

INTERNATIONAL STANDARD

**Coaxial communication cables –
Part 5: Sectional specification for CATV trunk and distribution cables**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COAXIAL COMMUNICATION CABLES –

Part 5: Sectional specification for
CATV trunk and distribution cables

FOREWORD

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International Standard IEC 61196-5 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
46A/1095/FDIS	46A/1117/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This second edition cancels and replaces the first edition published in 2007. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

This standard has been updated and different requirements have been updated or added.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This standard is intended to be read in conjunction with IEC 61196-1. It is based on the second edition (2005) of that standard.

A list of all parts of the IEC 61196 series, under the general title: *Coaxial communication cables*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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COAXIAL COMMUNICATION CABLES –

Part 5: Sectional specification for CATV trunk and distribution cables

1 Scope

This part of IEC 61196 applies to coaxial communications cables. It specifies the requirements for trunk and distribution cables for use in cabled television distribution networks operating at temperatures between -40 °C and $+65\text{ °C}$ and in the frequency range of 5 MHz to 1 002 MHz.

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.

IEC 60068-1,— *Environmental testing – Part 1: General and guidance*¹

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60096-0-1, *Radio Frequency cables – Part 0-1: Guide to the design of detail specifications – Coaxial cables*

IEC 60811-4-1, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 4-1: Methods specific to polyethylene and polypropylene compounds – Resistance to environmental stress cracking – Measurement of the melt flow index – Carbon black and/or mineral filler content measurement in polyethylene by direct combustion – Measurement of carbon black content by thermogravimetric analysis (TGA) – Assessment of carbon black dispersion in polyethylene using a microscope*

IEC 61196-1:2005, *Coaxial communication cables – Part 1: Generic specification – General, definitions and requirements*

IEC 61196-1-1, *Coaxial communication cables – Part 1-1: Capability approval for coaxial cables*

IEC 61196-1-100 (all parts), *Coaxial communication cables – Part 1-1XX: Electrical test methods*

IEC 61196-1-101, *Coaxial communication cables – Part 1-101: Electrical test methods – Test for conductor d.c. resistance of cable*

IEC 61196-1-102, *Coaxial communication cables – Part 1-102: Electrical test methods – Test for insulation resistance of cable dielectric*

¹ 7th edition to be published.

IEC 61196-1-105, *Coaxial communication cables – Part 1-105: Electrical test methods – Test for withstand voltage of cable dielectric*

IEC 61196-1-106, *Coaxial communication cables – Part 1-106: Electrical test methods – Test for withstand voltage of cable sheath*

IEC 61196-1-108, *Coaxial communication cables – Part 1-108: Electrical test methods – Test for characteristic impedance, phase and group delay, electrical length and propagation velocity*

IEC 61196-1-112, *Coaxial communication cables – Part 1-112: Electrical test methods – Test for return loss (uniformity of impedance)*

IEC 61196-1-113, *Coaxial communication cables – Part 1-113: Electrical test methods – Test for attenuation constant*

IEC 61196-1-115, *Coaxial communication cables – Part 1-115: Electrical test methods – Test for regularity of impedance (pulse/step function return loss)*

IEC 61196-1-200 (all parts), *Coaxial communication cables – Part 1-2XX: Environmental test methods*

IEC 61196-1-201, *Coaxial communication cables – Part 1-201: Environmental test methods – Test for cold bend performance of cable*

IEC 61196-1-203, *Coaxial communication cables – Part 1-203: Environmental test methods – Test for water penetration of cable*

IEC 61196-1-206, *Coaxial communication cables – Part 1-206: Environmental test methods – Climatic sequence*

IEC 61196-1-300 (all parts), *Coaxial communication cables – Part 1-3XX: Mechanical test methods*

IEC 61196-1-301, *Coaxial communication cables – Part 1-301: Mechanical test methods – Test for ovality*

IEC 61196-1-302, *Coaxial communication cables – Part 1-302: Mechanical test methods – Test for eccentricity*

IEC 61196-1-308, *Coaxial communication cables – Part 1-308: Mechanical test methods – Test for tensile strength and elongation for copper-clad metals*

IEC 61196-1-310, *Coaxial communication cables – Part 1-310: Mechanical test methods – Test for torsion characteristics of copper-clad metals*

IEC 61196-1-313, *Coaxial communication cables – Part 1-313: Mechanical test methods – Adhesion of dielectric and sheath*

IEC 61196-1-314:2006, *Coaxial communication cables – Part 1-314: Mechanical test methods – Test for bending*

IEC 61196-1-316, *Coaxial communication cables – Part 1-316: Mechanical test methods – Test of maximum pulling force of cable*

IEC 61196-1-317, *Coaxial communication cables – Part 1-317: Mechanical test methods – Test for crush resistance of cable*

IEC 61196-1-324, *Coaxial communication cables – Part 1-324: Mechanical test methods – Test for abrasion resistance of cable*

IEC 62153 (all parts), *Metallic communication cables test methods*

IEC 62153-1-1, *Metallic communication cables 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 62153-4-3, *Metallic communication cable test methods – Part 4-3: Electromagnetic compatibility (EMC) – Surface transfer impedance – Triaxial method*

IEC 62153-4-4, *Metallic communication cable test methods – Part 4-4: Electromagnetic compatibility (EMC) – Shielded screening attenuation, test method for measuring of the screening attenuation as up to and above 3 GHz*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61196-1 apply.

4 Materials and cable construction

4.1 Cable construction

The cable construction shall be in accordance with 4.2 to 4.6 of this standard and the requirements stated in the relevant detail specification.

4.2 Inner conductor

4.2.1 Conductor material

Subclause 4.4.1 of IEC 61196-1:2005 applies. The conductor material shall be as stated in the relevant cable detail specification.

4.2.2 Conductor construction

The conductor shall consist of a single strand or tube.

In addition, 4.4.1 of IEC 61196-1:2005 applies.

The centre conductor diameter shall be stated in the relevant detail specification. The tolerance on the centre conductor shall be $\pm 0,03$ mm for conductors with a diameter ≤ 4 mm. For conductors with a diameter above 4 mm, the tolerance shall be stated in the detail specification.

4.3 Dielectric

The construction of the dielectric shall be one of the following:

- solid dielectric,
- air spaced dielectric,
- semi air spaced dielectric,
- gas-injected cellular polymer dielectric.

Life expectancy of the dielectric insulation by oxidative induction time (OIT) before and after ageing is intended to be defined by IEC 61196-1-213².

4.4 Outer conductor or screen

The type, material, nominal thickness and diameter of the outer conductor or screen shall be specified in the relevant detail specification. The tolerance of the outer conductor shall be $\pm 0,05$ mm for constructions in accordance with 4.6.1 c) of IEC 61196-1:2005, excluding corrugated designs. The tolerance for all other constructions, including corrugated designs, shall be $\pm 0,3$ mm in accordance with all other designs noted in 4.6.1 of IEC 61196-1:2005.

The construction and material of the outer conductor or screen shall be as stated in the relevant detail specification. The construction shall be in accordance with 4.6.1 c) or 4.6.1 f) or 4.6.1 g) of IEC 61196-1:2005.

For constructions with metal foil and/or braid, braid angle shall be between 15° and 45° . Coverage factor shall be specified in the detail specification.

4.5 Sheath

Subclause 4.7 of IEC 61196-1:2005 applies with the following amendments and additions:

Cables without an outer sheath shall not be subject to 4.5 of this standard.

The outer sheath of the cable shall be a thermoplastic material as specified in the relevant detail specification.

The nominal sheath thickness shall be stated in the relevant detail specification.

The nominal diameter of the sheath shall be stated in the relevant detail specification.

The maximum allowable tolerance of the diameter shall be stated in the relevant detail specification.

The maximum allowable values for ovality and eccentricity are given in Table 4 of this standard.

For aerial cables or cables for outdoor use with a black polyethylene sheath, the carbon black content shall be as specified in Table 3.

For other sheath material and colours of cables for outdoor use, the cable is intended to pass the UV stability test according to IEC 61196-1-212³.

The messenger type shall be specified in the relevant detail specification and shall include as a minimum the following criteria: type and material, tensile strength, corrosion properties and elongation.

4.6 Completed cable

The nominal dimensions and tolerances shall be stated in the detail specification.

² Under consideration.

³ Under consideration, taking into account EN 50289-4-17.

5 Standard ratings and characteristics

The ratings and characteristics applicable to each cable shall be specified herein or in the relevant detail specification.

6 Identification and marking

6.1 Cable identification

Subclause 6.1 of IEC 61196-1:2005 applies.

6.2 Cable marking

The cable marking shall be applied to the sheath or to the outer conductor when a sheath is not present. The marking shall consist of the IEC cable type number as given in 6.1.1 of IEC 61196-1:2005 and/or the manufacturer's designated markings when specified in the relevant cable specification.

6.3 Labelling

Labelling shall be provided in accordance with 6.3 of IEC 61196-1:2005 and the relevant detail specification.

7 Tests for completed cables

7.1 General

When tested in accordance with IEC 61196-1, the requirements given below shall apply.

Unless otherwise specified, all measurements shall be carried out under standard atmospheric conditions for testing in accordance with Clause 5 of IEC 60068-14.

Applicable test methods shall be in accordance with the IEC 61196-1-100, IEC 61196-1-200, and IEC 61196-1-300 series and the IEC 62153 series.

7.2 Electrical testing of the finished cable

7.2.1 Low-frequency and d.c. electrical measurements

Low-frequency and d.c. electrical measurements are indicated in Table 1.

Table 1 – Low-frequency and d.c. electrical measurements

No.	IEC test procedure	Parameter	Requirements/remarks
7.2.1.1	61196-1-101	Inner conductor resistance	Applicable, value in accordance with the detail specification.
	61196-1-101	Outer conductor resistance	$\leq 15 \text{ m}\Omega/\text{m}$
7.2.1.2	61196-1-102	Insulation resistance	$\geq 10^4 \text{ M}\Omega \times \text{km}$
7.2.1.3	61196-1-105	Withstand voltage of dielectric	2 kV d.c. or 1,5 kV a.c. for 1 min, unless otherwise specified in the relevant detail specification.
7.2.1.4	61196-1-106	Withstand voltage of sheath (r.m.s.)	Unless otherwise specified in the relevant detail specification. Sheath thickness up to and including 0,5 mm = 1 kV; Sheath thickness over 0,5 mm and up to and including 0,8 mm = 2 kV; Sheath thickness over 0,8 mm and up to and including 1,0 mm = 3 kV; Sheath thickness over 1,0 mm = 5 kV.
7.2.1.5	60096-0-1	Current carrying capacity	Value in accordance with the detail specification.

7.2.2 High-frequency electrical and transmission measurements

High-frequency electrical and transmission measurements are stated in Table 2.

Table 2 – High-frequency electrical and transmission measurements

No.	IEC test procedure	Parameter	Requirements/remarks
7.2.2.1	61196-1-108	Characteristic impedance	$75 \Omega \pm 2 \Omega$, unless the tolerance is otherwise specified in the relevant detail specification.
7.2.2.2	61196-1-108	Relative propagation velocity (velocity ratio)	May be specified for information purposes only in the detail specification.
7.2.2.3	61196-1-112	Return loss	$RLI \geq 26 \text{ dB}$ from 5 MHz to 1 002 MHz The measurement inaccuracy $a_{r,f}$ shall be $< 1 \text{ dB}$.

No.	IEC test procedure	Parameter	Requirements/remarks
7.2.2.4	61196-1-113	Attenuation constant	The maximum value at any frequency shall not be greater than calculated with the following formula: $\alpha = 10 \times \log_{10}(P_1/P_2) \times 100/l$ in (dB/100 m) where α is the attenuation constant in dB/100 m (frequency dependent); P_1 is the output power of a source where the load impedance and the source impedance are equal and of the same value as the nominal value of the specimen; P_2 is the output power measured when the specimen is inserted into the test system, where the load impedance and the source impedance are equal and of the same value as the nominal value of the specimen; l is the physical length of the specimen in meters (m).
7.2.2.5	61196-1-115	Regularity of impedance	Perform on both ends of tested cable Regularity ≥ 40 dB respectively ≤ 1 % Test procedure: IEC 61196-1-115 (time domain) or IEC 62153-1-1 (transformation from frequency domain into time domain by inverse discrete Fourier transformation (IDFT)).
7.2.2.6	62153-4-3	Transfer impedance After multiple bending: see 7.4.9	Class A: ≤ 5 m Ω /m from 5 MHz to 30 MHz Class A+: $\leq 2,5$ m Ω /m from 5 MHz to 30 MHz Class A++: $\leq 0,5$ Ω /m from 5 MHz to 30 MHz Test procedure according to IEC 62153-4-3, triaxial method, after completion of the flexure test according to the relevant detail specification.
7.2.2.7	62153-4-4	Screening attenuation After multiple bending: see 7.4.9	Class A: ≥ 85 dB from 30 MHz to 1 002 MHz Class A+: ≥ 95 dB from 30 MHz to 1 002 MHz Class A++: ≥ 105 dB from 30 MHz to 1 002 MHz Test procedure according to IEC 62153-4-4 (triaxial method) after completion of the flexure test according to the relevant detail specification. NOTE An alternative test method (GTEM method) is under consideration.

7.3 Environmental testing of the finished cable

Environmental testing is specified in Table 3.

Table 3 – Environmental testing of the finished cable

No.	IEC test procedure	Parameter	Requirements/remarks
7.3.1	61196-1-201	Cold bend performance	Test method A, B, or C as specified in the relevant detail specification. The test temperature shall be stated in the relevant detail specification. No physical damages of conductors, dielectric and sheath.
7.3.2	61196-1-203	Water penetration	When required, in accordance with the relevant detail specification.

No.	IEC test procedure	Parameter	Requirements/remarks
7.3.3	61196-1-206	Climatic sequence	<p>$T_A = -40\text{ °C}$; $T_B = +65\text{ °C}$; $t_i = 24\text{ h}$, unless otherwise specified in the detail specification.</p> <p>Number of cycles: 3</p> <p>Influenced mechanical and electrical characteristics shall be tested and defined in the relevant detail specification.</p>
7.3.4	60068-2-78	Damp heat (steady state)	<p>Influenced mechanical and electrical characteristics shall be tested and defined in the relevant detail specification.</p> <p>a) Test temperature</p> <p>b) Percentage relative humidity</p> <p>c) Test durations</p>
7.3.5	Under consideration	Ultraviolet stability of the sheath or jacket	<p>All cables for outdoor or other applications which are subjected to UV radiation shall meet the following requirements.</p> <p>No visual cracks</p> <p>– change in elongation $\pm 20\%$ maximum after 720 h</p> <p>– change in tensile strength $\pm 20\%$ maximum after 720 h</p>
7.3.6	61196-1-209 ⁵	Thermal ageing	<p>Transmission characteristics shall remain within the specified limits as defined in the relevant detail specification.</p>
7.3.7	61196-1-213 ⁶	Oxidative induction time (OIT)	<p>Requirements for OIT</p> <p>Initial: 20 min minimum,</p> <p>after ageing: 70 % of initial value</p>
7.3.8	60811-4-1	Carbon black content	<p>Only for cables with black PE; $\geq 2,0\%$ ^a</p>
<p>^a In some regions, a value of $\geq 2,5\%$ is required for Carbon black content.</p>			

⁵ Under consideration.

⁶ Under consideration.

7.4 Tests for mechanical characteristics of the finished cable

Tests for mechanical characteristics are specified in Table 4.

Table 4 – Tests for mechanical characteristics of the finished cable

No.	IEC test procedure	Parameter	Requirements/remarks
7.4.1	61196-1-301	Ovality of outer conductor or screen	≤7 %
7.4.2	61196-1-301	Ovality of the sheath	≤7 %
7.4.3	61196-1-302	Eccentricity of dielectric	≤10 %
7.4.4	61196-1-302	Eccentricity of the sheath	≤10 %
7.4.5	61196-1-308	Tensile strength and elongation of the copper or copper-clad inner conductor	Shall be in accordance with 4.4.1 of IEC 61196-1:2005.
7.4.6	61196-1-310	Torsion test for copper-clad metals	The surface shall not reveal any irregular seams, pits or slivers of sufficient magnitude or inherent defects.
7.4.7	61196-1-313	Adhesion testing	Inner conductor to dielectric, sample length = 50 mm Pressure force F_a required to remove dielectric shall be $0,1 \text{ MPa} \leq F_a \leq 1,0 \text{ MPa}$ Refer to footnotes ^a and ^b below.
7.4.8	61196-1-314	Bending characteristics	Single bending: According to the detail specification. Multiple bending: Test method to be performed per IEC 61196-1-314:2006, 8.3.2, procedure 1. Radius of mandrel: As specified by the manufacturer. Tension: As defined in 7.4.10 of this standard. Speed: ≤1 m/s. Number of cycles: 3.
7.4.9	61196-1-316	Tensile strength of cable (longitudinal pull)	According to the detail specification.
7.4.10	61196-1-317	Crush resistance of cable	Load = According to the detail specification, applied for 2 min. After a 2 min recovery time, the maximum impedance irregularity shall be ≤1 %, when measured in accordance with IEC 61196-1-115. No physical damage of the sheath or jacket.
7.4.11	61196-1-324	Abrasion resistance	According to the detail specification.
<p>^a The adhesion of the dielectric to the inner conductor, F_a, is given in MPa by the following formula: $F_a = \frac{F}{\pi \cdot d \cdot l}$</p> <p>where F is the force, d is the diameter of inner conductor, l is the length of the sample.</p> <p>^b Other values may be required if special tools for preparing connector mounting are used (see relevant detail specification). Limits should be given in the detail specification.</p>			

7.5 Fire performance

When intended to be installed in buildings, these cables may fall under the requirements of local, regional or governmental fire and safety standards as outlined in Table 5.

Table 5 – Fire performance requirements

No.	Test method /standard	Parameter	Requirements/remarks – according to the relevant detail specification
7.5.1		Flame propagation	
7.5.2		Acid gas emission	
7.5.3		Smoke generation	
7.5.4		Toxic gas emission	
7.5.5		To be defined (as required)	

8 Quality assessment

When specified in the sectional or detail specifications, quality procedures shall be in accordance with IEC 61196-1-1.

9 Delivery and storage

Delivery of cables shall be in accordance with Clause 9 of IEC 61196-1:2005.

