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INTERNATIONAL STANDARD

Coaxial communication cables –
Part 9-2: Detail specification for 50-0,4 type RF flexible cables

IEC 61196-9-2:2022-03(en)

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CONTENTS

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COAXIAL COMMUNICATION CABLES –

Part 9-2: Detail specification for 50-0,4 type RF flexible cables

FOREWORD

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IEC 61196-9-2 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
46A/1553/FDIS	46A/1558/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This part of IEC 61196 is to be used in conjunction with IEC 61196-1:2005 and IEC 61196-9:2014.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- withdrawn,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

COAXIAL COMMUNICATION CABLES –

Part 9-2: Detail specification for 50-0,4 type RF flexible cables

1 Scope

This part of IEC 61196 applies to coaxial communication cables described in IEC 61196-9. It specifies the requirements for 50-0,4 type RF flexible cables. These cables are used in routers, notebook computers, mobile phones or other electronics. The operating frequency is from 5 MHz to 6 000 MHz.

It determines the layout and style with respect to the model and type.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE Documents which are needed to achieve the tests according to Clause 4, item [8] or item [9], respectively, are listed in IEC 61196-9.

IEC 60068-2-20:2021, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

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

IEC 61196-9:2014, *Coaxial communication cables – Part 9: Sectional specification for RF flexible cables*

IEC 61196-1-115:2006, *Coaxial communication cables – Part 1-115: Electrical test methods – Test for regularity of impedance (pulse/step function return loss)*

IEC 61196-1-314:2015, *Coaxial communication cables – Part 1-314: Mechanical test methods – Test for bending*

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) – Test method for measuring of the screening attenuation as up to and above 3 GHz, triaxial method*

IEC 62153-4-5, *Metallic communication cable test methods – Part 4-5: Electromagnetic compatibility (EMC) – Screening or coupling attenuation - Absorbing clamp method*

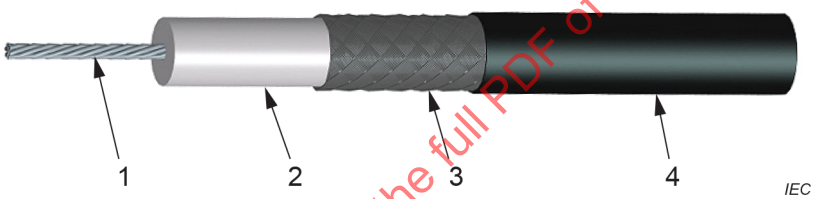
3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

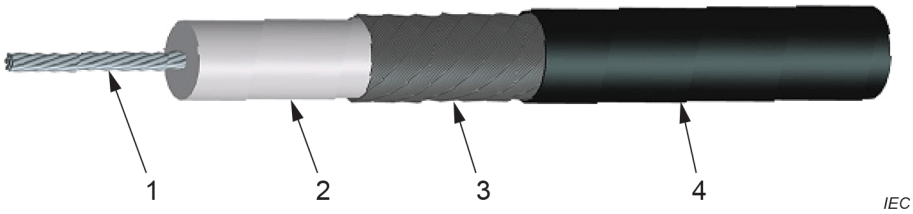
- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Detail specification

<table>
<tr><td colspan="11">COAXIAL COMMUNICATION CABLES –
Part 9-2: Detail specification for 50-0,4 type RF flexible cables</td></tr>
<tr><td colspan="3">[1] Prepared by:
IEC SC 46A</td><td colspan="3"></td><td colspan="5">[2] Document No.: IEC 61196-9-2
Issue: First
Date:</td></tr>
<tr><td colspan="3">[3] Available from:
IEC</td><td colspan="8">[4] Generic specification: IEC 61196-1
Sectional specification: IEC 61196-9</td></tr>
<tr><td colspan="11">[5] Additional references</td></tr>
<tr><td colspan="11">[6] Cable construction</td></tr>
<tr><td colspan="11">50-0,4-XYZ-IEC 61196-9-2 (Braid shield cable)</td></tr>
<tr><td colspan="11"> 

1 Inner conductor (SPC) 2 Dielectric (Solid FEP or PFA)
3 Braid shield (TC or SPC) 4 Sheath or jacket (FEP or PFA)
NOTE For abbreviations, see the end of this table.</td></tr>
<tr><td colspan="2">Variants [a]
Constructions</td><td>50-0,4-F11</td><td>50-0,4-F12</td><td>50-0,4-F21</td><td>50-0,4-F22</td><td>50-0,4-F_k11</td><td>50-0,4-F_k12</td><td>50-0,4-F_k21</td><td>50-0,4-F_k22</td></tr>
<tr><td rowspan="2">Inner conductor</td><td>Material</td><td colspan="4">SPC</td><td colspan="4">SPC</td></tr>
<tr><td>Stranding No. of Strands × diameter (mm)</td><td colspan="4">7 × 0,05</td><td colspan="4">7 × 0,05</td></tr>
<tr><td rowspan="2">Dielectric</td><td>Material</td><td colspan="4">FEP</td><td colspan="4">PFA</td></tr>
<tr><td>Diameter (mm)</td><td colspan="4">Nom.0,41</td><td colspan="4">Nom.0,41</td></tr>
<tr><td rowspan="2">Outer conductor or shield</td><td>Material</td><td colspan="2">SC</td><td colspan="2">TC</td><td colspan="2">SC</td><td colspan="2">TC</td></tr>
<tr><td>Braid coverage (%)</td><td colspan="2">≥85</td><td colspan="2">≥85</td><td colspan="2">≥85</td><td colspan="2">≥85</td></tr>
<tr><td rowspan="2">Sheath or jacket</td><td>Material</td><td>FEP</td><td>PFA</td><td>FEP</td><td>PFA</td><td>FEP</td><td>PFA</td><td>FEP</td><td>PFA</td></tr>
<tr><td>Diameter (mm)</td><td colspan="2">Nom.0,81</td><td colspan="2">Nom.0,81</td><td colspan="2">Nom.0,81</td><td colspan="2">Nom.0,81</td></tr>
<tr><td colspan="11">[a] Variants are shown in Annex A.</td></tr>
</table>

50-0,4-XYZ-IEC 61196-9-2 (Spiral shield cable)



1 Inner conductor (SPC)
2 Dielectric (Solid FEP or PFA)
3 Spiral shield (TC or SPC)
4 Sheath or jacket (FEP or PFA)

NOTE For abbreviations, see the end of this table.

Variants [a] **Constructions**		50-0,4-F31	50-0,4-F32	50-0,4-F41	50-0,4-F42	50-0,4-F_k31	50-0,4-F_k32	50-0,4-F_k41	50-0,4-F_k42
Inner conductor	Material	SPC				SPC			
	Stranding No. of Strands × diameter (mm)	7 × 0,05				7 × 0,05			
Dielectric	Material	FEP				PFA			
	Diameter (mm)	Nom.0,44				Nom.0,44			
Outer conductor or shield	Material	SPC		TC		SPC		TC	
	Wrap coverage (%)	≥85		≥85		≥85		≥85	
Sheath or jacket	Material	FEP	PFA	FEP	PFA	FEP	PFA	FEP	PFA
	Diameter(mm)	Nom.0,64		Nom.0,64		Nom.0,64		Nom.0,64	

NOTE

SPC — Silver plated copper wire

TC — Tinned copper wire

FEP — Fluorinated ethylene propylene

PFA — Perfluoroalkoxy

[7] Engineering information (reference only)

Operating temperature range	−55 °C to 200 °C (SPC shield) −55 °C to 150 °C (TC shield)
Operating frequency range	5 MHz to 6 000 MHz
Nominal characteristic impedance	50 Ω
Minimum bending radius (static state)	5D (D is the nominal cable outer diameter)
Minimum bending radius (dynamic state)	10D (D is the nominal cable outer diameter)
Relative propagation velocity	70 % (nominal)

[8] Parameter or characteristic	[9] IEC 61196-9:2014 Subclause	[10] Value	[11] Remarks
Electrical characteristics	**7.1**		
Low-frequency and DC electrical measurements	7.1.1		
Continuity	7.1.1.1	Inner conductor and outer conductor shall be continuous	
Conductor resistance – inner	7.1.1.2	≤ 1,37 Ω/m	at 20 °C
Conductor resistance – outer	7.1.1.3	≤ 0,24 Ω/m (SC braid) ≤ 0,36 Ω/m (SC wrap) ≤ 0,26 Ω/m (TC braid) ≤ 0,39 Ω/m (TC wrap)	at 20 °C
Insulation resistance	7.1.1.4	≥ 1 000 MΩ•km	
Withstand voltage of dielectric	7.1.1.5	1,5 kV AC or 2,1 kV DC,1 min	
Withstand voltage of sheath [a]	7.1.1.6	2,5 kV AC or 3,6 kV DC,1 min	
Spark test (in-process inspection) [a]	7.1.1.7	2,5 kV AC	
Capacitance	7.1.1.8	≤ 105 pF/m	
High-frequency electrical and transmission measurements	**7.1.2**		
Characteristic impedance	7.1.2.1	50 Ω ± 2 Ω	200 MHz
Relative propagation velocity	7.1.2.2		See [7]
Return loss (uniformity of impedance)	7.1.2.3	≥ 19,1 dB (5 MHz to 6 000 MHz) (Braid shield) ≥ 16,5 dB (5 MHz to 6 000 MHz) (Spiral shield)	The measurement inaccuracy $a_{r,f}$ shall be < 1 dB
Attenuation constant,α	7.1.2.4	See Annex B	20 °C
Regularity of impedance	7.1.2.5	≥ 40 dB resp ≤1 %	Perform on both ends of tested cable Test procedure: IEC 61196-1-115 (time domain)
PIM	7.1.2.6	NA	
RF power rating	7.1.2.7	NA	
Phase variation with temperature	7.1.2.8	NA	
Phase stability with mechanic	7.1.2.9	NA	
Transfer impedance	7.1.2.10	≤ 150 mΩ /m from 5 MHz to 30 MHz (braid shield)	Test procedure: IEC 62153-4-3
Screening attenuation	7.1.2.11	≥ 60 dB from 30 MHz to 6 000 MHz (braid shield)	Test procedure: IEC 62153-4-4

[8] Parameter or characteristic	[9] IEC 61196-9:2014 Subclause	[10] Value	[11] Remarks
Environmental testing of finished cable	**7.2**		
Cold bend performance	7.2.1	a) No physical damages of sheath b) Return loss shall meet IEC 61196-9:2014, 7.1.2.3	a) Test method: Method B b) Mandrel diameter: 10 × cable diameter c) Test temperature: −55 °C ± 2 °C
Water penetration	7.2.2	NA	
Climatic sequence	7.2.3	a) No physical damages of sheath b) Insulation resistance is not less than 1 000 M•km c) Magnitude of change in attenuation constant is no more than 10 % in Annex B	a) Test temperature: T_A = −55 °C ± 2 °C, T_B = 150 °C ± 2 °C (TC shield) T_B = 200 °C ± 2 °C (SC shield) b) t_1: 24 h c) Number of cycles: 3
Environmental stress	7.2.4	NA	
Thermal ageing	7.2.5	a) No physical damages of sheath b) Magnitude of change in attenuation constant is no more than 10 % in Annex B	a) Test temperature: 150 °C ± 2 °C (TC shield) 200 °C ± 2 °C (SC shield) b) Test times:168 h
Thermal cycling	7.2.6	a) No physical damages of sheath b) Magnitude of change in attenuation constant is no more than 10 % in Annex B	a) Test temperature: Low temperature: −55 °C ± 2 °C High temperature: 150 °C ± 2 °C (TC shield) 200 °C ± 2 °C (SC shield) b) Test times:168 h c) Duration time:30 min
UV stability	7.2.7	NA	

[8] Parameter or characteristic	[9] IEC 61196-9:2014 Subclause	[10] Value	[11] Remarks
Mechanical characteristics of finished cable	**7.3**		
Visual examination	7.3.1	No observable defects	
Dimensional examination	7.3.2	See [6]	
Ovality of the dielectric	7.3.3	≤7 %	
Ovality of the sheath	7.3.4	≤7 %	
Eccentricity of dielectric	7.3.5	≤10 %	
Eccentricity of sheath	7.3.6	≤10 %	
Carbon black content	7.3.7	NA	
Adhesion testing: Inner conductor to dielectric	7.3.8	NA	
Bending	7.3.9	No physical damage of the sheath	The bending test according to IEC 61196-1-314:2015, Clause 5: a) Test mandrel radius: 10 × cable diameter b) Number of cycles: 100 000 c) Test angle: ±90° d) Test temperature: 20 °C ± 5 °C e) Load: 0,5 N After bending, measure the screening attenuation according to IEC 62153-4-5
Tensile strength of cable (longitudinal pull)	7.3.10	Impedance at maximum load: 50 Ω ± 3 Ω	Maximum load: 5 N Length of the specimen:1 m
Crush resistance of cable	7.3.11	a) No physical damage of the sheath b) The maximum impedance irregularity shall be ≤1 %	a) Test load: 70 N b) Test time: 2 min
Abrasion resistance	7.3.12	NA	
Solderability	7.3.13	The dipped surface shall be in accordance with IEC 60068-2-20:2021, 4.2.6 The dipped surface relevant for soldering shall be covered with a solder coating with only small amounts of scattered imperfections such as pinholes or un-wetted or de-wetted areas. All leads shall exhibit a continuous solder coating free from defects for a minimum of 95 % of the critical area of any individual lead. Solder alloys containing lead solder shall be smooth and bright.	a) Test method: Method 1 (solder bath) b) Test temperature: (260 ± 3) °C c) Immersion depth: 25 mm d) Duration: (2 ± 0,5) s

[a] One of these tests can be selected.