

INTERNATIONAL STANDARD



**Radio-frequency connectors –
Part 35: Sectional specification for 2,92 series RF connectors**

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**Radio-frequency connectors –
Part 35: Sectional specification for 2,92 series RF connectors**

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RADIO-FREQUENCY CONNECTORS –**Part 35: Sectional specification for 2,92 series RF connectors**

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International Standard IEC 61169-35 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 first edition cancels and replaces IEC/PAS 61169-35, published in 2009, of which it constitutes a minor revision. The only change is that the PAS has been changed into and International Standard.

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

FDIS	Report on voting
46F/191/FDIS	46F/196/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 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 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- withdrawn,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 standard may be issued at a later date.

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RADIO-FREQUENCY CONNECTORS –

Part 35: Sectional specification for 2,92 series RF connectors

1 Scope

This sectional specification provides information and rules for preparation of detail specification of 2,92 series RF coaxial connectors together with the pro-forma blank detail specification.

It also prescribes mating face dimensions for high performance connectors - grade 1, dimensional detail of standard test connectors - Grade 0, gauging information and tests selected from IEC 61169-1 applicable to all detail specifications relating to 2,92 series RF coaxial connectors.

This specification indicates recommended performance characteristics to be considered when writing a detail specification and it covers test schedules and inspection requirements for assessment levels M and H.

The 2,92 series coaxial connectors with characteristic impedance $50\ \Omega$, 2,92 mm inner diameter of outer conductor and screw coupling, are used for millimeter wave applications, connecting with RF cables or microstrips. The operating frequency limit is up to 40 GHz.

Mating interface standards of the 2,92 series connectors are similar to IEEE std 287-2007 (2,92 mm) and MIL-std-348A (SMK). The 2,92 connectors can be inter-mated with SMA, and 3,5 mm connectors as per following standards. SMA: IEC 61169-35, MIL-PRF-39012D and MIL-STD-348A. 3,5 mm: IEC 60169-23, IEEE std 287-2007.

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*¹

Amendment 1 (1996)

Amendment 2 (1997)

3 Mating face and gauge information

3.1 Dimensions – High performance connectors – Grade 1

3.1.1 Connector with pin-centre contact

Inch dimensions are original dimensions.

All undimensioned pictorial configurations are for reference purpose only.

¹ There exists a consolidated edition 1.2 (1998) that comprises IEC 61169-1:1992, its Amendment 1:1996 and its Amendment 2:1997.

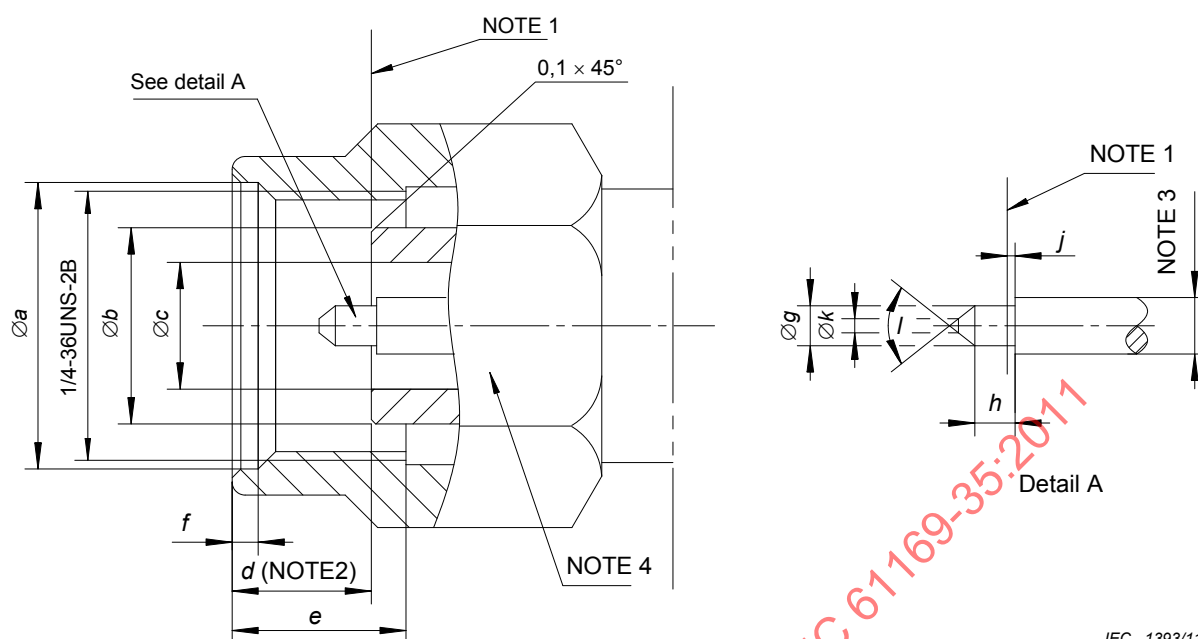
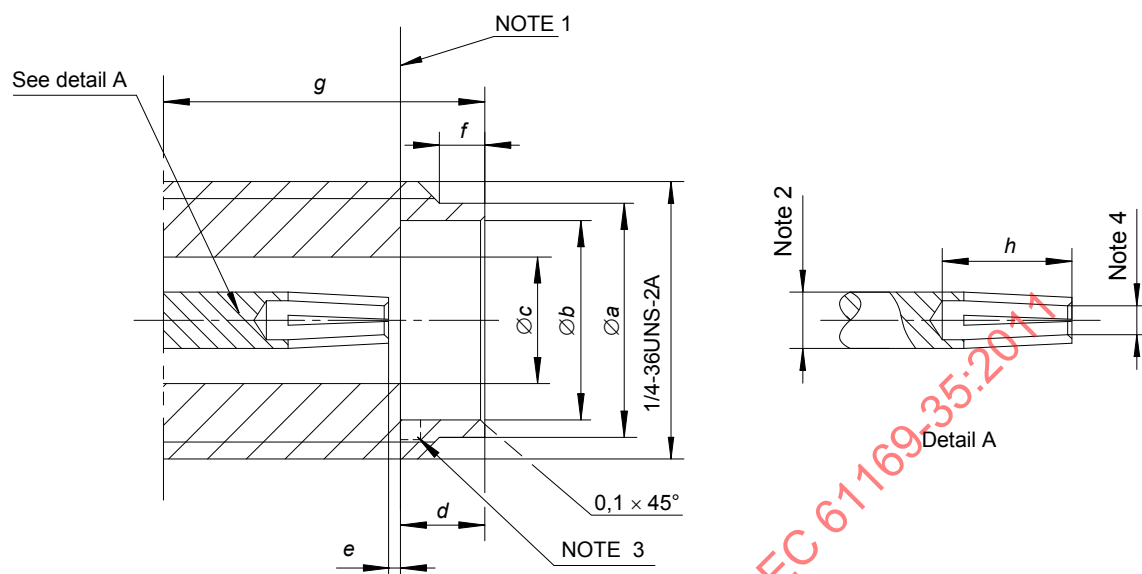


Figure 1 – Connector with pin-centre contact
(for dimensions and notes, see Table 1)

Table 1 – Dimensions of connector with pin-centre contact

Ref.	mm		in	
	Min.	Max.	Min.	Max.
a	6,48	6,73	0,255	0,256
b	4,521	4,592	0,1780	0,1808
c	2,90	2,95	0,114	0,116
d	2,36	3,56	0,0929	0,1401
e	3,43	4,01	0,1351	0,1579
f	0,38	1,14	0,015	0,045
g	0,906	0,922	0,0357	0,0363
h	1,02	1,12	0,040	0,044
j	0,02	0,13	0,0008	0,0051
k	0,20	0,30	0,008	0,012
l	56°	64°	56°	64°
NOTE 1 Mechanical and electrical reference plane.				
NOTE 2 Nut fully forward.				
NOTE 3 Diameter is chosen to obtain a normal impedance of 50 Ω.				
NOTE 4 Hexagon, width across two sides is 7,85 mm to 8,00 mm (0,309 in to 0,315 in), length of the plane is 3,18 mm (0,125 in) min.				

3.1.2 Connector with socket-centre contact



IEC 1394/11

**Figure 2 – Connector with socket-centre contact
(for dimensions and notes, see Table 2)**

Table 2 – Dimensions of connector with socket-centre contact

Ref.	mm		in	
	Min.	Max.	Min.	Max.
a	5,28	5,46	0,208	0,215
b	4,60	4,65	0,181	0,183
c	2,90	2,95	0,114	0,116
d	1,88	1,98	0,074	0,078
e	0,02	0,13	0,0008	0,0051
f	0,38	1,14	0,015	0,045
g	5,54	—	0,218	—
h	2,65	—	0,104	—
NOTE 1 Mechanical and electrical reference plane. NOTE 2 Diameter is chosen to obtain a normal impedance of 50 Ω. NOTE 3 Design for root cut to be allowed. Chamfer not to be allowed. NOTE 4 Design of centre contact is optional, but should meet electrical and mechanical performance requirements when mating with Ø 0,906 mm to Ø 0,922 mm (Ø 0,0357 in ~ Ø 0,0363 in) gauge pin.				

3.2 Gauges

3.2.1 Gauge pins for socket-centre contact

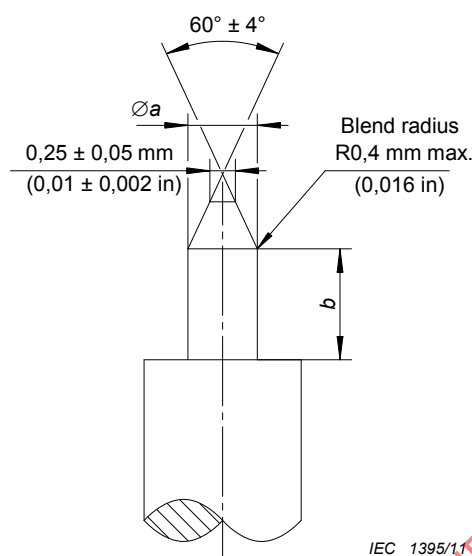


Figure 3 – Gauge pins for socket-centre contact
(for dimensions and notes, see Table 3)

Table 3 – Dimensions of gauge pins for socket-centre contact

Gauge A					Gauge B			
Maximum material for sizing purposes					Minimum material for measurement of retention force			
					Mass of gauge: 40 g ± 1 g			
Ref.	mm		in		mm		in	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<i>a</i>	0,9360	0,9385	0,0369	0,0370	0,917	0,9195	0,0361	0,0362
<i>b</i>	0,76	1,14	0,0299	0,0449	1,27	1,90	0,0500	0,0748
Material: steel, polished, surface roughness: Ra=0,4 µm (16 µin) maximum.								

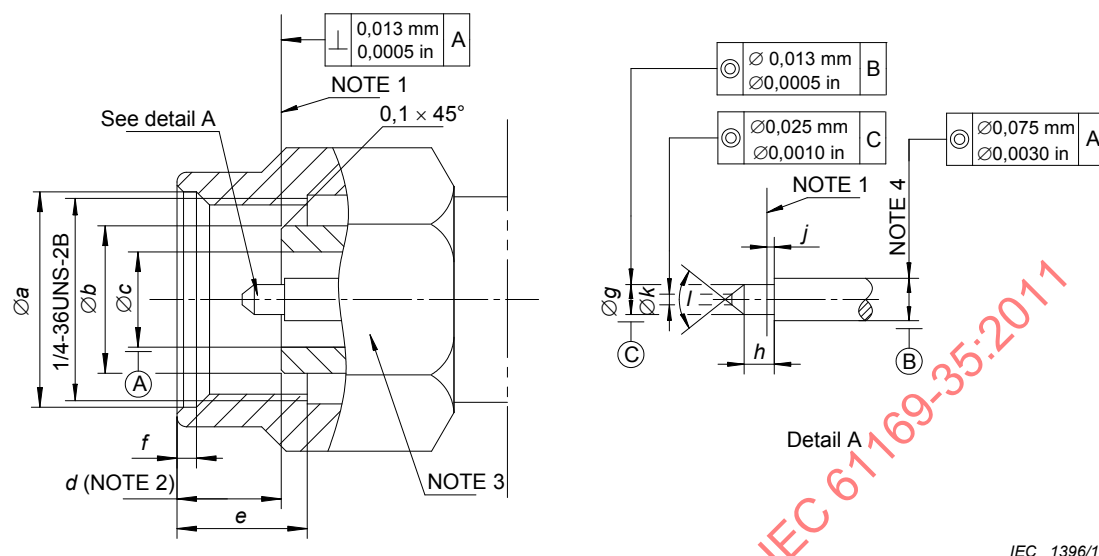
3.2.2 Test procedure

The gauge A shall be inserted into the socket-centre contact one time with a minimum depth of 0,76 mm (0,0299 in). This is a sizing operation and should only be carried out when the socket-centre contact is removed from the connector.

After this, the gauge B shall be inserted into socket-centre contact. The contact shall retain the mass of the gauge in a vertical downward position.

3.3 Dimensions – standard test connectors – Grade 0

3.3.1 Connector with pin-centre contact



IEC 1396/11

Figure 4 – Connector with pin-centre contact
(for dimensions and notes, see Table 4)

Table 4 – Dimensions of connector with pin-centre contact

Ref.	mm		in	
	Min.	Max.	Min.	Max.
a	6,38	6,73	0,251	0,256
b	4,547	4,577	0,179	0,1802
c	2,91	2,93	0,1145	0,1153
d	2,36	3,56	0,0929	0,1401
e	3,43	4,01	0,1351	0,1579
f	0,38	1,14	0,015	0,045
g	0,906	0,922	0,0357	0,0363
h	1,02	1,12	0,040	0,044
j	0,02	0,076	0,0008	0,003
k	0,20	0,30	0,008	0,012
l	56°	64°	56°	64°
NOTE 1 Mechanical and electrical reference plane, surface roughness: Ra = 0,4 µm (16 µin) maximum.				
NOTE 2 Nut fully forward.				
NOTE 3 Hexagon, width across two sides is 7,85 mm to 8,00 mm (0,309 in to 0,315 in), length of the plane is 3,18 mm (0,125 in) min.				
NOTE 4 Diameter is chosen to obtain a normal impedance of 50 Ω ± 0,5 Ω.				

3.3.2 Connector with socket-centre contact

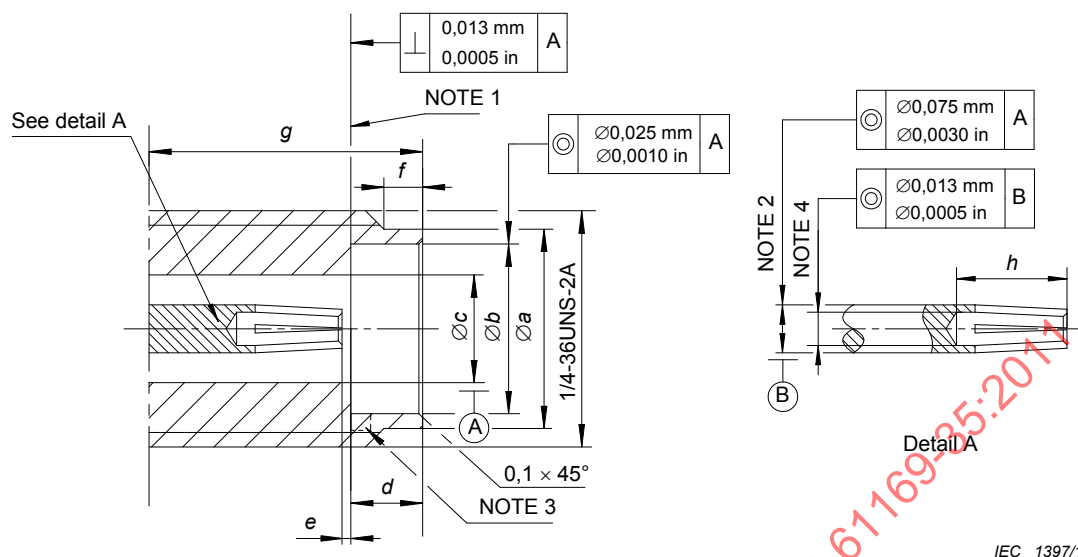


Figure 5 – Connector with socket-centre contact
(for dimensions and notes, see Table 5)

Table 5 – Dimensions of connector with socket-centre contact

Ref.	mm		in	
	Min.	Max.	Min.	Max.
<i>a</i>	5,28	5,46	0,208	0,215
<i>b</i>	4,60	4,63	0,181	0,1822
<i>c</i>	2,91	2,93	0,1145	0,1153
<i>d</i>	1,88	1,98	0,074	0,078
<i>e</i>	0,02	0,076	0,0008	0,003
<i>f</i>	0,38	1,14	0,015	0,045
<i>g</i>	5,54	—	0,218	—
<i>h</i>	2,65	—	0,104	—
NOTE 1 Mechanical and electrical reference plane, surface roughness: $R_a = 0,4 \mu\text{m}$ (16 μin) maximum,				
NOTE 2 Diameter is chosen to obtain a normal impedance of $50 \Omega \pm 0,5 \Omega$,				
NOTE 3 Design for root cut to be allowed, chamfer not to be allowed.				
NOTE 4 Design of centre contact is optional, but should meet electrical and mechanical performance requirements, when mating with $\varnothing 0,906 \text{ mm}$ to $\varnothing 0,922 \text{ mm}$ ($\varnothing 0,0360 \text{ in}$ to $\varnothing 0,0368 \text{ in}$) gauge pin.				

4 Quality assessment procedure

4.1 General

The following subclauses provide recommended rating, performance and test conditions to be considered when writing a detail specification. They also provide an appropriate schedule of tests with minimum levels of conformance inspection sampling, together with the pro forma blank detail specification (BDS) and instructions for the preparation of a detail specification.

4.2 Rating and characteristics (see Clause 6 of IEC 61169-1)

The values indicated below are recommended for 2,92 series RF connectors and are given for the writer of the detail specification. They are applicable for the condition when the connectors are fully mated.

Certain tests are listed without any recommended values being given. These tests will usually not be required. When these tests are required, appropriate values shall be entered in the detail specification at the discretion of the specification writer.

Table 6 – Rating and characteristics

Rating and characteristics	IEC 61169-1 Subclause	Values	Remarks, deviations from standard test method
Electrical			
Nominal impedance		50 Ω	
Frequency range Grade 1 connectors		DC~ 40 GHz	Or upper frequency limit of cable
Reflection factor ^a General connectors - straight styles - right-angle styles - component mounting styles - solder bucket and PCB mounting styles	9.2.1	DC~18 GHz: 0,0501 max. 18 GHz to 26,5 GHz 0,0631 max 26,5 GHz to 40 GHz 0,1259 max. See DS See DS See DS	
Centre contact resistance ^b - initial - after conditioning	9.2.3	$\leq 3,0 \text{ m}\Omega$ $\leq 4,0 \text{ m}\Omega$	
Outer conductor continuity ^b - initial - after conditioning	9.2.3	$\leq 2,0 \text{ m}\Omega$ $\leq 3,0 \text{ m}\Omega$	
Insulation resistance - initial - after conditioning	9.2.5	$\geq 5\,000 \text{ M}\Omega$ $\geq 200 \text{ M}\Omega$	
Proof voltage at sea-level ^{c,d} - uncabled styles - semi-rigid 0,118 in diameter - semi-rigid and semi-flexible 0,086 in diameter - semi-rigid and semi-flexible 0,047 in diameter	9.2.6	750 V 750 V 750 V 500 V	
Proof voltage at 4,4 kPa ^{c,d} - uncabled styles - semi-rigid 0,118 in diameter - semi-rigid and semi-flexible 0,086 in diameter - semi-rigid and semi-flexible 0,047 in diameter	9.2.6	150 V 150 V 150 V 100 V	4,4 kPa approximately equivalent to 20 km

Rating and characteristics	IEC 61169-1 Subclause	Values	Remarks, deviations from standard test method
Environmental test voltage at sea level ^{c,d} - uncabled styles - semi-rigid 0,118 in diameter - semi-rigid and semi-flexible 0,086 in diameter - semi-rigid and semi-flexible 0,047 in diameter	9.2.6	250 V 250 V 250 V 175 V	
Environmental test voltage at 4,4 kPa ^{c,d} - uncabled styles - semi-rigid 0,118 in diameter - semi-rigid and semi-flexible 0,086 in diameter - semi-rigid and semi-flexible 0,047 in diameter	9.2.6	65 V 65 V 65 V 45 V	4,4 kPa approximately equivalent to 20 km
Screening effectiveness (straight cables only) ^g	9.2.8	≥ 100 dB at 1 GHz	
Discharge test (corona effect)	9.2.9	See DS	Extinction voltage
Mechanical			
Gauge retention force (resilient contacts) - centre	9.3.4	≥ 0,4 N	
Centre contact captivation - axial force - torque	9.3.5	20 N 0,01 N•m min	Maximum displacement 0,076 mm in each direction
Engagement and separation - coupling nut friction	9.3.6	≤ 0,23 N•m	Can be carried out by hand
Coupling torque - standard torque - Nm-proof torque	9.3.6	0,8 ~ 1,1 N•m 1,69 N•m	
Technical tests on cable fixing - cable rotation (nutation) - cable pulling - cable bending - cable torsion	9.3.7.2 9.3.8 9.3.9 9.3.10	See DS See DS See DS See DS	
Tensile strength of coupling mechanism	9.3.11	≥ 100 N	
Bending torque	9.3.12	Na ^f	
Vibration	9.3.3	150 m/s ² 10~2 000 Hz	15 g _n
Shock	9.3.14	500 m/s ² 1/2 sine wave 11 ms	50 g _n
Environmental			
Climatic category	9.4.2	A:40/085/21 B:55/125/21	
Sealing non-hermetic	9.4.5.1	≤ 100 kPa•cm ³ /h	100 kPa to 110 kPa differential
Hermetic	9.4.5.2	≤ 10 ⁻³ Pa•cm ³ /s	100 kPa to 110 kPa differential
Salt mist	9.4.6	48 h spray	

4.3 Test schedule and inspection requirements – Acceptance tests

Table 7 – 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
Group A1									
Visual examination	9.1.2	a	II	1,0	Lot	a	S-3	1,5	Lot
Group B1									
Outline dimension	9.1.3.1	a	S-4	0,40		a	S-3	4,0	
Mechanical compatibility	9.1.3.3	a	II	1,0	By	a	S-3	1,5	By
Engagement and separation	9.3.6	a	S-4	0,40		a	S-3	1,5	
Gauge retention (resilient contacts)	9.3.4	ia	II	1,0	Lot	ia	S-3	1,5	Lot
Sealing									
non-hermetic	9.4.5.1	ia	II	0,65		ia	S-3	1,0	
hermetic	9.4.5.2	ia	II	0,015		ia	S-3	0,025	
Voltage proof	9.2.6	a	II	0,40		a	II	4,0	
Solderability (d)	9.3.2.1.1	ia	S-4	0,40		ia	S-3	4,0	
Insulation resistance	9.2.5	a	S-4	0,40		a	S-3	4,0	

For the symbols, abbreviations and procedures, see the end of Table 8.

4.3.2 Periodic tests

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

Table 8 – Periodic tests

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group ^a	Period	Test required	Number of specimens	Permitted failures per group ^a	Period
Group D1 (d)			6	1	3 years		3	1	3 years
Solderability	9.3.2.1.1	ia				ia			
- connector assemblies									
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							
- cable bending	9.3.9								
- cable torsion	9.3.10	ia							
Bending moment	9.3.12	ia				ia			
Strength of coupling mechanism	9.3.11	a				a			
Group D2 (d)			6	1	3 years		3	1	3 years
Contact resistance	9.2.3	a				a			
Outer conductor and screen continuity	9.2.3								
Centre conductor continuity	9.2.3	a				a			
Vibration	9.3.3	a				a			
Shock	9.3.14	a							
Damp heat, steady state	9.4.3								
Salt mist	9.4.6	a							
Group D3			^b	1	3 years		^b	1	3 years
Dimensions piece part and materials	9.1.3.2	a				a			
Group D4 (d)			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								

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group ^a	Period	Test required	Number of specimens	Permitted failures per group ^a	Period
Group D5 (d) Reflection factor Screening effectiveness Water immersion	9.2.1 9.2.8 9.2.7	ia ia	6	1	3 years	ia ia	3	1	3 years
Group D6 (d) Contact captivation Discharge test (corona effect) Rapid change of temperature Climatic sequence	9.3.5 9.2.9 9.4.4 9.4.2	ia a a a	6	1	3 years	ia a a	3	1	3 years
Group D7 (d) Resistance to solvents and contamination fluids	9.7		1 ^c	1	3 years		1 ^c	1	3 years
ABBREVIATIONS: a - applicable na - not applicable ia - test required (if technically applicable) (d) - destructive test -specimens shall not be returned to stock IL - inspection level AQL-acceptable quality level									
^a For qualification approval, a total of 2 failures only permitted for level H and 1 failure only permitted for level M from groups D1 to D7. ^b One set of piece parts each style and variant unless using common piece parts. ^c Group D7 - number of pairs for each solvent.									

4.4 Procedures

4.4.1 Quality conformance inspection

This shall consist of test groups A1 and B1 on a lot-by-lot basis and test groups D1 to D7 on a periodic basis.

4.4.2 Qualification approval and its maintenance

This still consists of three consecutive lots passing test groups A1 and B1 followed by selection of specimens from the lots as appropriate. These specimens shall successfully pass the specified periodic D tests.

5 Instructions for preparation of detail specifications

5.1 General

Detail specifications (DS) writer shall use the appropriate blank detail specification (BDS) proforma. The following pages comprise the BDS dedicated for use with type 2,92 connectors. As such, it will already have entered on it information relating to:

- a) the basic specification number applicable to all the detail specifications covering connector styles of the type covered by the sectional specification;
- b) the connector series designation.

The specification writer should enter the details relating to the connector style to be covered as indicated. The numbers in brackets in the BDS correspond to the following indications which shall be given.

5.2 Identification of the detail specification

- (1) The name of the National authorized institution (NAI) under whose authority the DS is published and, if applicable, the organization from whom the DS is available.
- (2) The number allocated to the DS by the relevant National authorized institution immediately preceded by the ISO two letter national identity code or "XX" when the DS is produced by an IEC technical subcommittee.
- (3) The number and issue number of the IEC/IECQ generic specification and, when applicable, the sectional specification with the national reference if different.
- (4) If different from the IEC/IECQ number, any national number of the DS, date of issue and any further information required by the national system, together with any amendment numbers.

5.3 Identification of the component

- (5) Enter the following details:
 - Style: the style designation of the connector including type of fixing and sealing, if applicable.
 - Attachment: by deletion of the inapplicable options of cable/wire: given for centre and outer conductors.
 - Special features and marking: as applicable.
 - Series designation: in bold characters/digits approximately 15 mm high.
- (6) Enter detail of assessment level and the climatic category.
- (7) A reproduction of the outline drawing and details of the panel piercing, if applicable. It shall provide the maximum envelope dimensions, also the position of the reference plane and, in the case of a fixed connector, the position of the mounting plane(s) relative to the front face of the connector.

Any maximum panel thickness limitations for fixed connectors shall be stated.
- (8) Particulars of all variants covered by the DS. As appropriate, the information shall include
 - cable type (or sizes) applicable to each variant.
 - alternative plated or protective finishes.
 - details of alternative mounting flanges having either tapped or plain mounting holes.
 - details of alternative solder spills or solder buckets including, when applicable, those for use with microwave integrated circuit (MIC) components.

5.4 Performance

- (9) Performance data listing the most important characteristics of the connector in accordance with the requirements of the relevant sectional specification. Deviations from the minimum requirements shall be clearly indicated. Not applicable shall be marked "na".

5.5 Marking, ordering information and related matters

- (10) Insert marking and ordering information as appropriate, together with details of related documents and any invoked structural similarity.

5.6 Selection of tests, test conditions and severities

- (11) 'na' shall be used to indicate non-applicable tests. All tests marked 'a' by the detail specification writer shall be mandatory.

When using the normal procedure with a dedicated BDS, the letter "a" – for applicable – shall be entered in the "test required" column against each of the tests indicated as being mandatory in the test schedule of the relevant sectional specification. Any additional test required at the discretion of the specification writer shall also be indicated by an "a".

The specification writer shall also indicate, when necessary, details of deviations from the standard test methods and test conditions, including any relevant deviations given in the test schedule of the sectional specification.

The qualification approval and conformance inspection shall be such that the National Supervising Inspectorate (NSI) shall be satisfied that they are appropriate and in line with those for other connectors within the system providing a reasonably comparable service.

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The following pages contain the complete BDS pro-forma.

[illegible]

(9) Performance (including limiting conditions of use)

Ratings and characteristics	IEC 61169-1 Subclause	Value	Remarks including any deviations from standard test methods
<i>Electrical</i>			
Nominal impedance		50 Ω	
Frequency range		0 GHz - 18 GHz	Measurement frequency range
Reflection factor	9.2.1		
Variant No. Designation 01.....			
Centre contact resistance	9.2.3	≤mΩ ≤mΩ	Initial After conditioning
Centre conductor continuity	9.2.4	mΩmΩmΩmΩ	Resistance change due to conditioning
Outer contact continuity	9.2.3	≤mΩ ≤mΩ	Initial After conditioning
Insulation resistance	9.2.5	≥GΩ ≥GΩ	Initial After conditioning
#+ Proof voltage at sea level	9.2.6	kVkVkVkV	86 kPa to 106 kPa
#+ Proof voltage at 4,4 kPa		VVVV	kPa (if not 4,4 kPa)
#+ Environment test voltage at sea level		VVVV	86 kPa to 106 kPa
Environment test voltage at 4,4 kPa		VVVV	kPa (if not 4,4 kPa)
<i>Electrical</i>			
Screening effectiveness	9.2.8	≥ dB at...GHz	Z _c ≤.....Ω
01.....			
ADDITIONAL ELECTRICAL CHARACTERISTICS			

+ Voltage values are r.m.s. values at 50 Hz-60 Hz, unless otherwise specified.