

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radio frequency and coaxial cable assemblies –
Part 4: Sectional specification for semi-rigid coaxial cable assemblies**

**Cordons coaxiaux et cordons pour fréquences radioélectriques –
Partie 4 : Spécification intermédiaire pour cordons coaxiaux semi-rigides**

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL
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ICS 33.120.10

ISBN 978-2-8322-8408-7

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RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –**Part 4: Sectional specification for semi-rigid coaxial cable assemblies**

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IEC 60966-4 has been prepared by IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

This third edition cancels and replaces the second edition published in 2003. This edition constitutes a technical revision.

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

- a) added Subclause 4.3 "The relative position dimensions of the interface";
- b) added Figure 2;
- c) added Clause 6 "IEC type designation";
- d) modified Figure 3;

- e) added Clause 7 "Rating and characteristics";
- f) added "Requirements/Remarks" to all the tests in Clause 8;
- g) added "Corona extinction voltage" in Table 3;
- h) rewrote test schedules;
- i) added Annex A and Annex B.

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

Draft	Report on voting
46/964/FDIS	46/994/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/publications.

A list of all parts in the IEC 60966, published under the general title *Radio frequency and coaxial cable assemblies*, 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

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RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –

Part 4: Sectional specification for semi-rigid coaxial cable assemblies

1 Scope

This part of IEC 60966 is a sectional specification that relates to semi-rigid coaxial cable assemblies operating in the transverse electromagnetic mode (TEM). It specifies the design and construction, IEC type designation, workmanship, marking and packaging, standard rating and characteristics, electrical, mechanical and environmental requirements of finished semi-rigid cable assemblies, quality assessment, delivery and storage, etc.

This part of IEC 60966 applies to semi-rigid cable assemblies composed of semi-rigid coaxial cables and coaxial connectors. Semi-rigid cable assemblies are widely used in mobile communication systems, microwave test equipment, radar, aerospace and other fields.

NOTE 1 For the purpose of this sectional specification, a cable assembly is always regarded as an integral unit. All specifications apply to the finished assembly and not to individual and non-assembled parts thereof.

NOTE 2 This sectional specification can be supplemented with detail specifications giving additional details as required by the particular application. This application will not necessarily require all tests.

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.

<https://standards.iteh.ai/>
<https://standards.iteh.ai/document/iec-60966-4-2024>

<https://standards.iteh.ai/document/iec-60068-1-2013>, *Environmental testing – Part 1: General and guidance*

IEC 60966-1:2019, *Radio frequency and coaxial cable assemblies – Part 1: Generic specification – General requirements and test methods*

IEC 61169 (all parts), *Radio frequency connectors*

IEC 61196-1-126, *Coaxial communication cables – Part 1-126: Electrical test methods – Corona extinction voltage*

IEC 61196-10, *Coaxial communication cables – Part 10: Sectional specification for semi-rigid cables with fluoropolymer dielectric*

IEC 61196-11, *Coaxial communication cables – Part 11: Sectional specification for semi-rigid cables with polyethylene (PE) dielectric*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60966-1:2019 apply.

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

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

4 Design and construction

4.1 Cable design and construction

Cables should conform to IEC 61196-10 or IEC 61196-11 and their related detail specifications. Where cable designs deviating from these publications are required, they shall comply with the requirements of the relevant detail specification of the cable.

If required, the manufacturer can use additional protective tubing or cable deviating from IEC 61196-10 or IEC 61196-11 to comply with the requirements of the relevant detail specification.

The materials used in the cable shall be given as engineering information in the relevant detail specification.

4.2 Connector design and construction

Connectors should conform to the IEC 61169 series. Where connector designs deviating from the IEC 61169 series are required, the interface should conform to the relevant part of IEC 61169 where available and shall comply with the requirements of the relevant detail specification.

The materials used in the connector shall be given as engineering information in the relevant detail specification.

4.3 The relative position dimensions of the interface

The relative position dimensions of the interface of end connector(s) of the cable assemblies shall comply with the interface of the relevant part of IEC 61169 or the relevant detail specification. The relative position dimensions of the interface of end connector(s) include the dimension of inner conductor relative to dielectric and inner conductor relative to outer conductor.

The relative position dimensions of the interface of some typical connectors are shown in Annex A.

4.4 Outline of the cable assembly

The outline shall be in accordance with the relevant detail specification of the cable assembly.

The length, unless otherwise specified in the relevant detail specification, is defined as between the reference planes of the connectors. In the case of right-angle connectors, the length applies to the axis of the connectors (see Figure 1 and Figure 2).

Unless specified in the relevant detail specification, the length tolerance shall be $\pm 1\%$ for cables equal to or longer than 300 mm and ± 3 mm for cables shorter than 300 mm.

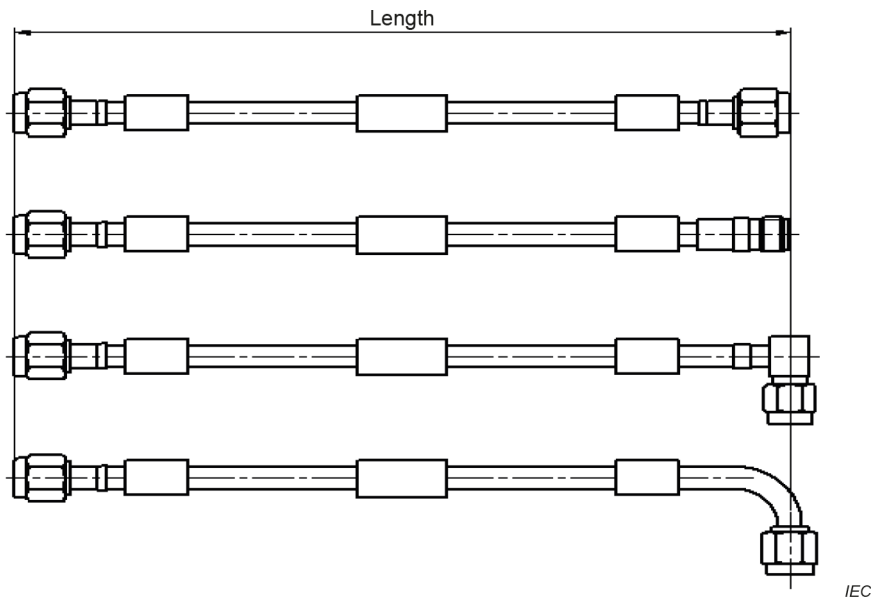


Figure 1 – Length definition of cable assemblies with two connectors

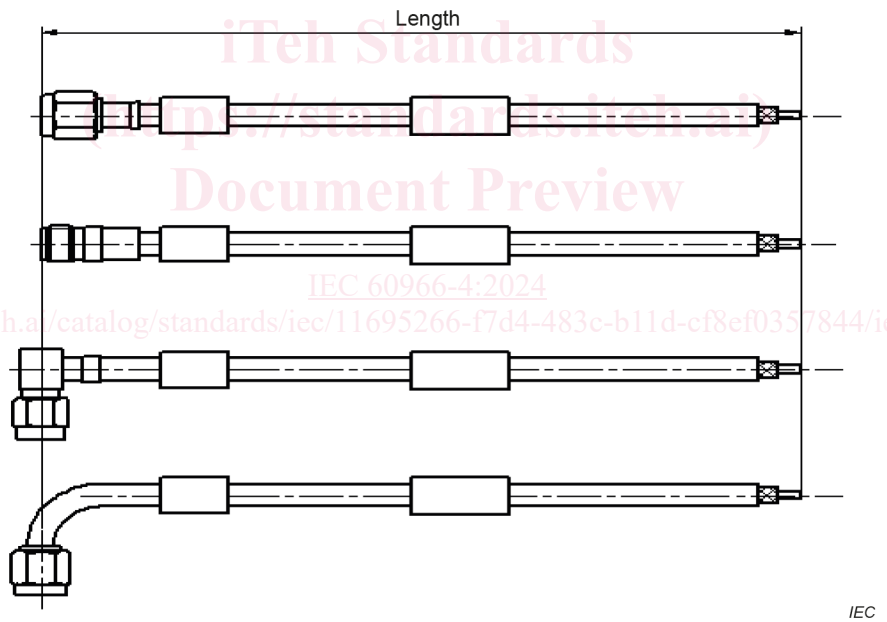
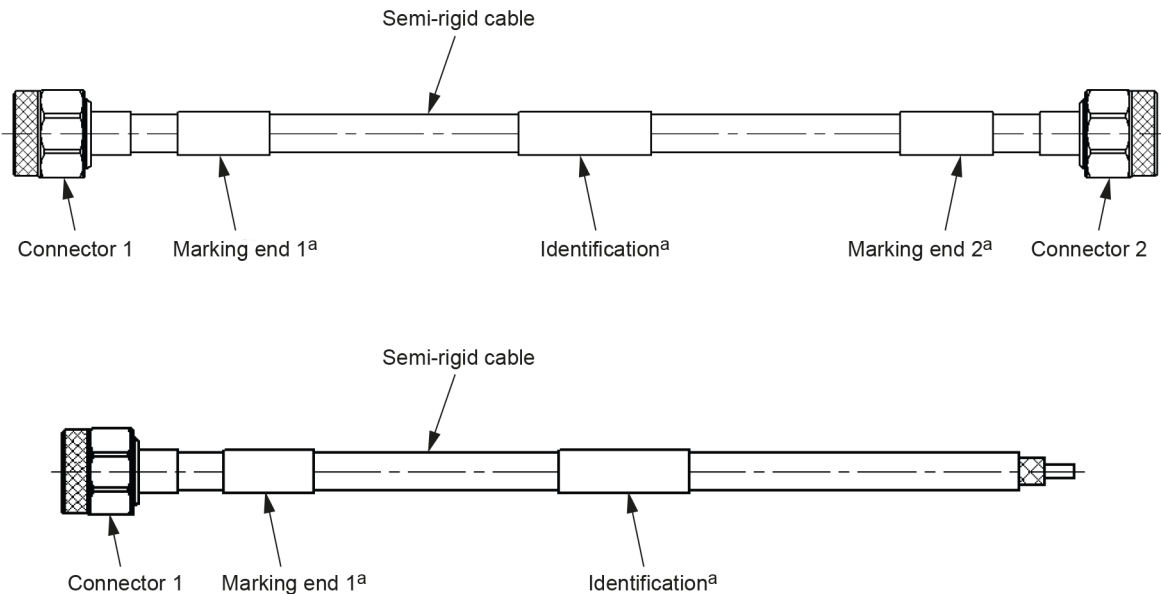


Figure 2 – Length definition of cable assemblies with one connector

5 Workmanship, marking and packaging

IEC 60966-1:2019, Clause 5 and the following paragraph applies:

Cable assemblies made in accordance with this sectional specification comprise a section of cable and two connectors (see Figure 1). Occasionally, the cable assembly will comprise only a cable and one connector (see Figure 2). When specified in the relevant detail specification, the assembly may additionally include markers for identification of the assembly and interconnecting ends. End caps and other accessories may also be specified (see Figure 3).



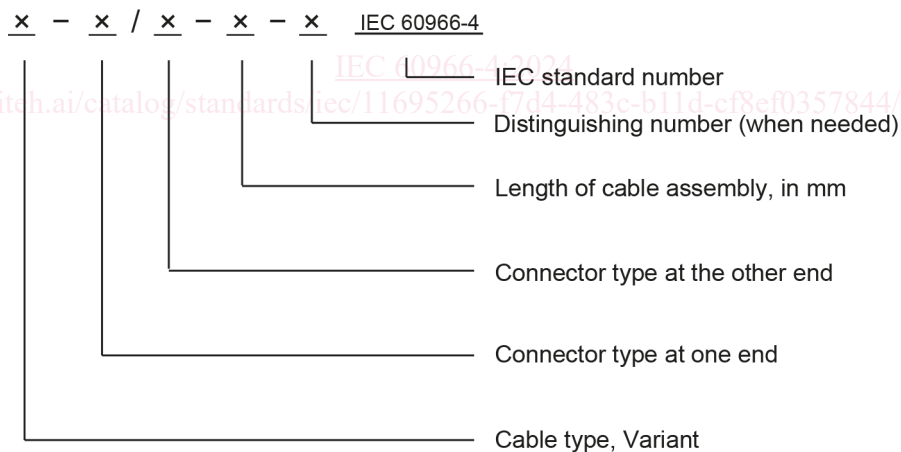
IEC

^a When specified.

Figure 3 – The marking example of a cable assembly

6 IEC type designation

IEC type designation of cable assembly consists of the type of cable and connectors, the length of the cable assembly and the IEC standard number, as shown below:



IEC

Example 1: 50-5(1/4")-LSZH-H-SMA-P/SMA-P-100-A-IEC60966-4 cable assembly is composed of 50-5(1/4")-LSZH-H semi-rigid cable, one end is SMA-P pin connector and the other end is SMA-P pin connector, the length of the cable assembly is 100 mm, its distinguishing number is A. This cable assembly complies with IEC 60966-4.

Example 2: 50-5(1/4")-LSZH-H-SMA-P-100-A-IEC60966-4 cable assembly is composed of 50-5(1/4")-LSZH-H semi-rigid cable, one end is SMA-P pin connector and the other end empty, the length of the cable assembly is 100 mm, its distinguishing number is A. This cable assembly complies with IEC 60966-4.

7 Rating and characteristics

7.1 Nominal characteristic impedance

The nominal characteristic impedance shall be 50 Ω or as specified in the relevant detail specification.

7.2 Temperature range

The rated temperature range of the cable assemblies with different cables shall be in accordance with Table 1 or Table 2 or as specified in detail specification.

Table 1 – Rated temperature of cable assemblies with semi-rigid cables with polyethylene dielectric (IEC 61196-11)

Parameter	PE sheath °C	LSZH sheath °C
Operational temperature range	-40 to 70	-25 to 70
Storage temperature range	-40 to 70	-25 to 70
Installation temperature range	-30 to 60	-15 to 60

Table 2 – Rated temperature of cable assemblies with semi-rigid cables with fluoropolymer dielectric (IEC 61196-10)

Parameter	No sheath °C	PVC sheath °C	PVDF sheath °C	LSZH sheath °C
Operational temperature range	-55 to 125 ^a	-40 to 75	-40 to 125	-25 to 70
Storage temperature range	-55 to 125 ^b	-40 to 75	-40 to 125	-25 to 70
Installation temperature range	-10 to 40	-30 to 60	-40 to 60	-15 to 60

^a Operational temperature range of type 50-1(0,034 ") and 50-6(0,250") is -55 °C to 105 °C.

^b Storage temperature range of type 50-1(0,034 ") and 50-6(0,250") is -55 °C to 105 °C.

8 Requirements of finished cable assemblies

8.1 General

For finished cable assemblies, the requirements given below shall apply when they are tested in accordance with IEC 60966-1:2019 and the test methods specified herein.

When needed, cable assemblies with one connector shall be terminated with a suitable connector at the cable end to do the test and cut off after the test.

Unless otherwise specified, all measurements shall be carried out under standard atmospheric conditions for testing in accordance with IEC 60068-1:2013, Clause 4.

8.2 Electrical requirements

Electrical requirements are given in Table 3.

Table 3 – Electrical requirements

No.	Parameter	Test method IEC 60966-1:2019	Requirements/Remarks
1	Reflection properties (Return loss)	8.1	<p>While the parameter return loss (A_r) is preferred, the reflection factor (r) or the VSWR (voltage standing wave ratio) may be specified</p> <p>where</p> $A_r = -20 \log_{10} r $ <p>and</p> $\text{VSWR} = \frac{1 + r }{1 - r }$ <p>The return loss shall meet the following requirements within the operating frequency range of the cable or in accordance with the relevant detail specification.</p> <p>For semi-rigid cables with polyethylene</p> <ul style="list-style-type: none"> ≥24,5 dB (10 MHz to 2 200 MHz) ≥21,5 dB (2 200 MHz to 4 000 MHz) ≥20,0 dB (4 000 MHz to 6 000 MHz) <p>For semi-rigid cables with fluoropolymer dielectric</p> <ul style="list-style-type: none"> ≥23,1 dB (10 MHz to 6 000 MHz) ≥20,8 dB (6 000 MHz to 12 000 MHz) ≥19,1 dB (12 000 MHz to 18 000 MHz) ≥16,5 dB (18 000 MHz to 26 500 MHz) ≥15,6 dB (26 500 MHz to 40 000 MHz)
2	Uniformity of impedance	8.2	<p>Rise time of the TDR system in accordance with the relevant detail specification.</p> <p>The characteristic impedance variation shall not exceed $\pm 5\%$ of the nominal value or shall be in accordance with the relevant detail specifications.</p>
3	Insertion loss	8.3	Value in accordance with the relevant detail specification
4	Propagation time	8.5	When required, value in accordance with the relevant detail specification
5	Phase difference	8.7	<p>When required, the phase difference shall not exceed the limits specified in the relevant detail specification.</p> <p>When more than two cable assemblies are measured, the reference cable shall be clearly marked.</p>
6	Phase variation with temperature	8.8	When required, value in accordance with the relevant detail specification.
7	Screening effectiveness	8.9	<p>Value of transfer impedance or shield attenuation in accordance with the detail specification.</p> <p>a) transfer impedance: when test frequency is less than 30 MHz, the maximum value is 300 $\mu\Omega/\text{m}$;</p> <p>b) shield attenuation: better than $(100 - f)$ dB, f:GHz.</p>
8	Voltage proof	8.10	<p>Value in accordance with the relevant detail specification.</p> <p>There shall be no breakdown, arcing or flashover throughout.</p>

No.	Parameter	Test method IEC 60966-1:2019	Requirements/Remarks
9	Insulation resistance	8.11	≥ 5 000 MΩ, or in accordance with the relevant detail specification.
10	Inner and outer conductor continuity	8.12	Test voltage: ≤ 36 V DC. Inner conductor and outer conductor shall be continuous
11	Power rating	8.13	When required, test conditions and value in accordance with the relevant detail specification.
12	Intermodulation level measurement	8.14	When required, it is applicable to 50 Ω assemblies, the test frequencies (f_1 and f_2), input power, PIM in accordance with the relevant detail specification. Typical assemblies with following connectors, when tested at frequency 700 MHz\ 800 MHz\ 900 MHz\ 1 800 MHz\ 2 100 MHz\ 2 600 MHz, input power: 2×20 W, the PIM shall be as follows: <ul style="list-style-type: none"> - ≤-150 dBc (with N type connectors); - ≤-155 dBc (with 4.3/10 type connectors); - ≤-155 dBc (with 7/16 type connectors),
13	Corona extinction voltage	IEC 61196-1-126	When required, sample preparation is not required, and the test is carried out in air without immersion in insulating oil, value shall be specified in the relevant detail specification.

8.3 Mechanical requirements

Mechanical requirements are given in Table 4.

Table 4 – Mechanical requirements

No.	Parameter	Test method IEC 60966-1:2019	Requirements/Remarks
1	Visual inspection	7.2	Meets the requirements of IEC 60966-1:2019, Clause 5 and 7.2.
2	The relative position dimensions of the interface	7.3.1	Value in accordance with the relevant detail specification. The relative position dimensions of the interface of some typical connectors are shown in Annex A.
3	Outline of the cable assembly	7.3.2	Value in accordance with the relevant detail specification.
4	Tensile	9.1	Value of the force and duration in accordance with the relevant detail specification. Normally, the duration is 60 s. Requirements after the test: <ul style="list-style-type: none"> a) no visual damage or loosening of the assembly; b) the relative position dimensions of the interface shall meet the requirement of No.2 of Table 4; c) the return loss shall meet the requirement of No.1 of Table 3.