

Connectors for electronic equipment —

**Part 2-101: Circular connectors —
Detail specification for circular
connectors M8 with screw- or
snap-locking, M12 with screw-locking
for low voltage applications**

ICS 31.220.10

National foreword

This British Standard is the UK implementation of EN 61076-2-101:2003+A1:2006. It is identical with IEC 61076-2-101:2003, incorporating amendment 1:2006. It supersedes BS EN 61076-2-101:2003 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The UK participation in its preparation was entrusted by Technical Committee EPL/48, Electromechanical components and mechanical structures for electronic equipment, to Subcommittee EPL/48/2, Connectors for electronic equipment.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English version

Connectors for electronic equipment
Part 2-101: Circular connectors –
Detail specification for circular connectors
M8 with screw- or snap-locking,
M12 with screw-locking for low voltage applications
(IEC 61076-2-101:2003)

Connecteurs pour équipements
électroniques
Partie 2-101: Connecteurs circulaires -
Spécification particulière pour
les connecteurs circulaires M8 à vis
ou à encliquetage, M12 à vis
pour applications basse tension
(CEI 61076-2-101:2003)

Steckverbinder für elektronische
Einrichtungen
Teil 2-101: Rundsteckverbinder -
Bauartspezifikation für
Rundsteckverbinder M8 mit Schraub-
oder Rastverriegelung und M12
mit Schraubverriegelung für
Niederspannungsanwendungen
(IEC 61076-2-101:2003)

This European Standard was approved by CENELEC on 2003-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 48B/1362/FDIS, future edition 1 of IEC 61076-2-101, prepared by SC 48B, Connectors, of IEC TC 48, Electromechanical components and mechanical structures for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61076-2-101 on 2003-12-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-12-01

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given for information only. In this standard, annex ZA is normative and annex A is informative. Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61076-2-101:2003 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 48B/1591/FDIS, future amendment 1 to IEC 61076-2-101:2003, prepared by SC 48B, Connectors, of IEC TC 48, Electromechanical components and mechanical structures for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61076-2-101:2003 on 2006-02-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2006-11-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2009-02-01

Endorsement notice

The text of amendment 1:2006 to the International Standard IEC 61076-2-101:2003 was approved by CENELEC as an amendment to the European Standard without any modification.

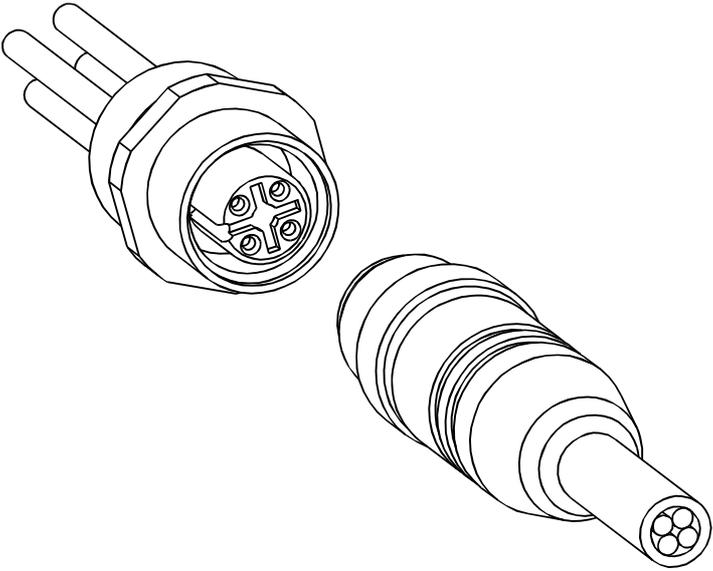
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**CONNECTORS FOR ELECTRONIC EQUIPMENT –
Part 2-101: Circular connectors –
Detail specification for circular connectors M8
with screw- or snap-locking, M12 with screw-locking
for low voltage applications**

<p>INTERNATIONAL ELECTROTECHNICAL COMMISSION</p> <p>IEC SC 48B – Connectors</p>	<p>IEC 61076-2-101</p>
<p>ELECTRONIC COMPONENTS in accordance with IEC 61076-1</p>	<p>Blank detail specification</p> <p>IEC 61076-2-001</p>
 <p style="text-align: right; margin-right: 50px;"><small>IEC 2336/03</small></p>	<p>Circular connectors M8/Ø8 mm 3 and 4 poles M12 2 to 8 poles Pin and socket connectors Rewireable – Non-rewireable</p>
	<p>Free cable connectors Straight and right angle connectors</p> <p>Fixed connectors</p> <p>Flange mounting Single hole mounting</p> <p>Pin sockets</p>
	<p>Assessment level: B, G</p>
<p>Information on the availability of components qualified to this detail specification is given in the qualified products list.</p>	

1 General information

Throughout this detail specification dimensions are in mm.

1.1 Scope

This part of IEC 61076 describes circular connectors for use in industrial control circuits devices like switchgear and controlgear. These connectors consist of fixed and free connectors either rewirable or non-rewirable, M8 with screw-locking or \varnothing 8 mm with snap-locking, M12 with screw-locking.

Male connectors have round contacts \varnothing 0,8 mm and \varnothing 1,0 mm.

A1 It also applies to 4 pole M12 circular connectors with integrated codings (i.e. D-coding) for use in industrial environments at frequencies of 100 MHz and beyond like Industrial Ethernet (see Note 1), to 5 pole M12 circular connectors with an integrated coding (B-coding) for use in industrial environments in fieldbuses like Profibus DP and Interbus, and to a 5-pole M12 circular connectors with an integrated coding (P-coding) for use in low voltage applications as a 4 + PE interface, with a centre contact dedicated to PE as a first make last break contact (see Note 2).

The B, D and P-codings prevent the mating of these coded male or female connectors to any other interfaces and cross mating between B, D, and P-coding.

NOTE 1 D-codings for other applications/frequency ranges are under consideration.

NOTE 2 Ratings and characteristics for the 4+PE versions (P-coding) and Profibus DP/ Interbus (B-coding) are the same as for 5 pole version. **A1**

1.2 Recommended method of termination

The contact terminations shall be of the following types: screw, crimp, solder, insulation piercing or insulation displacement.

1.2.1 Number of contacts or contact cavities

Connectors type D	M12	2 to 8 contacts
Connectors type E	M8/ \varnothing 8 mm	3 and 4 contacts

1.3 Ratings and characteristics

Rated voltage:	Connectors type D:	2 to 4 poles	250 V AC/DC
		5 poles	60 V AC/DC
		6 to 8 poles	30 V AC/DC
	Connectors type E:	3 poles	60 V AC/DC
		4 poles	30 V AC/DC
Current rating:	Type D	2 to 5 poles	= 4 A
		6 to 8 poles	= 2 A
	Type E	3 poles	= 3 A
		4 poles	= 3 A
Insulation resistance:	> $10^8 \Omega$		
Climatic category:	see 4.1 and Table 8		
Contact spacing:	see Clause 3		

Information on the availability of components or manufacturer who have components qualified to this detail specification is given in the qualified products list.

1.4 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 60050-581, *International Electrotechnical Vocabulary – Electromechanical components for electronic equipment*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
Amendment 1 (1992)

IEC 60352 (all parts), *Solderless connections*

IEC 60512 (all parts), *Connectors for electronic equipment – Tests and measurements*

IEC 60512-1-100, *Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60998-2-1, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*

IEC 60999 (all parts), *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units*

IEC 61076-1:1995, *Connectors with assessed quality, for use in d.c., low frequency analogue and in digital high speed data applications – Part 1: Generic specification*
Amendment 1 (1996)

IEC 61076-2, *Connectors for use in d.c., low-frequency analogue and digital high speed data applications – Part 2: Circular connectors with assessed quality – Sectional specification*

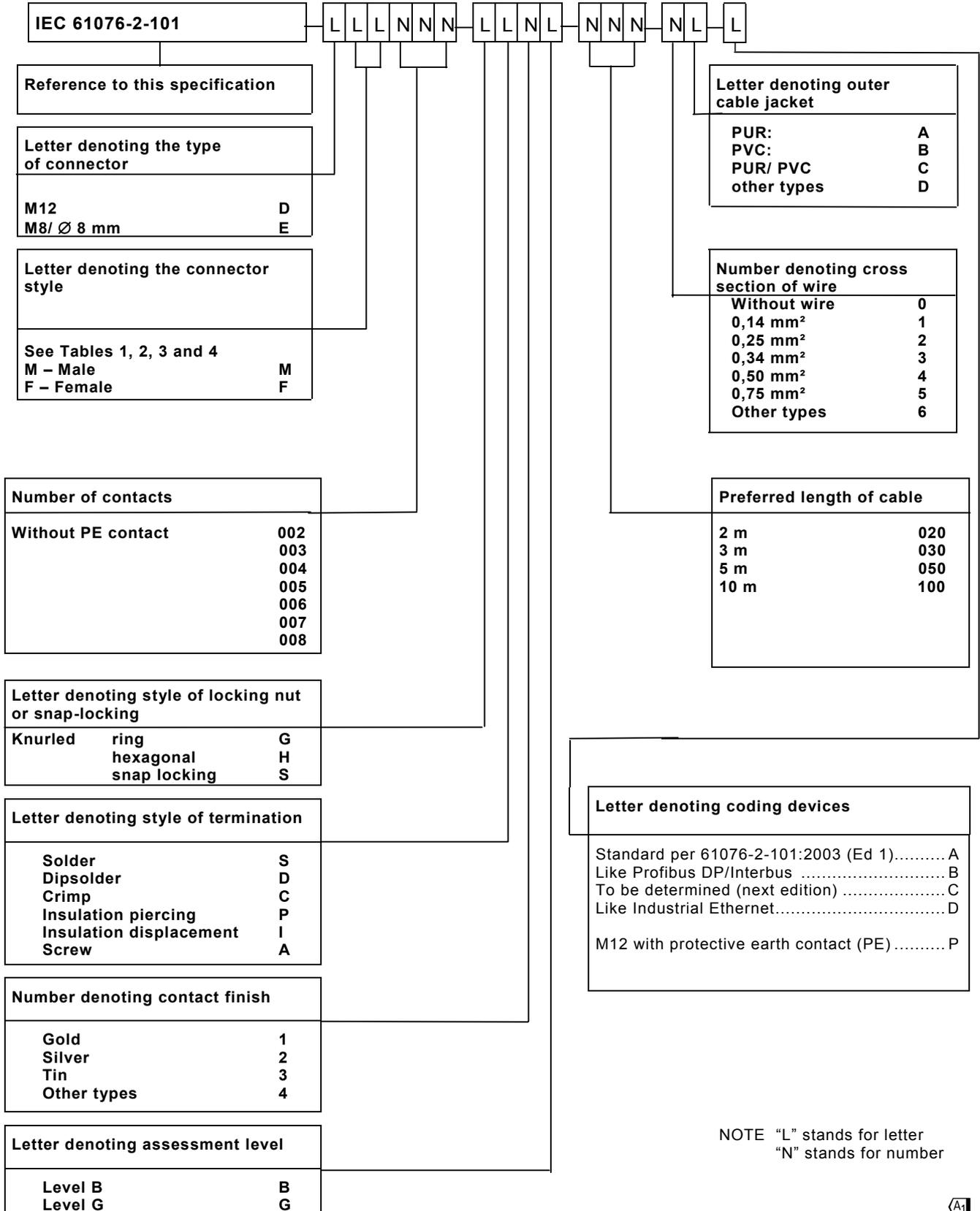
IEC 61076-2-001, *Connectors for electronic equipment – Part 2-001: Circular connectors – Blank detail specification*

ISO 1302, *Geometrical Product Specifications (GPS) – Indication of surface texture in technical product documentation*

1.5 Marking

The marking of the connector and the package shall be in accordance with 2.6 of IEC 61076-2.

1.6 IEC Type designation



1.7 Ordering information

For ordering connectors to this detail specification, the type designation described in 1.6 shall be used.

EXAMPLE 1

non-rewireable free connector.
DMF 004 – G1B – 020 – 3A – D

Free connector M12 Style MF, non-rewireable, right angled version with female contacts, 4 poles, with knurled ring, gold contact finish, assessment level B, cable length 2,0 m, cross section of wire 0,34 mm², PUR cable jacket, D-coding.

EXAMPLE 2

rewireable free connector.
DKM 004 – GC3B – D

Free connector M12 Style KM, rewireable, right angled version with female contacts, with 4 poles, with knurled ring, crimp terminals, tin contact finish, assessment level B, D-coding.

2 Technical information

Dimensions in mm.

2.1 Definitions

For the purposes of this part of IEC 61076, the terms and definitions given in IEC 581 apply.

2.2 Survey of styles and variants

2.2.1 Fixed connectors type D

Type D denotes M12 connectors. For interface dimensions, see 3.2.1.

Table 1 – Styles of fixed connectors type D

Style	Description
AM	Tube insert mounting without thread, male contacts
BM	Tube insert mounting with thread M12x1, male contacts
DM	Fixed connector, square flange front mounting, male contacts
EM	Fixed connector, with wire ends, single hole mounting Pg9, ¹⁾ , male contacts
FM	Fixed connector, with wire ends, single hole mounting Pg13,5, ¹⁾ , male contacts
GM	Fixed connector, with wire ends, single hole mounting Pg9, ¹⁾ , keyway orientation, male contacts
HM	Fixed connector, with wire ends, single hole rear mounting Pg13,5, ¹⁾ , keyway orientation, male contacts
EF	Fixed connector, with wire ends, single hole mounting Pg9, ¹⁾ , female contacts
FF	Fixed connector, with wire ends, single hole mounting Pg13,5, ¹⁾ , female contacts
GF	Fixed connector, with wire ends, single hole rear mounting Pg9, ¹⁾ , keyway orientation, female contacts
HF	Fixed connector, with wire ends, single hole rear mounting Pg13,5, ¹⁾ , keyway orientation, female contacts
¹⁾ For Pg dimensions, see Annex A.	

2.2.1.1 Style AM

Dimensions in mm

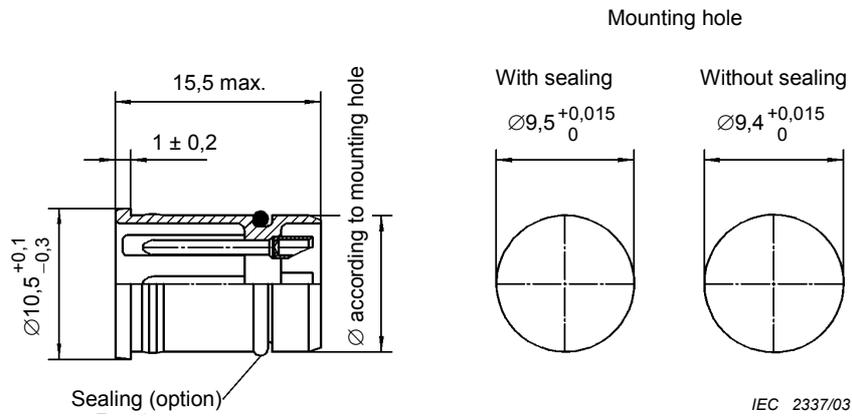


Figure 1 – Tube insert mounting without thread, male contacts

2.2.1.2 Style BM

Dimensions in mm

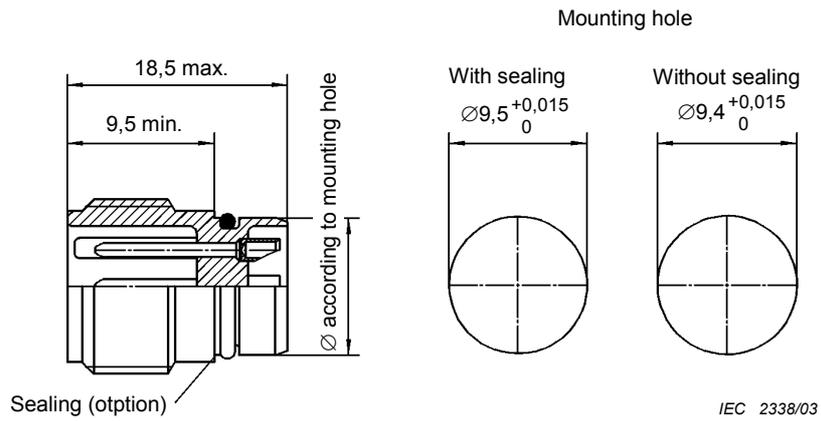
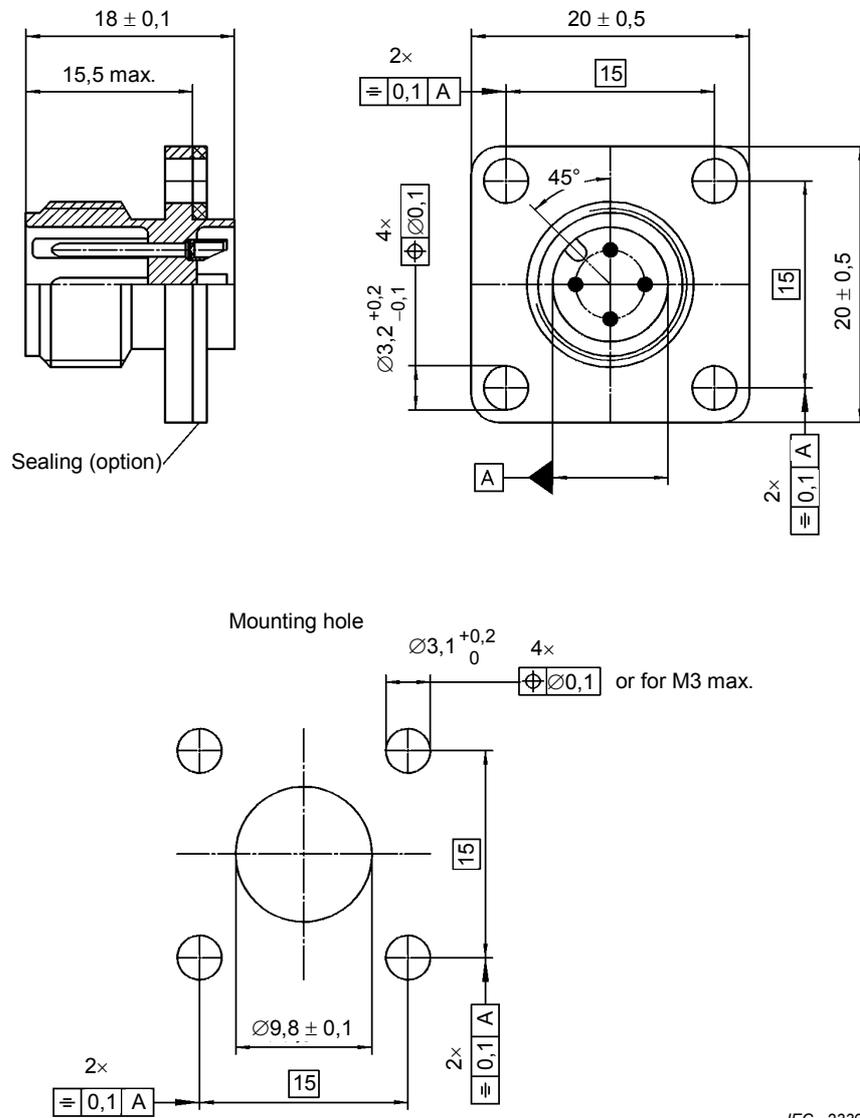


Figure 2 – Tube insert mounting with thread M12x1, male contacts

2.2.1.3 Style DM

Dimensions in mm



IEC 2339/03

Figure 3 – Fixed connector, square flange front mounting, male contacts

2.2.1.4 Style EM

Dimensions in mm

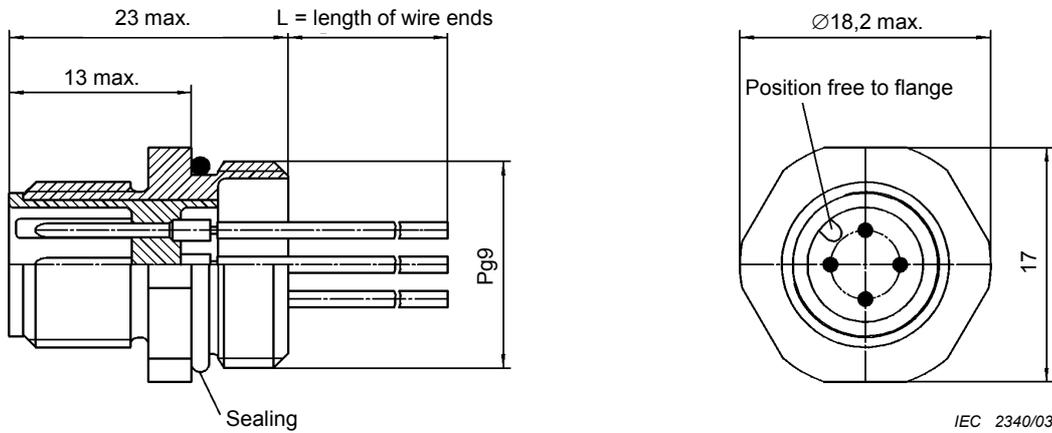


Figure 4 – Fixed connector, with wire ends, single hole mounting Pg9, male contacts

2.2.1.5 Style FM

Dimensions in mm

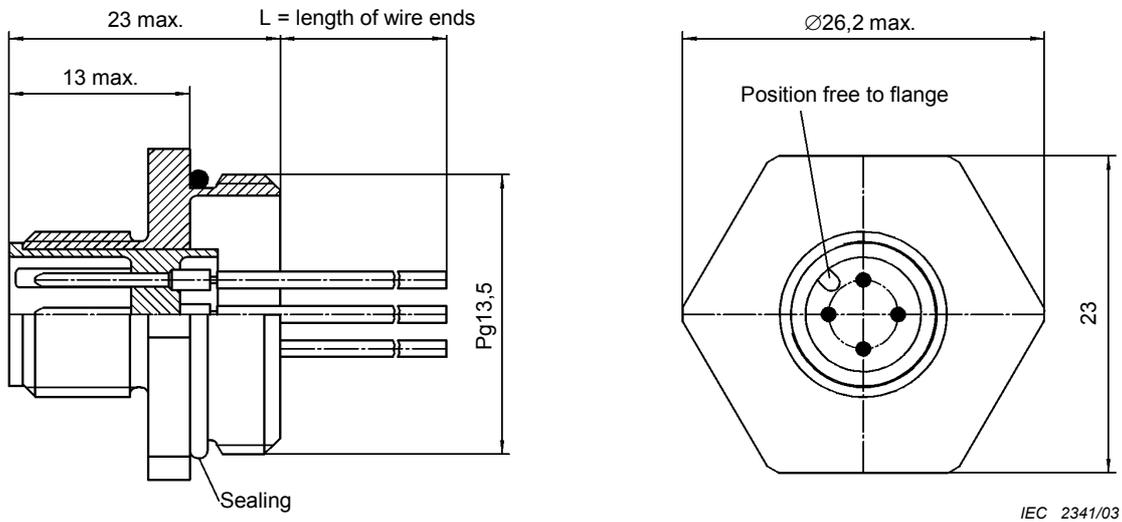


Figure 5 – Fixed connector, with wire ends, single hole mounting Pg13,5, male contacts

2.2.1.6 Style GM

Dimensions in mm

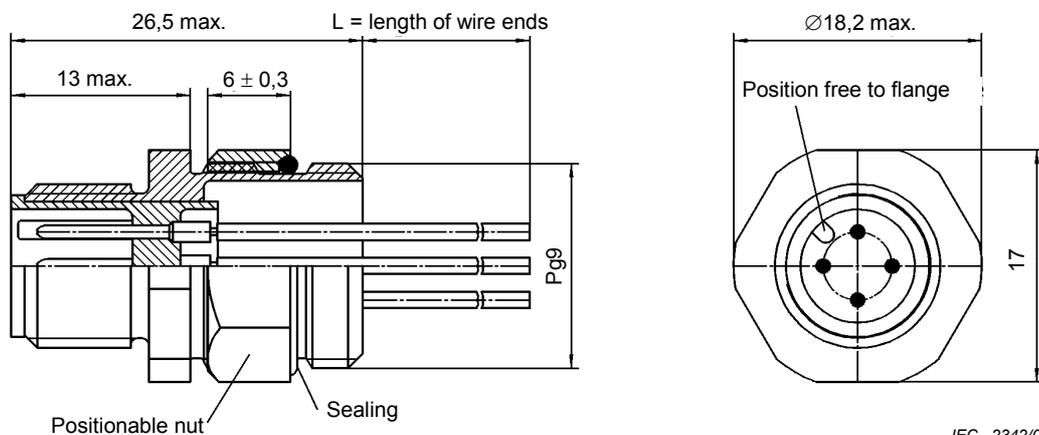


Figure 6 – Fixed connector with wire ends, single hole mounting Pg9, keyway orientation, male contacts

2.2.1.7 Style HM

Dimensions in mm

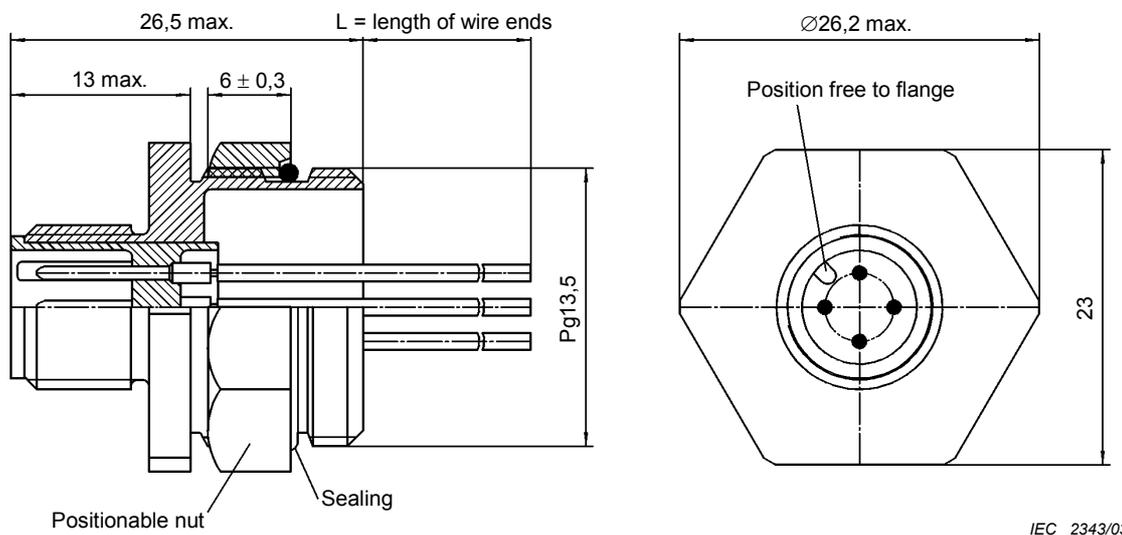


Figure 7 – Fixed connector, with wire ends, single hole rear mounting Pg13,5, keyway orientation, male contacts

2.2.1.8 Style EF

Dimensions in mm

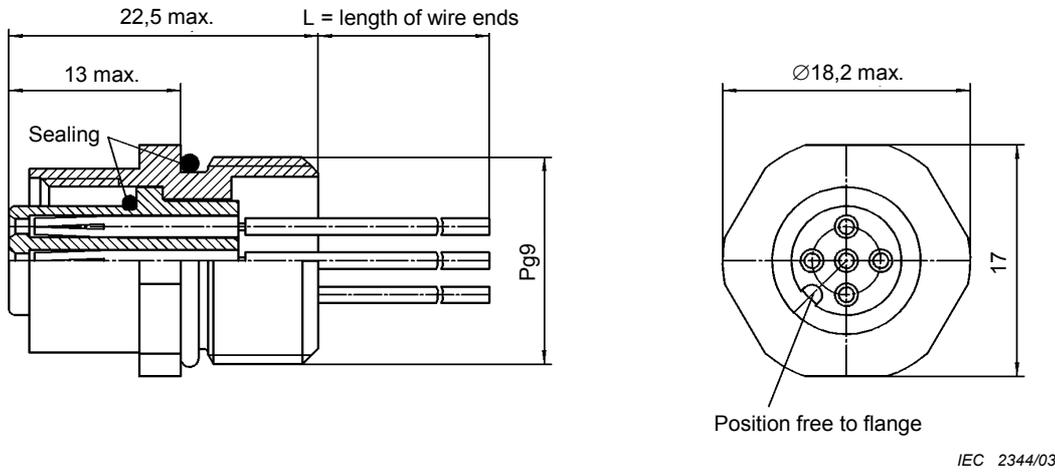


Figure 8 – Fixed connector, with wire ends, single hole mounting Pg9, female contacts

2.2.1.9 Style FF

Dimensions in mm

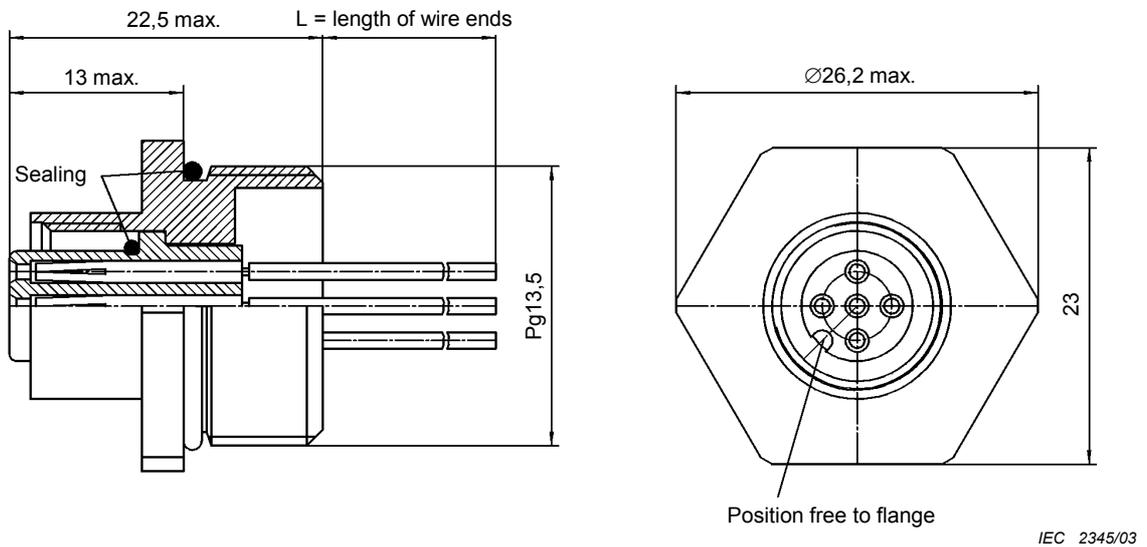
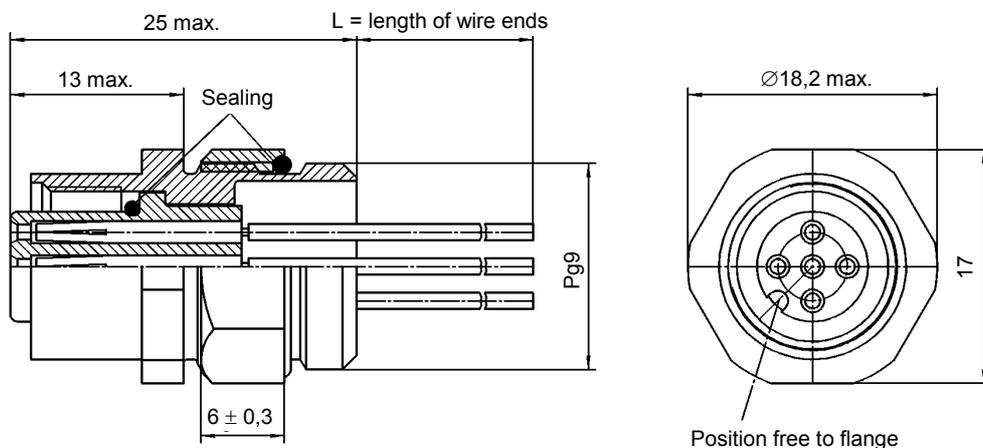


Figure 9 – Fixed connector, with wire ends, single hole mounting Pg13,5, female contacts

2.2.1.10 Style GF

Dimensions in mm

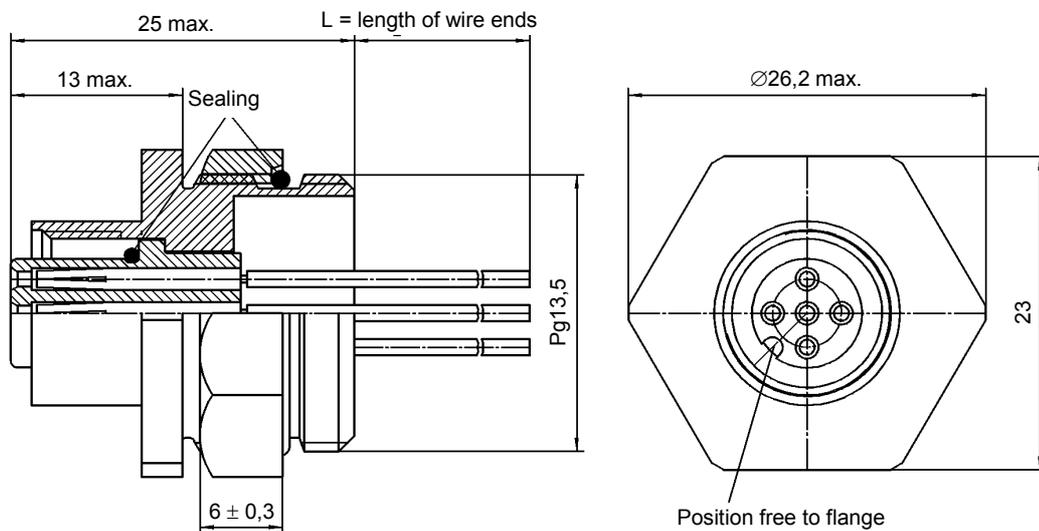


IEC 2346/03

Figure 10 – Fixed connector, with wire ends, single hole rear mounting Pg9 keyway orientation, female contacts

2.2.1.11 Style HF

Dimensions in mm



IEC 2347/03

Figure 11 – Fixed connector, with wire ends, single hole rear mounting Pg13,5, keyway orientation, female contacts

2.2.2 Free connectors type D

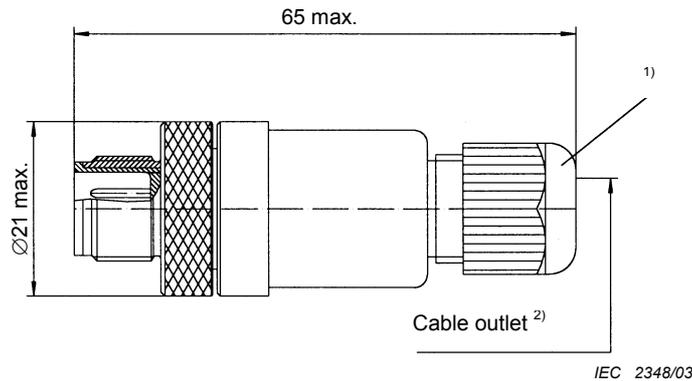
Type D denotes M12 connectors. For interface dimensions, see 3.2.1.

Table 2 – Styles of free connectors type D

Style	Description
JM	Rewireable connector, straight version, with locking nut, male contacts
JF	Rewireable connector, straight version, with locking nut, female contacts
KM	Rewireable connector, right angled version, with locking nut, male contacts
KF	Rewireable connector, right angled version, with locking nut, female contacts
LM	Non-rewireable connector, straight version, with locking nut, male contacts
LF	Non-rewireable connector, straight version, with locking nut, female contacts
MM	Non-rewireable connector, right angled version, with locking nut, male contacts
MF	Non-rewireable connector, right angled version, with locking nut, female contacts

2.2.2.1 Style JM

Dimensions in mm

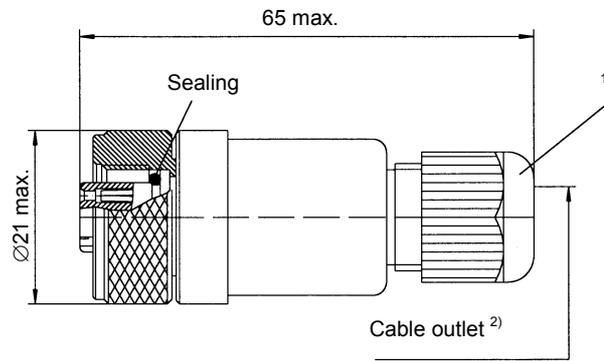


- 1) Cable outlet alternatively inside.
- 2) Cable outlet diameter range upon agreement.

Figure 12 – Rewireable connector, straight version, with locking nut, male contacts

2.2.2.2 Style JF

Dimensions in mm



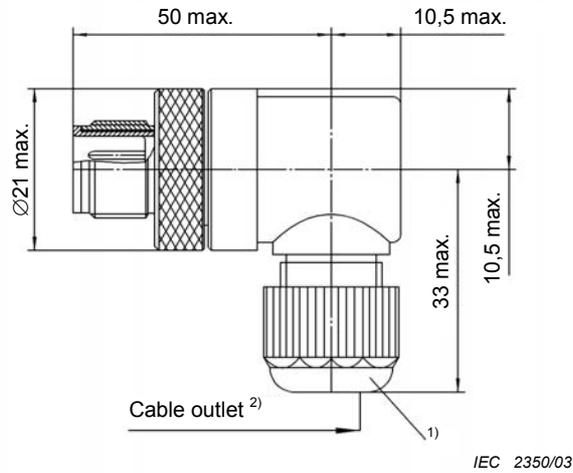
IEC 2349/03

- 1) Cable outlet alternatively inside.
- 2) Cable outlet diameter range upon agreement.

Figure 13 – Rewireable connector, straight version, with locking nut, female contacts

2.2.2.3 Style KM

Dimensions in mm

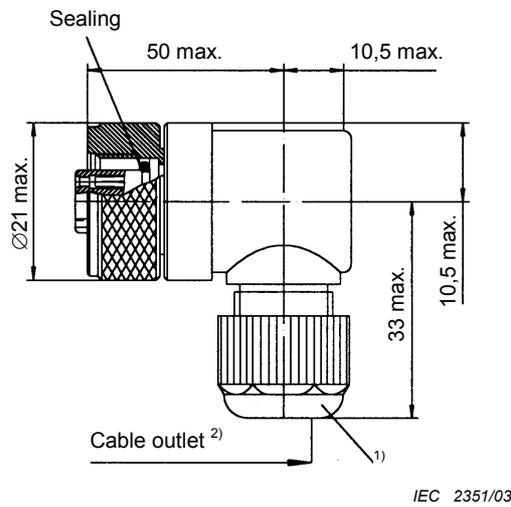


- 1) Cable outlet alternatively inside.
- 2) Cable outlet diameter upon agreement.

Figure 14 – Rewireable connector, right angled version, with locking nut, male contacts

2.2.2.4 Style KF

Dimensions in mm



- 1) Cable outlet alternatively inside.
- 2) Cable outlet diameter upon agreement.

Figure 15 – Rewireable connector, right angled version, with locking nut, female contacts

2.2.2.5 Style LM

Dimensions in mm

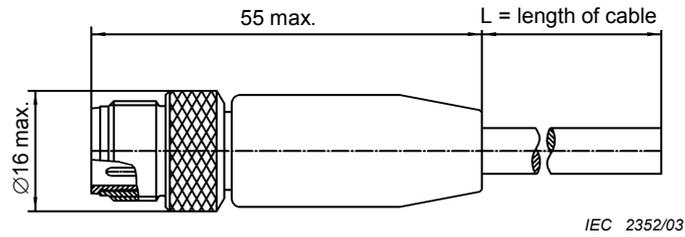


Figure 16 – Non-rewireable connector, straight version, with locking nut, male contacts

2.2.2.6 Style LF

Dimensions in mm

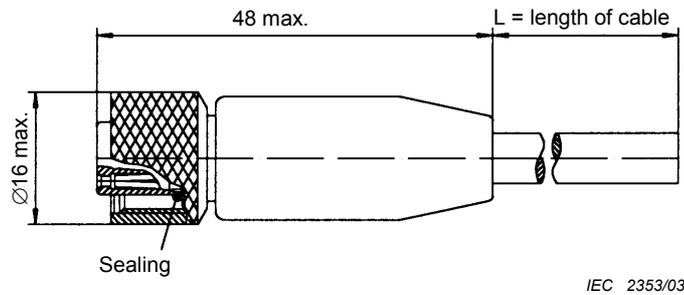
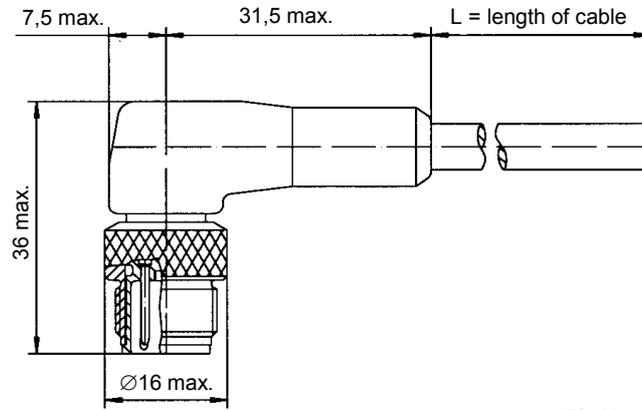


Figure 17 – Non-rewireable connector, straight version, with locking nut, female contacts

2.2.2.7 Style MM

Dimensions in mm

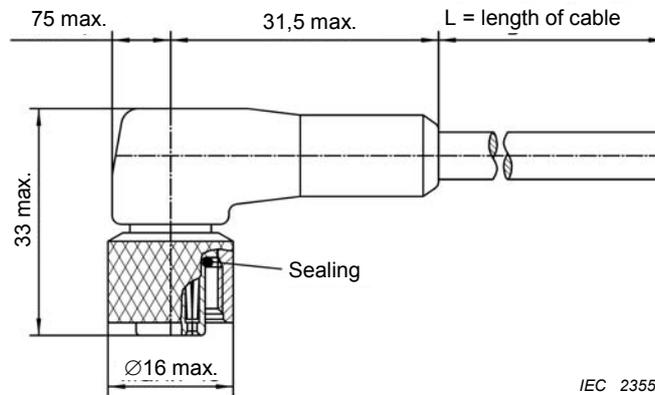


IEC 2354/03

Figure 18 – Non-rewireable connector, right angled version, with locking nut, male contacts

2.2.2.8 Style MF

Dimensions in mm



IEC 2355/03

Figure 19 – Non-rewireable connector, right angled version, with locking nut, female contacts

2.2.3 Fixed connectors type E

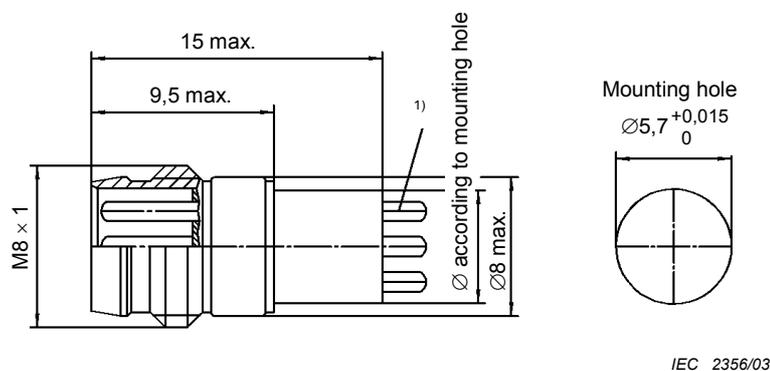
Type E denotes connectors M8 or \varnothing 8 mm. For interface dimensions, see 3.2.2.

Table 3 – Styles of fixed connectors type E

Style	Description
BM	Tube insert, mounting long version, male contacts dip solder
CM	Tube insert, mounting short version, male contacts dip solder
EM	Fixed connector with wire ends, single hole rear mounting, male contacts
EF	Fixed connector with wire ends, single hole rear mounting, female contacts

2.2.3.1 Style BM

Dimensions in mm

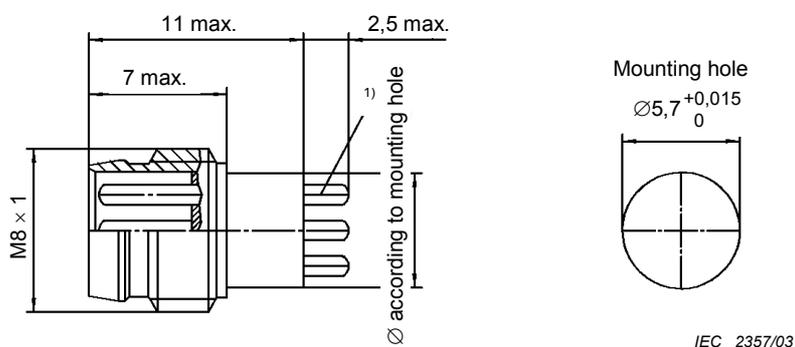


1) Length and diameter shall be agreed between the manufacturer and the user.

Figure 20 – Tube insert, mounting long version, male contacts dip solder

2.2.3.2 Style CM

Dimensions in mm



1) Length and diameter shall be agreed between the manufacturer and the user.

Figure 21 – Tube insert, mounting short version, male contacts dip solder

2.2.3.3 Style EM

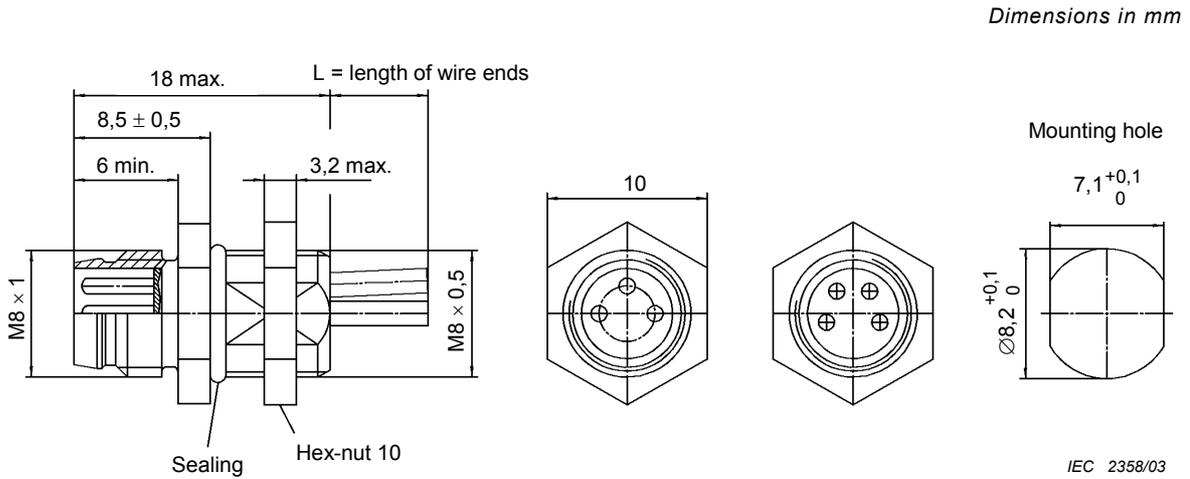


Figure 22 – Fixed connector with wire ends, single hole rear mounting, male contacts

2.2.3.4 Style EF

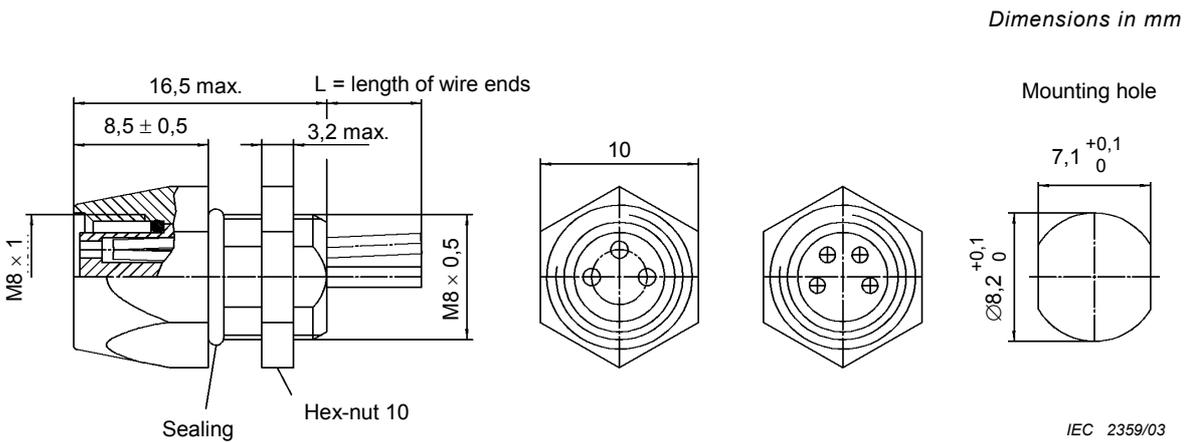


Figure 23 – Fixed connector with wire ends, single hole rear mounting, female contacts

2.2.4 Free connectors type E

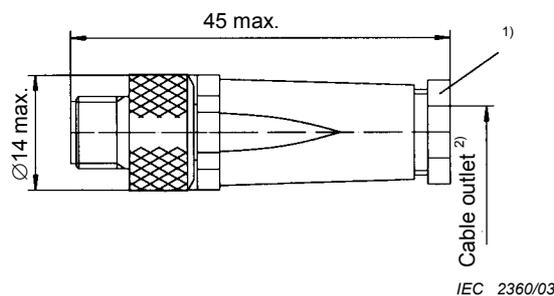
Type E denotes connectors M8 or \varnothing 8mm. For interface dimension, see 3.2.2.

Table 4 – Styles of free connectors type E

Style	Description
JM	Rewireable connector, straight version, with locking nut, male contacts
JF	Rewireable connector, straight version, with locking nut, female contacts
KM	Rewireable connector, right angled version, with locking nut, male contacts
KF	Rewireable connector, right angled version, with locking nut, female contacts
NM	Non-rewireable connector, straight version, snap locking, male contacts
NF	Non-rewireable connector, straight version, snap locking, female contacts
QF	Non-rewireable connector, angled version, snap locking, female contacts
LM	Non-rewireable connector, straight version, with locking nut, male contacts
LF	Non-rewireable connector, straight version, with locking nut, female contacts
MM	Non-rewireable connector, angled version, with locking nut, male contacts
MF	Non-rewireable connector, angled version, with locking nut, female contacts

2.2.4.1 Style JM

Dimensions in mm

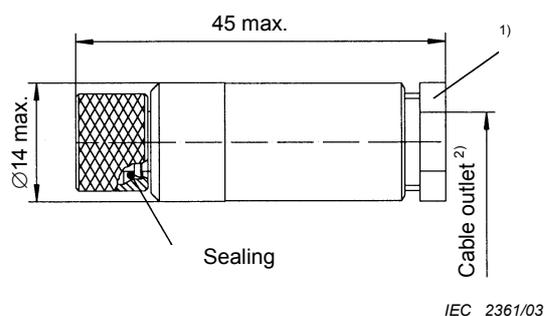


- 1) Cable outlet alternatively outside
- 2) Cable outlet diameter range upon agreement

Figure 24 – Rewireable connector, straight version, with locking nut, male contacts

2.2.4.2 Style JF

Dimensions in mm

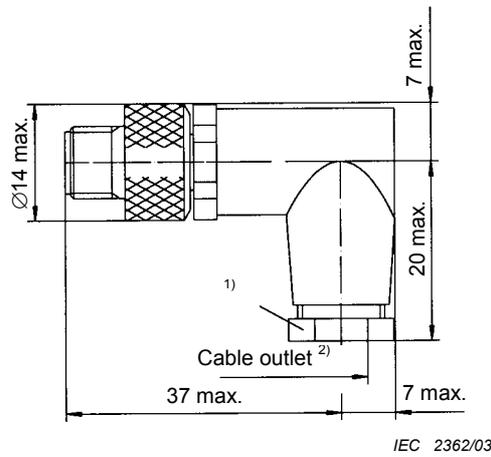


- 1) Cable outlet alternatively outside
- 2) Cable outlet diameter range upon agreement

Figure 25 – Rewireable connector, straight version, with locking nut, female contacts

2.2.4.3 Style KM

Dimensions in mm

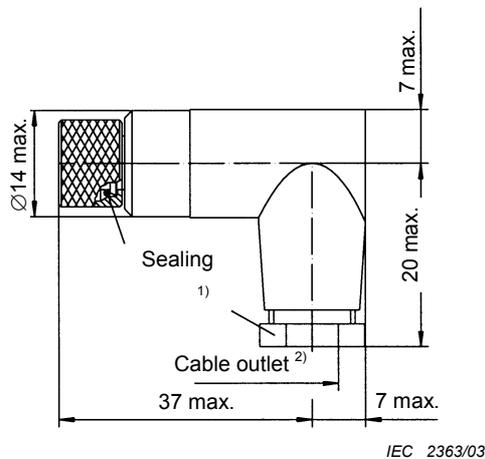


- 1) Cable outlet alternatively outside
- 2) Cable outlet diameter range upon agreement

Figure 26 – Rewireable connector, right angled version, with locking nut, male contacts

2.2.4.4 Style KF

Dimensions in mm

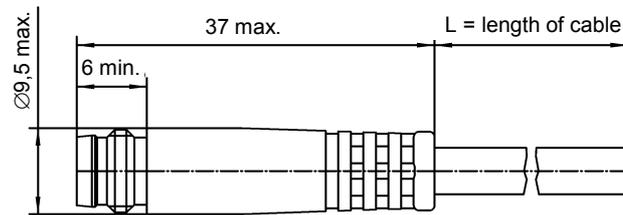


- 1) Cable outlet alternatively outside
- 2) Cable outlet diameter range upon agreement

Figure 27 – Rewireable connector, right angled version, with locking nut, female contacts

2.2.4.5 Style NM

Dimensions in mm

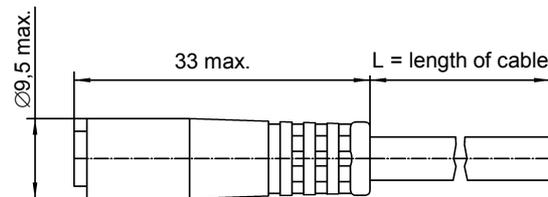


IEC 2364/03

Figure 28 – Non-rewireable connector, straight version, snap locking, male contacts

2.2.4.6 Style NF

Dimensions in mm

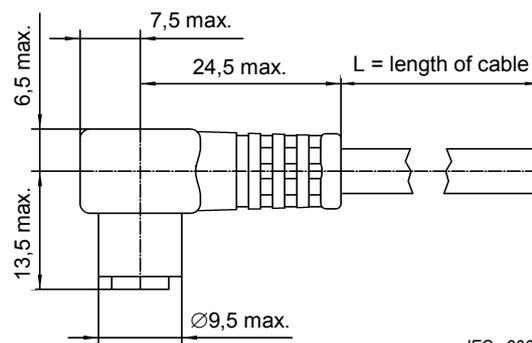


IEC 2365/03

Figure 29 – Non-rewireable connector, straight version, snap locking, female contacts

2.2.4.7 Style QF

Dimensions in mm



IEC 2366/03

Figure 30 – Non-rewireable connector, angled version, snap locking, female contacts

2.2.4.8 Style LM

Dimensions in mm

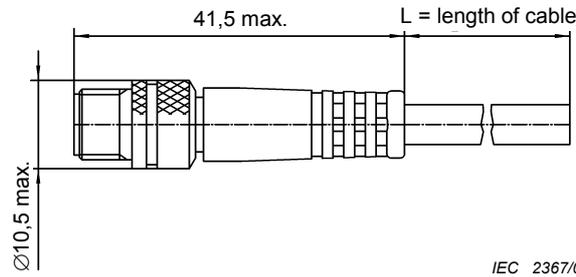


Figure 31 – Non-rewireable connector, straight version, with locking nut, male contacts

2.2.4.9 Style LF

Dimensions in mm

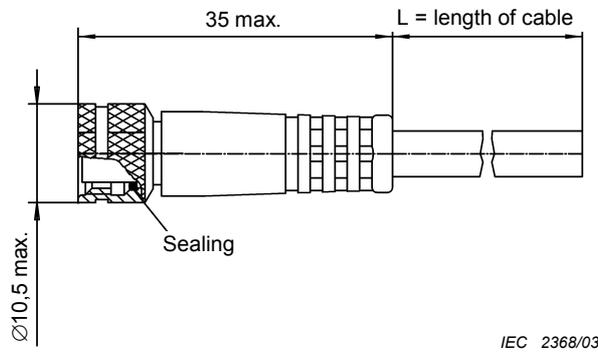


Figure 32 – Non-rewireable connector, straight version, with locking nut, female contacts

2.2.4.10 Style MM

Dimensions in mm

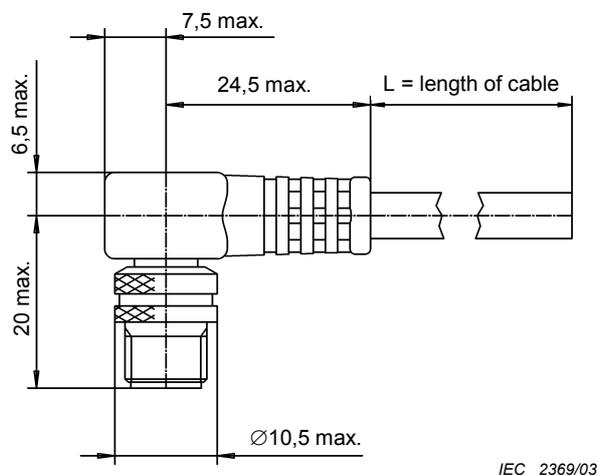


Figure 33 – Non-rewireable connector, angled version, with locking nut, male contacts

2.2.4.11 Style MF

Dimensions in mm

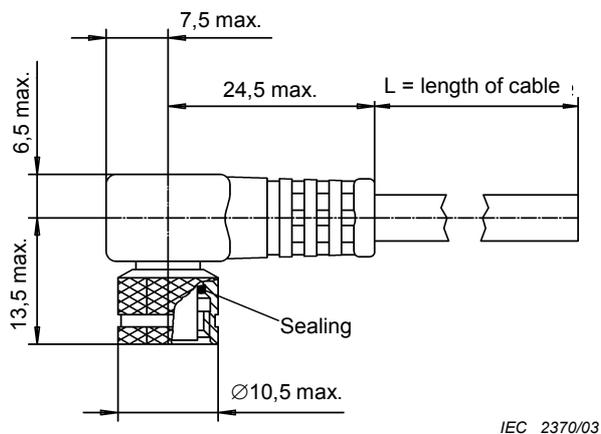


Figure 34 – Non-rewireable connector, angled version with locking nut, female contacts

3 Dimensions

3.1 General

All dimensions in mm are original. Drawings are shown in the first angle projection. The shape of the connectors may deviate from those given in the following drawings as long as the specified dimensions are not influenced.

For connector dimensions, see Figures 1 to 34.

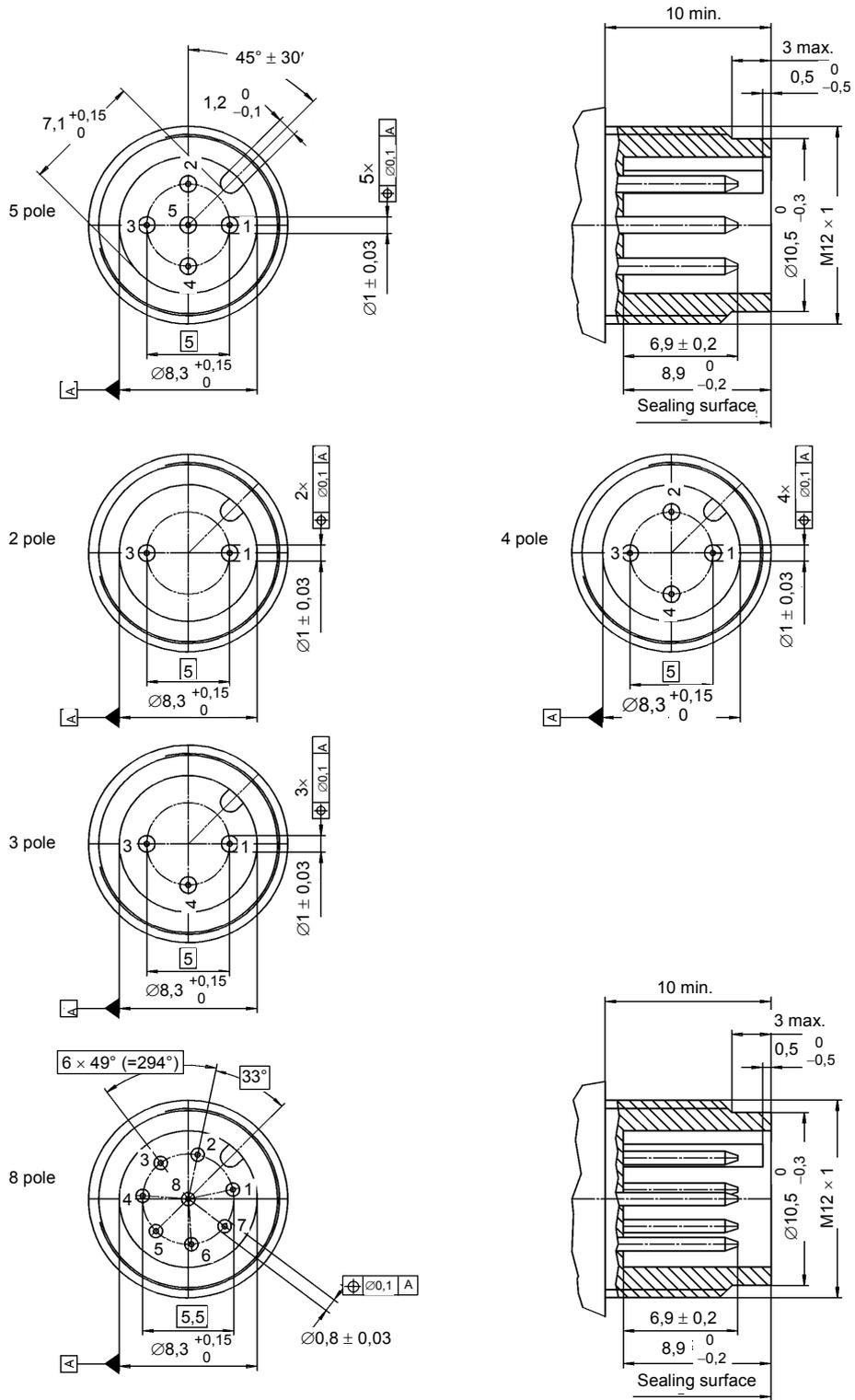
Missing dimensions shall be chosen according to common characteristics and intended use.

3.2 Interface dimensions

3.2.1 Pin front view of connectors type D

Dimensions in mm

A1



IEC 2371/03

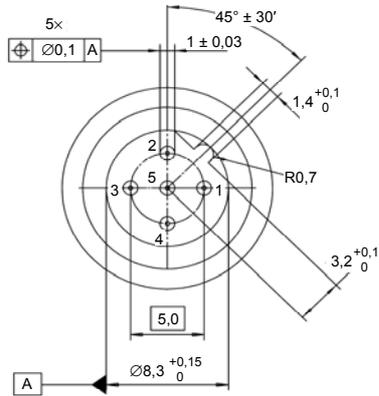
A1

Figure 35 – Type D – Front view of connectors

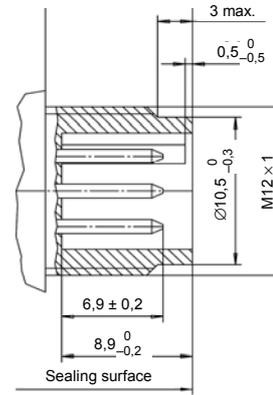
Dimensions in mm

A1

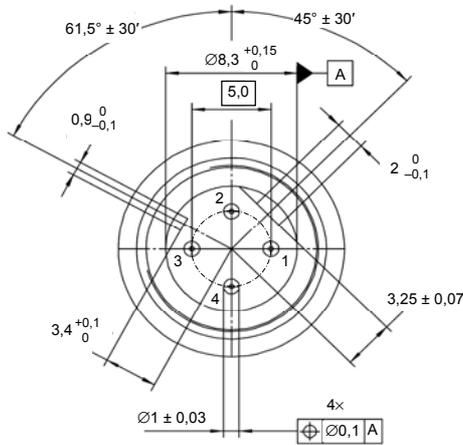
5 pole
B-coding



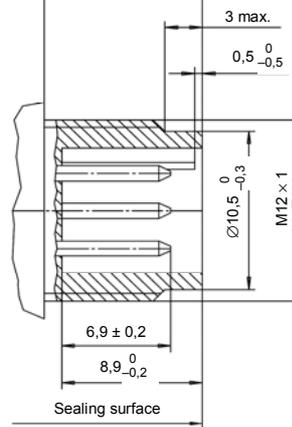
10 min.



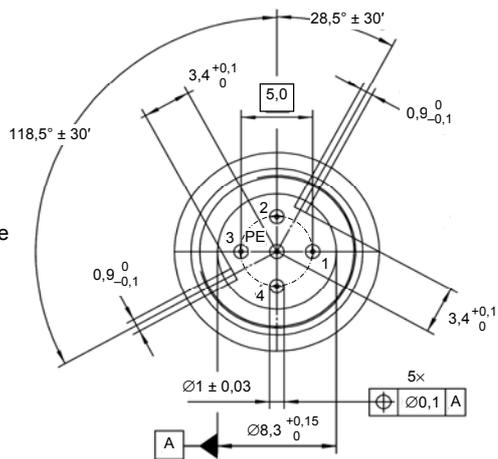
4 pole
D-coding



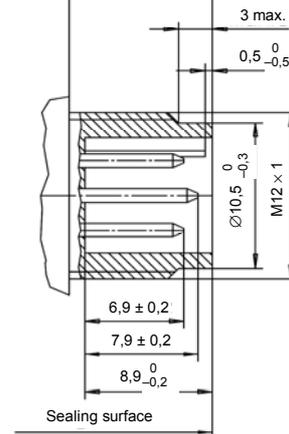
10 min.



4 + PE pole
P-coding

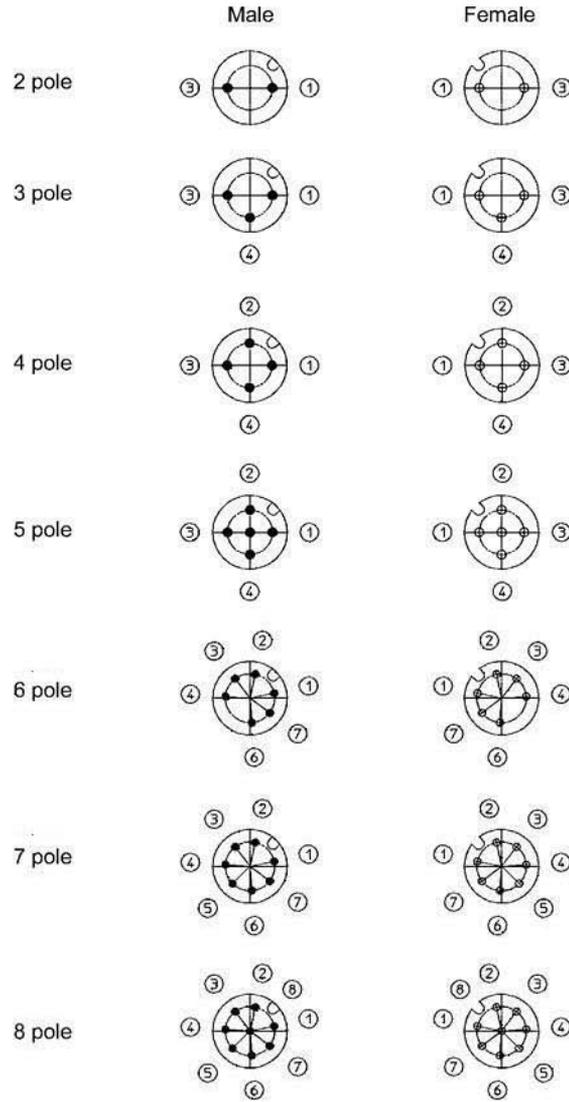


10 min.



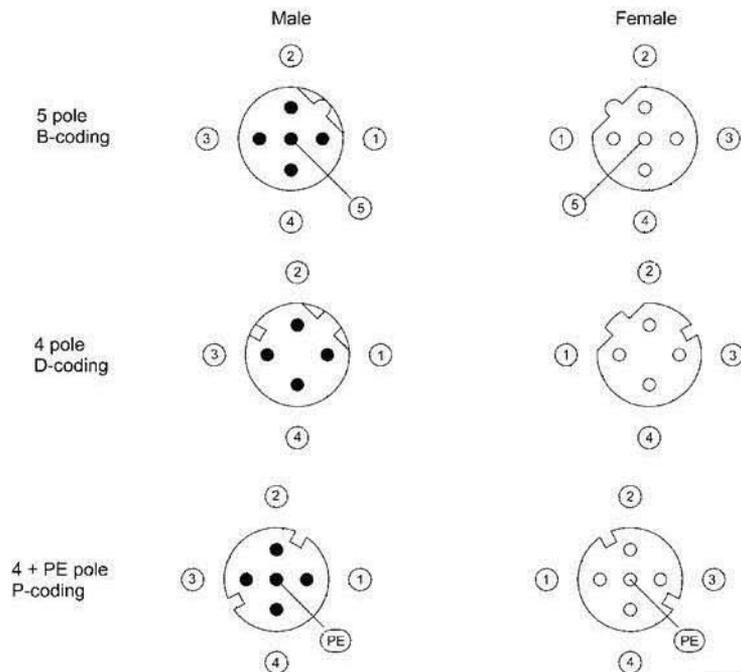
IEC 047/06

Figure 35 – Type D – Front view of connectors (continued) A1



IEC 2372/03

A1



IEC 048/06

A1 Note deleted A1

A1

Figure 36 – Type D – Contact marking of connectors

3.2.2 Pin front view of connectors type E

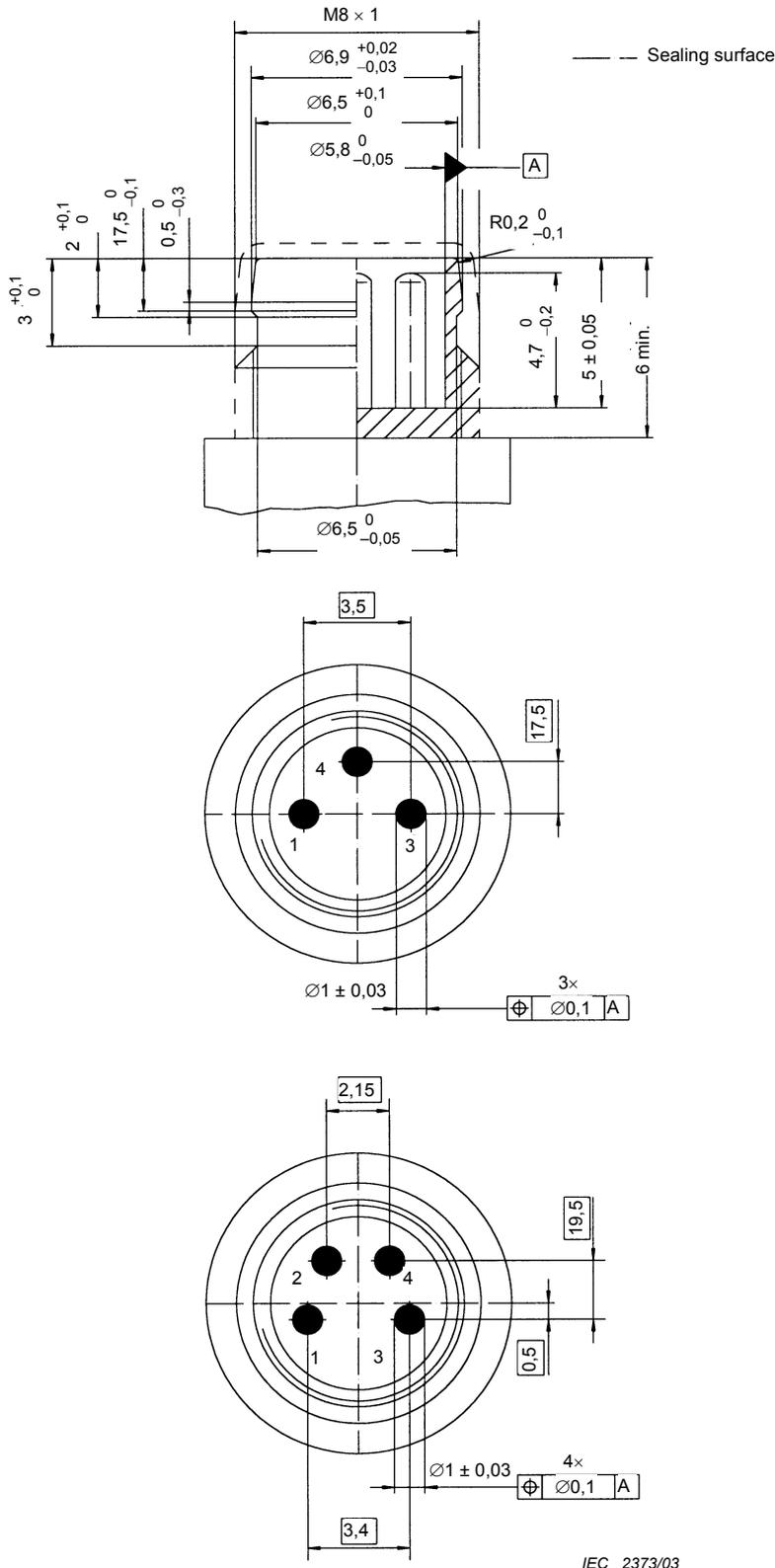


Figure 37 – Type E – Front view of connectors

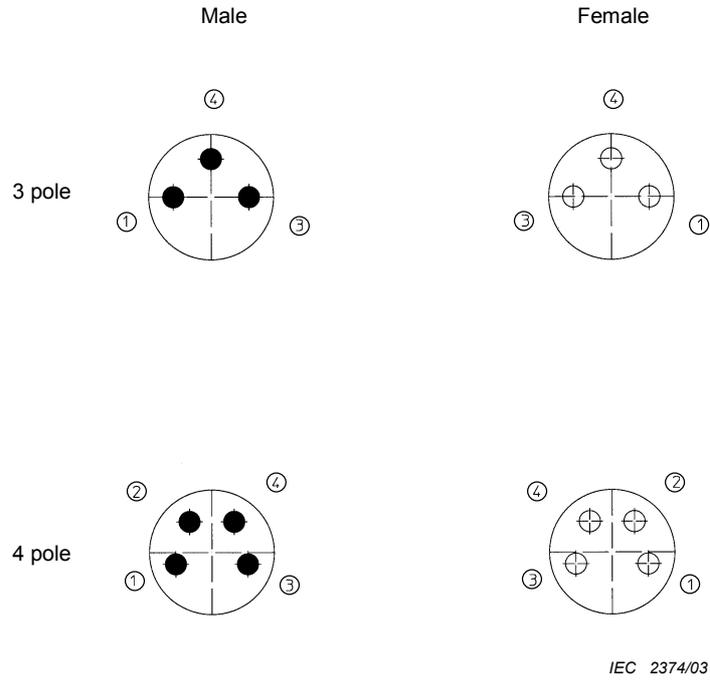


Figure 38 – Type E – Contact marking of connectors

The contact marking shall be on the mating side of the connector insert, as long as the size of the component allows the placement there. The markings are shown in Figures 36 to 38.

3.3 Engagement (mating) information

Arrows indicate mating direction

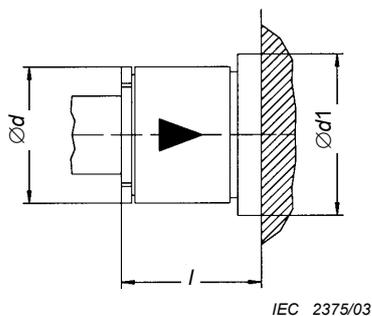


Figure 39a)

IEC 2375/03

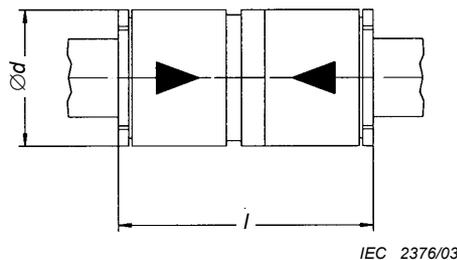


Figure 39b)

IEC 2376/03

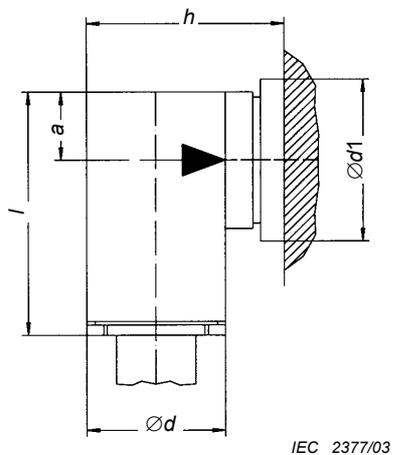


Figure 39c)

IEC 2377/03

Figure 39 – Engagement (mating) information

Table 5 – Dimensions of connectors type D in mated and locked position

Figure	Combination of styles	a max.	d max.	d1	h ^{a)} max.	l ^{a)} max.
39a)	AM-JF	–	∅ 21	–	–	65
	AM-LF	–	∅ 16	–	–	48
	BM-JF	–	∅ 21	–	–	68
	BM-LF	–	∅ 16	–	–	51
	DM-JF	–	∅ 21	∅ 21	–	73
	DM-LF	–	∅ 16	∅ 21	–	56
	EM-JF	–	∅ 21	∅ 18,2	–	69
	EM-LF	–	∅ 16	∅ 18,2	–	52
	FM-JF	–	∅ 21	∅ 26,2	–	69
	FM-LF	–	∅ 16	∅ 26,2	–	52
	GM-JF	–	∅ 21	∅ 18,2	–	69
	GM-LF	–	∅ 16	∅ 18,2	–	52
	HM-JF	–	∅ 21	∅ 26,2	–	69
	HM-LF	–	∅ 16	∅ 26,2	–	52
	EF-JM	–	∅ 21	∅ 18,2	–	69
	EF-LM	–	∅ 16	∅ 18,2	–	59
	GF-JM	–	∅ 21	∅ 18,2	–	69
	GF-LM	–	∅ 16	∅ 18,2	–	59
	FF-JM	–	∅ 21	∅ 26,2	–	69
	FF-LM	–	∅ 16	∅ 26,2	–	59
HF-JM	–	∅ 21	∅ 26,2	–	69	
HF-LM	–	∅ 16	∅ 26,2	–	59	
39b)	JM-JF	–	∅ 21	–	–	122
	JM-LF	–	∅ 21	–	–	105
	JF-LM	–	∅ 21	–	–	112
	LM-LF	–	∅ 16	–	–	95
39c)	AM-KF	11	∅ 21	–	62	45
	AM-MF	8	–	–	35	39
	BM-KF	11	∅ 21	–	64	45
	BM-MF	8	–	–	38	39
	DM-KF	11	∅ 21	∅ 21	69	45
	DM-MF	8	–	∅ 21	43	39
	EM-KF	11	∅ 21	∅ 18,2	65	45
	EM-MF	8	–	∅ 18,2	39	39
	FM-KF	11	∅ 21	∅ 26,2	65	45
	FM-MF	8	–	∅ 26,2	39	39
	GM-KF	11	∅ 21	∅ 18,2	65	45
	GM-MF	8	–	∅ 18,2	39	39
	HM-KF	11	∅ 21	∅ 26,2	65	45
	HM-MF	8	–	∅ 26,2	39	39
	EF-KM	11	∅ 21	∅ 18,2	65	45
	EF-MM	8	–	∅ 18,2	37	39
GF-KM	11	∅ 21	∅ 18,2	65	45	
GF-MM	8	–	∅ 18,2	37	39	
FF-KM	11	∅ 21	∅ 26,2	65	45	
FF-MM	8	–	∅ 26,2	37	39	
HF-KM	11	∅ 21	∅ 26,2	65	45	
HF-MM	8	–	∅ 26,2	37	39	
All dimensions are in mm.						
See Figure 39.						
a) Dimensions in mated and locked position, additional space for insertion: 15 mm.						

Table 6 – Dimensions of connectors type E in mated and locked position

Figure	Combination of styles	a max.	d max.	h ^{a)} max.	l ^{a)} max.
39a)	BM-JF	–	∅ 14	–	45
	BM-NF	–	∅ 9,5	–	38
	BM-LF	–	∅ 10,5	–	40
	CM-JF	–	∅ 14	–	45
	CM-NF	–	∅ 9,5	–	38
	CM-LF	–	∅ 10,5	–	40
	EM-JF	–	∅ 14	–	45
	EM-NF	–	∅ 9,5	–	38
	EM-LF	–	∅ 10,5	–	40
	EF-JM	–	∅ 14	–	45
EF-LM	–	∅ 10,5	–	45	
39b)	JM-JF	–	∅ 14	–	75
	JM-LF	–	∅ 14	–	74
	JF-NM	–	∅ 14	–	77
	JF-LM	–	∅ 14	–	74
	NM-NF	–	∅ 9,5	–	65
	NM-LF	–	∅ 10,5	–	67
	NF-LF	–	∅ 10,5	–	–
LM-LF	–	∅ 10,5	–	72	
39c)	BM-KF	7	∅ 14	48	27
	BM-QF	7,5	–	25	32
	BM-MF	7,5	–	25	32
	CM-KF	7	∅ 14	45	27
	CM-QF	7,5	–	25	32
	CM-MF	7,5	–	25	32
	EM-KF	7	∅ 14	48	27
	EM-QF	7,5	–	25	32
	EM-MF	7,5	–	25	32
	EF-KM	7	∅ 14	41	27
EF-MM	7,5	–	31	32	
All dimensions are in mm.					
See Figure 39.					
a) Dimensions in mated and locked position, additional space for insertion: 10 mm.					

3.4 Gauges

3.4.1 Sizing gauges and retention force gauges

Material: tool steel, hardened

∇ = Surface roughness according to ISO 1302: Ra = 0,25 µm max.
0,15 µm min.

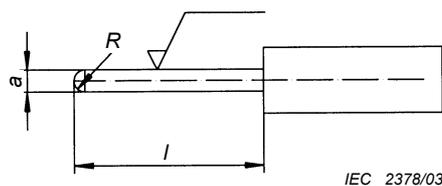


Figure 40 – Gauge dimensions

Table 7 – Gauges

Gauge	Mass g	Application	Ø a mm	l min. mm
P11	–	Sizing	1,03	5
P12	20	Retention force	0,97	5
P21	–	Sizing	0,83	5
P22	20	Retention force	0,77	5
See Figure 40.				

4 Characteristics

4.1 Climatic category

Conditions: IEC 60068-1

Table 8 – Climatic category

Climatic category	Category of temperature		Damp heat steady-state		Days
	Lower °C	Upper °C	Temperature °C	Relative humidity %	
25/85/21	–25	+85	40	93	21

4.2 Electrical

4.2.1 Rated voltage – Rated impulse voltage – Pollution degree

Conditions: IEC 60664-1

The permissible rated voltage depends on the application or specified safety requirement. Reductions in creepage or clearance distances may occur due to the printed board or wiring used and shall be duly taken into account.

Connectors type D

**Table 9 – Rated voltage – Impulse voltage –
Pollution degree connectors type D**

Contact arrangement according to 3.2.1	Rated voltage V	Rated impulse voltage kV	Pollution degree
2	250	2,5	3 a)
3	250	2,5	3 a)
4	250	2,5	3 a)
5	60	1,5	3 a)
6	30	0,8	3 a)
7	30	0,8	3 a)
8	30	0,8	3 a)

a) Only in mated and locked condition.

Connectors type E

**Table 10 – Rated voltage – Impulse voltage –
Pollution degree connectors type E**

Contact arrangement according to 3.2.2	Rated voltage V	Rated impulse voltage kV	Pollution degree
3	60	1,5	3 a)
4	30	0,8	3 a)

a) Only in mated and locked condition.

4.2.2 Voltage proof

Conditions: IEC 60512, Test 4a
Standard atmospheric conditions
Mated connectors

Connectors type D

Table 11 – Voltage proof connectors type D

Contact arrangement according to 3.2.1	Between contacts Impulse withstand voltage		Between contacts and metal housing	
	Fixed connectors	Free connectors	Fixed connectors	Free connectors
	kV		kV	
2	1,4	1,4	1,4	1,4
3	1,4	1,4	1,4	1,4
4	1,4	1,4	1,4	1,4
5	1,0	1,0	1,0	1,0
6	0,65	0,65	0,65	0,65
7	0,65	0,65	0,65	0,65
8	0,65	0,65	0,65	0,65

Connectors type E

Table 12 – Voltage proof connectors type E

Contact arrangement according to. 3.2.1	Between contacts Impulse withstand voltage		Between contacts and metal housing	
	Fixed connectors	Free connectors	Fixed connectors	Free connectors
	kV		kV	
3	1,0	1,0	0,85	0,85
4	0,65	0,65	0,65	0,65

4.2.3 Current-carrying capacity

Conditions: IEC 60512, Test 5b
All contacts
Values at 40 °C

Type D 2 to 5 pole = 4 A
6 to 8 pole = 2 A

Type E 3 pole = 3 A
4 pole = 3 A

4.2.4 Contact resistance

Conditions: IEC 60512, Test 2a
Standard atmospheric conditions
Connecting points see 5.1.1

4.2.5 Insulation resistance

Conditions: IEC 60512, Test 3a, Method A
Standard atmospheric conditions
Test voltage 500 V ± 15 V d.c.

4.3 Mechanical

4.3.1 IP degree of protection

IP65 and IP67 according to IEC 60529 connectors in mated and locked position
IP68 and higher as agreed between manufacturer and user

4.3.2 Mechanical operation

Conditions: IEC 60512, Test 9a
Standard atmospheric conditions
Max. speed of operations = 10 mm/s
Rest: 30 s, unmated

Table 13 – Number of mechanical operations

Contact finish	Mechanical operations
Gold	100
Silver	50
Tin	20
Other types	a)

a) Other mating cycles are permissible when agreed between manufacturer and user.

4.3.2 Insertion and withdrawal forces

Conditions: IEC 60512, Test 13b
Standard atmospheric conditions
Max. speed = 10 mm/s

Table 14 – Insertion and withdrawal forces

A1

Number of poles	Total insertion force N	Total withdrawal force N
2 to 5	Max. 10	Max. 15
6 to 8	Max. 25	Max. 30

A1

4.3.3 Contact retention in insert

Not applicable

4.3.4 Polarizing method

Conditions: IEC 60512, Test 13e
Insertion force min. 35 N

4.3.5 Vibration (sinusoidal)

Conditions: IEC 60512, Test 6d
Standard atmospheric conditions
Connectors in mated and locked position
The fixed and free connector shall be rigidly installed in a suitable fixture as specified in 5.1.2
Vibration Severity: 10 Hz to 500 Hz and 0,35 mm or 5 g

5 Test schedule**5.1 General**

This test schedule shows the tests and the order in which they shall be carried out as well as the requirements to be met.

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 60068-1, as directed by the applicable part of IEC 60512.

Unless otherwise specified, mated and locked sets of connectors shall be tested. Care shall be taken to keep a particular combination of connectors together during the complete test sequence, i.e. when unmating is necessary for a certain test, the same connector styles as before shall be mated for the subsequent tests.

In the following, a mated and locked sets of connector styles is called a specimen.

When the initial tests have been completed, all the specimens are divided up according to the test groups.

Before testing commences, the connectors shall be stored for at least 24 h in the non-engaged state under standard atmospheric conditions as per IEC 60068-1.

The necessary specimens are stated in Table 15.

Table 15 – Number of test specimens

	Test group						
	P	AP	BP	CP	DP	EP	FP
Number of specimen	10	2	2	2	2	20 single contacts	20 (5 per test phase)

5.1.1 Arrangement for contact resistance measurements

Conditions: see 4.2.4

The measurement of contact resistance shall be carried out on the number of contacts specified. Any subsequent measurements of contact resistance shall be made on the same contacts.

Dimensions in mm

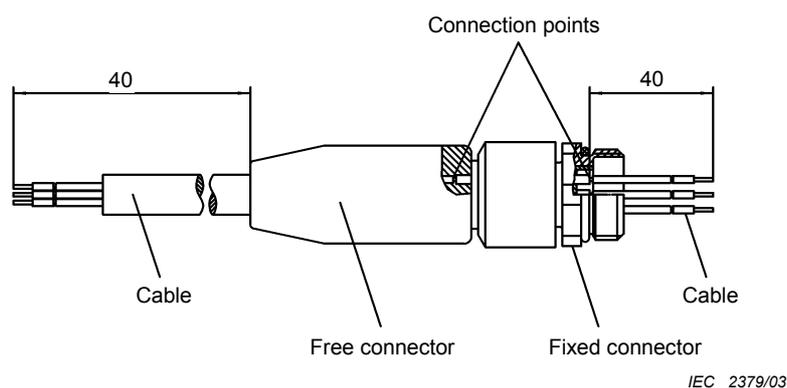


Figure 41 – Contact resistance arrangement

5.1.2 Arrangement for dynamic stress tests (vibration)

Conditions: see 4.3.6

Dimensions in mm

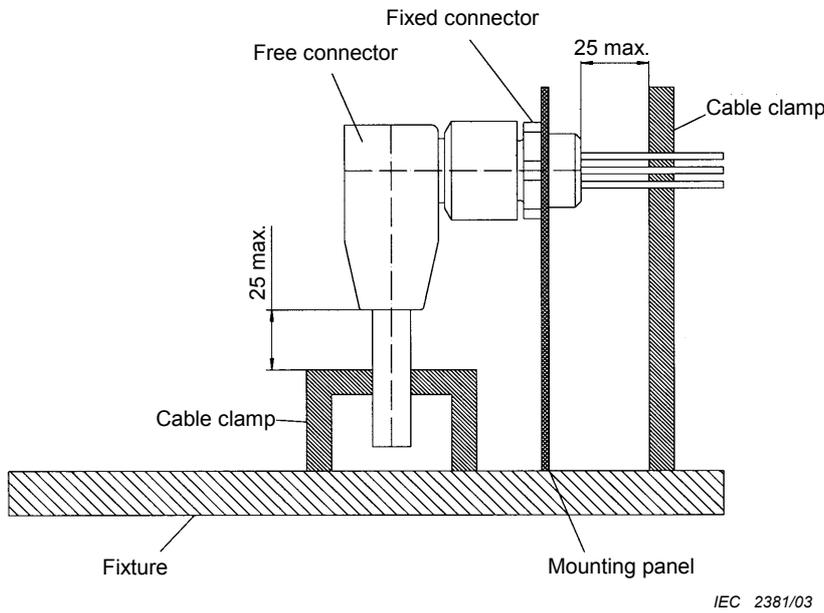
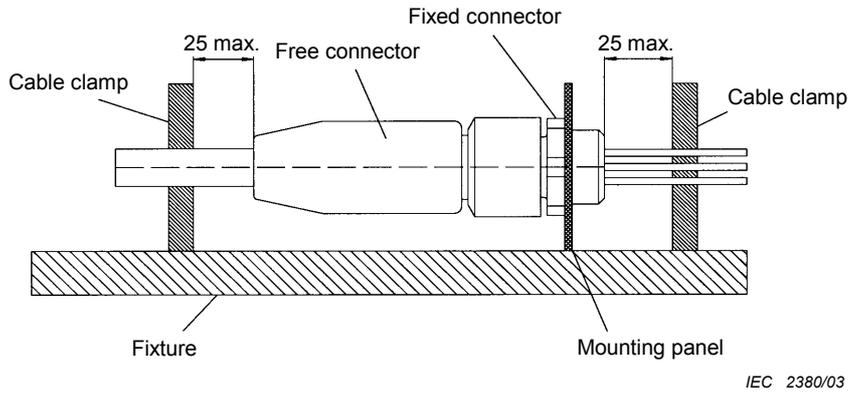


Figure 42 – Dynamic stress test arrangement

5.2 Test schedule

5.2.1 Test group P-Preliminary

All specimens shall be subject to the following tests.

Table 16 – Test group P

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
P1	General examination	1	Unmated connectors	Visual examination	1a	There shall be no defect that would impair normal operation
				Dimensional examination	1b	The dimensions shall comply with those specified in 2.2 and 3
A₁ P2	Polarizing and keying method	13e	Table 14 Force used in attempts of unintended mating: 20 N			It shall be possible to correctly align and mate the appropriate mating connectors. It shall not be possible to mate the connectors in any other way than the correct manner. Attempts to engage connector pairs of different coding keys detailed in 3.2.1. All coding key combinations shall be tested, or as agreed between manufacturer and user.
P2a	Visual examination	1a	Unmated connectors			There shall be no defect that would impair normal operation. A₁
P3			Connection points according to 5.1.1 all contacts per specimens	Contact resistance – Millivolt level method	2a	Initial value max. 10 mΩ
P4			Test voltage 500 V ± 15 V d.c. Method A	Insulation resistance	3a	≥10 ⁸ Ω
P5			Contact/contact same measuring points as for P4	Voltage proof	4a	According to 4.2.2

The specimen shall be divided into five groups. All connectors in each group shall undergo the tests specified for the relevant group.

5.2.2 Test group AP – Dynamic/ Climatic

Table 17 – Test group AP

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
AP1			See 4.3.3	Insertion and withdrawal forces	13b	Requirements see 4.3.3
AP2	Gauge retention force		Female contacts only 3 contacts/ specimen sizing and retention force gauge see 3.4.1	Engaging and separating forces	16e	See 3.4.1
AP3	Vibration	6d	10 Hz–500 Hz 0,35 mm resp. 5 g Sweep cycles: 10 Full duration: 6 h	Contact disturbance	2e	Duration of disturbance 1 μ s max.
				Contact resistance – Millivolt level method	2a	Rise in relation to initial values ≤ 15 m Ω
				Visual examination	1a	There shall be no defect that would impair normal operation
AP4	Shock	6c	Arrangement according to 5.1.2 Half sine shock acceleration 490 m/s ² (50 g) Duration of impact: 11 ms	Contact disturbance	2e	Duration of disturbance 1 μ s max.
				Contact resistance – Millivolt level method	2a	Rise in relation to initial values ≤ 15 m Ω
				Visual examination	1a	There shall be no defect that would impair normal operation
AP5	Rapid change of temperature	11d	–25 °C to 85 °C $r = 30$ min. 5 cycles	Contact resistance – Millivolt level method	2a	Rise in relation to initial values ≤ 15 m Ω
				Insulation resistance	3a	$\geq 10^8$ Ω
				Voltage proof	4a	According to 4.2.2
				Visual examination	1a	There shall be no defect that would impair normal operation

Table 17 – Test group AP (continued)

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
AP6	Climatic sequence	11a				
AP6.1	Dry heat	11i	Temperature: 85 °C Duration: 16 h	Insulation resistance at high temperature	3a	$\geq 10^8 \Omega$
AP6.2	Damp heat, cyclic, first cycle	11m	Method Db Temperature: 40 °C Recovery time: 2 h	Visual examination	1a	There shall be no defect that would impair normal operation
AP6.3	Cold	11j	Temperature: -25 °C Duration: 2 h Recovery time: 2 h	Visual examination	1a	There shall be no defect that would impair normal operation
AP6.4	Damp heat, cyclic, remaining cycles	11m	Conditions according to AP6.2 5 cycles Recovery time: 2 h	Contact resistance – Millivolt level method	2a	Rise in relation to initial values $\leq 15 \text{ m}\Omega$
				Insulation resistance	3a	$\geq 10^8 \Omega$
				Voltage proof	4a	According to 4.2.2
				Insertion and withdrawal forces	13b	Requirements see 4.3.3
				Visual examination	1a	There shall be no defect that would impair normal operation
AP7	Impacting water	14g	Duration: 1 h	Contact resistance – Millivolt level	2a	Rise in relation to initial values $\leq 15 \text{ m}\Omega$
					2b	
				Insulation resistance	3a	$\geq 10^8 \Omega$
				Voltage proof	4a	According to 4.2.2
				Insertion and withdrawal forces	13b	For requirements, see 4.3.3
AP8				Visual examination	1a	There shall be no defect that would impair normal operation

5.2.3 Test group BP – Mechanical endurance

Table 18 – Test group BP

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
BP1			Female contacts only 3 contacts/specimen sizing and retention force gauge see 3.4.1	Gauge retention force	16e	See 3.4.1
BP2	Mechanical operation (half of the specified number of operations)	9a	Speed 10 mm/s max. Rest 30 s (unmated) Operations see 4.3.2 Speed: 10 mm/s max. Rest time: 30 s (unmated)			
			Contact resistance – Millivolt level method	2a	Rise in relation to initial values $\leq 15 \text{ m}\Omega$	
			Visual examination	1a	There shall be no defect that would impair normal operation	
BP3	Climatic test					
BP3.1	Damp heat steady state	11c		Contact resistance – Millivolt level method	2a	Rise in relation to initial values $\leq 15 \text{ m}\Omega$
BP4	Mechanical operation (remaining half of specified number of operations)	9a	See BP2	Contact resistance – Millivolt level method	2a	Rise in relation to initial values $\leq 15 \text{ m}\Omega$
				Insulation resistance	3a	$\geq 10^8 \Omega$
				Voltage proof	4a	According to 4.2.2
			Unmated connectors	Visual examination	1a	There shall be no defect that would impair normal operation
BP5				Insertion and withdrawal forces	13b	For requirements, see 4.3.3
BP6			Female contacts only 3 contacts/specimen sizing and retention force gauge see 3.4.1	Gauge retention force	16e	See 3.4.1

5.2.4 Test group CP – Electrical load

Table 19 – Test group CP

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
CP1	Rapid change of temperature	11d	–25 °C to 85 °C $r = 1$ h 5 cycles	Contact resistance – Millivolt level method	2a	Rise in relation to initial values ≤ 15 m Ω
				Insulation resistance	3a	$\geq 10^8$ Ω
				Voltage proof	4a	According to 4.2.2
CP2	Mechanical Operation	9a	See BP2			
CP3	Electrical load and temperature	9b	Duration: 1 000 h Amp.Temp.: 40 °C Current load according to 4.2.3 Recovery time: 2 h Temperature: sensor in center of specimen	Contact resistance – Millivolt level method	2a	Rise in relation to initial values ≤ 15 m Ω
				Insulation resistance	3a	$\geq 10^8$ Ω
				Voltage proof	4a	According to 4.2.2
CP4		7a	Unmated connectors	Visual examination	1a	There shall be no defect that would impair normal operation

5.2.5 Test group DP – Chemical resistivity

Table 20 – Test group DP

Test phase	Test			Measurement to be performed		Requirement
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
DP1	Resistance to fluids	19c	Upon agreement between manufacturer and user			Upon agreement between manufacturer and user
DP2	Retreatment		Clearing of specimen by washing briefly in light petrol	Contact resistance – Millivolt level	2a	Rise in relation to initial values ≤ 15 m Ω
DP3				Voltage proof	4a	According to 4.2.2
DP4			Unmated connectors	Visual examination	1a	There shall be no defect that would impair normal operation

5.2.6 Test group EP – Connection method tests

Table 21 – Test group EP

Test phase	Test			Measurement to be performed		Requirement
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	All connector styles
EP1	Connections solderless, nominal cross section area, insulation piercing, insulation displacement termination crimp, screw-type terminations	IEC 60352	See relevant IEC 60352 standard For screw-type terminations, see relevant IEC 60998-2-1 or IEC 60999			
EP2	Unwrapping, solderless wrapped connections	16m				
EP3	Tensile strength (crimped connection)	16d				

A1 5.2.7 Test Group FP

This test is applicable for D-coding connectors for balanced cabling, the measurements shall be performed with one pair connected to the contacts 1 and 3 and the other pair to the contact positions 2 and 4.

Table 22 – Test Group FP

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	D-coding connector style
FP 1				Insertion loss	25b	$<0,04 \sqrt{f}$ rounded to superior 0,1 dB c, d, e
FP 2			All pairs, both directions, (pair to pair)	NEXT loss	25a	$83 - 20\log(f)^{a,d,e}$
FP 3			All pairs, both directions	Return loss	25e	$60 - 20\log(f)^{b,d,e}$
FP 4				Transfer impedance		For $1 \leq f \leq 10$: $0,1 \times f^{0,301} \Omega$ For $10 \leq f \leq 100$: $0,02 \times f \Omega$
FP 5				Coupling attenuation	EN 50289-1-14	$[\geq 35 - 20\log_{10}(f/100)]$ dB from > 100 to 1 000 MHz
FP 6	Input to output resistance		Measurement points as defined in 5.1.1 All signal contacts and screen/specimens	Millivolt level method	2a	Signal contact resistance = 200 m Ω maximum Screen resistance = 100 m Ω maximum
FP 7	Resistance unbalance		Measurement points as defined in 5.1.1 All signal contacts	Millivolt level method	2a	Unbalance resistance = 50 m Ω maximum

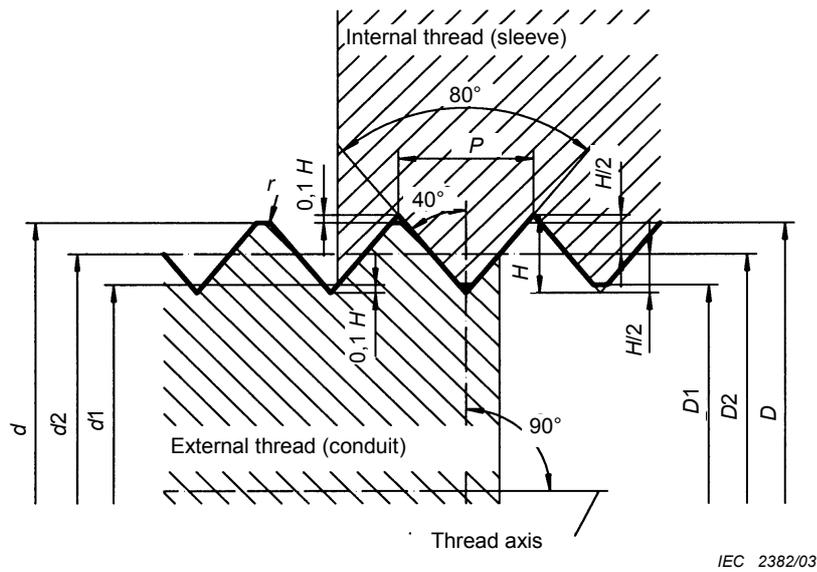
a NEXT loss at frequencies that correspond to calculated values of greater than 80 dB shall revert to a minimum requirement of 80 dB.
b Return loss at frequencies that correspond to calculated values of greater than 30 dB shall revert to a minimum requirement of 30 dB.
c Attenuation at frequencies that correspond to calculated values of less than 0,1 dB shall revert to a requirement of 0,1 dB maximum.
d All transmission results shall report worst case overall for the corresponding pair or pair combination after testing the all samples.
e All measurements to be performed on mated connectors.

A1

Annex A
(informative)

Steel conduit thread, sizes

Dimensions in mm



IEC 2382/03

$$P = 25,4/z$$

$$r = 0,107 P$$

$$H = 0,595 875 P$$

$$H_1 = 0,8H = 0,476 7 P$$

Figure A.1 – Dimensions Pg thread

Table A.1 – Dimensions

Term	External thread (conduits)						Thread pitch P	Pitch z
	Outside diameter d		Pitch diameter d_2		Minor diameter d_1			
	max.	min.	max.	min.	max.	min.		
	mm		mm		mm			
Pg9 ^{a)}	15,2	15	14,53	14,33	13,86	13,66	1,41	18
Pg13,5 ^{a)}	20,4	20,2	19,73	19,53	19,06	18,85	1,41	18
Term	Internal thread (sleeve)						Depth of thread H_1	Radius r
	Outside diameter d		Pitch diameter d_2		Minor diameter d_1			
	max.	min.	max.	min.	max.	min.		
	mm		mm		mm			
Pg9 ^{a)}	15,2	15,35	14,53	14,68	13,56	14,01	0,67	0,15
Pg13,5 ^{a)}	20,4	20,55	19,73	19,88	19,08	19,21	0,67	0,15

^{a)} Metric thread alternatively M16 (Pg9), M20 (Pg13,5) according to IEC 60423.



Annex B (informative)

Diameter of the female connector body

It is recommended that the outside diameter of the female connector body should be $8,2_{-0,15}^0$ (preferable at the upper diameter), to improve the safety regarding unintended matings between different coding types A, B, D and P as tested in Table 16 test P2 and P2a.

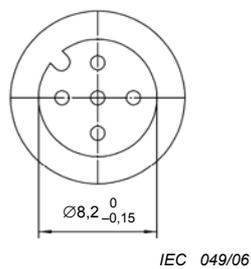


Figure B.1 – Diameter of the female connector body



Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-581	- ¹⁾	International Electrotechnical Vocabulary (IEV) Chapter 581: Electromechanical components for electronic equipment	-	-
IEC 60068-1 + corr. October + A1	1988 1988 1992	Environmental testing Part 1: General and guidance	EN 60068-1	1994
IEC 60352	Series	Solderless connections	EN 60352	Series
IEC 60512	Series	Connectors for electronic equipment - Tests and measurements	EN 60512	Series
IEC 60512-1-100	- ¹⁾	Connectors for electronic equipment - Tests and measurements Part 1-100: General - Applicable publications	EN 60512-1-100	2001 ²⁾
IEC 60529	- ¹⁾	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991 ²⁾
IEC 60664-1	1992	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests	EN 60664-1 ³⁾	2003
IEC 60998-2-1 (mod)	- ¹⁾	Connecting devices for low-voltage circuits for household and similar purposes Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units	EN 60998-2-1	1993 ²⁾

1) Undated reference.

2) Valid edition at date of issue.

3) EN 60664-1 includes A1:2000 + A2:2002.

BS EN 61076-2-101:2003+A1:2006

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60999	Series	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units	EN 60999	Series
IEC 61076-1	1995	Connectors with assessed quality, for use in d.c., low frequency analogue and in digital high-speed data applications Part 1: Generic specification - Capability approval	EN 61076-1	1995
A1	1996		A1	1996
IEC 61076-2	- ¹⁾	Part 2: Circular connectors with assessed quality - Sectional specification	EN 61076-2	1999 ²⁾
IEC 61076-2-001	- ¹⁾	Part 2-001: Circular connectors - Blank detail specification	EN 61076-2-001	2001 ²⁾
ISO 1302	- ¹⁾	Geometrical Product Specifications (GPS) - Indication of surface texture in technical product documentation	EN ISO 1302	2002 ²⁾

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