

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Radio-frequency connectors –
Part 24: Sectional specification – Radio frequency coaxial connectors with screw
coupling, typically for use in 75 Ω cable networks (type F)**

**Connecteurs pour fréquences radioélectriques –
Partie 24: Spécification intermédiaire – Connecteurs coaxiaux pour fréquences
radioélectriques avec couplage vissé, typiquement utilisés dans des réseaux
de distribution par câbles de 75 Ω (type F)**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIO-FREQUENCY CONNECTORS –

Part 24: Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)

FOREWORD

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International Standard IEC 61169-24 has been prepared by subcommittee 46F: RF and microwave passive components, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

This bilingual version (2014-01) corresponds to the monolingual English version, published in 2009-02.

This second edition cancels and replaces the first edition published in 2001. It constitutes a technical revision.

This second edition differs from the first edition in that all drawings have been reworked and improved to allow frequency extension up to 3 GHz.

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

FDIS	Report on voting
46F/108/FDIS	46F/128/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.

The French version of this standard has not been voted upon.

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

A list of all parts of the IEC 61169 series, under the general title: *Radio-frequency connectors*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

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RADIO-FREQUENCY CONNECTORS –

Part 24: Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)

1 Scope

This part of IEC 61169, which is a sectional specification (SS), provides information and rules for the preparation of detail specifications (DS) for RF coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F).

It describes the interface dimensions with gauging information and the mandatory tests selected from IEC 61169-1, applicable to all DS relating to type F connectors.

This specification indicates the recommended performance characteristics to be considered when writing a DS and covers test schedules and inspection requirements.

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.

IEC 61169-1:1992, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*
Amendment 1 (1996)
Amendment 2 (1997)

EN 60068-2-52, *Environmental testing – Test methods. Tests. Test Kb. Salt mist cyclic (sodium chloride solution)*

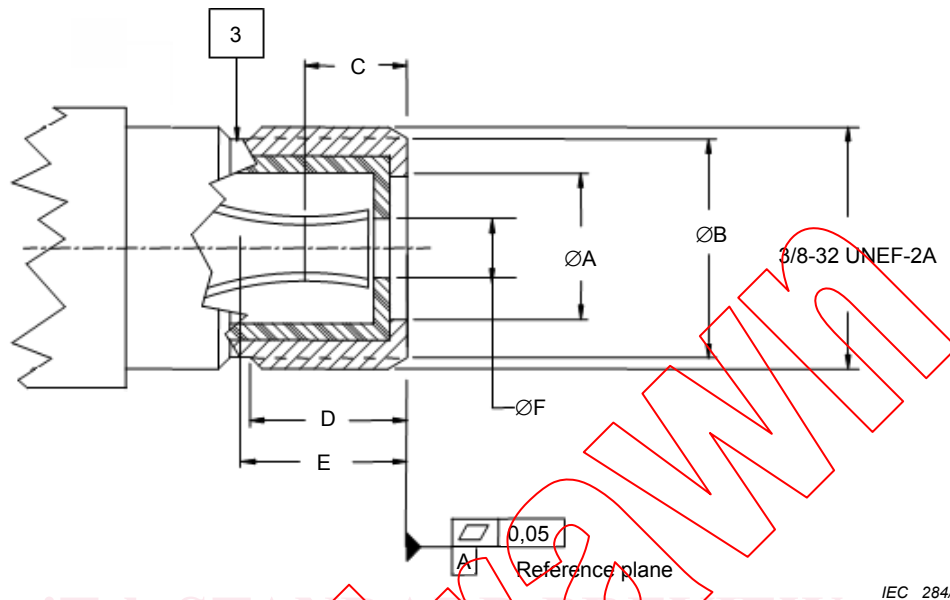
3 Interface dimensions

3.1 Dimensions

Millimetres are original dimensions.

All undimensioned pictorial configurations are for reference purposes only.

3.1.1 Connector "F" type female socket (indoor) physical dimensions



IEC 284/09

Figure 1 – Connector "F" type female socket (indoor) (for dimensions, see Table 1)

Table 1 – Connector "F" type female socket (indoor)

Description	Reference	mm		inch		Note
		Min.	Max.	Min.	Max.	
Reference plane opening inner diameter	A	3,90	7,4	0,154	0,291	2
Reference plane outer diameter	B	7,50	8,50	0,295	0,335	
Positive contact point depth	C	-	4,70	-	0,185	4
Port minimum full thread length	D	7,50	-	0,295	--	3
Minimum center contact depth	E	9,00	-	0,354	-	5
Center conductor guide inner diameter	F	1,2	1,5	0,047	0,059	
NOTE 1 Drawing not to scale.						
NOTE 2 No protrusion of the dielectric beyond the reference plane is permitted.						
NOTE 3 Thread relief not to exceed two full threads.						
NOTE 4 Recommended mating male center conductor diameter: 0,025 in (0,64 mm) min. to 0,042 in. (1,07 mm) max.						
NOTE 5 Center contact geometry optional.						

3.1.2 Connector "F" type male plug (indoor) physical dimensions

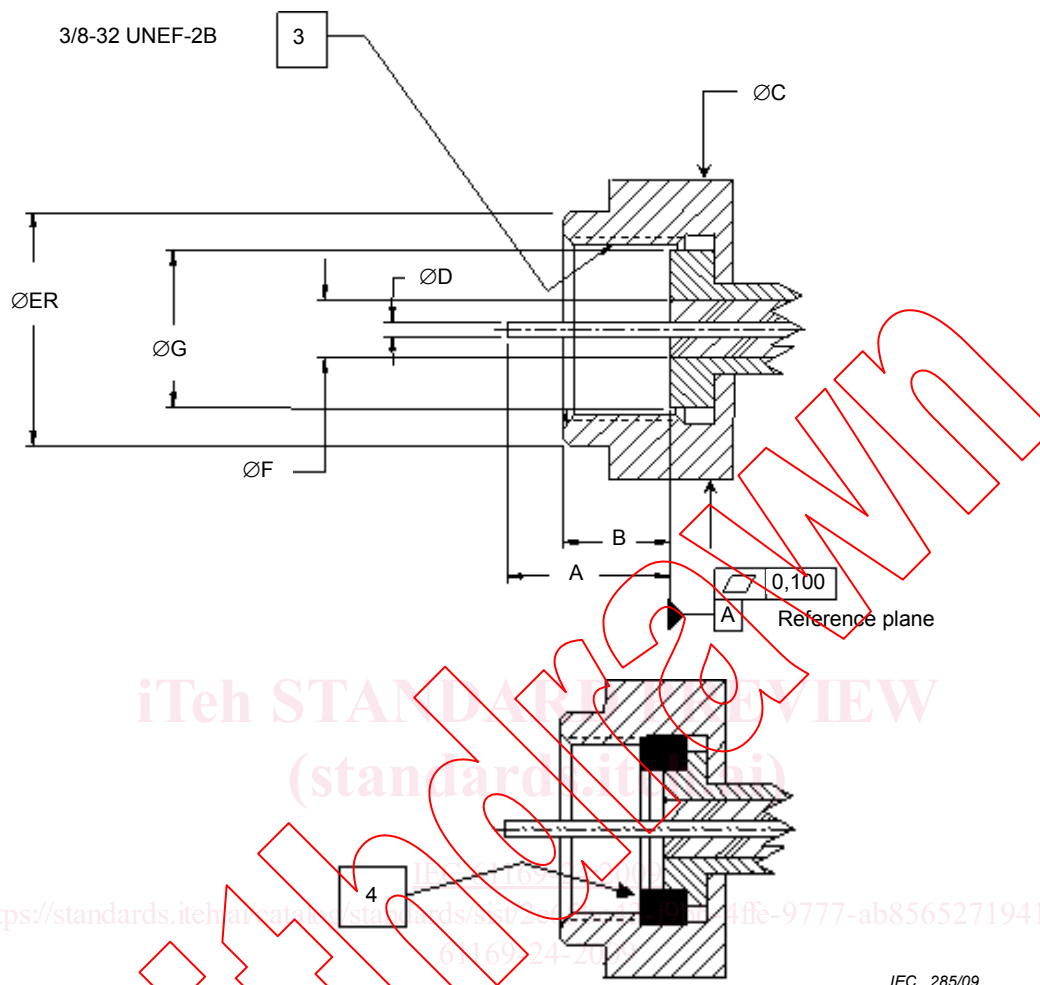


Figure 2 – Connector "F" type male plug (indoor) (for dimensions, see Table 2)

Table 2 – Connector "F" type male plug (indoor)

Description	Reference	mm		inch		Note
		Min.	Max.	Min.	Max.	
Inner conductor length	A	6,35	8,63	0,250	0,340	
Length of nut	B	4,00	7,29	0,157	0,287	2
Maximum envelope dimension	C	-	16,61	-	0,654	
Inner conductor diameter	D	0,64	1,13	0,025	0,044	
Sealing surface diameter for seal ring	E	10,41	11,04	0,410	0,435	
Reference plane opening inner diameter	F	-	5,84	-	0,230	2
Reference plane opening outer diameter	G	7,88		0,310		

NOTE 1 Drawing not to scale.

NOTE 2 No protrusion of the dielectric beyond the reference plane is permitted.

NOTE 3 The mating of the F female socket to the reference plane is not impeded.

NOTE 4 Gasket seal optional, if used, does not avoid to meet all performance requirements.

3.2 Mechanical gauges

Millimetres are original dimensions.

All undimensioned pictorial configurations are for reference purposes only.

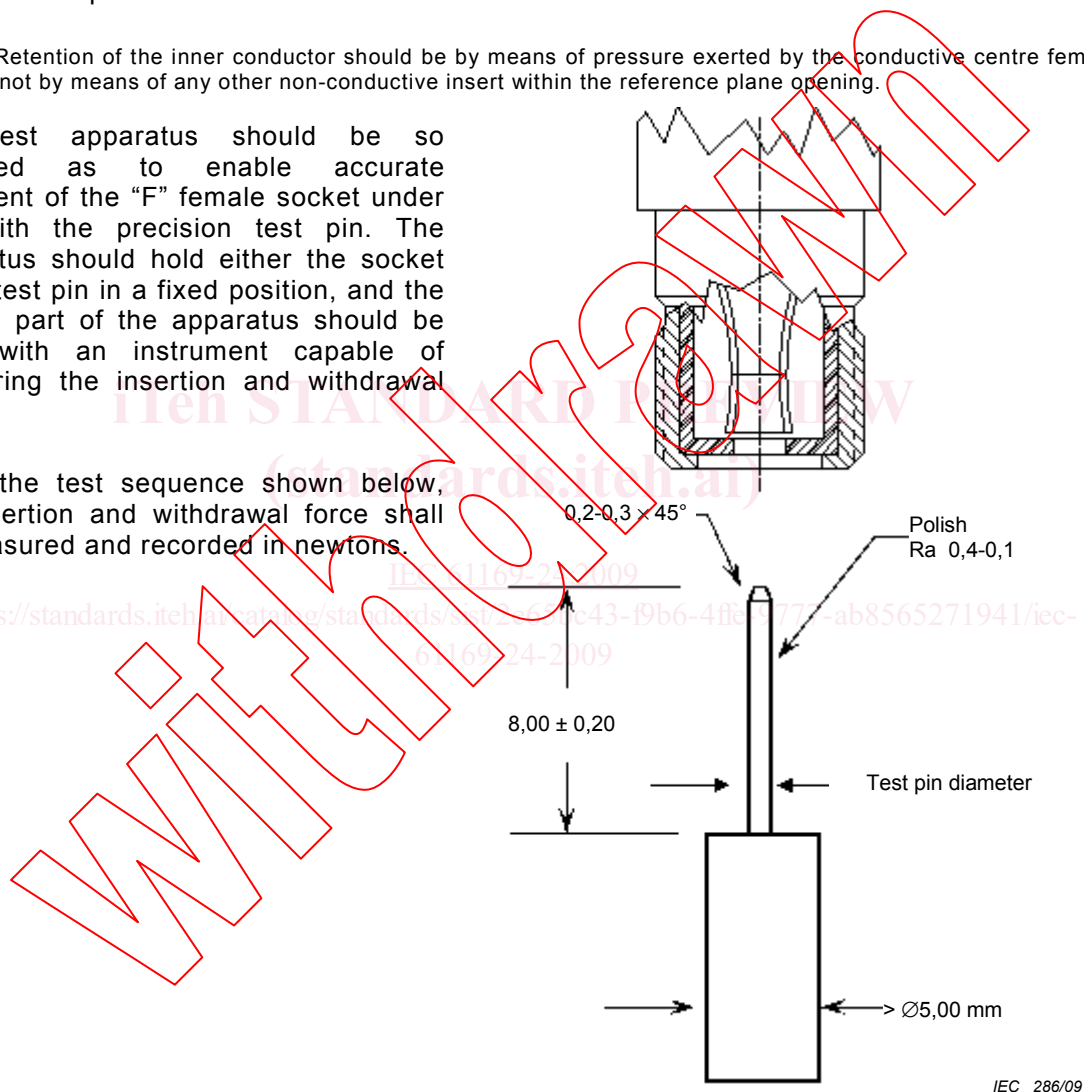
3.2.1 Mating socket centre conductor acceptance diameter test

In order to verify that the centre female contact of the socket does not suffer from mechanical deformation when mated with the full range of indicated inner conductor diameters, a test has been devised. This test measures the force required to insert and withdraw a selection of precision test pins into and out of the “F” female socket under test.

NOTE Retention of the inner conductor should be by means of pressure exerted by the conductive centre female contact, not by means of any other non-conductive insert within the reference plane opening.

The test apparatus should be so designed as to enable accurate alignment of the “F” female socket under test with the precision test pin. The apparatus should hold either the socket or the test pin in a fixed position, and the moving part of the apparatus should be fitted with an instrument capable of measuring the insertion and withdrawal force.

Using the test sequence shown below, the insertion and withdrawal force shall be measured and recorded in newtons.



IEC 286/09

Figure 3 – Gauge for the centre socket conductor

Table 3 – Test sequence for the centre socket conductor

Test sequence	1 st test	2 nd test	3 rd test	4 th test	5 th test	6 th test
Test pin diameter	0,635 +/- 0,005 mm	0,850 +/- 0,005 mm	1,136 +/- 0,005 mm	0,635 +/- 0,005 mm	1,136 +/- 0,005 mm	0,635 +/- 0,005 mm

The insertion force required to insert the test pin into the socket centre female contact shall not exceed 20 N under all circumstances.

The withdrawal force required to withdraw the test pin from the socket centre female contact shall be a minimum of 0,3 N under all circumstances.

3.2.2 Mating port centre conductor acceptance electrical test

After completion of the mechanical tests described in 3.2.1, the centre conductor contact resistance, when re-mated with a male “F” plug whose centre conductor diameter is 0,635 mm, shall not exceed 10 mΩ with an applied test ampere rate of 1 A.

3.2.3 Reference plane electrical contact

The electrical contact shall be made by the mating of the reference plane face of the “F” female socket with the mating face of the “F” male plug and not by the threads alone.

4 Quality assessment procedures

4.1 General

The following subclauses provide recommended ratings, performance and test conditions to be considered when writing a detail specification (DS). They also provide an appropriate schedule of tests with minimum levels of conformance inspection.

4.2 Ratings and characteristics

The RF connectors defined in this standard are designed for use with a variety of flexible and semi-rigid coaxial cables and in microwave integrated circuits and similar uncabled applications.

Table 4 – Ratings and characteristics

Ratings and characteristics	IEC 61169-1 subclause	Value	Remarks including any deviations from standard test methods
<i>Electrical</i>			
Nominal impedance			Shall meet the requirements of 9.2.1.1 of IEC 61169-1 when terminating a $Z_c = 75 \Omega$ cable
Frequency range		5 MHz to 1 GHz 5 MHz to 2 GHz 5 MHz to 3 GHz	See DS For most applications For some satellite applications For some head end applications
Reflection factor	9.2.1		
– straight styles •		Min. 30 dB up to 1 000 MHz min. 25 dB up to 2 GHz min. 20 dB up to 3 GHz	
– right angle styles			See DS
– solder bucket and PCB mounting style			Under consideration

Table 4 (continued)

Ratings and characteristics	IEC 61169-1 subclause	Value	Remarks including any deviations from standard test methods
– insertion loss		0,1 dB max. up to 1 GHz 0,2 dB max. at 2 GHz 0,3 dB max. at 3 GHz	
Centre contact resistance	9.2.3		
– initial		$\leq 5 \text{ m}\Omega$	
– after conditioning		$\leq 10 \text{ m}\Omega$	
Outer conductor continuity	9.2.3		
– initial		$\leq 2,5 \text{ m}\Omega$	
– after conditioning		$\leq 5 \text{ m}\Omega$	
Insulation resistance	9.2.5		
– initial		$> 1 \text{ G}\Omega$	
– after conditioning		$> 1 \text{ M}\Omega$	
Proof voltage at sea level + #	9.2.6	750 V	86 kPa – 106 kPa
Screening effectiveness	9.2.8	$a_s \geq 90 \text{ dB}$	$Z_t < 3,2 \text{ m}\Omega$
Discharge test (Corona)	9.2.9	na	
<u>Mechanical</u>			
Gauge retention force (resilient contacts)	9.3.4		See 3.2 of IEC 61169-1
Contact captivation	9.3.5		
– axial force		20 N max.	Captivated contacts only
– torque		na	
Engagement and separation	9.3.6		Screw coupling connectors
Coupling torque			To overcome friction of a coupling nut
– friction		0,066 Nm max.	
– coupling		0,46 Nm to 0,69 Nm	
– proof		2,8 Nm	
Mechanical tests on cable			
– cable pulling #	9.3.8	120 N	
– cable torsion #	9.3.10	0,1 Nm	
Tensile strength of coupling mechanism	9.3.11	300 N	
Bending moment	9.3.12	2 Nm	Relative to reference plane
<u>Environmental</u>			
Vibration	9.3.3	98 m/s ² 10 Hz to 500 Hz	10 g acceleration
Climatic sequence	9.4.2	40/70/21	
Sealing	9.4.5	1 cm ³ /h max	100 kPa – 110 kPa pressure
Salt mist	9.4.6	48 h	
<u>Endurance</u>			
Mechanical	9.5	1 000 cycles	
High temperature	9.6	1 000 h	

Table 4 (continued)

Details of symbols, abbreviations and procedures:

- these values apply to basic connectors. They depend on the cable used. Relevant values are given in the DS.
- + voltage values are r.m.s. values at 50 Hz - 60 Hz, unless otherwise specified.
- # cables used with these connectors may have values of lower performance than those given in this table.
- na not applicable.

4.3 Environmental characteristics for outdoor sockets (see Annex A)

When the “F” type male plug and the “F” type female socket are mated, the physical attributes shall be protected and sealed to prevent moisture ingress and as a minimum shall meet IPX8 rating.

Any “F” type (outdoor) male plug or female socket shall be resistant to corrosion and shall meet EN 60068-2-52 salt mist cyclic test.

4.4 Test schedule and inspection requirements

4.4.1 Acceptance tests

Table 5 – Acceptance tests

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	IL	AQL %	Period	Test required	IL	AQL %	Period
<i>Group A1</i>									
Visual examination	9.1.2	a	II	1,0		a	S3	1,5	
<i>Group B1</i>									
Outline dimensions	9.1.3.1	a	S4	0,4		a	S3	4,0	
Mechanical compatibility	9.1.3.3	a	II	1,0		a	S3	1,5	
Engagement and separation	9.3.6	a	S4	0,40	Lot	a	S3	1,5	Lot
Gauge retention (resilient contact)	9.3.4	ia	II	1,0		ia	S3	1,5	
Sealing, non-hermetic	9.4.5.1	ia	II	0,65	by	ia	S3	1,0	by
Sealing, hermetic	9.4.5.2	ia	II	0,015		ia	S3	0,02 5	
Voltage proof	9.2.6	a	S4	0,40	lot	a	II	4,0	lot
Solderability piece parts	9.3.2.1.1	ia	S4	0,40		ia	S3	4,0	
Insulation resistance	9.2.5	a	S4	0,40		a	S3	4,0	

Details of symbols, abbreviations and procedures:

- IL inspection level
- AQL acceptable quality level
- a suggested as applicable
- ia test suggested (if technically applicable)

4.4.2 Periodic tests

There are no group C tests for levels H and M.

Table 6 – Periodic tests

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test requir- ed	Number of speci- mens	Permit- ted failures per group	Period	Test requir- ed	Number of speci- mens	Permitted failures per group	Period
<i>Group D1 (d)</i>			6	1	3 years		3	1	3 years
Solderability connector assemblies	9.3.2.1.1	ia				ia			
Resistance to soldering heat	9.3.2.1.2	ia				ia			
Mechanical tests on cable fixing									
– cable rotation (nutation)	9.3.7.2	ia				ia			
– cable pulling	9.3.8	ia				ia			
– cable bending	9.3.9	ia				ia			
– cable torsion	9.3.10	ia				ia			
<i>Group D2 (d)</i>			6	1	3 years		3	1	3 years
Contact resistance, outer conductor and screen continuity centre conductor continuity	9.2.3	a				a			
Vibration	9.3.3	a							
Damp heat, steady state	9.4.3	a				a			
<i>Group D3 (d)</i>			1*	1	3 years		1*	1	3 years
Dimensions piece-parts and materials	9.1.3.2	a				a			
<i>Group D4 (d)</i>			6	1	3 years		3	1	3 years
Mechanical endurance	9.5	a				a			
High temperature endurance	9.6	a				a			
Sulphur dioxide	9.4.8	na				na			
<i>Group D5 (d)</i>			6	1	3 years		3	1	3 years
Reflection factor	9.2.1	a				a			
Screening effectiveness	9.2.8	a				a			
Water immersion	9.2.7	ia				ia			
<i>Group D6 (d)</i>			6	1	3 years		3	1	3 years
Contact captivation	9.3.5	a				a			