

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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

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



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INTERNATIONAL  
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INTERNATIONALE

ICS 31.220.10

ISBN 978-2-8322-7077-6

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**RADIO-FREQUENCY CONNECTORS –****Part 24: Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75  $\Omega$  cable networks (type F)**

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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, RF connectors, RF and microwave passive components and accessories.

This third edition cancels and replaces the second edition published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition: all drawings have been reworked and improved to allow frequency extension up to 3 GHz.

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

CDV	Report on voting
46F/417/CDV	46F/436A/RVC

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
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## RADIO-FREQUENCY CONNECTORS –

### Part 24: Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75 $\Omega$ 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  $\Omega$  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.

NOTE Millimetres are original dimensions. All undimensioned pictorial configurations are for reference purposes only.

#### 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.

IEC 61169-1:2013, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

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

#### 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:

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- ISO Online browsing platform: available at <http://www.iso.org/obp>

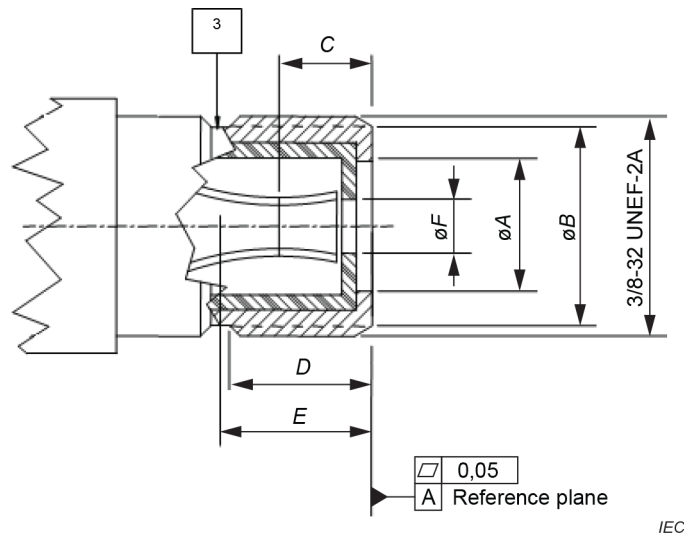
#### 4 Interface dimensions

##### 4.1 Dimensions

##### 4.1.1 Connector “F” type female socket (indoor) physical dimensions

Figure 1 shows a connector “F” type female socket (indoor).





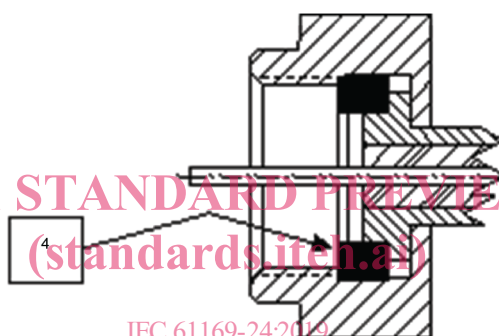
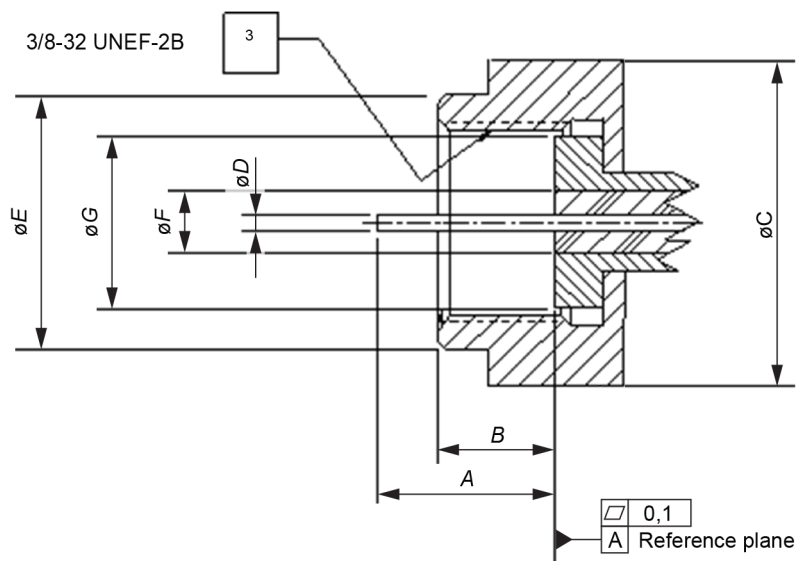
**Figure 1 – Connector “F” type female socket (indoor)**  
(for dimensions, see Table 1)

**Table 1 – Connector “F” type female socket (indoor)**

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

#### 4.1.2 Connector “F” type male plug (indoor) physical dimensions

Figure 2 shows a connector “F” type male plug (indoor).



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

**Table 2 – Connector “F” type male plug (indoor)**

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

1 No protrusion of the dielectric beyond the reference plane is permitted.  
 2 The mating of the F female socket to the reference plane is not impeded.  
 3 Gasket seal optional, if used, does not avoid to meet all performance requirements.

## 4.2 Mechanical gauges

### 4.2.1 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.

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.

Figure 3 shows a gauge for the centre socket conductor.

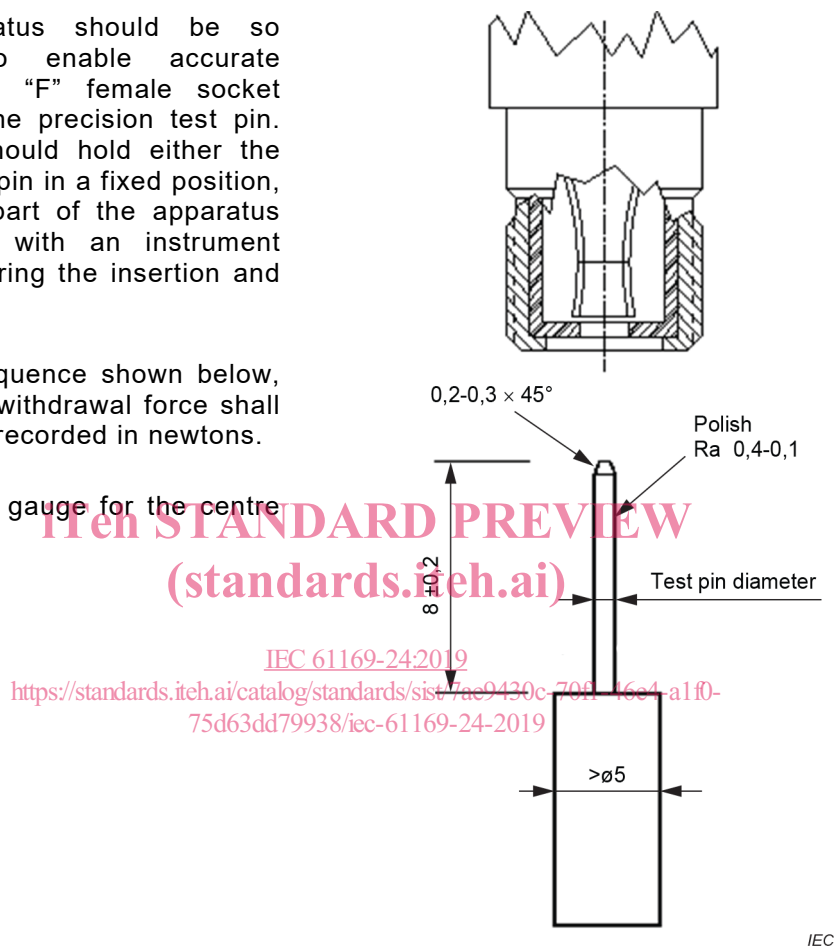


Figure 3 – Gauge for the centre socket conductor

Table 3 – Test sequence for the centre socket conductor

Test sequence	1 <sup>st</sup> test	2 <sup>nd</sup> test	3 <sup>rd</sup> test	4 <sup>th</sup> test	5 <sup>th</sup> test	6 <sup>th</sup> 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.

#### 4.2.2 Mating port centre conductor acceptance electrical test

After completion of the mechanical tests described in 4.2.1, 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.

#### 4.2.3 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.

### 5 Quality assessment procedures

#### 5.1 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.

#### 5.2 Ratings and characteristics

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

Rating and characteristics are given in Table 4.

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Table 4 – Ratings and characteristics

Ratings and characteristics	IEC 61169-1:2013 Subclause	Value	Remarks, deviation from standard test method
<b>Electrical</b>			
Nominal impedance			Shall meet the requirements of 9.2.1.1 of IEC 61169-1:2013 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 5 MHz to 6 GHz	See DS For most applications For some satellite applications For some head end applications For some satellite broadcasting and precision applications (Annex B)
Return loss	9.2.1		
– straight styles •		Min. 30 dB up to 1 GHz Min. 25 dB up to 2 GHz Min. 20 dB up to 3 GHz Min. 15 dB up to 6 GHz	Min. $37-7,5f+0,64f^2$ dB $f$ in GHz (1 GHz $\leq f \leq$ 6 GHz)
– right angle styles			See DS
– solder bucket and PCB mounting style			Under consideration
– insertion loss		0,1 dB max. up to 1 GHz 0,2 dB max. at 2 GHz 0,3 dB max. at 3 GHz 0,4 dB max. at 6 GHz	Max. $-0,04+0,15f - 0,013f^2$ dB $f$ in GHz (1 GHz $\leq f \leq$ 6 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 to 106 kPa
Screening effectiveness	9.2.7	$a_s \geq 90$ dB from 5 MHz to 3 GHz	$Z_t < 3,2 \text{ m}\Omega$ at 3 GHz
Discharge test (Corona)	9.2.8	na	
<b>Mechanical</b>			
Insertion force (resilient contacts)	9.3.4		See 3.2 of IEC 61169-1:2013
Contact captivation	9.3.5		
– axial force		20 N max.	Captivated contacts only
– torque		na	
Engagement and separation	9.3.6		
Coupling torque			Screw coupling connectors To overcome friction of a coupling nut

Ratings and characteristics	IEC 61169-1:2013 Subclause	Value	Remarks, deviation from standard test method
– 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	
Strength of coupling mechanism	9.3.11	300 N	
Bending moment	9.3.12	2 Nm	Relative to reference plane
<b>Environmental</b>			
Vibration	9.3.3	98 m/s <sup>2</sup> 10 Hz to 500 Hz	10 g acceleration
Climatic sequence	9.4.2	40/70/21	
Sealing	9.4.7	1 cm <sup>3</sup> /h max	100 kPa to 110 kPa pressure
Salt mist	9.4.10	48 h	
<b>Endurance</b>			
Mechanical	9.3.15	1 000 cycles	
High temperature	9.4.5	1 000 h	
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 RMS values at 50 Hz to 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.			

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### 5.3 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.

### 5.4 Test schedule and inspection requirements

#### 5.4.1 Acceptance tests

Table 5 describes the acceptance tests to be performed.

**Table 5 – Acceptance tests**

	IEC 61169-1:2013 Subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	IL	AQL %	Period	Test required	IL	AQL %	Period
<b>Group A1</b>									
Visual examination	9.1.1	a	II	1,0		a	S3	1,5	
<b>Group B1</b>									
Outline dimensions	9.1.2	a	S4	0,4		a	S3	4,0	
Mechanical compatibility	9.1.2.2	a	II	1,0		a	S3	1,5	
Engagement and separation	9.3.6	a	S4	0,40	Lot	a	S3	1,5	Lot
Insertion force (resilient contacts)	9.3.4	ia	II	1,0		ia	S3	1,5	
Sealing, non-hermetic	9.4.7	ia	II	0,65	by	ia	S3	1,0	by
Sealing, hermetic	9.4.8	ia	II	0,015		ia	S3	0,025	
Voltage proof	9.2.6	a	S4	0,40	lot	a	II	4,0	lot
Solderability	9.3.2.2	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) <a href="https://standards.iteh.ai/catalog/standards/sist/7ae9430c-70ff-46e4-a10-75d63dd79938/iec-61169-24-2019">IEC 61169-24:2019</a>									

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#### 5.4.2 Periodic tests

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

Table 6 describes the periodic tests to be performed.