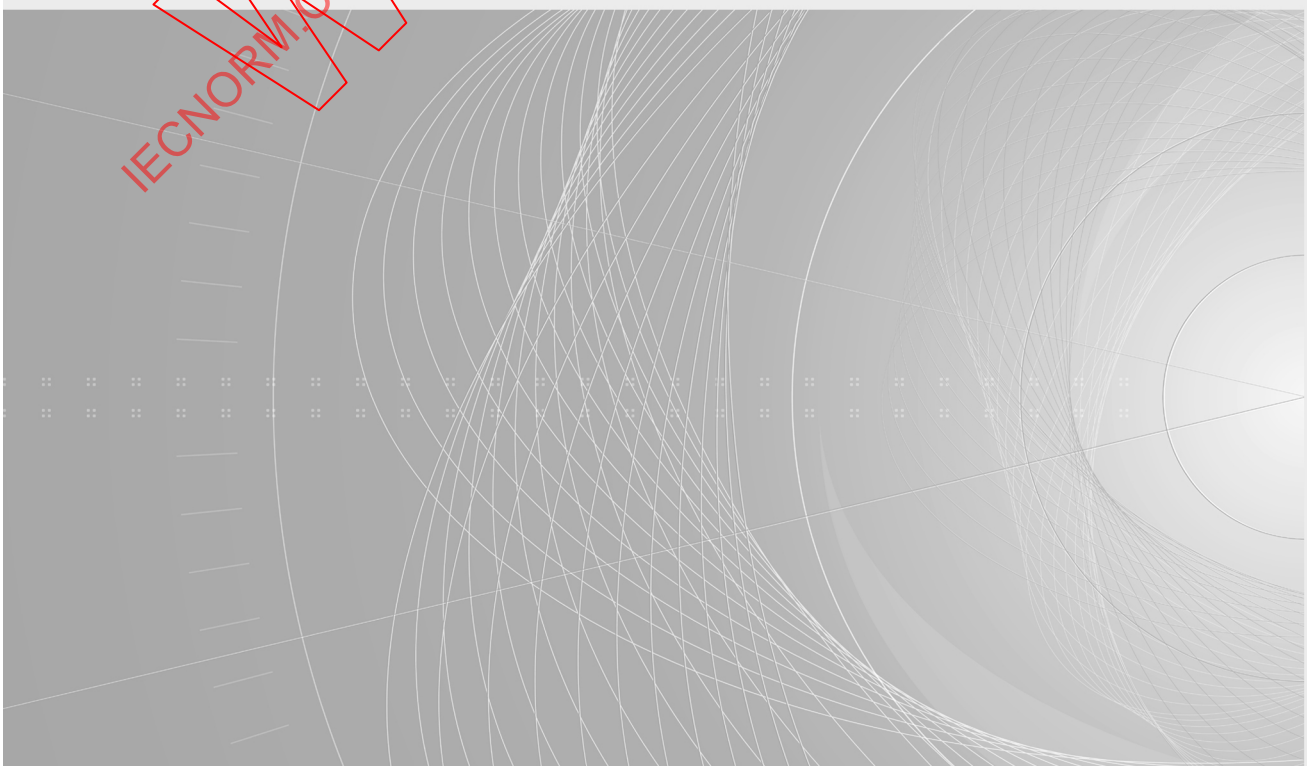
IEC/PAS 61169-41

Edition 1.0 2009-04

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Radio-frequency connectors –
Part 41: Sectional specification for CQA series quick lock R.F. coaxial connectors



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RADIO-FREQUENCY CONNECTORS –

Part 41: Sectional specification for CQA series quick lock R.F. coaxial connectors

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IEC-PAS 61169-41 has been processed 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.

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/100/PAS	46F/112/RVD

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INTRODUCTION

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RADIO-FREQUENCY CONNECTORS –

Part 41: Sectional specification for CQA series quick lock R.F. coaxial connectors

1 Scope

CQA series quick lock connectors with characteristic impedance 50 Ω are used in microwave, telecommunication, wireless and other fields, connecting with RF cables or micro-strips. The operating frequency limit is up to 18 GHz.

This PAS, which is a sectional specification, provides information and rules for preparation of detail specification of CQA series quick lock R.F. coaxial connectors together with the pro-forma blank detail specification.

It also prescribes mating face dimensions for general connectors-grade 2, dimensional detail of standard test connectors-grade 0, gauging information and tests selected from IEC 61169-1 applicable to all detail specifications relating to CQA series RF 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 levers M and H.

A CQA series connector with pin-centre contact can mate with a SMA series connector with socket-centre contact; when mating with a SMA series connector, an adjunct is required. The adjunct should meet the requirements of Annex A.

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)

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

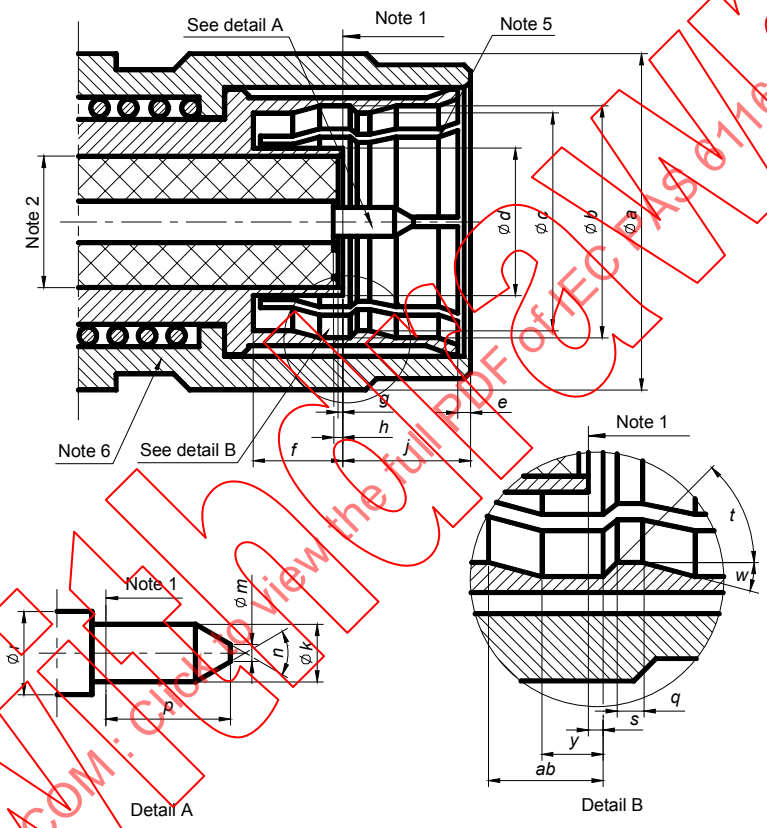
3 Mating face and gauge information

3.1 Dimensions-general connectors – Grade 2

3.1.1 Connector with pin-centre contact

Metric dimension are original dimensions.

All undimensioned pictorial configurations are for reference purpose only.



NOTE For dimensions and notes, see Table 1.

Figure 1 – Connector with pin-centre contact

Table 1 – Dimensions of connector with pin-centre contact

Ref.	mm		Notes
	Min.	Max.	
a	—	10,5	
b	7,25	—	
c	6,8 Nominal		Note 4
d	4,53	4,59	
e	0,25	0,75	
f	3,15	—	Note 3
g	0,00	0,18	
h	0,00	0,25	
j	—	4,02	
k	0,90	0,94	
m	—	0,38	
n	56°	64°	Angle
p	—	2,54	
q	—	0,50	
r	1,27 Nominal		
s	0,47	0,60	
t	45° Nominal		Angle
w	20°		Angle
y	0,60	—	
ab	2,00	—	

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Diameters are chosen upon the assumption that the PTFE dielectric has a dielectric constant of 2,02 to give an impedance of 50 Ω.

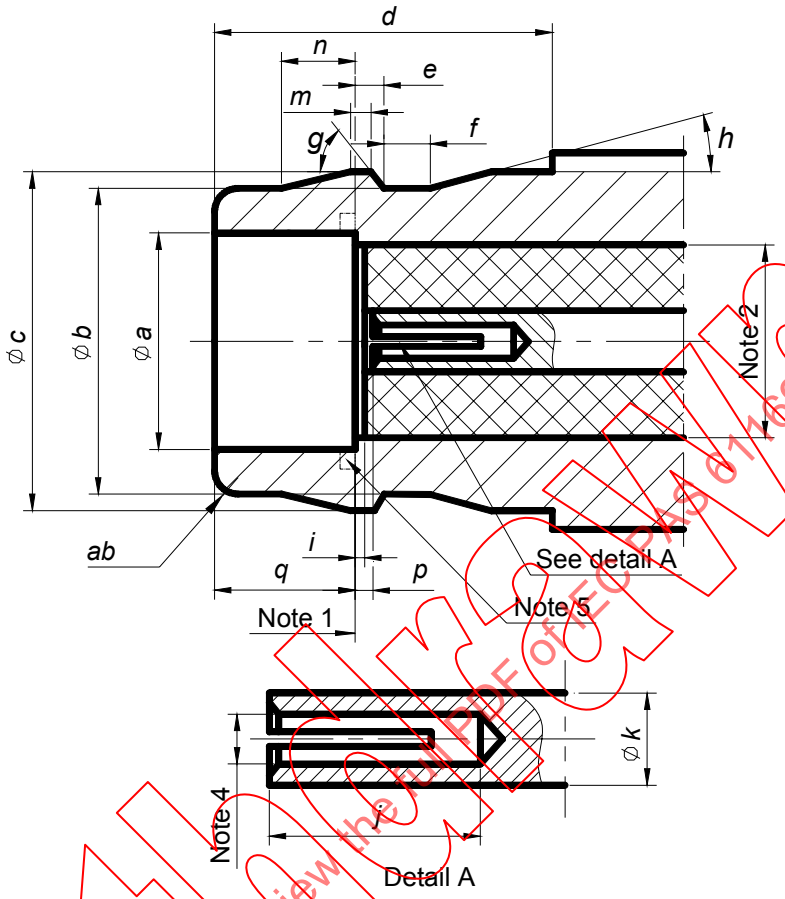
NOTE 3 Dimension *f* should be such that the reference planes coincide and the connectors meet the required electrical and environmental performance.

NOTE 4 Should meet mechanical requirements.

NOTE 5 Design for slotting is optional, and should meet electrical and mechanical performance requirements.

NOTE 6 Outer lock sleeve has a distance of 1,0 mm min. of movement from right to left.

3.1.2 Connector with socket-centre contact



NOTE For dimensions and notes, see Table 2.

Figure 2 – Connector with socket-centre contact

Table 2 – Dimensions of connector with socket-centre contact

Ref.	mm		Notes
	Min.	Max.	
a	4,60	—	
b	6,70	6,90	
c	7,15	7,24	
d	7,50	-	
e	0,32	0,45	
f	0,55	—	
g	60° Nominal		Angle Note 3
h	—	20°	Angle
i	0	0,18	
j	2,82	—	
k	1,27 Nominal		
p	0	0,25	
m	0,25	0,50	
n	1,70	2,00	
q	3,00	3,15	
ab	0,30	0,60	Radius

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Diameters are chosen upon the assumption that the PTFE dielectric has a dielectric constant of 2,02 to give an impedance of 50 Ω.

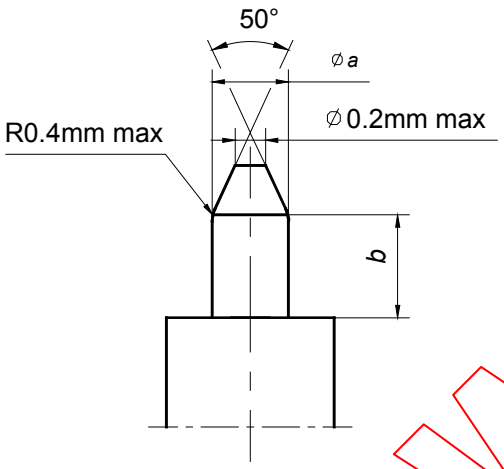
NOTE 3 Should meet mechanical requirements.

NOTE 4 Design for slotting is optional, and should meet electrical and mechanical requirements, when mating with Ø 0,90 mm to Ø 0,94 mm gauge pin.

NOTE 5 Design for root cut is allowed, no chamfer is allowed.

3.2 Gauges

3.2.1 Gauge pins for socket-centre contact



NOTE For dimensions and notes, see Table 3.

Figure 3 – Gauge pins for socket-centre contact

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

Ref.	Gauge A Maximum material for sizing purposes		Gauge B Minimum material for measurement of retention force Mass of gauge: 29 g ± 1 g	
	mm		mm	
	Min.	Max.	Min.	Max.
a	0,940	0,945	0,895	0,900
b	1,27	1,91	1,27	1,91
Material: steel, polished, surface roughness: Ra=0,4 µm maximum				

3.2.2 Test procedure

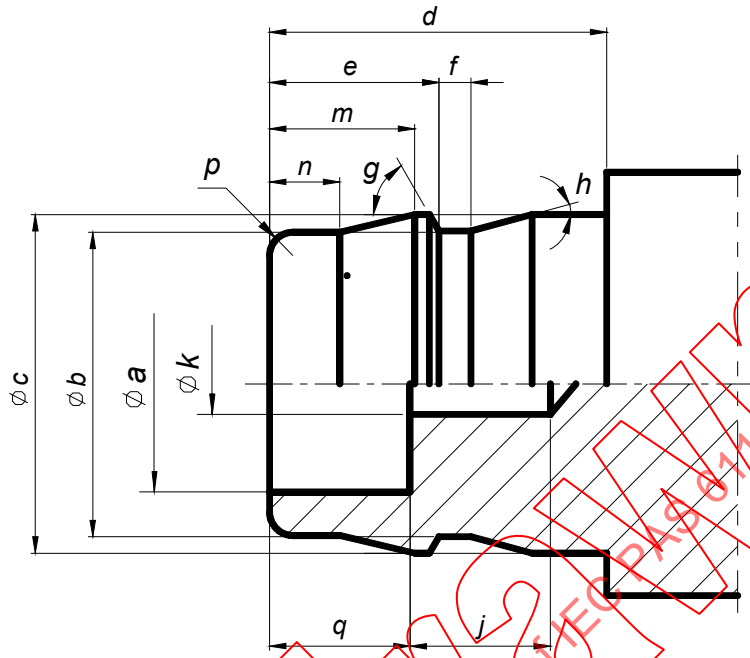
Gauge A shall be inserted into the socket-centre contact three times with a minimum depth of 1,27 mm. This is a sizing operation and should only be carried out when the socket-centre contact is removed from the connector.

After this, gauge B shall be inserted into the socket-centre contact. The contact shall retain the mass of the gauge in a vertical downward position. The test should also be carried out on connector when the socket-centre contact is not removed.

Additional test:

At the conclusion of the tests and if prescribed in the DS, the force necessary to insert gauge A shall be measured. When the additional test is required, the force required shall not exceed 13,3 N.

3.2.3 Gauge pins for outer contact of connector with pin-centre



NOTE For dimensions and notes, see Table 4.

Figure 4 – Gauge pins for outer contact

Table 4 – Gauge pins for outer contact

Ref.	Gauge A Maximum material for sizing purposes		Gauge B Minimum material for measurement of retention force Mass of gauge: 625 g ± 25 g	
	mm		mm	
	Min.	Max.	Min.	Max.
a	4,60	—	4,60	—
b	6,70	6,75	6,85	6,90
c	7,24	7,245	7,145	7,15
d	7,50	—	7,50	—
e	3,48	3,485	3,295	3,30
f	0,55	0,70	0,55	0,70
g	63°	63,5°	56,5°	57°
h	—	20°	—	20°
j	3,50	—	3,50	—
k	1,40	—	1,40	—
m	3,05	3,15	3,05	3,15
n	1,55	1,6	1,40	1,45
p	0,45	0,55	0,45	0,55
q	3,16	—	3,15	—
Material: steel, polished, surface roughness: Ra = 0,4 µm maximum				

3.2.4 Test procedure

Gauge A shall be inserted into the outer contact three times. This is a sizing operation and should only be carried out when the outer contact is removed from the connector.

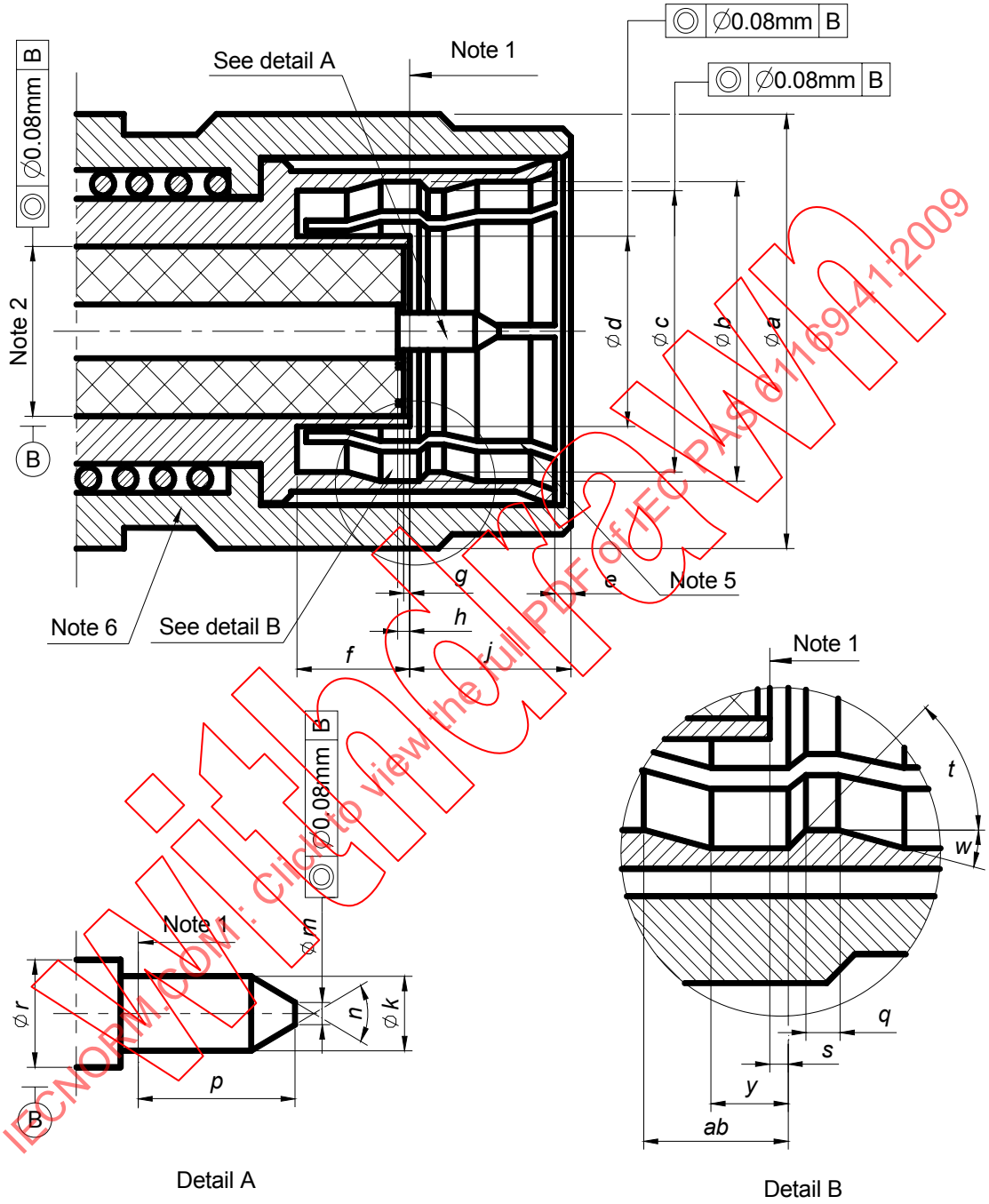
After this, gauge B shall be inserted into the socket-centre contact. The contact shall retain the mass of the gauge in a vertical downward position. The test should be carried out on connector when the outer contact is not removed.

Additional test:

At the conclusion of the tests and if prescribed in the DS, the force necessary to insert gauge A shall be measured. When this additional test is required, the force required shall not exceed 25 N. This test should be carried out on connector when the outer contact is not removed.

3.3 Dimensions- standard test connectors – Grade 0

3.3.1 Connector with pin-centre contact



NOTE For dimensions and notes, see Table 5.

Figure 5 – Connector with pin-centre contact

Table 5 – Dimensions of connector with pin-centre contact

Ref.	mm		Notes
	Min.	Max.	
a	—	10,5	
b	7,25	7,28	
c	6,75	6,85	Note 4
d	4,53	4,59	
e	0,25	0,75	
f	3,15	—	Note 3
g	0	0,05	
h	0	0,076	
j	—	4,02	
k	0,90	0,927	
m	—	0,38	
n	50°		Angle
p	2,03	2,29	
q	0,45	0,50	
r	1,27 nominal		Note 2
s	0,50	0,57	
t	45° nominal		Angle
w	20°		Angle
y	0,60	—	
ab	2,00	—	

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Diameters are chosen upon the assumption that the PTFE dielectric has a dielectric constant of 2,02 to give an impedance of 50 Ω ± 0,5 Ω.

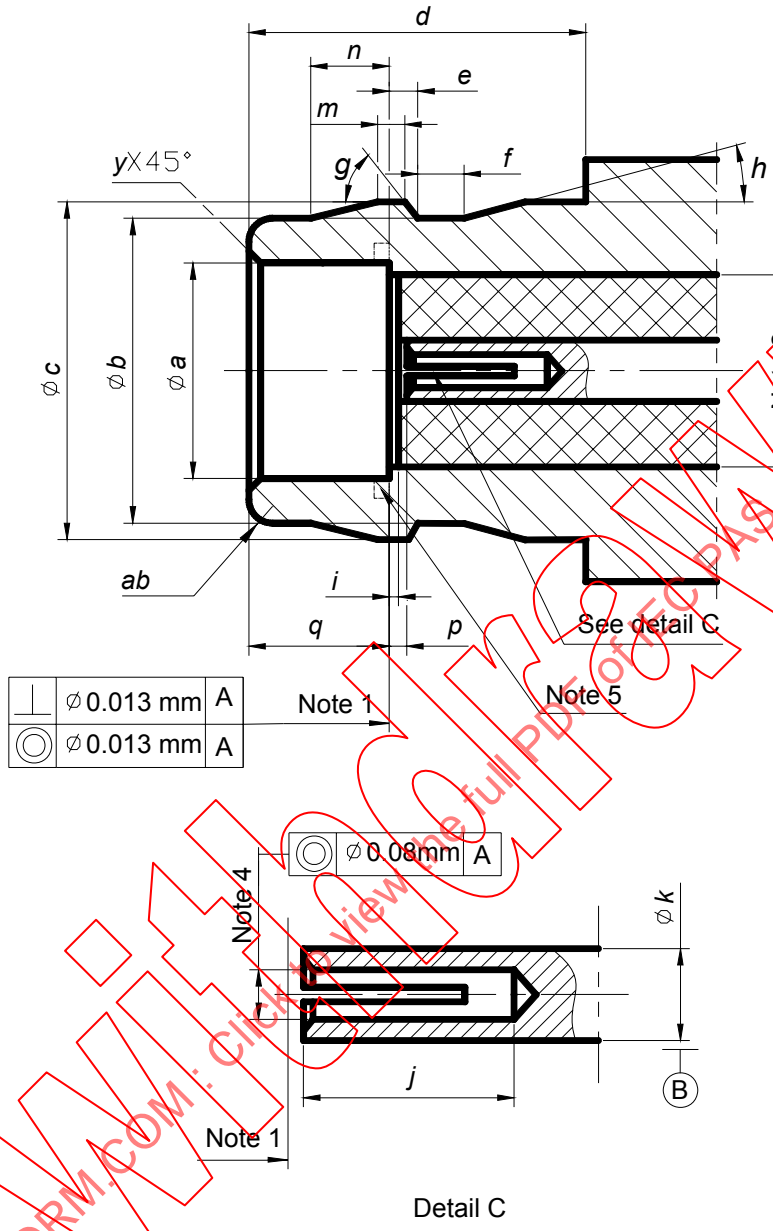
NOTE 3 Dimension *f* should be such that the reference planes coincide and the connectors meet the required electrical and environmental performance.

NOTE 4 Should meet electrical and mechanical performance requirements.

NOTE 5 Design for slotting is optional, and should meet electrical and mechanical performance requirements.

NOTE 6 Design for spring is optional, and should meet the requirement of outer lock sleeve having a axial movement distance of 1,0 mm min.

3.3.2 Connector with socket-centre contact



NOTE For dimensions and notes, see Table 6.

Figure 6 – Connector with socket-centre contact

Table 6 – Dimensions of connector with socket-centre contact

Ref.	mm		Notes
	Min.	Max.	
a	4,60	4,67	
b	6,75	6,85	
c	7,18	7,22	
d	7,50	—	
e	0,32	0,45	
f	0,55	—	
g	60°		Angle Note 3
h	—	20°	Angle
i	—	0,05	
j	2,82	—	
k	1,27 Nominal		Note 2
m	0,25	0,50	
n	1,70	2,00	
p	—	0,076	
q	3,01	3,06	
y	—	0,25	
ab	0,45	0,55	Radius

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Diameters are chosen upon the assumption that the PTFE dielectric has a dielectric constant of 2,02 to give an impedance of 50 Ω ± 0,5 Ω.

NOTE 3 Should meet mechanical requirements.

NOTE 4 Design for slotting is optional, and should meet electrical and mechanical requirements, when mating with Ø 0,914 mm ± 0,002 5 mm gauge pin.

NOTE 5 Design for root cut is allowed, no chamfer is allowed.

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 CQA series R.F. coaxial 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

Rating and characteristics	Test method IEC 61169-1 Subclause	Values	Remarks deviations from standard test method
Electrical			
Nominal impedance		50 Ω	
Frequency range			
Grade 2 connectors			
- flexible cable, straight styles		Up to 12,4 GHz	Or upper frequency limit of cable
- semi-rigid and semi-flexible cable straight styles		Up to 18 GHz	
- right-angle styles		Up to 12,4 GHz	
Reflection factor [1]	9.2.1		
Grade 2 connectors		DC to 6 GHz	
- straight styles		0,069 8 max.	
		6 GHz to 12,4 GHz	
		0,111 1 max.	
		12,4 GHz to 18 GHz	
		0,166 7 max.	
- right-angle styles		See DS	
- component mounting styles		See DS	
- solder bucket and PCB mounting styles		See DS	
Centre contact resistance [2]	9.2.3		
- initial		≤ 3,0 mΩ	
- after conditioning		≤ 6,0 mΩ	
Outer conductor continuity [2]	9.2.3		
- initial		≤ 2,0 mΩ	
- after conditioning		≤ 5,0 mΩ	
Insulation resistance [2]	9.2.5		
- initial		≥ 5 000 MΩ	
- after conditioning		≥ 200 MΩ	
Proof voltage at sea-level [3][4]	9.2.6		
- uncabled styles		1 000 V	
- 96IEC50-3 cable		1 000 V	
- 96IEC50-2 cable		750 V	
- 96IEC50-1 cable		500 V	
- semi-rigid and semi-flexible 0,141 in (3,58 mm) diameter		1 000 V	
- semi-rigid and semi-flexible 0,086 in (2,16 mm) diameter		750 V	
Proof voltage at 4,4 kPa [3][4]	9.2.6		
-uncabled styles		200 V	4,4 kPa approximately equivalent to 20 km
- 96IEC50-3 cable		200 V	
- 96IEC50-2 cable		150 V	
- 96IEC50-1 cable		100 V	
- semi-rigid and semi-flexible 0,141 in (3,58 mm) diameter		200 V	
		150 V	

Rating and characteristics	Test method IEC 61169-1 Subclause	Values	Remarks deviations from standard test method
- semi-rigid and semi-flexible 0,086 in (2,16 mm) diameter			
Environmental test voltage at sea level[3)4)]	9.2.6		
- uncabled styles		480 V	
- 96IEC50-3 cable		480 V	
- 96IEC50-2 cable		350 V	
- 96IEC50-1 cable		170 V	
- semi-rigid and semi-flexible 0,141 in (3,58 mm) diameter		480 V	
- semi-rigid and semi-flexible 0,086 in (2,16 mm) diameter		250 V	
Environmental test voltage at 4,4 kPa[3)4)]	9.2.6		
- uncabled styles		85 V	4,4 kPa approximately equivalent to 20 km
- 96IEC50-3 cable		85 V	
- 96IEC50-2 cable		65 V	
- 96IEC50-1 cable		45 V	
- semi-rigid and semi-flexible 0,141in (3,58 mm) diameter		85 V	
- semi-rigid and semi-flexible 0,086 in (2,16 mm) diameter		65 V	
Screening effectiveness (straight cables only)[7)]	9.2.8	≥ 80 dB at 1 GHz	
Discharge test (corona effect)	9.2.9	See DS	Extinction voltage
Mechanical			
Gauge retention force (resilient contacts)	9.3.4		
- centre		≥ 0,28 N	
- outer[8)]		See DS	
Centre contact captivation	9.3.5		
- axial force		≤ 26,7 N	Maximum displacement 0,25 mm in each direction
- torque		≤ 0,028 N · m	
Engagement and separation force and torques	9.3.6		
- engagement force		≤ 25 N	
- separation force		≥ 20 N	
Technical tests on cable fixing			
- cable rotation (nutation)	9.3.7.2	See DS	
- cable pulling	9.3.8	See DS	
- cable bending	9.3.9	See DS	
- cable torsion	9.3.10	See DS	
Tensile strength of coupling mechanism	9.3.11	≥150 N	
Bending moment	9.3.12	na[6)]	
Vibration	9.3.3	150 m/s^2	15 g_n
		10 Hz ~2 000 Hz	

Rating and characteristics	Test method IEC 61169-1 Subclause	Values	Remarks deviations from standard test method
Shock	9.3.14	500 m/s^2 1/2 sine wave 11 ms	50 g_n
Environmental			
Climatic category	9.4.2	Climatic category A: 40/085/21 Climatic category 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	≤ 1 Pa · cm^3/s	100 kPa to 110 kPa differential
Salt mist	9.4.6	48 h spray	
Endurance			
Mechanical endurance	9.5	200 operations	
High temperature endurance [5)]	9.6	Climatic category A: 1 000 h at 85 °C Climatic category B: 1 000 h at 125 °C	

1) These values apply to 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 specified.

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 and semi-flexible cables are used, the upper temperature is limited to 115 °C maximum.

6) na -not applicable

7) When interfaces are fully mated.

8) For this value to rely on a certain outer contact configuration, the value reference should always be made to the actual values given in the detail specification, and should not influence the requirement of engagement and separation force.

4.3 Test schedule and inspection requirements – Acceptance tests

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	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	II	0,025	
Voltage proof	9.2.6	a	S-4	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 symbols, abbreviations and procedures, see the end of Table 9.									

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[1)]	Period	Test required	Number of specimens	Permitted failures per group[1)]	Period
Group D1 (d) Solderability - connector assemblies	9.3.2.1.1	ia	6	1	3 years	ia	3	1	3 years
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								
Bending moment	9.3.12	a				a			
Strength of coupling mechanism	9.3.11	ia				ia			

	Test method IEC61169-1 Subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group[1)]	Period	Test required	Number of specimens	Permitted failures per group[1)]	Period
Group D2 (d) Contact resistance	9.2.3	a	6	1	3 years	a	3	1	3 years
Outer conductor and screen continuity Centre conductor continuity	9.2.3								
Bump	9.3.13	na				na			
Vibration	9.3.3	a				a			
Shock	9.3.14	a				a			
Damp heat, steady state	9.4.3	a				a			
Salt mist	9.4.6	a				a			
Group D3 Dimensions piece part and materials	9.1.3.2	a	1[2)]	1	3 years	a	1[2)]	1	3 years
Group D4 (d) Mechanical endurance	9.5	a	6	1	3 years	a	3	1	3 years
High temperature endurance	9.6	a				a			
Sulphur dioxide	9.4.8	na				na			

	Test method IEC61169-1 Subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group[1)]	Period	Test required	Number of specimens	Permitted failures per group[1)]	Period
Group D5 (d) Reflection factor	9.2.1	a	6	1	3 years	a	3	1	3 years
Screening effectiveness	9.2.8	a				a			
Water immersion	9.2.7	ia				ia			
Group D6 (d) Contact captivation	9.3.5	ia	6	1	3 years	ia	3	1	3 years
Discharge test (corona effect)	9.2.9	a				a			
Rapid change of temperature	9.4.4	a				a			
Climatic sequence	9.4.2	a				a			
Group D7 (d) Resistance to solvents and contaminating fluids	9.7	na	1[3)]	1	3 years	na	1[3)]	1	3 years

1) For qualification approval, a total of 2 failures only is permitted for level H and 1 failure only for level M from groups D1 to D7.

2) One set of piece parts for each style and variant unless using common piece parts.

3) Group D7 - number of pairs for each solvent.

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.

4.4 Procedures

4.4.1 Quality conformance inspection

This shall consist of test group 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) writers shall use the appropriate BDS pro-forma. The following pages comprise the pro-forma BDS dedicated for use with 50 Ω type SSMA connectors. It already contains 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 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 markings: As applicable.

(6) Enter details 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 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.

5.3 Performance

(9) Performance data listing the most important characteristics of the connector taking into account the recommended values in 4.2 of this specification. Deviations from the minimum requirements shall be clearly indicated. Non-applicable parameters shall be marked ‘na’.

5.4 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.

5.5 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 4.3 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.