

Radio-frequency connectors RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling — Characteristic impedance 50 ohms (75 ohms) (Type N)

ICS 33.120.30

Committees responsible for this British Standard

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- AEA Technology
- BEAMA Electrical Cable and Conductor Accessory Manufacturers
- British Non-Ferrous Metals Federation
- British Telecommunications plc
- Federation of the Electronics Industry
- Ministry of Defence
- National Supervisory Inspectorate
- Society of Cable Television Engineers

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National foreword

This British Standard has been prepared by Subcommittee EPL/46/2 and is identical with IEC 169-16:1982 *Radio-frequency connectors — Part 16: RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling — Characteristic impedance 50 ohms (75 ohms) (Type N)*, including Amendment 1:1996, published by the International Electrotechnical Commission (IEC). IEC 169-16 also designated QC 222100, is a harmonized specification within the IEC Q system for electronic components of assessed quality.

For ease of reproduction some of the text of the French version of this international standard has been retained. References to IEC page numbers in the text should be ignored.

Cross-references

Publication referred to ^a	Corresponding British Standard
IEC 68	BS EN 60068 <i>Environmental testing</i>
IEC 169-1	BS 2011 <i>Environmental testing</i>
	BS 3041 <i>Radio-frequency connectors</i>
	BS 3041-1:1977 <i>Specification for general requirements and measuring methods</i>
IEC 1169-1	BS EN 61169 <i>Radio-frequency connectors</i>
(QC 220000)	BS EN 61169-1:1996 <i>Generic specification. General requirements and measuring methods</i>

^a Undated in text.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 28, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This standard concerns pin and socket r.f. coaxial connectors, with screw coupling mechanism, for low to medium power applications. The connector is commonly known as the "Type N".

Three versions of the 50 Ω characteristic impedance Type N connector are included, each version being mateable with each of the others.

The general purpose connector (Grade 2) derived from the United States of America specifications MIL-C-71B and MIL-C-39012 may preferably be used with r.f. cable 96 IEC 50-7 up to about 12 GHz maximum frequency.

The high performance connector (Grade 1) is particularly suitable for microwave applications when lower reflection factors than are offered by the General purpose connector are required. The connectors may also be suitable for microwave components. The tolerances of the interface dimensions lie between those for Grade 0 and Grade 2, and are chosen to give the performance required. Some Grade 1 connectors conforming to this standard may be used up to 18 GHz maximum frequency.

The standard test connector (Grade 0) has a closely controlled interface to provide a reference for the measurement of connectors, cable assemblies, components and equipment with the above two interfaces. It may also be used as a microwave connector in situations when the most precise interface for use up to 18 GHz maximum frequency is required.

A 75 Ω characteristic impedance connector is given in Appendix A even though the use of 75 Ω Type N connectors is strongly deprecated.

Accidental cross-coupling of 75 Ω with 50 Ω connectors can destructively damage the 75 Ω version, but in view of the extensive use of a number of marginally different 75 Ω versions, the interface now given provides common design guidance. 75 Ω connectors should be clearly identified.

2 IEC type designation

Connectors conforming to this standard shall be designated by:

- a) the reference to this standard: 169-16 IEC;
- b) characteristic impedance: 50 Ω (75 Ω);
- c) number of the grade:
 - Grade 0 = standard test connector = G 0;
 - Grade 1 = high performance connector = G 1;
 - Grade 2 = general purpose connector
 - if Grade 2 is required, no grade designation is necessary.

d) a group of figures specifying the climatic category (see Clause 4).

Example:

169-16 IEC-50-G 0 denotes a standard test connector, Type N, 50 Ω .

3 Ratings

The r.f. connectors defined in this standard are designed for use with a variety of coaxial braided and semi-rigid cables and rigid lines.

3.1 Grade 2 — General purpose connectors

This grade is preferably used with 7 mm braided coaxial cable 96 IEC 50-7, but varieties are available for both larger and smaller cables and for semi-rigid cables. Connectors shall not introduce a reflection factor greater than 0.13 at frequencies up to 11 GHz, or approximately 80 % of the upper cutoff frequency of the cable, whichever is lower. The reflection factor shall be not more than 0.03 at 1 GHz.

3.2 Grade 1 — High performance connectors

Grade 1 connectors are intended particularly for use with semi-rigid cables and rigid lines, but may also be used with braided cables and microwave components. They will exhibit reflection factors less than the reflection factor of Grade 2 connectors of the same configuration (pattern). The reflection factor and frequency range, which may be up to 18 GHz, shall be agreed between purchaser and manufacturer. The best achievable limit for the reflection factor is deemed to be defined by the equation $r_{\max} = 0.005 + 0.003 f$, where f is the frequency in gigahertz.

3.3 Grade 0 — Standard test connector

This grade is preferably used with 7 mm rigid lines such as are recommended in IEC

Publication 457: Rigid Precision Coaxial Lines and Their Associated Precision Connectors. It may also be possible, on rigid lines and other test equipment, to exchange connectors of this grade for connectors recommended in IEC

Publication 457-2-2:50 ohm 7 mm Rigid Precision Coaxial Line and Associated Hermaphroditic Precision Coaxial Connector.

The maximum reflection factor of a connector at frequencies up to 18 GHz shall be not greater than $0.0015 + 0.001 f$, where f is the frequency in gigahertz.

4 Climatic categories (see IEC

Publication 68: Basic Environmental Testing Procedures)

Under consideration.

5 Dimensions — Connecteurs d’usage général — Niveau 2

Les dimensions en inches sont les dimensions originales.

NOTE Les valeurs des dimensions en millimètres dérivées des dimensions en inches ne sont pas nécessairement exactes (conformément à la Norme ISO 370: Dimensions tolérées. Conversion d’inches en millimètres et réciproquement), mais elles doivent être considérées comme acceptables par rapport aux valeurs initiales.

Toutes les représentations non cotées ne sont données qu’à titre de référence.

5.1 Connecteur avec contact central mâle

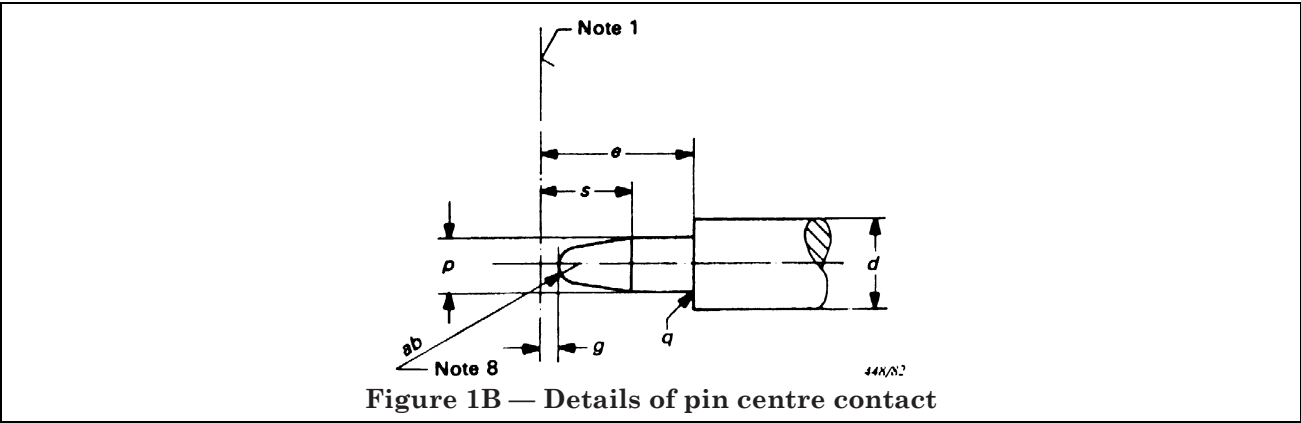
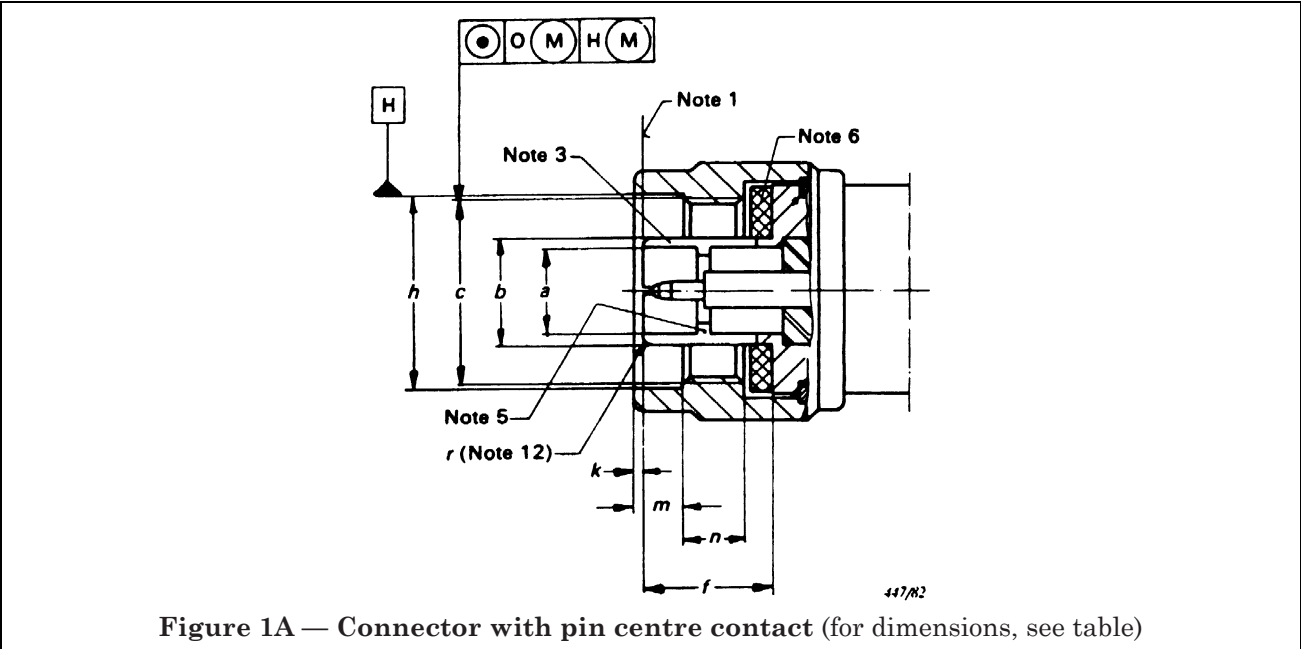
5 Dimensions — General purpose connectors — Grade 2

Inch dimensions are original dimensions.

NOTE The values for dimensions in millimetres derived from those in inches are not necessarily exact (according to ISO Standard 370: Toleranced dimensions — Conversion from inches into millimetres and vice versa), but they are to be considered as acceptable alternatives to the original values.

All undimensioned pictorial configurations are for reference purposes only.

5.1 Connector with pin centre contact



Réf. Ref.	mm		inches		Note
	Min.	Max.	Min.	Max.	
<i>a</i>	7,00 nom.		0,2756 nom.		2, diam.
<i>b</i>	—	8,027	—	0,316	3/14, diam.
<i>c</i>	—	—	5/8-24 UNEF-2B		4
<i>d</i>	3,04 nom.		0,120 nom.		2, diam.
<i>e</i>	5,33	—	0,210	—	6
<i>f</i>	9,25	—	0,364	—	
<i>g</i>	0,0	1,57	0,0	0,062	
<i>h</i>	16,0	—	0,630	—	14, diam.
<i>k</i>	0,41	1,52	0,016	0,060	11
<i>m</i>	4,013	4,267	0,158	0,168	
<i>n</i>	4,5	—	0,177	—	12
<i>p</i>	1,600	1,676	0,063	0,066	
<i>q</i>	—	0,1	—	0,004	
<i>r</i>	0,15	—	0,006	—	12
<i>s</i>	2,79	3,56	0,110	0,140	
<i>ab</i>	—	0,64	—	0,025	8, myon/rad.

NOTE 1 Plan de référence mécanique et électrique.

NOTE 2 Diamètre du contact extérieur et central afin d'obtenir l'impédance caractéristique nominale de 50 Ω et satisfaire aux prescriptions concernant les performances électriques.

NOTE 3 Fentes ou autres formes d'élasticité facultatives. Lorsqu'il n'y a pas de fente, la dimension donnée *b* est obligatoire. Lorsqu'il y a une fente, il convient que la dimension *b* ne dépasse pas 8,38 mm (0,330 in). Pour les prescriptions concernant le calibrage, voir paragraphe 6.1.1.

NOTE 4 Filetage 5/8 — 24 UNEF — 2B (conformément à la Norme ISO 263).

NOTE 5 Compensation facultative de l'inductance du jeu du conducteur intérieur, pour une paire de connecteurs accouplés.

NOTE 6 Les dimensions sont données lorsqu'il n'y a pas de joint d'étanchéité. Si l'étanchéité est prescrite, il convient que la dimension *f* (Figure 1) soit modifiée de telle façon qu'avec le joint une pression correcte soit appliquée à la face avant (dimensions *w* et *x*) du connecteur femelle (Figure 2) et qu'une bonne étanchéité soit assurée.

NOTE 8 Rayon, ou chanfrein, forme du cône à choisir, plat maximal admissible 0,25 mm (0,010 in).

NOTE 11 S'applique lorsque l'écrou est positionné en avant.

NOTE 12 Forme extérieure du bord du contact extérieur à choisir, mais il convient que le connecteur satisfasse aux performances électriques et mécaniques.

NOTE 14 Il convient que les diamètres *b*, *h* et *p* et le filetage *c* soient calibrés pour s'assurer que sur MMC chaque caractéristique est correcte et peut avoir un axe commun.

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Diameter of outer and centre contact to provide nominal (50 Ω) characteristic impedance to meet electrical performance requirements.

NOTE 3 Slots or other forms of resilience optional. If not slotted, indicated dimension *b* is compulsory. In case of slotting, dimension *b* should not exceed 8.38 mm (0.330 in). Gauging requirements (see Sub-clause 6.1.1) to be met.

NOTE 4 Thread 5/8 — 24 UNEF — 2B (according to ISO Standard 263).

NOTE 5 Compensation for inductance of inner conductor gap in mated pair of connectors optional.

NOTE 6 Dimensions given assume no sealing gasket fitted. If sealing is required, dimension *f* (Figure 1) should be arranged so that with the gasket chosen adequate pressure is applied to the front face (dimensions *w* and *x*) of the socket connector (Figure 2) to ensure adequate sealing.

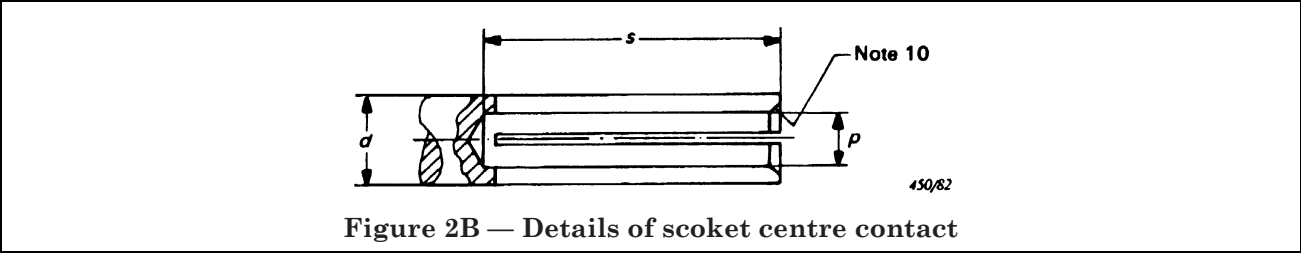
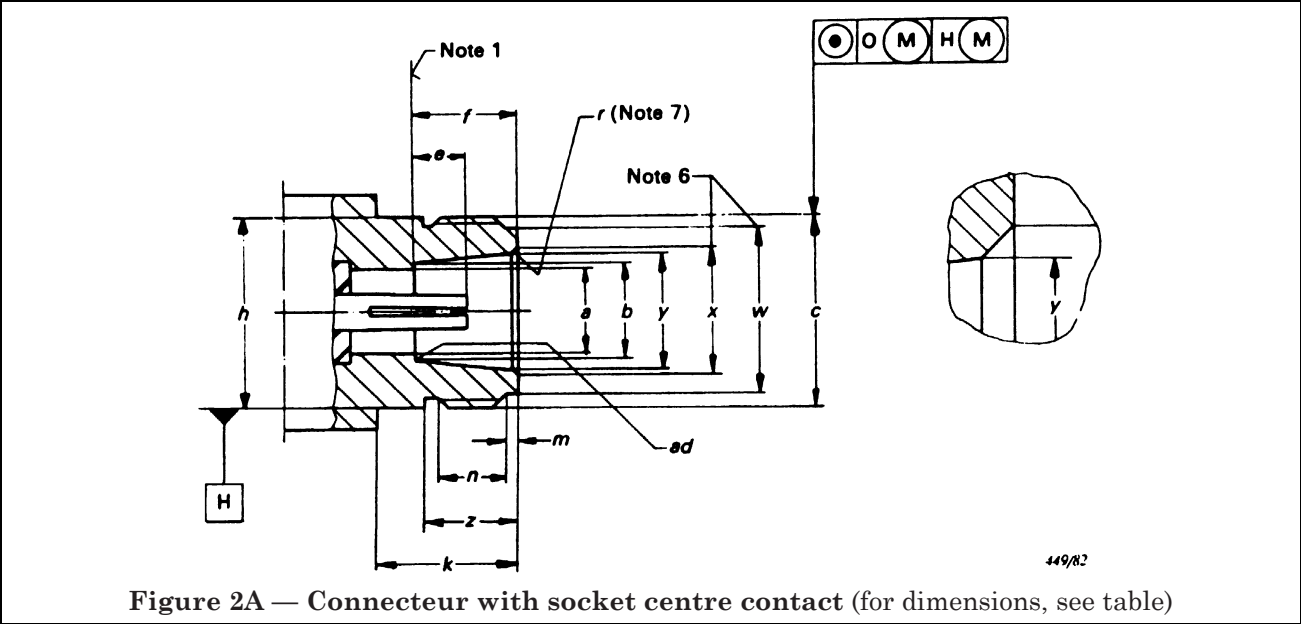
NOTE 8 Radius or chamfer, shape of tip optional. 0.25 mm (0.010 in) maximum flat permitted.

NOTE 11 Applies with nut biased forward.

NOTE 12 External form of leading edge of outer contact optional, but connector should meet electrical and mechanical performance requirements.

NOTE 14 Diameters *b*, *h* and *p* and thread *c* should be gauged to ensure that on MMC each feature is on or can take up a common axis.

5.2 Connecteur avec contact central femelle 5.2 Connector with socket centre contact



Réf. Ref.	mm		inches		Note
	Min.	Max.	Min.	Max.	
<i>a</i>	—	7,06	—	0,278	2, diam.
<i>b</i>	8,027	8,13	0,316	0,320	diam.
<i>c</i>	—	—	5/8-24 UNEF-2A		4
<i>d</i>	3,04 nom.		0,120 nom.		2, diam.
<i>e</i>	4,75	5,26	0,187	0,207	
<i>f</i>	9,05	9,19	0,356	0,362	
<i>h</i>	—	15,93	—	0,627	diam.
<i>k</i>	10,72	—	0,422	—	
<i>m</i>	1,19	1,96	0,047	0,077	
<i>n</i>	4,37	—	0,172	—	13
<i>p</i>	—	—	—	—	10, diam.
<i>r</i>	—	1,2	—	0,047	7
<i>s</i>	5,33	—	0,210	—	
<i>w</i>	—	—	—	—	6, diam.
<i>x</i>	—	—	—	—	6, diam.
<i>y</i>	8,53	8,74	0,336	0,344	diam.
<i>z</i>	6,76	—	0,266	—	
<i>ad</i>	—	0,13	—	0,005	rayon/rad.

NOTE 1 Plan de référence mécanique et électrique.

NOTE 2 Diamètre nominal intérieur du conducteur extérieur 7,0 mm (0,2756 in). Diamètre du contact extérieur et central afin d'obtenir l'impédance caractéristique nominale de 50 Ω et satisfaire aux prescriptions concernant les performances électriques.

NOTE 4 Filetage 5/8 — 24 UNEF — 2A (conformément à la Norme ISO 263).

NOTE 6 Si l'étanchéité est prescrite, il convient que la dimension *f* (Figure 1) soit modifiée de telle façon qu'avec le joint une pression correcte soit appliquée à la face avant (dimensions *w* et *x*) du connecteur femelle (Figure 2) et qu'une bonne étanchéité soit assurée.

NOTE 7 Royon destiné uniquement à assurer une étanchéité satisfaisante; en cas d'utilisation d'un chanfrein, il ne doit pas engager la matière par rapport à la cote minimale avec rayon.

NOTE 10 Forme du contact central à choisir. Il convient cependant de satisfaire aux prescriptions de calibrage du paragraphe 6.1.2 et aux prescriptions concernant le facteur de réflexion correspondant de l'article 3 en utilisant un connecteur de classe 0 conformément à la Figure 5.

NOTE 13 S'applique à la longueur du filetage et non à la dépouille.

NOTE 1 Mechanical and electrical reference plane.

NOTE 2 Nominal inner diameter of outer conductor 7.0 mm (0.2756 in). Diameter of outer and centre contact to provide nominal (50 Ω) characteristic impedance to meet electrical performance requirements.

NOTE 4 Thread 5/8 — 24 UNEF — 2A (according to ISO Standard 263).

NOTE 6 If sealing is required, dimension *f* (Figure 1) should be arranged so that with the gasket chosen, adequate pressure is applied to the front face (dimensions *w* and *x*) of the socket connector (Figure 2) to ensure adequate sealing.

NOTE 7 Radius only to ensure satisfactory sealing, but if chamfer is used it should not encroach into minimum material condition of the design using the radius.

NOTE 10 Centre contact design is optional. It should however meet the gauging requirements of Sub-clause 6.1.2 and relevant reflection factor requirements of Clause 3 using Grade 0 connector in accordance with Figure 5.

NOTE 13 Applies to length of thread and not undercut.

6 Calibres et connecteurs de référence

6.1 Calibres mécaniques

6.1.1 Connecteurs avec contact central mâle

6.1.1.1 Calibre pour contact extérieur du connecteur mâle

6 Gauges and standard test connectors

6.1 Mechanical gauges

6.1.1 Connectors with pin centre contact

6.1.1.1 Gauge for outer contact of pin connector

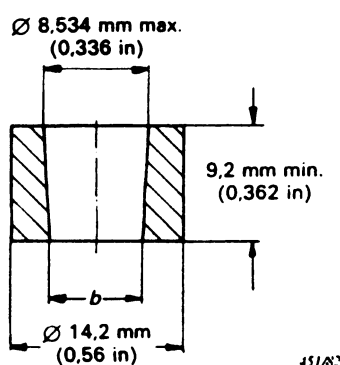


FIG. 3a

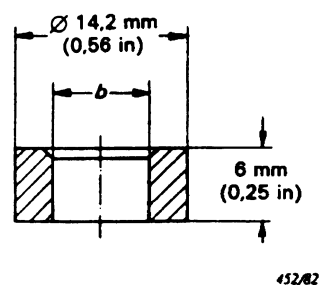


FIG. 3b

Figure 3 — Gauge rings for outer contact of pin connector

Pour les contacts extérieurs fendus, un anneau en acier (Figure 3a ci-dessus) de diamètre intérieur b de 8,027 mm (0,316 in) max., doit être placé sur le contact extérieur électrique du connecteur.

Force d'insertion: 113 N max.

C'est une opération de calibrage.

Après cette opération, un anneau en acier (Figure 3b) avec un diamètre intérieur b de 8,23 mm (0,324 in) doit être placé sur le contact électrique extérieur. Tous les doigts du contact doivent toucher le diamètre b dans la région des extrémités.

La force minimale de retenue doit être de 2 N.

Masse recommandée du calibre: 200 g.

Le calibre retourné en position verticale doit être maintenu.

For slotted outer contacts, a steel test ring (Figure 3a above) with an inner diameter b of 8.027 mm (0.316 in) max. shall be placed over the outer electrical contact of the connector.

Insertion force: 113 N max.

This is a sizing operation.

After this a steel test ring (Figure 3b) with an inner diameter b of 8.23 mm (0.324 in) shall be placed over the outer electrical contact. All contact fingers shall touch the diameter b in the region of the tip ends.

The minimum withdrawal force shall be 2 N.

Recommended mass of the gauge: 200 g.

The gauge shall be retained in a vertical downward position.

6.1.2 Connecteurs avec contact central femelle

6.1.2.1 Broches mâles de calibrage et d'essai pour les contacts centraux femelles

6.1.2 Connectors with socket centre contact

6.1.2.1 Gauge and test pins for socket centre contact

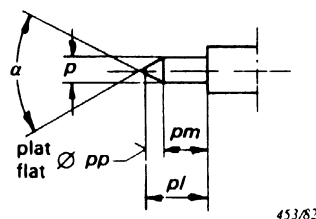


Figure 4 — Gauge and test pins for socket centre contact. The pins to be made of steel

Réf. Ref.	Broche/Pin n° 1				Broche/Pin n° 2			
	mm		inches		mm		inches	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<i>pl</i>	—	5,33	—	0,210	—	5,33	—	0,210
<i>pm</i>	3,18	—	0,125	—	3,18	—	0,125	—
<i>pp</i>	—	0,25	—	0,01	—	0,25	—	0,01
<i>p</i>	1,676 ^{+0,005} _{−0}		0,0660 ^{+0,002} _{−0}		1,660 ⁺⁰ _{−0,005}		0,0630 ⁺⁰ _{−0,0002}	
<i>a</i>	38° ± 2°				38° ± 10°			

NOTE Le fini de surface de la partie cylindrique de longueur *pm* sera de $0,4 \mu\text{m}$ ($16 \mu\text{in}$) pour la broche n° 2 dont la masse recommandée est de 56 g.

6.1.2.2 Séquence d'essai

La séquence d'essai comporte les opérations suivantes:

- a) Calibrage: Insérer une fois la broche n° 1.
- b) Force d'insertion: Insérer encore une fois la broche n° 1, effort d'insertion 9 N maximum.
- c) Rétention: Insérer une fois la broche n° 2, effort de rétention 0,56 N minimum.

NOTE Test pin No. 2 shall have a $0,4 \mu\text{m}$ ($16 \mu\text{in}$) finish on the cylindrical surface of length *pm*. It is recommended that this pin has a mass of 56 g.

6.1.2.2 Test sequence

The test sequence consists of:

- a) Gauging: Insert pin No. 1 once.
- b) Insertion force: When inserting pin No. 1 once more: the insertion force shall at maximum be 9 N.
- c) Retaining: Insert pin No. 2 once: the retention force shall at minimum be 0,56 N.