PUBLICLY
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SPECIFICATION

IEC PAS 61169-38

Pre-Standard

First edition
2007-06

Radio-frequency connectors –

Part 38:
Sectional specification –
Radio-frequency coaxial connectors model, slide-in (rack and panel applications) –
Characteristic impedance 50 Ω (type TMA) –
50 Ω applications

Reference number
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IEC-PAS 61169-38 has been prepared by IEC 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.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
46F/58A/PAS	46F/68A/RVD

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RADIO-FREQUENCY CONNECTORS –

Part 38: Sectional specification – Radio-frequency coaxial connectors model, slide-in (rack and panel applications) – Characteristic impedance 50 Ω (type TMA) – 50 Ω applications

1 Scope

This PAS provides information and rules for the preparation of detail specifications for series TMA r.f. connectors together with the pro forma blank detail specification.

Series TMA connectors have a characteristic impedance of 50 Ω and are normally used with r.f. cables or microstrip in microwave fields that has a blind entry and middle low power. The connectors can be used up to a frequency of at least 6 GHz.

It also prescribes mating face dimensions for general purpose connectors, dimensional details of standard test connectors grade 0, gauging information and tests selected from IEC 61169-1 applicable to all detail specifications relating to series TMA connectors.

This PAS indicates the 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.

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*

3 Mating face and gauge information

Metric dimensions are original dimensions.

All undimensioned pictorial configurations are for reference purposes only.

3.1 Dimensions – General connectors – Grade 2

3.1.1 Connectors with pin-centre contact

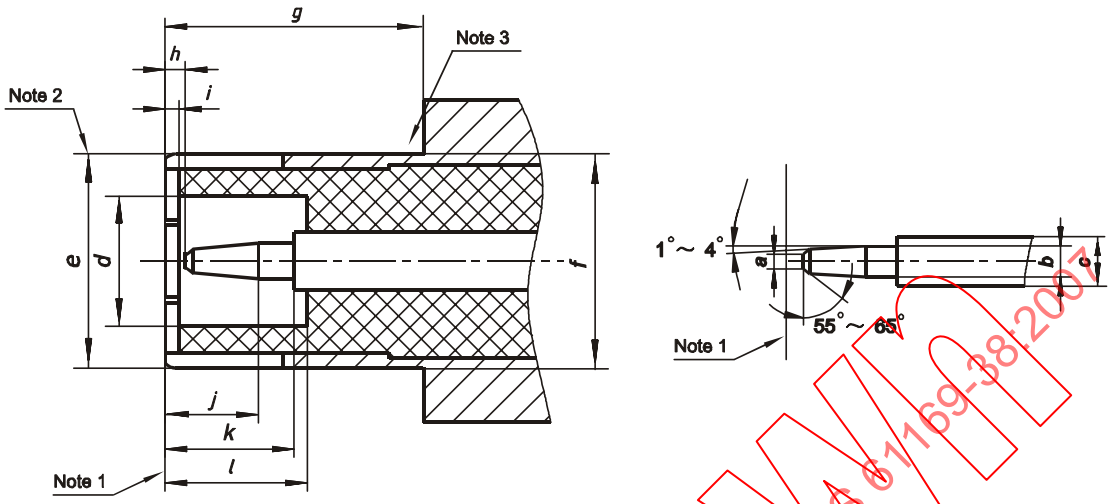

Figure 1 – Connectors with pin-centre contact

(for dimensions, see Table 1)

Table 1 – Dimensions of connector with pin-centre contact

Ref.	Millimetres		Inches		Notes
	Min.	Max.	Min.	Max.	
a	—	0,64	—	0,025	Diameter
b	1,32	1,37	0,052	0,054	Diameter
c	2,06	2,21	0,081	0,087	Diameter
d	4,83	—	0,190	—	Diameter
e	—	—	—	—	Diameter (see Note 2)
f	8,00	8,05	0,315	0,317	Diameter
g	8,60	—	0,339	—	
h	0,08	1,02	0,003	0,040	
i	0,15	—	0,006	—	
j	1,96	3.05	0,078	—	
k	5,33	5,84	0,210	0,230	
l	5,28	5,79	0,208	0,228	

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Slotted and flared to meet electrical and mechanical requirements.

NOTE 3 Design and location of the sealing feature is optional but should ensure that environmental performance requirement are met.

3.1.2 Connectors with socket-centre contact

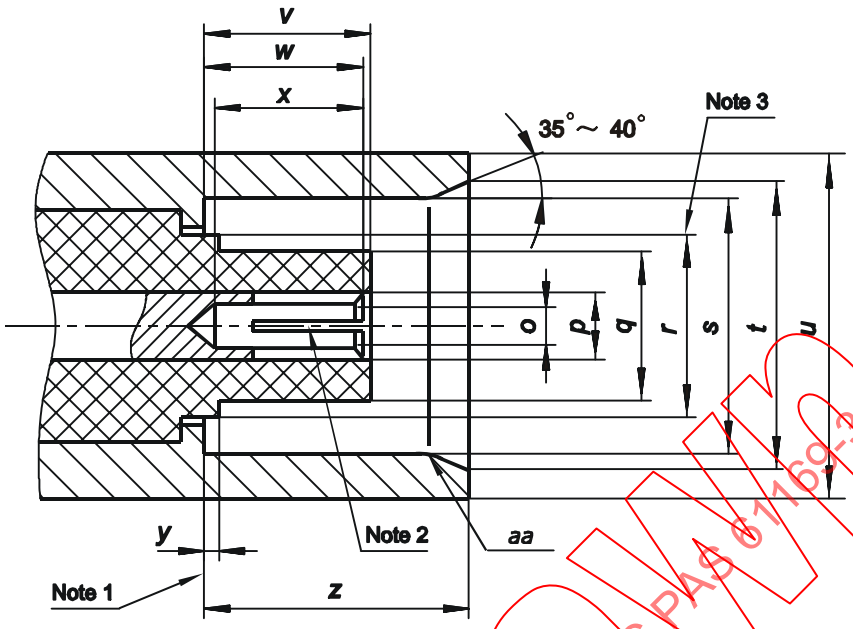

Figure 2 – Connectors with socket-centre contact
(for dimensions, see Table 2)

Table 2 – Dimensions of connectors with socket-centre contact

Ref.	Millimetres		Inches		Notes
	Min.	Max.	Min.	Max.	
o	—	—	—	—	Diameter (see Note 2)
p	2,06	2,21	0,081	0,087	Diameter
q	—	4,72	—	0,186	Diameter
r	—	6,50	—	0,256	Diameter (see Note 3)
s	8,10	8,15	0,319	0,321	Diameter
t	10,00	10,15	0,394	0,400	Diameter
u	12,3	12,4	0,484	0,488	Diameter
v	4,78	5,28	0,188	0,208	
w	4,72	5,23	0,186	0,206	
x	4,95	—	0,195	—	
y	—	0,15	—	0,006	
z	8,31	8,51	0,327	0,335	
aa	—	—	—	—	See Note 4

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Slotted and closed to meet electrical and mechanical requirements.

NOTE 3 Applies only when dielectric extends beyond reference plane.

NOTE 4 Radius.

3.2 Gauges

3.2.1 Connectors with pin-centre contact

3.2.1.1 Gauge for outer contact of pin connector

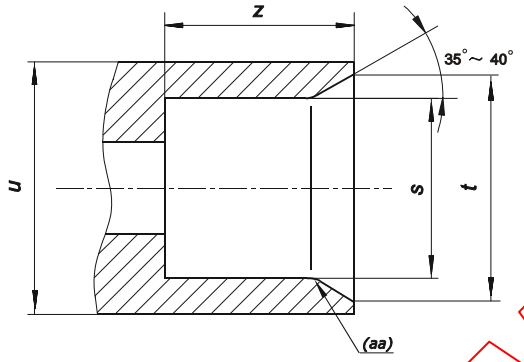

Figure 3 – Gauge for outer contact of pin connector
(for dimensions, see Table 3)

Table 3 – Dimensions of gauge for outer contact of pin connectors

Gauge A (for sizing purposes)					Gauge B (for measurement of gauge retention force for outer conductor) Mass of gauge(weight): 225 ± 5 g				Notes
Ref.	Millimetres		Inches		Millimetres		Inches		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
s	8,08	8,10	0,318	0,319	8,15	8,18	0,321	0,322	Diameter
t	10,00	10,15	0,394	0,400	10,00	10,15	0,394	0,400	Diameter
u	12,4	—	0,488	—	12,4	—	0,488	—	Diameter
z	8,41	8,46	0,331	0,333	8,36	8,41	0,329	0,331	Diameter
aa	0,8		0,031		0,8		0,031		Radius (see Note 2)
NOTE 1 Material: steel, polished, surface roughness: Ra ≤ 0,4 µm (16 µin).									
NOTE 2 Parentheses indicate the reference size for size									

3.2.1.2 Test sequence

Gauge A shall be placed once over the outer electrical contact of the connector. This is a sizing operation and should only be carried out when the insulator is removed from the connector.

After this, gauge B shall be placed over the outer contact in a vertical position. The gauge shall be retained. This test can also be carried out on connectors when the insulator is not removed.

3.2.2 Connectors with socket-centre contact

3.2.2.1 Gauge pin with socket-centre contact

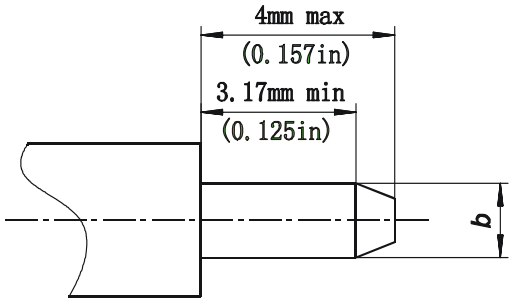

Figure 4 – Gauge pin for socket-centre contact
(for dimensions, see Table 4)

Table 4 – Dimensions of gauge pin for socket-centre contact

Ref.	Gauge C (for sizing purpose)				Gauge D (for measurement of gauge retention force for inner conductor) Mass (weight) of gauge: 57 ± 1 g				Note
	Millimetres		Inches		Millimetres		Inches		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
b	1,372	1,377	0,0540	0,0542	1,308	1,321	0,0515	0,0520	Diameter
NOTE Material: steel, polished, surface roughness: Ra ≤ 0,4 µm (16 µin).									

3.2.2.2 Test sequence

Test pin gauge C shall be inserted into the centre contact three times with a minimum distance of 3,17mm (0,125 in). This is a sizing operation and should only be carried out when the socket-centre contact is removed from the connector.

After this, gauge D shall be inserted and held in the vertical position. The gauge shall be retained. This test can also be carried out on connectors when the socket-centre contact is not removed.

3.3 Dimensions – Standard test connectors – Grade 0

3.3.1 Connectors with pin-centre contact

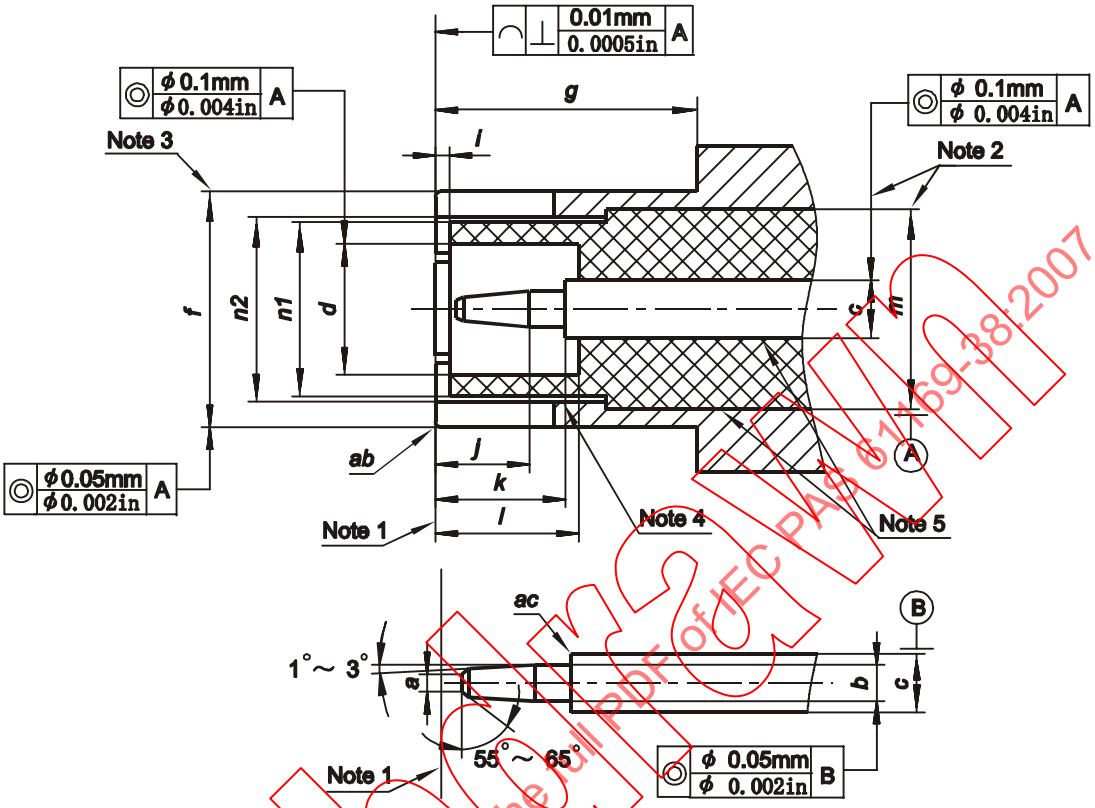

Figure 5 – Standard test connector with pin-centre contact
(for dimensions, see Table 5)

Table 5 – Dimensions of standard test connector with pin-centre contact

Ref.	Millimetres		Inches		Notes
	Min.	Max.	Min.	Max.	
a	—	0,64	—	0,025	Diameter
b	1,35	1,37	0,0530	0,0541	Diameter
c	2,140 nom		0,0842 nom		Diameter (see Note 2)
d	4,88	4,93	0,192	0,194	Diameter
f	8,06	8,09	0,3175	0,3185	Diameter (see Note 3)
g	8,60	—	0,339	—	
i	0,15	0,30	0,006	0,012	
j	3,66	3,98	0,144	0,157	
k	5,31	5,38	0,209	0,212	
l	5,38	5,54	0,212	0,218	
m	6,99	7,01	0,2752	0,2760	Diameter (see Note 2)
*n*1	6,60	6,65	0,260	0,262	Diameter
*n*2	6,72	6,74	0,2645	0,2655	Diameter
ab	0,1	0,3	0,004	0,012	Radius
ac	—	0,13	—	0,005	Radius

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 These diameters are for polytetrafluorethylene (PTFE) insulation with dielectric constant 2,02. Characteristic impedance of transmission line determined by diameters *m* and *c* should be 50 Ω ± 0,2 Ω.

NOTE 3 Before slotting. Six slots 60° ± 1° apart, 0,36 mm to 0,41 mm (0,014 in to 0,016 in) wide, 5,84 mm to 6,10 mm (0,230 in to 0,240 in) deep. After slotting and flaring, the inner diameter of the outer contact should be 6,718 mm to 6,744 mm (0,2645 in to 0,2655 in) when inserted into a ring gauge with an inner diameter of 8,125 mm to 8,131 mm (0,3199 in to 0,3201 in).

NOTE 4 If concentric, 0,05 mm (0,002 in) nominal radial air gap when inserted into a ring gauge with an inner diameter of 8,125 mm to 8,131 mm (0,3199 in to 0,3201 in).

NOTE 5 Zero air gap.

3.3.2 Connectors with socket-centre contact

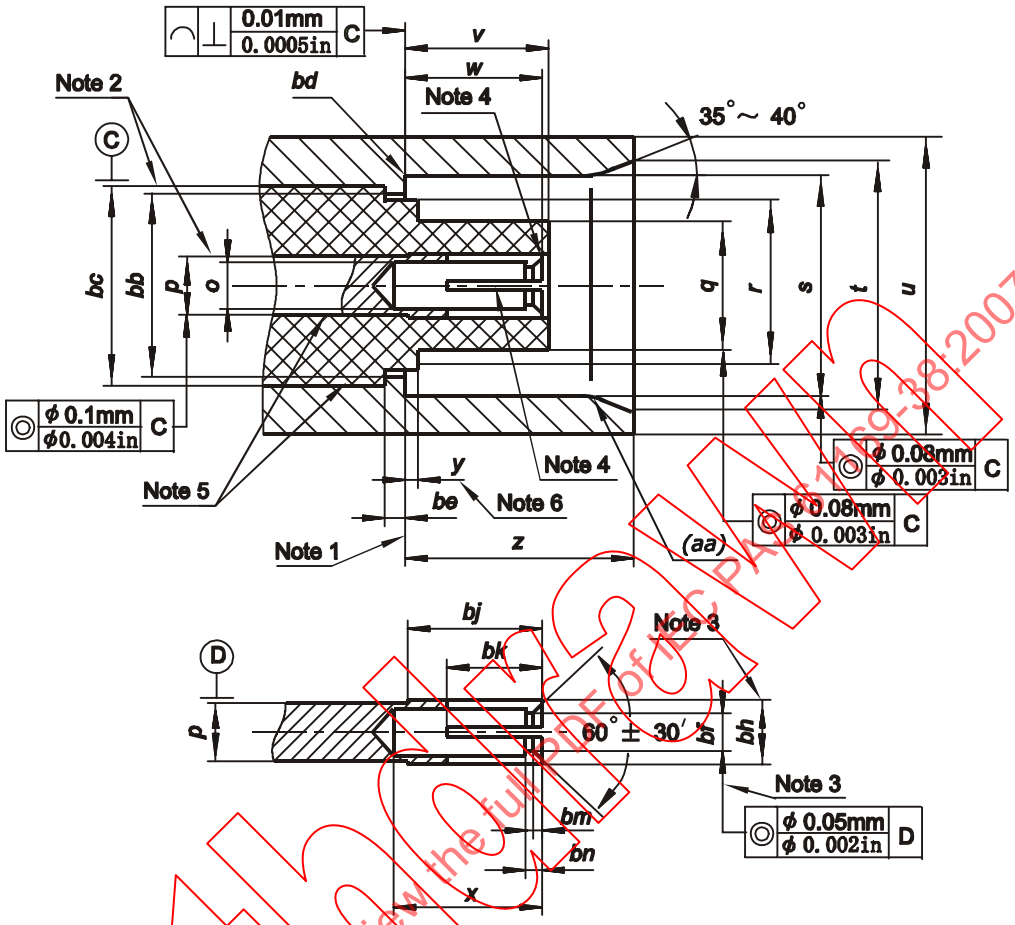

Figure 6 – Standard test connectors with socket-centre contact
(for dimensions, see Table 6)

Table 6 – Dimensions of standard test connectors with socket-centre contact

Ref.	Millimetres		Inches		Notes
	Min.	Max.	Min.	Max.	
o	1,52	1,63	0,060	0,064	Diameter
p	2,140 nom		0,0842 nom		Diameter (see Note 2)
q	4,67	4,72	0,184	0,186	Diameter
r	6,58	6,68	0,259	0,263	Diameter
s	8,10	8,15	0,319	0,321	diameter
t	10,00	10,15	0,394	0,400	Diameter
u	12,3	12,4	0,484	0,488	Diameter
v	5,08	5,23	0,200	0,206	
w	5,21	5,28	0,205	0,208	
x	5,21	—	0,205	—	
y	0,0	0,15	0,00	0,006	See Note 6
z	8,36	8,46	0,329	0,333	
aa	0,8		0,031		Diameter (see Note 6)
bb	6,71	6,76	0,264	0,266	Diameter
bc	6,99	7,01	0,2752	0,2760	Diameter (see Note 2)
bd	—	0,1	—	0,004	Radius
be	0,79	0,84	0,031	0,033	
bf	1,356	1,361	0,0534	0,0536	Diameter (see Note 3)
bh	2,16	2,18	0,0849	0,0859	Diameter (see Note 3)
bj	6,05	6,10	0,238	0,240	
bk	4,62	4,88	0,182	0,192	
bm	0,05	0,2	0,002	0,008	
bn	0,38	0,89	0,015	0,035	

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 These diameters are for polyterafluorethylene(PTFE) insulation with dielectric constant 2,02. Characteristic impedance of transmission line determined by diameters *p* and *bc* should be 50 Ω ± 0,2 Ω.

NOTE 3 Four slots 0,18 mm to 0,23 mm (0,007 in to 0,009 in) wide; 90° 30' to 89° 30' apart. Diameter *y* with 1,356 mm (0,0534 in) min: 1,361 mm (0,0536 in) max. pin gauge inserted after slotting and closing.

NOTE 4 If concentric 0,02 mm (0,0008 in) radial air gap when mated with 1,359 mm (0,0535 in) diameter pin.

NOTE 5 Zero air gap.

NOTE 6 Insulator should be flush or protruding.

NOTE 7 Parentheses indicate the reference size for size.

3.4 General requirements for connector mounting in modules and on panels

3.4.1 Radial misalignment

The radial misalignment between engaging connectors refers to the coaxiality error *A* (Figure 7) between a connector with socket-centre contact and a connector with pin-centre contact at the beginning and during the engagement.

At the beginning of the engagement, the radial misalignment of a rigidly mounted connector and a float-mounted connector shall be no more than 0,51 mm.

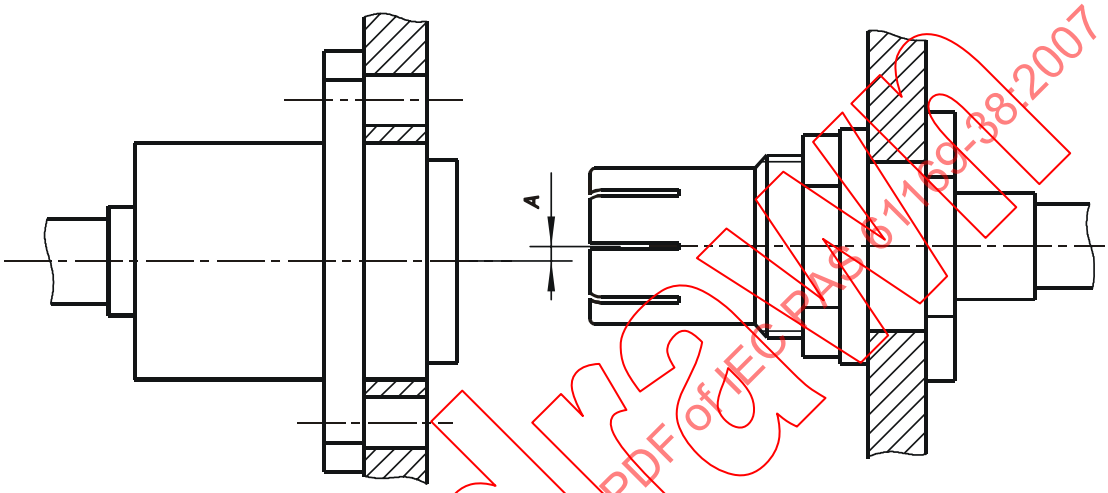

Figure 7 – Sketch map of connector radial misalignment

3.4.2 Axial misalignment

For rigidly mounted and float-mounted connectors, the float mounting allows a total of 1,52 mm (0,060 in) axial travel. The mounting arrangements should, however, ensure a minimum length of travel of 0,26 mm (0,010 in) [0,76 mm (0,030 in) preferred] to ensure that the full length of engagement is maintained under operational conditions (Figure 8).

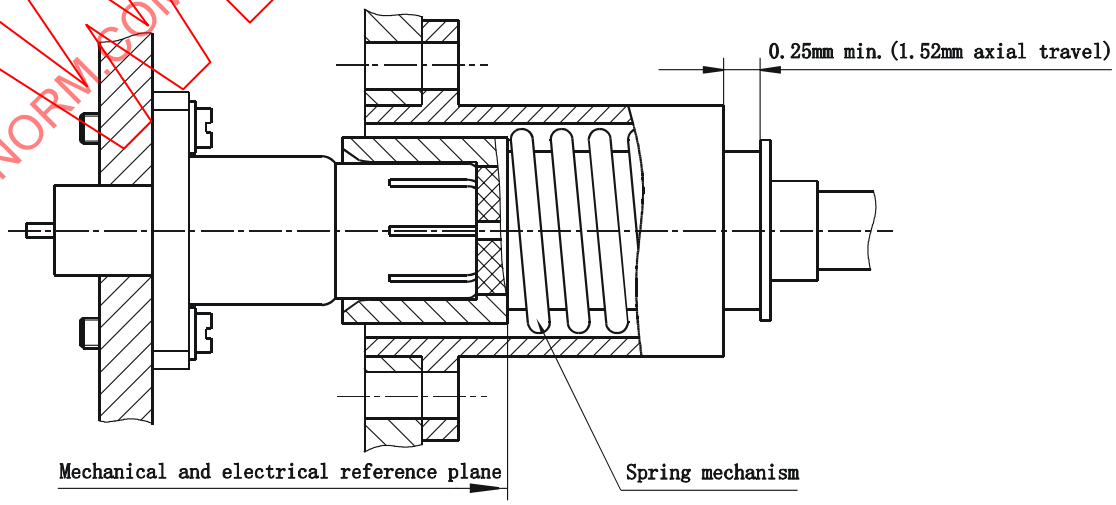

Figure 8 – Sketch map of rigidly mounted and float-mounted connectors

4 Quality assessment procedure

4.1 General

The following clauses 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 series TMA 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 7 – Rating and characteristics

Ratings and characteristics	Test method IEC 61169-1 subclause	Value	Remarks, deviations from standard test method
Electrical			
Nominal impedance		50 Ω	
Frequency range			
Grade 2 connectors		Up to 6 GHz	Or upper frequency limit of cable
Reflection factor[1]	9.2.1		
Grade 2 connectors			
– straight styles		⩽0,13	
– right-angle styles		⩽0,15	
– component mounting styles		See detail specification	
– solder bucket and PCB mounting styles			
Centre contact resistance[2]	9.2.3		
– initial		⩽ 1,5 mΩ	
– change due to conditioning		⩽ 2 mΩ	
Outer conductor continuity[2]			
– initial	9.2.3	⩽ 2 mΩ	
– after conditioning		⩽ 3 mΩ	
Insulation resistance[2]	9.2.5		
– initial		⩾ 5 GΩ	
– after conditioning		⩾200 MΩ	

Ratings and characteristics	Test method IEC 61169-1 subclause	Value	Remarks, deviations from standard test method
Proof voltage at sea-level[2,3]	9.2.6		
– cables 96IEC 50-4		1 000 V	
– cables 96IEC 50-3		1 000 V	
– cables 96IEC 50-2		750 V	
Proof voltage at 4,4 kPa[3,4]			4,4 kPa approximately equivalent to 20 km (70 000 ft) altitude
– cables 96IEC 50-4		180V	
– cables 96IEC 50-3		180 V	
– cables 96IEC 50-2		150 V	
Environmental test voltage at sea-level[3,4]			
– cables 96IEC 50-4		400 V	
– cables 96IEC 50-3		400 V	
– cables 96IEC 50-2		350 V	
Environmental test voltage at 4,4kPa[3,4]			4,4 kPa approximately equivalent to 20 km (70 000 ft) altitude
– cables 96IEC 50-4		90 V	
– cables 96IEC 50-2		90 V	
– cables 96IEC 50-3		85 V	
Screening effectiveness[7] (straight cable connectors only)	9.2.8	60 dB, 3GHz	$Z_t \leqslant$ 100 mΩ
Discharge test at sea-level (corona effect) – cables 96IEC 50-3	9.2.9	⩾500	Extinction voltage
Mechanical			
Centre contact captivation	9.3.5		
– axial force		15 N	Maximum displacement 0,25 mm in each direction
– torque		na	
Engagement and separation	9.3.6		
– engagement force		≤ 20 N	
– separation force		≥2,25 N	
Gauge retention force (resilient contacts)	9.3.4		
– centre		≥0,57 N	
– outer		≥2,25 N	
Technical tests on cable fixing		See detail specification	
– cable rotation (nutation)	9.3.7.2		
– cable pulling	9.3.8		
– cable bending	9.3.9		
– cable torsion	9.3.10		
Tensile strength of coupling mechanism	9.3.11	Na	
Bending moment	9.3.12	Na	

Ratings and characteristics	Test method IEC 61169-1 subclause	Value	Remarks, deviations from standard test method
Vibration	9.3.3	150 m/s^2 10-2 000 Hz	Acceleration: 15 gn
Shock	9.3.14	750 m/s^2 11ms saw tooth	Acceleration: 75 gn
Environmental			
Climatic category[5]	9.4.1	55/155/21	
Sealing, non hermetic	9.4.5.1	1 cm^3/h 100 kPa ~ 110 kPa differential	
Sealing, hermetic	9.4.5.2	5 pa cm^3/s 100 kPa – 110 kPa differential	
Salt mist	9.4.6	48 h spraying	
Endurance			
Mechanical	9.5	500 operations	
High temperature[5]	9.6	1 000 h at 155 °C	

[1] These values apply to the basic connector. In practice, these may be influenced by the cable used and reference should always be made to the actual values given in the detail specification.

[2] Values for a single pair of connectors.

[3] Voltages are r.m.s values of a.c. at 40 Hz to 65 Hz, unless otherwise stated.

[4] Some cables usable with these connectors have ratings lower than the values given here.

[5] For certain connectors, the upper temperature limit is restricted by the cable characteristics. Reference should be made to the relevant cable specification. When semi-rigid cables are used, the upper temperature is limited to 115 °C maximum.

[6] na = not applicable.

[7] When interfaces are fully mated.

4.3 Test schedule and inspection requirements

4.3.1 Acceptance tests

Table 8 – 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		a	S3	1,5	
Group B1									
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	0,025	
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	

NOTE For details of symbols, abbreviations and procedures, see 4.3.2

4.3.2 Periodic tests

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

Table 9 – 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#	Period	Test required	Number of specimens	Permitted failures per group#	Period
Group D1 (d)			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			
Group D2 (d)			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			
Group D3 (d)			1*	1	3 years		1*	1	3 years
Dimensions piece-parts 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	na				na			
Group D5 (d)			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			
Group D6 (d)			6	1	3 years		3	1	3 years
Contact captivation	9.3.5	a				a			
Rapid change of temperature	9.4.4	na				na			
Climatic sequence	9.4.2	a				a			

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group#	Period	Test required	Number of specimens	Permitted failures per group#	Period
Group D7 (d) Resistance to solvents and contaminating fluids	9.7	ia	1§		3 years	ia	1§		3 years

Details of symbols, abbreviations and procedures

a = suggested as applicable

ia = test suggested (if technically applicable)

na = not applicable

IL = Inspection Level

AQL = Acceptable Quality Level

* = one set of piece-parts each style and variant, unless using common piece parts

= for Qualification Approval (QA) a total of two failures only permitted for level H and 1 failure only for level M from groups D1 to D7

§ = Group D7 – number of pairs for each solvent

(d) = destructive tests – specimens shall not be returned to stock

4.4 Procedures

4.4.1 Quality conformance inspection

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

4.4.2 Qualification approval and its maintenance

This shall consist 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) writers shall use the appropriate BDS pro-forma. The following pages comprise the pro forma BDS dedicated for use with type BNC 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/variant(s) to be covered as indicated. The numbers in brackets on the BDS pro-forma correspond to the following indications which shall be given.

5.2 Identification of the detail specification

(1) The name of the National Standards Organization (NSO) under whose authority the DS is published and, if applicable, the organization from whom the DS is available.

(2) The relevant mark of conformity and the number allotted to the DS by the relevant national or international organization authorizing the DS.

(3) The number and issue number of the IEC/IECQ generic or sectional specification as relevant; also 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) The following details shall be entered.

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 markings: As applicable.

(6) The details of assessment level and climatic category shall be entered.

(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 types (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 taking into account the recommended values of 7.2 in this specification. Deviations from the minimum requirements shall be clearly indicated. Non-applicable parameters 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 as in 7.3 of this specification. Any additional tests 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.