: <i>Pressure test at high temperature — Tests for resistance to cracking</i>	EN 60811-3-1 ⁶⁾	1995
IEC 811-3-2	1985	Section 2: <i>Loss of mass test — Thermal stability test</i>	EN 60811-3-2 ⁷⁾	1995
IEC 811-4-1	1985	Part 4: <i>Methods specific to polyethylene and polypropylene compounds</i> Section 1: <i>Resistance to environmental stress cracking — Wrapping test after thermal ageing in air — Measurement of the melt flow index — Carbon black and/or mineral content measurement in PE</i>	EN 60811-4-1 ⁸⁾	1995
ISO/R 402		<i>Tensile testing of copper and copper alloy wire</i>		
CISPR 8B		<i>Reports and study questions of the CISPR 2 Supplement, Amendment No. 1</i>		

¹⁾ EN 60068-1 includes A1 : 1992 to IEC 68-1.

²⁾ HD 323.2.3 S3 includes A1: 1984 to IEC 68-2-2.

³⁾ IEC 332-1: 1979 is harmonized as HD 405.1 S1 : 1983.

⁴⁾ EN 811-1-2 includes corrigendum May 1986 and A1 : 1989 to IEC 811-1-2.

⁵⁾ EN 811-1-4 includes corrigendum May 1986 and A1 : 1993 to IEC 811-1-4.

⁶⁾ EN 811-3-1 includes corrigendum May 1986 to IEC 811-1-2.

⁷⁾ EN 811-3-2 includes corrigendum May 1986 and A1 : 1993 to IEC 811-3-2.

⁸⁾ EN 811-4-1 includes corrigendum May 1986 and A2 : 1993 to IEC 811-4-1.

3 Definitions

3.1 IEV definitions

Terms used in the Publication which are defined in the International Electrotechnical Vocabulary IEC Publication 50 are given in the table below:

Term	IEV definition	Term	IEV definition
absorption	726-06-05	matched termination	726-22-09
absolute error	301-08-06	megohmmeter	20-15-160
analogue signal	37-15-050	measurement	301-10-04
armour of cable	25-30-110		
attenuation	303-01-04	noise	303-0-09
attenuation coefficient	55-05-255	normalized impedance	726-07-03
attenuation distortion	55-10-010		
attenuator	303-03-17	pad attenuator	726-12-03
		phase delay	55-05-230
bonded screen	461-03-06	phase distortion	55-10-015
braiding	25-30-090	phase velocity	726-05-13
brazing soldering	40-15-005	plug-in unit	303-03-16
		port	726-11-05
cable	55-30-010	probe	303-03-15
cable core	25-30-045	propagation coefficient	726-0-0
cable drum	461-20-01		
capacitance	05-15-175	radio frequency	55-05-060
capacitance meter	20-15-2	reflection coefficient	726-07-08
coaxial cable	55-30-050	reflected wave	726-02-05
coaxial pair	55-30-045	relative error	301-08-07
composite loss	55-05-175	repeatability of measurement	301-10-04
conductor	461-01-01	reproducibility of measurement	301-10-05
conductor resistance	05-20-140	resolution	301-10-03
		resonance method of measurement	301-01-09
delay distortion	55-10-020	return loss	55-05-195
delay time	726-15-24	rise time	351-04-02
dielectric	05-15-095		
dielectric constant/permittivity	05-15-120	screen	55-25-355
dielectric strength	05-15-205	sensitivity	66-10-385
digital signal	37-15-055	sheath (of a cable)	25-30-105
direction of propagation	726-02-01	short circuit	
directional coupler	726-14-02	signal generator	303-03-12
directivity	726-14-03	slotted line	726-19-06
drain wire	461-03-07	spark test	461-22-01
		spectrum analyser	303-03-09
earth	05-40-155	stabilized supply apparatus	303-03-11
electrification	05-15-015	standing wave minimum (maximum)	726-02-09
		strand	461-01-19
frequency	05-02-055	surface wave	726-02-13
frequency range	303-06-10		
		termination	726-11-07
gain	303-01-05	thermoplastic insulation	461-02-10
group delay	726-05-16	transformer bridge	302-05-03
group velocity	726-05-17	transmission line	726-01-01
guided wave	726-02-10	transmitted wave	726-02-06
		travelling wave	726-02-02
impedance to earth	303-02-15		
incident wave	25-50-055	VSWR	726-07-09
input (output) impedance	303-02-13		
insertion loss	726-06-17	wheatstone bridge	302-05-01
insulation resistance	05-40-200		
intrinsic error	301-01-09		
Kelvin/Thomson double bridge	302-05-02		

3.2 Additional definitions

In addition to the definitions given in IEC Publication 50 the following will apply.

3.2.1 air spaced cables

Cables in which the dielectric is air, except for the portion occupied by insulating spacers assembled on the inner conductor at regular intervals or helically applied tapes and/or threads. It is characteristic of this type of insulation that outside the spacers it is possible to pass from the inner conductor to the outer conductor without passing through a layer of solid plastic dielectric.

3.2.2 braiding formulae

The variables used in the formulae are given in the following table:

Variable	Description
d	Diameter of braid wire or thickness of braid tape
D	Mean diameter of braid i.e. diameter over dielectric plus $2.25 d$
L	Lay length of braid
n	Number of ends of wire per spindle
m	Total number of spindles

3.2.2.1 braid angle θ

The braid angle θ is defined as:

$$\theta = \arctan(\pi D / L) \quad (1)$$

3.2.2.2 lay factor K_l

The lay factor is defined as:

$$K_l = \sqrt{(1 + \pi^2 D^2 / L^2)} \quad (2)$$

3.2.2.3 filling factor K_f

The filling factor is defined as:

$$K_f = \left(\frac{mnd}{2\pi D} \right) \sqrt{(1 + \pi^2 D^2 / L^2)} \quad (3)$$

which may also be expressed as

$$K_f = \left(\frac{mnd}{2L \sin \theta} \right) \quad (4)$$

3.2.2.4 coverage factor K_c

The coverage factor is related to the filling factor such that:

$$K_c = 2 K_f - K_f^2 \quad (5)$$

3.2.3 void

3.2.4 ovality

The ovality of the cross section of a dielectric or cable is defined as the ratio of the maximum difference between two orthogonal diameters divided by the mean of these diameters and expressed as a percentage.

3.2.5 screening attenuation

The screening attenuation is defined as the logarithmic ratio of power in a matched primary (*inner*) circuit to the maximum of total power in the secondary (*outer*) circuit.

3.2.6 screening effectiveness

Aptitude of the outer conductor and/or screen(s) to increase immunity of the cable against electromagnetic disturbances or radiation.

3.2.7 semi-air spaced cables

Cables in which the dielectric is a plastics/air construction comprising either cellular polymer or an insulating tube at the centre of which the inner conductor is supported by discs, or another construction.

It is characteristic of this type of cable that it is not possible to pass from the inner conductor to the outer conductor without passing through a layer of plastic dielectric.

3.2.8 solid dielectric cables

Cables in which all the space between the inner conductor and the outer conductor is substantially filled by solid plastic dielectric. The dielectric may be either homogeneous or composite, the latter comprising two or more concentric layers which may have different properties.

3.2.9 transfer impedance Z_T

The transfer impedance is defined as the ratio of the voltage measured along the inside of the screen of the cable to the current flowing along the outside of the screen or vice versa.

3.2.10 minimum static bending radius

Minimum static bending radius is the minimum permissible bending radius for a single bend in a fixed installation with no performance degradation.

3.2.11 minimum dynamic bending radius

Minimum dynamic bending radius is the minimum permissible bending radius for multiple bending during handling with no performance degradation.

4 Materials and cable construction

4.1 Cable construction

The cable construction shall be in accordance with the details and dimensions given in the relevant cable specification.

4.2 Inner conductor

4.2.1 Conductor material

The conductor shall consist of annealed copper uniform in quality and free from defects. The properties of the copper shall be in accordance with IEC Publication 28.

Alternatively the conductor shall consist of copper clad steel. The layer of copper coating shall be continuous and shall adhere to the steel conductor circular in cross section such that the maximum resistance of the coated conductor shall not exceed that given for a copper conductor in accordance with IEC Publication 28 by more than a factor of 2.8 for 40 % nominal conductivity grade copper clad steel. The percentage of the elongation at break when tested in accordance with sub-clause 9.7 of this Standard shall be not less than 1 %. The minimum tensile strength shall be 760 N/mm².

Alternatively the conductor shall consist of copper clad aluminium. The layer of copper coating shall be continuous and shall adhere to an aluminium conductor circular in cross section such that the maximum resistance of the coated conductor shall not exceed that given for copper conductor in accordance with IEC Publication 28 by more than a factor of 1.8. The percentage of the elongation when tensile tested in accordance with sub-clause 9.6 of this Standard shall not be less than 10 %.

4.2.2 Conductor construction

The construction and material of the inner conductor shall be as specified in the relevant cable specification.

Where the inner conductor consists of a single wire or tube there shall be no joint in the wire or tube made subsequent to the last drawing operation.

Joints in individual strands of a stranded copper inner conductor shall be cold pressure welded, brazed or silver soldered using a non acid flux such that the strand diameter shall not be increased.

No joint in an individual strand shall be within 0.3 m of a joint in any other individual strand.

4.3 Dielectric

The type of dielectric required for each cable shall be specified in the relevant cable specification. The diameter over dielectric and ovality shall be given in the relevant cable specification.

4.4 Outer conductor or screen

The construction and material of the outer conductor and/or screen shall be specified in the detail specification.

The outer conductor or screen may be:

- a) A double braid of plain or tinned annealed copper wire. Joints in the braiding wires shall be soldered, twisted or woven-in and there shall be no joint in the complete braid. The braid shall be evenly applied. The braid angle and the filling factor shall be specified in the detail specification;
- b) A copper or aluminium tape formed round the core as a continuous and closed screen with a sufficient overlap bonded or not bonded as specified in the detail specification;
- c) A gas-tight tube of copper or aluminium material (i.e. extruded, welded smooth or corrugated);
- d) A layer of metal or metallized film applied with a sufficient overlap, bonded or not bonded, covered with a copper braid where the foil is copper, and an aluminium or tinned copper braid where the foil is aluminium, as in item a) above, applied over the film;
- e) A layer of metal or metallized film applied with a sufficient overlap bonded or not bonded, covered with two layers bi-directional helically wound wires of copper where the foil is copper, and an aluminium or tinned copper braid where the foil is in aluminium, as in item a) above, applied over the film.

4.5 Sheath

The outer sheath of the cable shall be of plastic material and specified in the relevant cable specification.

Black polyethylene shall have a carbon black content of $(2,5 \pm 0,5) \%$. Green and blue polyethylene may be allowed and shall be specified in the relevant cable specification.

PVC shall be coloured in accordance with IEC Publication 304.

Low smoke halogen free materials can be used. Their characteristics and the related test methods are under consideration.

5 Standard ratings and characteristics

The ratings and characteristics applicable to a cable shall be stated in the relevant cable specifications.

6 Identification marking and labelling

6.1 Cable identification

Cable identification shall be defined by sheath marking.

6.2 Sheath marking

Sheath marking shall be in accordance with the relevant cable specification.

6.3 Labelling

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

- designation of cable;
- length of cable;
- name of supplier.

7 Delivery and storage

Delivery shall be made on drums or as coils with suitable protection.

The ends of the finished cable shall be adequately sealed to prevent the ingress of moisture. Sealing shall be carried out immediately after inspection and acceptance tests.

Temperature ranges for storage, installation and operation shall be stated in the relevant specification.