IEC/PAS 61076-3-119

Edition 1.0 2013-10

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Connectors for electronic equipment – Product requirements – Part 3-119: Rectangular connectors – Detail specification for unshielded, free and fixed 10-way connectors with push-pull coupling for industrial environments with frequencies up to 100 MHz

IEC/PAS 61076-3-119:2013(E)

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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**
48B/2351/PAS	48B/2359/RVD

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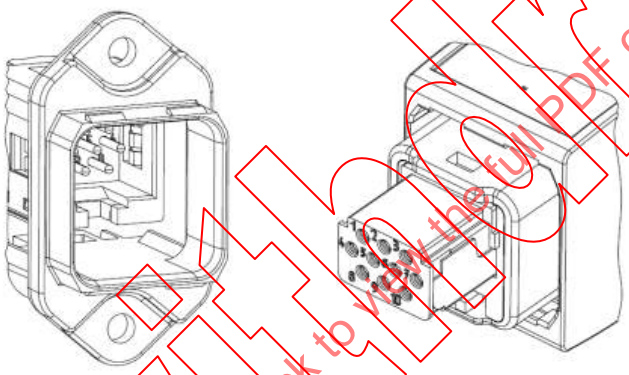
A bilingual version of this publication may be issued at a later date.

CONNECTORS FOR ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 3-119: Rectangular connectors – Detail specification for unshielded, free and fixed 10-way connectors with push-pull coupling for industrial environments with frequencies up to 100 MHz

IEC SC 48B – Connector Specifications available from: IEC General secretariat or from the addresses shown on the inside cover.	IEC PAS 61076-3-1xx Ed. 1.0
ELECTRONIC COMPONENTS DETAIL SPECIFICATION in accordance with IEC 61076-1 and IEC 61076-3	Page 6 of 26
Outline drawing 	Rectangular connector for signals with push-pull coupling
	Fixed and free connectors, for industrial environments

1 Scope

This part of IEC 61076 establishes specifications and test requirements for a connector with ten contacts, for use in industrial environments.

This PAS specifies free and fixed connector inserts, with round contacts, suitable for screw or crimp terminations. Other terminations techniques, as solder or printed board connections are upon agreement between manufacturer and user. The free and fixed connectors have a push-pull locking mechanism for IP65 and IP67 protection according to IEC 60529.

Connectors according this PAS are without breaking capacity COC according to IEC 61984, therefore they are not intended to be engaged or disengaged in normal use when live or under load, if not otherwise specified by the manufacturer.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-581:2008, *International Electrotechnical Vocabulary – Chapter 581: Electro-mechanical components for electronic equipment*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-20, *Environmental testing - Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60352 (all parts): *Solderless connections*

IEC 60512 (all parts), *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods*

IEC 60512-1-2, *Connectors for electronic equipment - Tests and measurements - Part 1-2: General examination - Test 1b: Examination of dimension and mass*

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

IEC 61076-1:2006, *Connectors for electronic equipment – Part 1: Generic specification*

IEC 61984:2008, *Connectors – Safety requirements and tests*

IEC 62197-1:2006, *Connectors for electronic equipment – Quality assessment requirements – Part 1: Generic specification*

IEC 62430, *Environmentally conscious design for electrical and electronic products*

IEC Guide 109, *Environmental aspects – Inclusion in electrotechnical product standards*

ISO 1302: 2002, *Geometrical Product Specifications (GPS) – Indication of surface texture in technical product documentation*

ISO 11469:2000, *Plastics – Generic identification and marking of plastic products*

3 Technical information

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581 apply.

3.2 Systems of levels

3.2.1 Performance levels

Not applicable for this PAS.

3.2.2 Compatibility levels, according to IEC 61076-1:2006

Connectors according to this PAS are supposed to be intermateable.

3.3 Classification into climatic categories

Conditions: according to IEC 60068-1 and Table 1.

Table 1 – Climatic categories - selected values for environmental performance level 1

Climatic category	Lower temperature °C	Upper temperature °C	Damp heat steady state (days)
40/70/21	-40	70	21

3.4 Clearance and creepage distances

Clearance and creepage distances shall be measured according to IEC 60512-1-2 with the following additional requirements.

For this connector clearance and creepage distances shall be measured only in mated position (connector without breaking capacity as defined in IEC 61984:2008).

The connector has protection against electric shock by finger safety (IP2X or IPXXB), both in the mated or unmated condition, after mounting (see also 6.4.2.2 of IEC 61984:2008). The minimum values for clearance and creepage distances can be found in Table 2.

Table 2 – Clearance and creepage distances

Dimensions in millimetres

Minimum distance between contacts and earth contact		Minimum distance between adjacent contacts	
Creepage	Clearance	Creepage	Clearance
1,0	0,8	1,0	0,8

3.5 Current-carrying capacity

The current-carrying capacity shall be measured according to IEC 60512 Test No. 5b and stated by the manufacturer.

3.6 Marking

The marking of the connector and the package shall be in accordance with 2.7 of IEC 61076-1:2006.

The position of the contacts shall by identified by suitable marking. The contact marking shall be on the termination side of the connector (or the connector insert) as long as the size of the component allows the placement there.

4 Dimensional information

4.1 General

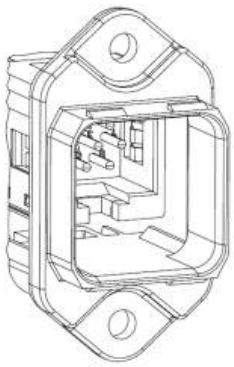
Dimensions are given in millimetres; drawings are shown in first angle projection. The shape of the connectors may deviate from those given in the following drawings as long as the specified dimensions are not influenced.

The following requirements apply to the complete connector consisting of both the free and fixed connectors.

For safety aspects IEC 61984:2008 shall be considered unless otherwise specified.

Missing dimensions shall be chosen according to the common characteristics and intended use. The interface dimensions of the female style shall be chosen according to the common characteristics of the male styles.

4.2 Isometric view and common features



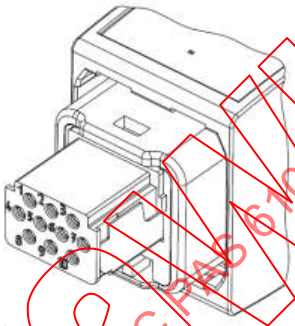


Figure 1 – Fixed (male) and free (female) connector

4.2.1 Common features

Not applicable.

4.2.2 Reference system

No special reference system is applied.

4.3 Engagement (mating) information

4.3.1 Engaging (mating) direction

Not applicable.

4.3.2 Contact levels and sequencing

All contacts have the same contact level (no first-make last-break contact).

4.3.3 Perpendicular to the engaging (mating) direction

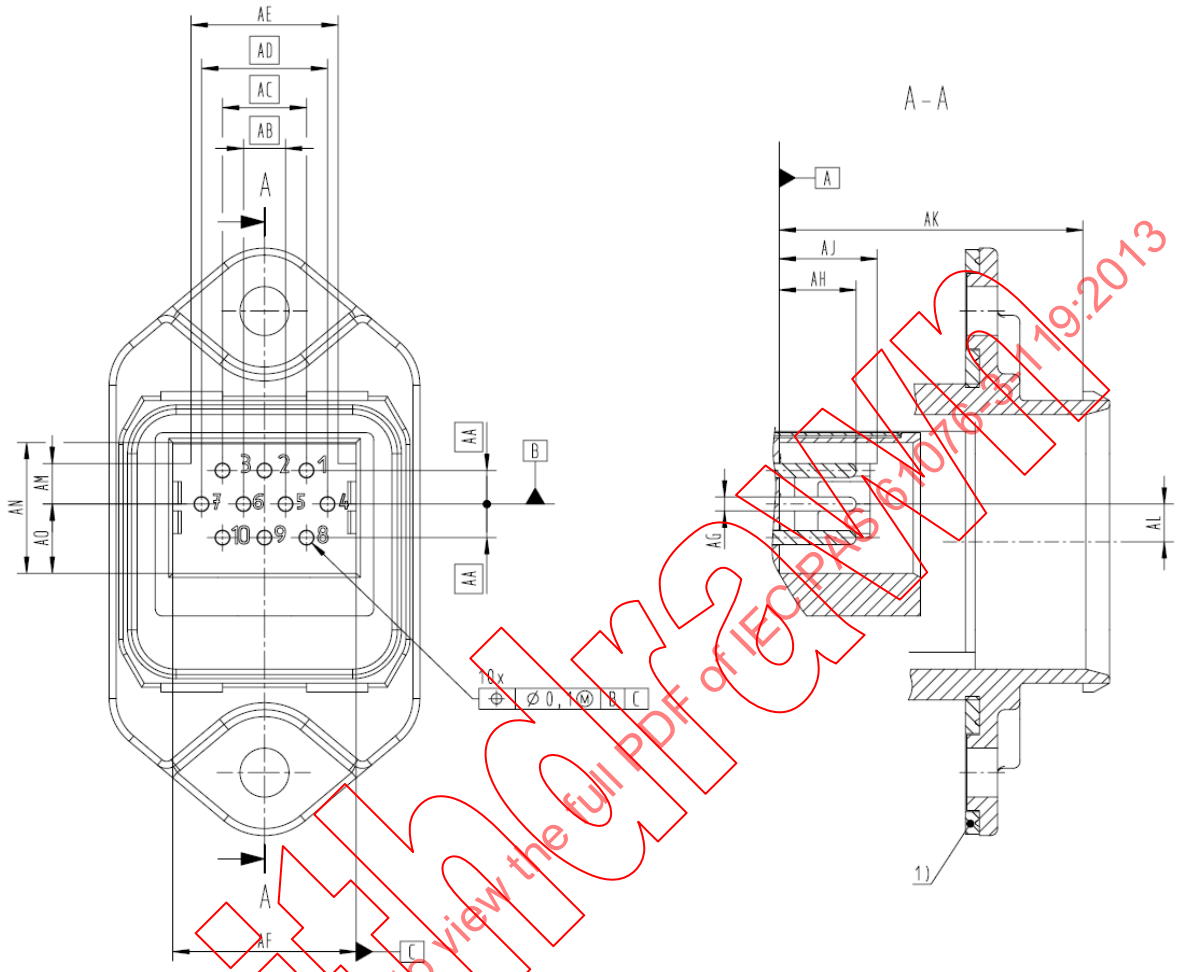
Not applicable.

4.3.4 Inclination

Not applicable.

4.4 Fixed connectors

4.4.1 Dimensions



1) Seal

Figure 2 – Fixed male connector

Table 3 – Dimensions of the fixed connector

Dimensions in millimetres

Letter	Maximum	Minimum	Nominal
AA			2,4
AB			3
AC			6
AD			9
AE	10,6	10,4	10,5
AF	13,25	13,05	13,15
AG	1,03	0,97	ø1
AH	5,8	4,8	5,3
AJ	7,1	6,9	7
AK	22,1	21,3	21,7
AL	2,8	2,6	2,7
AM	3	2,8	2,9
AN	9,45	9,25	9,35
AO	5,05	4,85	4,95

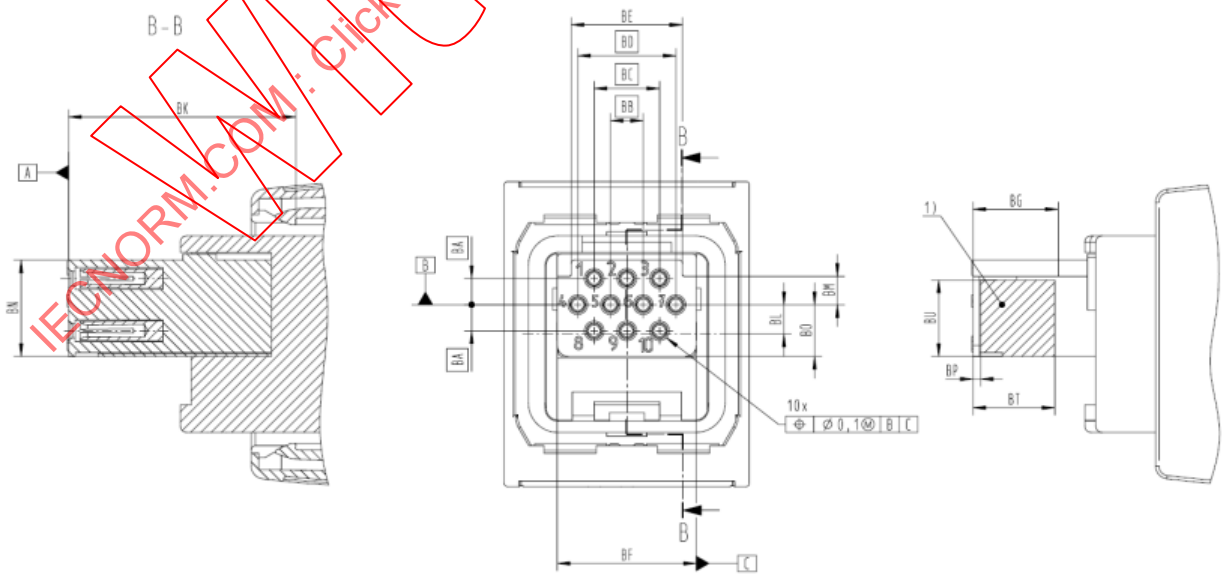
4.4.2 Terminations

Terminations according to the relevant IEC 61984:2008, 6.6

NOTE Other technologies like printed-board terminations could be applied upon agreement between manufacturer and customer.

4.5 Free connectors

4.5.1 Dimensions



[1] Area for shield-connection

Figure 3 – Free female connector

Table 4 – Dimensions of the free connector

Dimensions in millimetres

Letter	Maximum	Minimum	Nominal
BA			2,4
BB			3
BC			6
BD			9
BE	10,3	10,1	10,2
BF	12,8	12,7	12,75
BG		7,5	
BK	21,15	20,55	20,85
BL	2,8	2,6	2,7
BM	2,7	2,5	2,6
BN	8,95	8,75	8,85
BO	4,8	4,7	4,75
BP	1,5		
BT		7	
BU	7,5	6,5	7

4.5.2 Terminations

Terminations according to the relevant IEC 61984:2008, 6.6.

4.6 Accessories

Not applicable.

4.7 Mounting information for connectors

4.7.1 Mounting on panels

Mounting information for the fixed connector according to Figure 4 and Table 5.

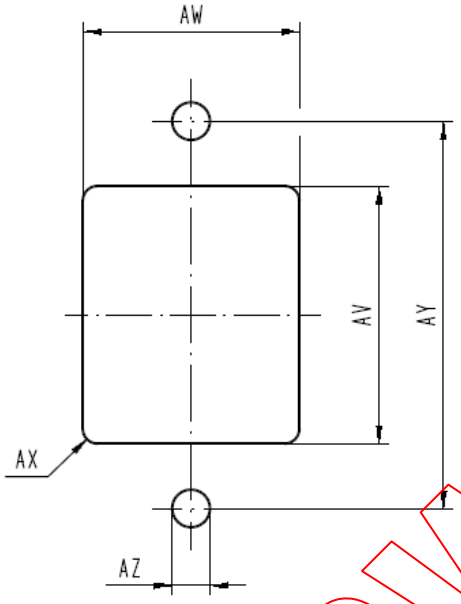


Figure 4 – Mounting drawing

Table 5 – Mounting information

Dimensions in millimetres

Letter	Maximum	Minimum	Nominal
AV	-	21,95	
AW	-	18,35	
AX	R 1,25	-	-
AY	33,1	32,9	33
AZ	-	-	M 3 or alternatively Ø 3,2

4.8 Gauges

4.8.1 Sizing gauges and retention force gauges

Material: tool steel, hardened.

=surface roughness according to ISO 1302: R_a = 0,25 µm max.
0,15 µm min.

Figure 5 shows gauge dimensions.

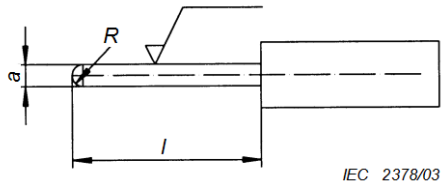


Figure 5 – Gauge

Table 6 shows gauges.

Table 6 – Gauge dimensions

Gauge	F min. N	Application	d mm	l mm
P1		Sizing	$1{,}03_{-0{,}005}$	$5{,}5_{-0{,}2}$
P2	0,2	Retention force	$0{,}97_{-0{,}005}$	$5{,}5_{-0{,}2}$

4.8.2 Mechanical function, engaging/separating/insertion/withdrawal force gauges

Not applicable.

4.8.3 Probes

Not applicable.

4.8.4 Contact resistance gauge

Not applicable.

4.8.5 Test panel (for voltage proof test)

Not applicable.

4.8.6 Test panel (for EMC/ crosstalk, etc.)

Not applicable.

5 Characteristics

5.1 General

There is no corresponding Detail Quality Specification for connectors conform to this PAS. If necessary the methods according to IEC 62197-1 could be applied upon agreement between manufacturer and customer.

5.2 Pin assignment and other definitions

For pin assignment see Figures 2 and 3.

5.3 Classification into climatic categories

Conditions: according to IEC 60068-1 and Table 1.

5.4 Electrical characteristics

5.4.1 Creepage and clearance distances

See 3.4.

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

5.4.2 Voltage proof

Condition: IEC 60512, test 4a

Standard atmospheric conditions

All variants: 1 500 V a.c. peak, contact-to-contact and contact-to-shield

5.4.3 Current-carrying capacity

Conditions: IEC 60512, test 5b

All contacts

The minimal value is 3 A at an ambient temperature of 40 °C for 0,5 mm² (AWG 20). The upper limiting temperature (ULT) is 70 °C.

5.4.4 Contact resistance

Conditions: IEC 60512, test 2a

Standard atmospheric conditions

All contacts: Initial value 10 mΩ max., rise in relation to initial value 15 mΩ max.

5.4.5 Insulation resistance

Conditions: IEC 60512, test 3a

Method A

Mated connectors

Standard atmospheric conditions

Test voltage: 500 V d.c.

Each contact to all others: 100 MΩ min.

5.4.6 Impedance

Not applicable.

5.4.7 Transmission characteristics

Not applicable.

5.5 Mechanical characteristics

5.5.1 Mechanical operation

Conditions: IEC 60512, test 9a

Standard atmospheric conditions

Speed: 10mm/s max.

PL1: 500 operations.

5.5.2 Effectiveness of connector coupling devices

Conditions: IEC 60512-8, test 15f

Standard atmospheric conditions

Force 50 N to be applied at the end of the free housing to load the coupling device with the maximum torque, time 60 s, force rise 44,5 N/s max.

5.5.3 Insertion and withdrawal forces

Conditions: IEC 60512, test 13b

Speed: 50 mm/min maximum

All types, insertion and withdrawal: 50 N

5.5.4 Contact retention in insert

Conditions: IEC 60512, test 15a

Standard atmospheric conditions, wiring of the specimens is not required.

Force 40 N

5.5.5 Polarizing and coding method

Conditions: IEC 60512, test 13e

Standard atmospheric conditions, tools and gauges are not required.

NOTE IEC 61984 requires a minimum of 20 N or 1,5 times the insertion force, whichever is higher.

5.6 Other characteristics

5.6.1 Shock and vibration (method sine)

5.6.1.1 Vibration (sine)

Conditions: IEC 60512, test 6d, standard atmospheric conditions

Frequency range 10 Hz-500 Hz, 0,35 mm, acceleration 5 g, duration 2 h over 3 axis.

5.6.1.2 Shock

Conditions: IEC 60512, test 6c

Standard atmospheric conditions

Acceleration 500 m/s²

Duration 11 ms, 3 shocks in each axis and direction, half-sine wave.

5.6.2 Degree of protection provided by enclosures (IP code)

Conditions: IEC 60529, test 14.2.5 and test 14.2.7 (second numeral) and IEC 60529:1989, test 6, Table 7 (first numeral)

IP65 and IP67 according to IEC 60529:1989, connectors in mated and locked position.

5.6.3 Screen and shielding properties

Not applicable.

5.7 Environmental aspects

5.7.1 Marking of insulation material (plastics)

If applicable and reasonable, all plastic material shall be marked according to ISO 11469 to ease recycling.

5.7.2 Design/ use of material

The design has to take into account the relevant IEC Guides for designing products (IEC 62430) and the use of material (IEC Guide 109) with regard to the environment.

6 Test schedule

6.1 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, mated sets of connectors shall be tested. Care shall be taken to keep a particular combination of connectors together during the complete test sequence; when unmating is, for example, necessary for a certain test, the same connectors shall be mated for the subsequent tests.

In the following, a mated set of connectors is called a specimen.

6.2 Climatic category

See 3.3.

6.3 Clearance and creepage distances

See 3.4.

6.4 Arrangement for contact resistance measurement

Conditions: IEC 60512, test 2a

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.

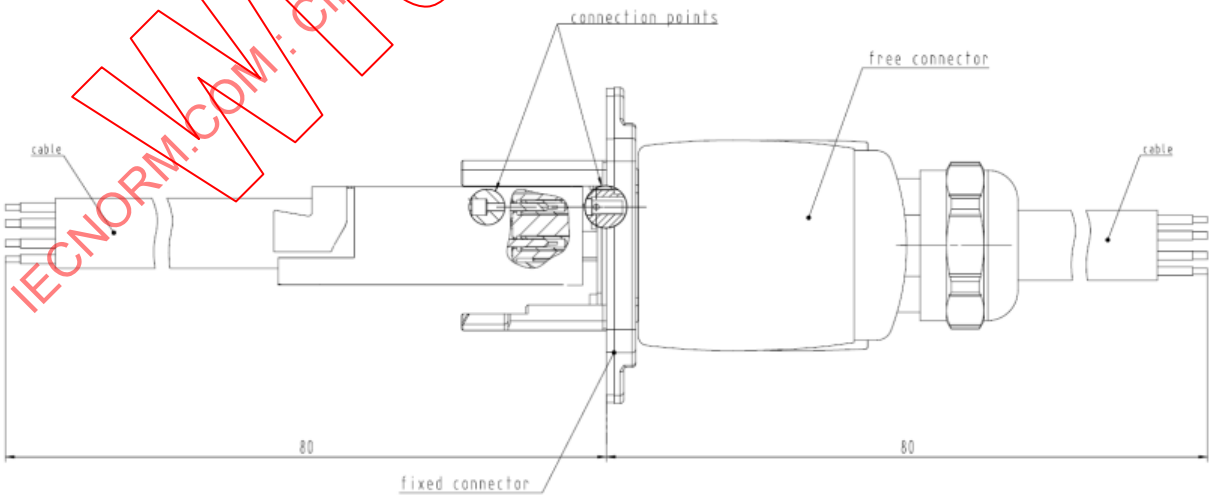


Figure 6 – contact resistance arrangement

6.5 Arrangement for dynamic stress tests

Conditions: IEC 60512, tests 6c and 6d

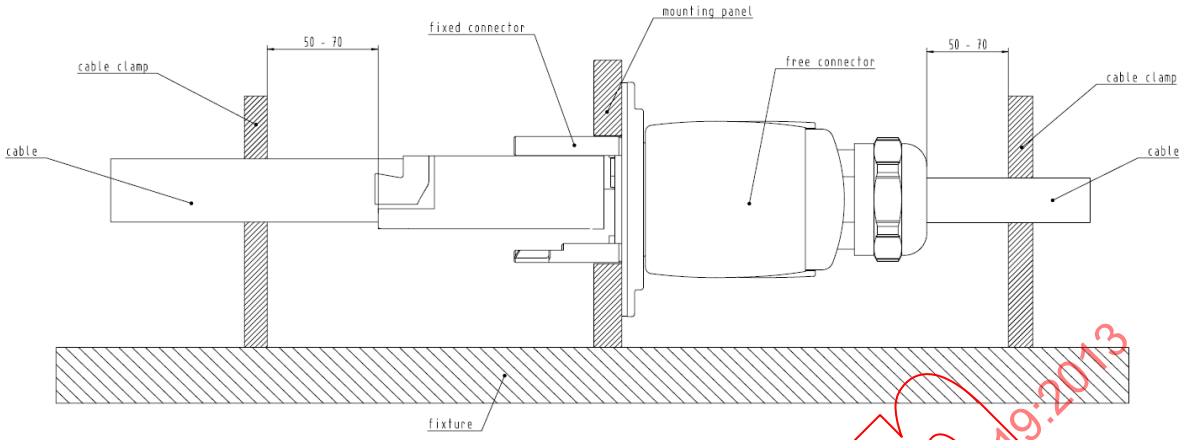


Figure 7 – contact resistance arrangement

6.6 Arrangement for testing static load; axial

Not applicable.

6.7 Wiring of specimens

Not applicable.

6.8 Test schedules

6.8.1 Basic (minimum) test schedule

Not applicable.

6.8.2 Full test schedule

6.8.2.1 General

Contact resistance measurements and contact disturbance measurements may be performed on different contacts. It is permissible to prepare separate connectors for each.

Dimensions shall be measured that affect clearance and creepage distances and other critical dimensions that affect intermateability.

The test parameters required shall not be less than those listed. The following tests specify the minimal characteristics to be checked and the minimal requirements to be fulfilled. The test results shall be written down in a test report.

As only one performance level exists, the tests do not differ depending on performance level.

Table 7 – Number of test specimens and contacts

Test group	AP	BP	CP	DP	EP	FP	GP	HP	JP	KP
Test specimens	3	3	3	3	3	3	Not applicable	Not applicable	see relevant test standard	3
Number of contacts	all	all	all	all	all	all	Not applicable	Not applicable	see relevant test standard	all

6.8.2.2 Test group P – Preliminary

All specimens shall be subject to the following tests.

Table 8 – 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			Visual examination	1a	There shall be no defect that would impair normal operation.
				Examination of dimensions and mass	1b	The dimensions shall comply with those specified in the relevant figure of Clause 4
P2	Polarizing method	13e	IEC 60512, test 13b Speed 50 mm/min maximum			50 N, see 5.5.3
P3	Contact retention in insert	15a	IEC 60512, test 15a			40 N, see 5.5.4
P4				Contact resistance	2a	All contacts, including PE: 10 mΩ max. see 5.4.4, initial value
P5				Insulation resistance	3a	100 MΩ min., see 5.4.5
P6				Voltage proof	4a	1 500 V a.c. peak, contact-to-contact and contact-to-shield, see 5.4.2

6.8.2.3 Test group AP – Dynamic/climatic

All specimens shall be subject to the following tests.

Table 9 – 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				Insertion and withdrawal forces	13b	50 N, see 5.5.3
AP2	Rapid change of temperature	11d	-40 °C to +70 °C mated connectors 25 cycles t_1= 30 min			
AP3				Insulation resistance	3a	100 MΩ min. (see 5.4.5)
AP4				Contact resistance	2a	All contacts, including PE: rise in relation to initial value 15 mΩ max. see 5.4.4
AP5				Voltage proof	4a	According 5.4.2
AP6				Visual examination	1a	see test phase P1
AP7	Climatic sequence	11a				
AP7.1	Dry heat	11l	+70 °C Mated connectors 16 h		3a	
AP7.2			Insulation resistance at high temperature (optional)			
AP7.3	Damp heat, cyclic	11m	21 cycles		1a	40 °C to 25 °C heat 93 % humidity 21 cycles see test phase P1
AP7.4			Visual examination			see test phase P1
AP8				Insulation resistance	3a	100 MΩ min. see 5.4.5
AP9				Voltage proof	4a	According 5.4.2
AP10				Contact resis-tance	2a	All contacts, including PE: rise in relation to initial value 15 mΩ max. see 5.4.4

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
AP10.1	Effectiveness of connector coupling device	15f	IEC 60512-8, test 15f			Applied force 50 N and duration 60 s, force rise 44,5 N/s max., see 5.5.2
AP11	Second characteristic numeral		Applied test method IPx5/x7	Test 14.2.5 and 14.2.7 of IEC 60529		As defined in IEC 60529
AP12	First characteristic numeral		Applied test method IP6x	Test 6, Table 7 of IEC 60529		As defined in IEC 60529
AP13				Insertion and withdrawal forces	13b	50 N, see 5.5.3
AP14			Not applicable			
AP15				Visual examination	1a	see test phase P1

6.8.2.4 Test group BP – Mechanical endurance

All specimens shall be subject to the following tests.

Table 10 – 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				Gauge retention force	16e	For conditions, see 4.8.1. The gauge P2 shall be retained.
BP2				Insertion and withdrawal forces	13b	50 N, see 5.5.3
BP3	Locking device mechanical operations (double of the specified number of cycles)		Not applicable			
BP4	Cable clamp robustness or other cable clamping tests		Not applicable			