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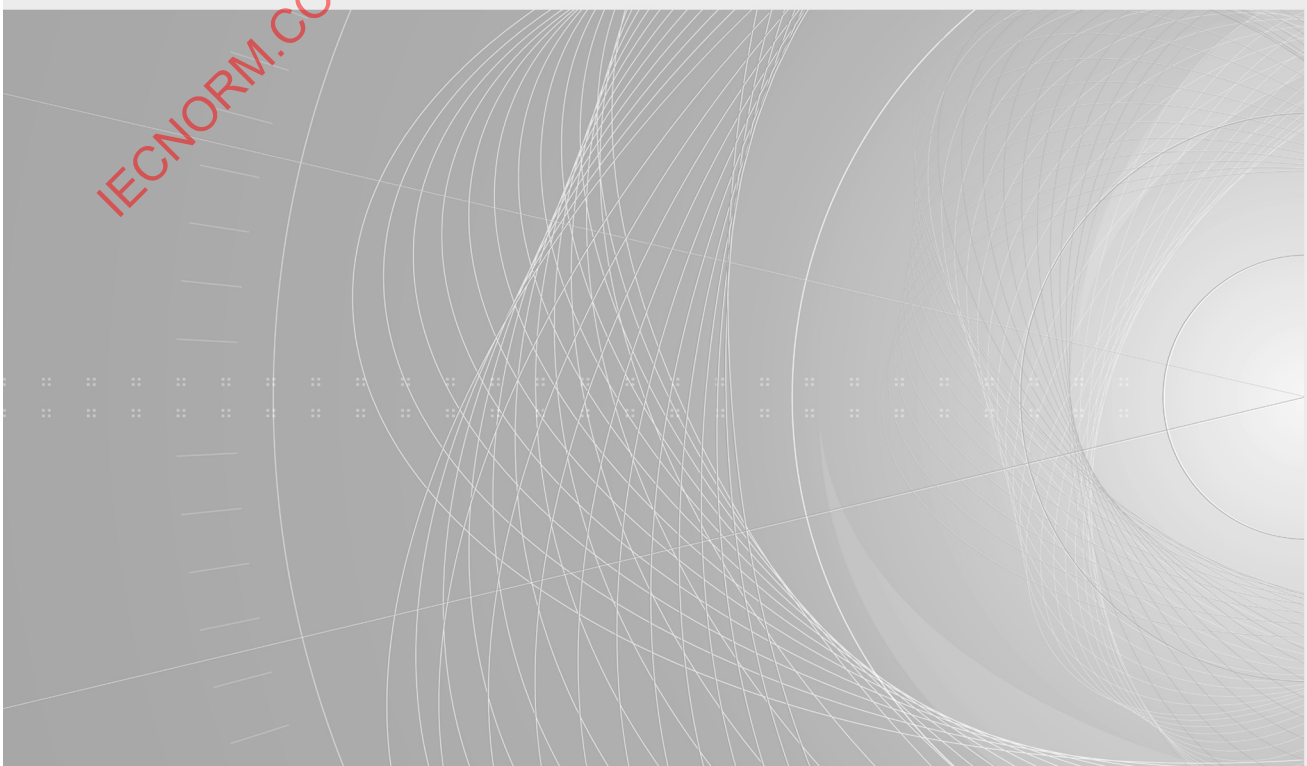
Edition 1.0 2018-01

PUBLICLY AVAILABLE SPECIFICATION

Connectors for electrical and electronic equipment – Product requirements – Part 3-126: Rectangular connectors – Detail specification for 5 pole power connectors for industrial environments with push-pull locking



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Edition 1.0 2018-01

PUBLICLY AVAILABLE SPECIFICATION

Connectors for electrical and electronic equipment – Product requirements – Part 3-126: Rectangular connectors – Detail specification for 5 pole power connectors for industrial environments with push-pull locking

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CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 3-126: Rectangular connectors – Detail specification for 5 pole power connectors for industrial environments with push-pull locking

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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/2593/PAS	48B/2612/RVC

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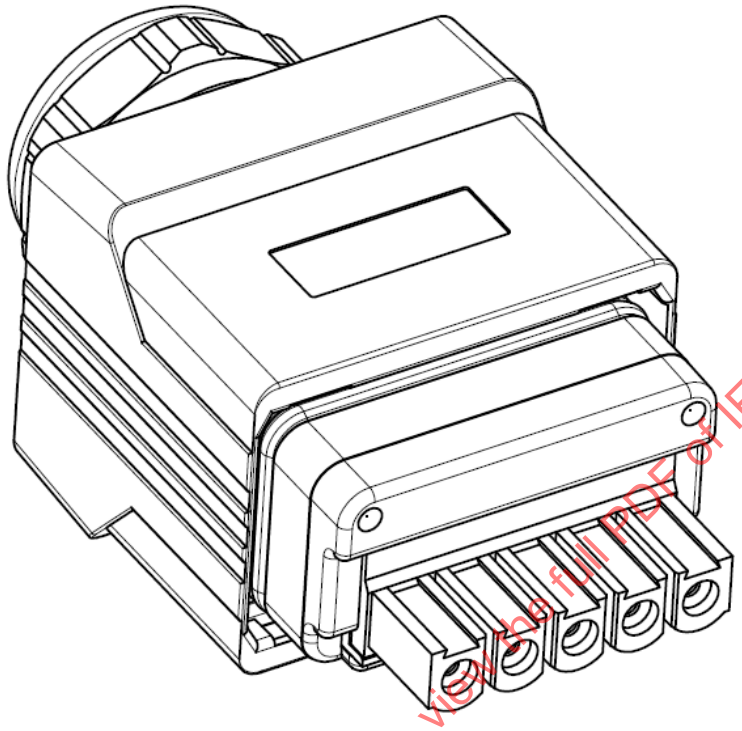
INTRODUCTION

IEC SC 48B – Electrical connectors Specification available from: IEC General secretariat or from the addresses shown on the inside cover.	IEC 61076-3-126 Ed.1
ELECTRONIC COMPONENTS DETAIL SPECIFICATION in accordance with IEC 61076-1	
	Rectangular connectors Detail specification for power connectors for industrial environments with push-pull locking Male and female connectors Male and female contacts Rewirable – Non-rewirable
	Free cable connectors Straight and right angle connectors Fixed connectors Flange mounting Single hole mounting

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 3-126: Rectangular connectors – Detail specification for 5 pole power connectors for industrial environments with push-pull locking

1 Scope

This document covers rectangular IP65/IP67 connectors with 5 poles for electric power supply up to 16 A. These connectors consist of fixed and free connectors, either rewirable or non-rewirable (for both portions). It uses the general function principles of the push-pull connector housing system described in IEC 61076-3-117 with IP65/IP67 degree of protection according to IEC 60529 for harsh applications.

Male connectors have 5 square 1 mm electric contacts, with 16 A rated current. Connectors according this document 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 are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-581:2008, *International Electrotechnical Vocabulary – Chapter 581: Electro-mechanical components for electronic equipment*

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

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60352-1, *Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance*

IEC 60352-2, *Solderless connections – Part 2: Crimped connections – General requirements, test methods and practical guidance*

IEC 60352-3, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-4, *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-5, *Solderless connections – Part 5: Press-in connections – General requirements, test methods and practical guidance*

IEC 60352-6, *Solderless connections – Part 6: Insulation piercing connections – General requirements, test methods and practical guidance*

IEC 60352-7, *Solderless connections – Part 7: Spring clamp connections – General requirements, test methods and practical guidance*

IEC 60352-8, *Solderless connections – Part 8: Compression mount connections – General requirements, test methods and practical guidance*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

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

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-2-2, *Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method*

IEC 60512-2-5, *Connectors for electronic equipment – Tests and measurements – Part 2-5: Electrical continuity and contact resistance tests – Test 2e: Contact disturbance*

IEC 60512-2-6, *Connectors for electronic equipment – Tests and measurements – Part 2-6: Electrical continuity and contact resistance tests – Test 2f: Housing (shell) electrical continuity*

IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance*

IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

IEC 60512-5-2, *Connectors for electronic equipment – Tests and measurements – Part 5-2: Current-carrying capacity tests – Test 5b: Current-temperature derating*

IEC 60512-6-1, *Connectors for electronic equipment – Tests and measurements – Part 6-1: Dynamic stress tests – Test 6a: Acceleration, steady state*

IEC 60512-6-2, *Connectors for electronic equipment – Tests and measurements – Part 6-2: Dynamic stress tests – Test 6b: Bump*

IEC 60512-6-3, *Connectors for electronic equipment – Tests and measurements – Part 6-3: Dynamic stress tests – Test 6c: Shock*

IEC 60512-6-4, *Connectors for electronic equipment – Tests and measurements – Part 6-4: Dynamic stress tests – Test 6d: Vibration (sinusoidal)*

IEC 60512-6-5, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 6: Dynamic stress tests – Section 5: Test 6e: Random vibration*

IEC 60512-8-1, *Connectors for electronic equipment – Tests and measurements – Part 8-1: Static load tests (fixed connectors) – Test 8a: Static load, transverse*

IEC 60512-8-2, *Connectors for electronic equipment – Tests and measurements – Part 8-2: Static load tests (fixed connectors) – Test 8b: Static load, axial*

IEC 60512-9-1, *Connectors for electronic equipment – Tests and measurements – Part 9-1: Endurance tests – Test 9a: Mechanical operation*

IEC 60512-9-2, *Connectors for electronic equipment – Tests and measurements – Part 9-2: Endurance tests – Test 9b: Electrical load and temperature*

IEC 60512-11-1, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 11: Climatic tests – Section 1: Test 11a – Climatic sequence*

IEC 60512-11-3, *Connectors for electronic equipment – Tests and measurements – Part 11-3: Climatic tests – Test 11c: Damp heat, steady state*

IEC 60512-11-4, *Connectors for electronic equipment – Tests and measurements – Part 11-4: Climatic tests – Test 11d: Rapid change of temperature*

IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-13, *Connectors for electronic equipment – Tests and measurements – Part 11-13: Climatic tests – Test 11n: Gas tightness, solderless wrapped connections*

IEC 60512-12-4, *Connectors for electronic equipment – Tests and measurements – Part 12-4: Soldering tests – Test 12d: Resistance to soldering heat, solder bath method*

IEC 60512-12-5, *Connectors for electronic equipment – Tests and measurements – Part 12-5: Soldering tests – Test 12e: Resistance to soldering heat, soldering iron method*

IEC 60512-13-1, *Connectors for electronic equipment – Tests and measurements – Part 13-1: Mechanical operation tests – Test 13a: Engaging and separating forces*

IEC 60512-13-2, *Connectors for electronic equipment – Tests and measurements – Part 13-2: Mechanical operation tests – Test 13b: Insertion and withdrawal forces*

IEC 60512-13-5, *Connectors for electronic equipment – Tests and measurements – Part 13-5: Mechanical operation tests – Test 13e: Polarizing and keying method*

IEC 60512-14-7, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 14: Sealing tests – Section 7: Test 14g: Impacting water*

IEC 60512-15-1, *Connectors for electronic equipment – Tests and measurements – Part 15-1: Connector tests (mechanical) – Test 15a: Contact retention in insert*

IEC 60512-16-5, *Connectors for electronic equipment – Tests and measurements – Part 16-5: Mechanical tests on contacts and terminations – Test 16e: Gauge retention force (resilient contacts)*

IEC 60512-15-6, *Connectors for electronic equipment – Tests and measurements – Part 15-6: Connector tests (mechanical) – Test 15f: Effectiveness of connector coupling devices*

IEC 60512-17-3, *Connectors for electronic equipment – Tests and measurements – Part 17-3: Cable clamping tests – Test 17c: Cable clamp resistance to cable pull (tensile)*

IEC 60512-17-4, *Connectors for electronic equipment – Tests and measurements – Part 17-4: Cable clamping tests – Test 17d: Cable clamp resistance to cable torsion*

IEC 60512-19-3, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 19: Chemical resistance tests – Section 3: Test 19c - Fluid resistance*

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

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60998-2-1:2002, *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 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm2 up to 35 mm^2 (included)*

IEC 60999-2, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping units for conductors above 35 mm2 up to 300 mm2 (included)*

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

IEC 61076-3:2008, *Connectors for electronic equipment – Product requirements – Part 3: Sectional specification for rectangular connectors*

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

IEC 62430:2009, *Environmentally conscious design for electrical and electronic products*

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

ISO 128-30:2001, *Technical drawings – General principles of presentation – Part 30: Basic conventions for views*

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

ISO 11469:2016, *Plastics – Generic identification and marking of plastics products*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

IEC Electropedia: available at http://www.electropedia.org/

ISO Online browsing platform: available at http://www.iso.org/obp

3.1
protective conductor
PE
conductor provided for purposes of safety, for example protection against electric shock

Note 1 to entry: In an electrical installation, the conductor identified PE is normally also considered as protective earthing conductor.

[SOURCE: IEC 60050-581:2008, 581-27-26]

3.2
functional earth conductor
FE
earthing conductor provided for functional earthing

Note 1 to entry: Functional earthing a point or points in a system or in an installation or in equipment, for purposes other than electrical safety.

[SOURCE: IEC 60050-195, Amendment 1: 2001, 195-01-13]

4 Technical information

4.1 Systems of levels

4.1.1 Performance levels

See Table 9.

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

Connectors according to this document are deemed to be intermateable.

4.2 Classification into climatic categories

Table 1 shows the climatic category.

Table 1 – Climatic category

Climatic category	Category temperature		Damp heat steady state		Days
	Lower	Upper	Temperature	Relative humidity	
	°C	°C	°C	%	
25/070/21	–25	+70	40	93	21

4.3 Clearance and creepage distances

Creepage and clearance distances shall meet the requirements given in 6.4.1.

4.4 Current-carrying capacity

See 6.4.3.

4.5 Marking

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

5 Dimensional information

5.1 Common features

Connectors meant to comply with IP ratings per IEC 60529 shall be appropriately mated and sealed in order to meet the requirements detailed in the test schedules in 7.2.

5.2 Reference system

Coordination dimensions are dimensions without tolerances which indicate the boundary or centre-line references in order to allow arrangement.

Dimensions are given in millimetres, drawings are shown in first angle projection according ISO 128-30. The shape of connectors may deviate from those shapes given in the following figures as long as the specified dimensions are not influenced.

5.3 Engagement (mating) information

5.3.1 Engaging (mating) direction

5.3.1.1 General

An arrow in Figure 1 indicates the mating direction.

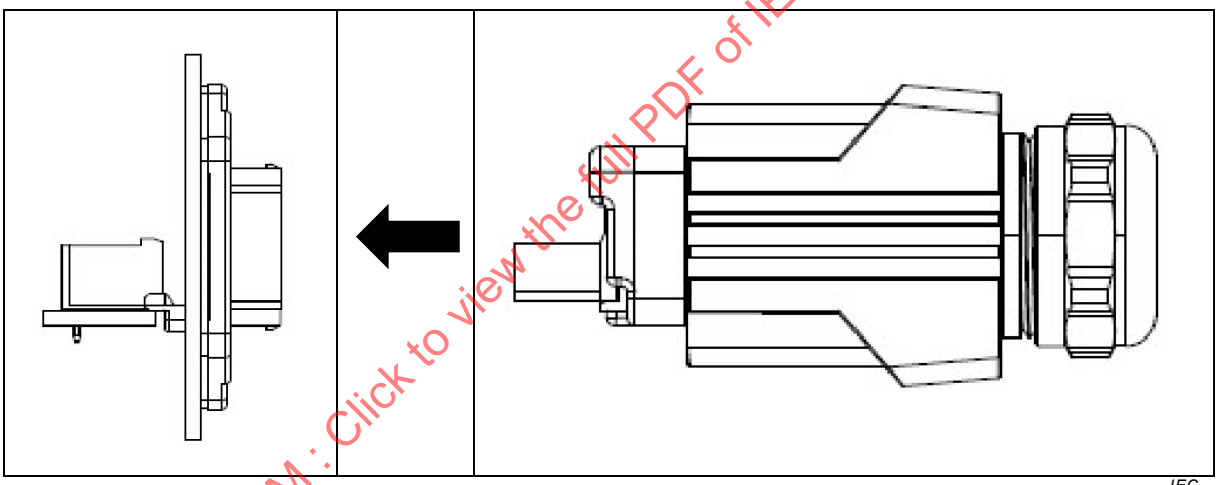


Figure 1 – View showing mating direction

5.3.1.2 Contact levels and sequencing

For all interfaces, the contact sequence during the connection process shall be:

- Protective Earth (if any)
- Functional Earth (if any)
- Power contacts

During disconnection the order shall be reversed.

5.3.2 Perpendicular to the engaging (mating) direction

Not applicable.

5.3.3 Inclination

Not applicable.

5.4 Fixed connectors

5.4.1 Dimensions

Figure 2 shows a fixed connector with male contacts and Table 2 shows the related dimensions.

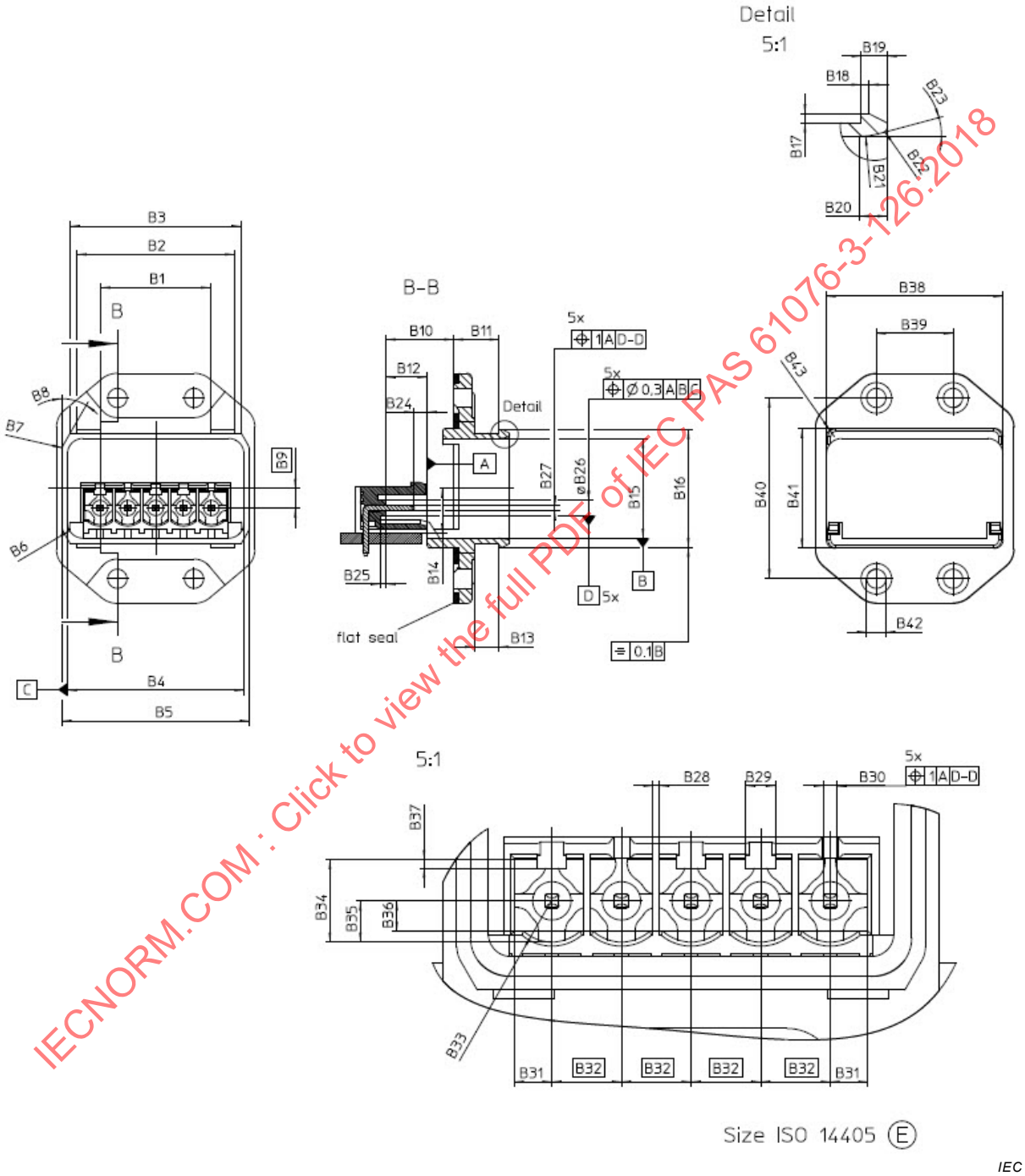


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Figure 2 – Fixed connector with male contacts

Table 2 – Dimensions of fixed connector

Dimensions in millimetres			
Letter	**Minimum**	**Nominal**	**Maximum**
B1	19,9	20	20,1
B2	28,7	28,8	28,9
B3	31,05	31,2	31,35
B4	32,15	32,2	32,25
B5	34,1	34,2	34,3
B6	R 2,75	R 2,8	R 2,85
B7	R 1,93	R 2	R 2,07
B8	29°	30°	31°
B9	-	3,6 1	
B10	12,2	12,35	12,5
B11	8,25	8,3	8,35
B12	7,44	7,5	7,56
B13	4,4	4,5	4,6
B14	8,05	8,15	8,25
B15	18,15	18,2	18,25
B16	21,45	21,5	21,55
B17	0,6	0,65	0,8
B18	0,55	0,6	0,65
B19	1,85	1,9	1,95
B20	1,9	2	2,1
B21	R 4,9	R 5	R 5,1
B22	R 0,3	R 0,4	R0,5
B23	14°	15°	16°
B24	1,4	2,4	2,6
B25	0,95	1	1,1
B26	2,73	2,8	2,87
B27	0,95	1	1,05
B28	0,40	0,5	0,55
B29	2,04	2,14	2,24
B30	0,95	1	1,05
B31	2,64	2,74	2,99
B32	-	5,08 1	-
B33	R 2,98	R 3,08	R 3,38
B34	5,95	6	6,2
B35	2,95	3	3,05
B36	2,1	2,2	2,35
B37	0,45	0,55	0,65
B38	32,1	32,25	32,4
B39	13,9	14	14,1
B40	32,9	33	33,1
B41	21,65	21,85	22,05
B42	3,4	3,5	3,6
B43	1,25	-	-
NOTE Theoretically precise dimension.			

5.4.2 Electrical terminations

The contact terminations shall be of any type.

Solderless terminations shall be in accordance with the relevant part of the IEC 60352 series.

Screw-type or screwless-type terminations shall be in accordance with IEC 60999-1.

5.5 Free connectors

5.5.1 Dimensions

Figure 3 shows a free connector with female contacts and Table 3 shows the related dimensions.

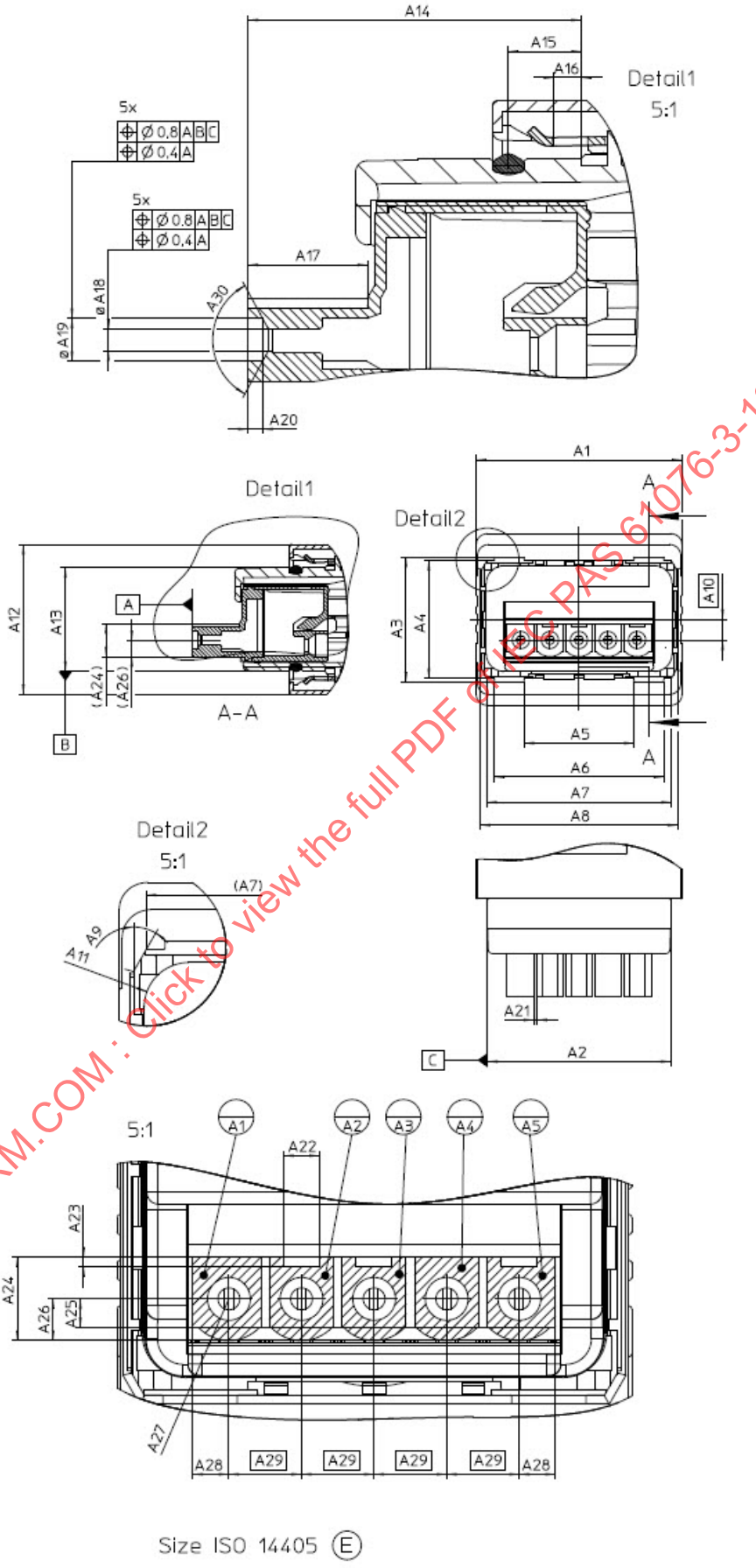


Figure 3 – Free connector with female contacts

Table 3 – Dimensions of free connector

Dimensions in millimetres			
Letter	**Minimum**	**Nominal**	**Maximum**
A1	35,95	36,2	36,45
A2	31,89	32,06	32,09
A3	21,7	-	-
A4	20,45	-	-
A5	-	-	19,35
A6	29,45	-	-
A7	31,45	-	-
A8	34,4	34,5	34,6
A9	29°	30°	31°
A10	-	3,6 [1]	-
A11	R 3,07	R 3,1	R 3,3
A12	-	-	26,8
A13	17,89	18,06	18,09
A14	23	23,2	23,4
A15	4,6	5,1	5,6
A16	2,15	2,25	2,45
A17	8,26	8,33	8,38
A18	1,48	1,53	1,58
A19	2,93	3	3,1
A20	0,95	1	1,1
A21	0,57	0,6	0.8
A22	2,5	2,6	2,7
A23	0,63	0,68	0,73
A24	5,73	5,83	5,88
A25	1,95	2	2,05
A26	2,89	2,92	2,95
A27	R 2,78	R 2,93	R 3,03
A28	2,1	2,52	2,57
A29	-	5,08 [1]	-
A30	120°	125	130°
NOTE [1] Theoretically precise dimension.			

5.5.2 Electrical terminations

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

Solderless terminations shall be in accordance with the relevant part of the IEC 60352 series.

Screw-type or screwless-type terminations shall be in accordance with IEC 60999-1.

5.6 Accessories

Not applicable.

5.7 Mounting information for connectors

Figure 4 shows a panel cut out for the fixed connector and Table 4 shows the related dimensions.

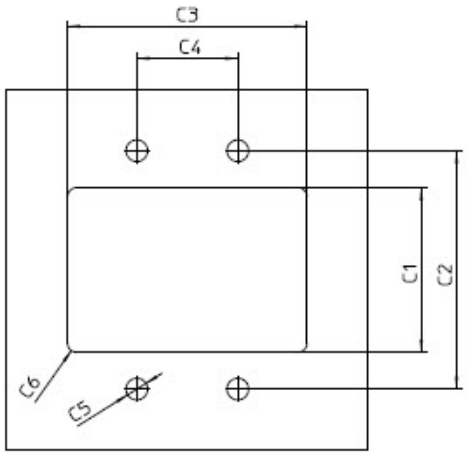


Figure 4 – Mounting information – panel cut-out outline

Table 4 – Mounting dimensions

Dimensions in millimetres			
Letter	**Minimum** mm	**Nominal** mm	**Maximum** mm
C1	22,7	22,8	22,9
C2	32,9	33	33,1
C3	33,1	33,2	33,3
C4	13,9	14	14,1
C5	-	M 3	-
C6	-	-	1,25

5.8 Gauges

5.8.1 Sizing gauges and retention force gauges

Material: tool steel, hardened

= Surface roughness acc. to ISO 1302: Ra_{max} = 0,25 µm, Ra_{min} = 0,15 µm

Surface clean and free of grease.

Figure 5 shows gauge dimensions.

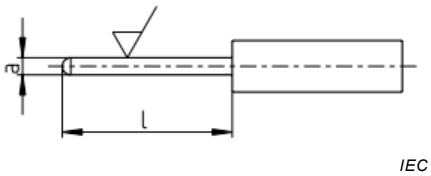


Figure 5 – Gauge dimensions

Table 5 shows gauge dimensions.

Table 5 – Gauge dimensions

Gauge	Mass g	Application	□ a mm	l min mm	Nom pin □ mm
P51	-	Sizing	1,03 mm +0,01 / 0 mm	10	1,0
P52	25	Retention force	0,97 mm 0 / -0,01 mm	10	

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

Not applicable.

5.8.3 Probes

Not applicable.

5.8.4 Contact resistance gauge

Not applicable.

5.8.5 Test panel (for voltage proof test)

For all styles of fixed connectors, the panel cut-out shall be designed according to the drawings in 5.7 with cut-out dimensions 2 µm larger than the maximum permitted corresponding dimension of the fixed connector. The test panel shall have the maximum thickness.

For free connectors, the connectors shall be wrapped into a foil of aluminium. The foil shall be connected to PE.

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

Not applicable.

6 Characteristics

6.1 General

For the ratings, see Table 6.

Table 6 – Ratings of connectors

Contacts	Rated voltage a.c. or d.c. V	Rated current A
5 (4+FE)	60	16

Insulation resistance: 10^8 Ω min.

Climatic category: see Table 1

Contact spacing: see Clause 5

The Detail Quality Specification according to IEC 62197-2-1xx is not applicable.

6.2 Pin assignment and other definitions

See Clause 5.

6.3 Classification into climatic categories

Conditions: IEC 60068-1

Table 1 shows the climatic category.

The lowest and highest temperatures and the duration of the damp heat, steady state test should be selected from the preferred values stated in 2.2 of IEC 61076-1:2006.

6.4 Electrical characteristics

6.4.1 Creepage and clearance 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 COC as defined in IEC 61984).

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). For minimum values for clearance and creepage distances see Clause 5.

6.4.2 Voltage proof

The coordination of creepage and clearance distances has to be performed according IEC 60664-1.

The connector shall be tested according to the ratings in 6.1 and shall be mounted to the test panel specified in 5.8.5.

Conditions: IEC 60512-4-1, Test 4a

Standard atmospheric conditions

Mated connectors

For ratings see Table 6 and Table 8.

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.

Table 7 shows rated impulse voltage and pollution degree.

Table 7 – Rated impulse voltage – Pollution degree

Rated impulse voltage kV	Pollution degree
1,5	3

Table 8 shows voltage proof.

Table 8 – Voltage proof

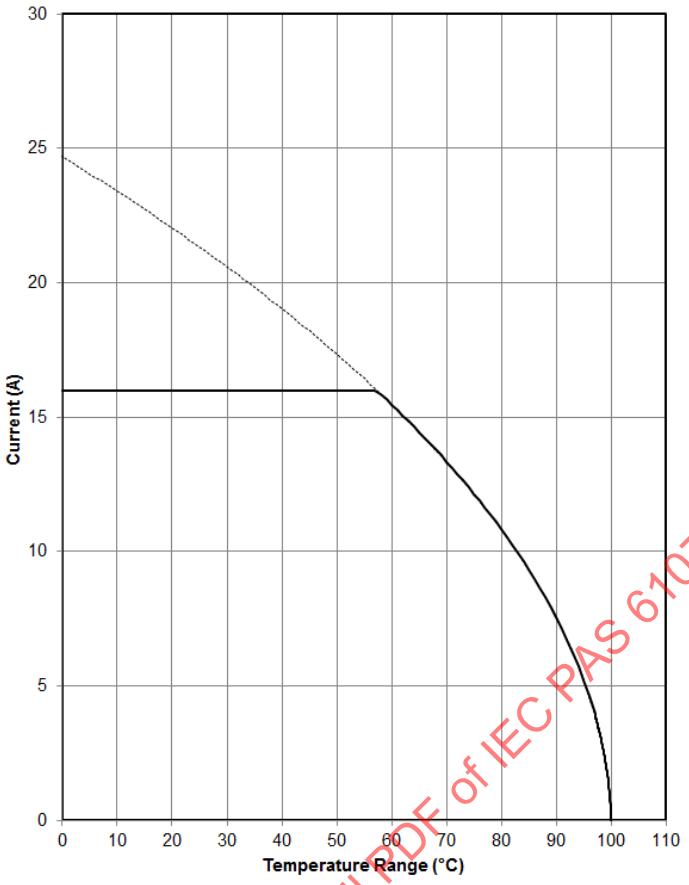
kV withstanding voltage			
Between contacts		Between contacts and metal-housing	
Fixed connectors	Free connectors	Fixed connectors	Free connectors
2,21	2,21	2,21	2,21

6.4.3 Current-carrying capacity

Conditions: IEC 60512-5-2, Test 5b

All contacts except FE and PE, connected in series.

The current-carrying capacity of connectors shall comply with the de-rating curve given in Figure 6 as a minimum requirement.



NOTE 1 The maximum permissible current I for an ambient temperature between T = -25 °C and T = 40 °C is I = 16 A.

NOTE 2 The maximum permissible current I for an ambient temperature between T = 40 °C and T= 70 °C is $I = 16\ A \cdot (1-(T-40)/35)^{0,5}$.

Figure 6 – Connector de-rating curve

6.4.4 Contact and shield resistance

Conditions: IEC 60512-2-1, Test 2a, IEC 60512-2-2, Test 2b and IEC 60512-2-6, Test 2f

Standard atmospheric conditions.

Conditions: IEC 60512-2-1, Test 2a

Mated connectors.

Measurement points: 40 mm behind the cable glands

Power contacts and FE contact: 10 mΩ max.

U_{max} ≤ 20 mV (AC or DC)

I_m ≤ 100 mA(AC or DC)

Shield contact (if any): not applicable.

Among all conductors, difference between maximum and minimum:

10 mΩ max.

$R2_{(after\ test)} \leq R1_{(before\ test)} + 5\ m\Omega$

6.4.5 Insulation resistance

Conditions: IEC 60512-3-1, Test 3a, Method A

Standard atmospheric conditions

Mated connectors
Test voltage: 500 V d.c.
Each contact to all others: 10^8 Ω min

6.4.6 Impedance

Not applicable.

6.4.7 Transmission characteristics

Not applicable.

6.5 Mechanical characteristics

6.5.1 Mechanical operation

Conditions: IEC 60512-9-1, Test 9a
Standard atmospheric conditions
Max. speed of operations = 10 mm/s
Rest: 30 s, unmated

Table 9 shows the number of mechanical operations.

Table 9 – Number of mechanical operations

Performance level	Mechanical operations
P21	100
other types	[a]
[a] Other mating cycles are upon agreement between manufacturer and user.	

6.5.2 Effectiveness of connector coupling devices

Conditions: IEC 60512-15-6, Test 15f

Standard atmospheric conditions
Applied force: 150 N
Test duration: 60s ± 5s
Force speed: ≤ 44,5 N/s

6.5.3 Engaging and separating forces (or insertion and withdrawal forces)

Conditions: IEC 60512-13-1 Test 13a

Coupling speed: ≤ 10 mm/s
All types, insertion and withdrawal: 60 N maximum
Initial torque test insertion: 1,0 Nm max. and withdrawal 0,7 Nm max.
After conditioning torque test insertion 2,0 Nm max. and withdrawal 1,2 Nm max.

6.5.4 Contact retention in insert

Not applicable.

6.5.5 Polarizing and coding method

See Table 10.

Conditions: IEC 60512-13-5, Test 13e

Standard atmospheric conditions

Table 10 – Total insertion force

Number of poles	Total insertion force N
5	Max. 90

6.6 Other characteristics

6.6.1 Vibration (method half-sine)

Conditions: IEC 60512-6-4, Test 6d

Frequency range: 10 Hz – 500 Hz

Amplitude: 0,35 mm

Frequency change: 1 octave/min.

Number of sweeps per axis: 10

Axes: 3 – x, y, z

Acceleration: 50 m/s²

Standard atmospheric conditions

Connectors in mated and locked position

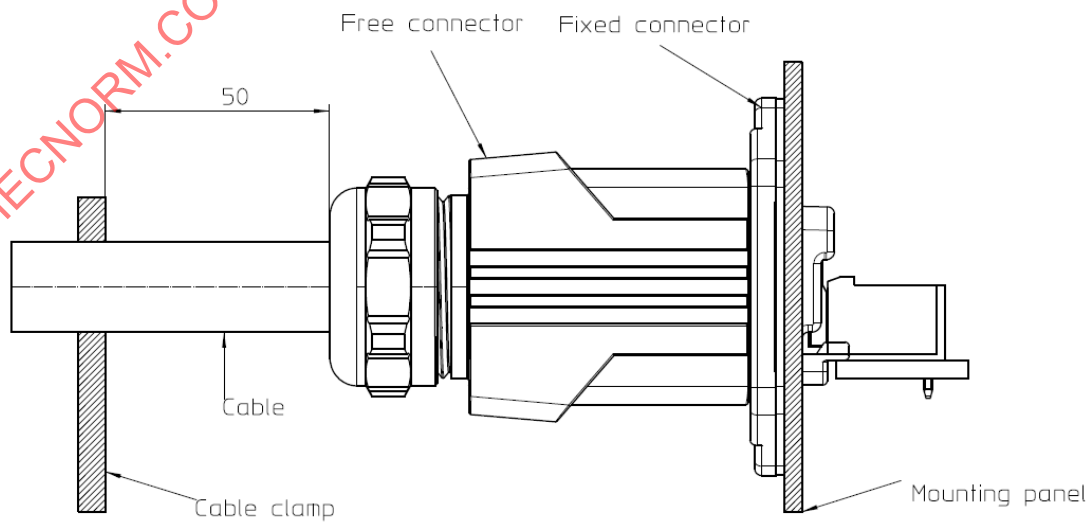
The fixed and free connector shall be rigidly installed in a suitable fixture as specified in Figure 7.

Duration: 10 swaps each axis

Cable with maximum wire size or overmoulded cable.

Figure 7 shows a dynamic stress test arrangement.

Dimension in millimetres



IEC

Figure 7 – Stress test arrangement

6.6.2 Shock (method half-sine)

Conditions: IEC 60512-6-3, Test 6c

Duration of the impact: 11 ms

Axes: 3 – x, y, z

Acceleration: 500 m/s^2

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 Figure 7.

Duration: 6 shocks per axis (3 positive axis, 3 negative axis)

Cable with maximum wire size or overmoulded cable.

6.6.3 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, IP6X test 6, Table 7 (first numeral)

Both IPX5 and IPX7 (second numeral) according to IEC 60529

Connectors in mated and locked position.

Fixed connector to be mounted according 5.8.5.

6.6.4 Screen and shielding properties

Not applicable.

6.6.5 Static load test

Conditions: IEC 60512-8-1, Test 8a.

A force of 50 N to be applied at the end of the free housing to load the coupling device with the maximum torque.

6.7 Environmental aspects

6.7.1 Marking of insulation material (plastics)

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

6.7.2 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.

7 Test schedule

7.1 General

7.1.1 Overview

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 set of connector styles shall be called a specimen.

7.1.2 Climatic category

The climatic category and related performance levels are stated in Table 1.

7.1.3 Creepage and clearance distances

The coordination of creepage and clearance distances has to be performed according IEC 60664-1.

See Table 6 for the rated voltage.

See Table 7 for the rated impulse voltage and pollution degree.

See Table 8 for the voltage proof.

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.

7.1.4 Arrangement for contact resistance measurement

Conditions: IEC 60512-2-1, Test 2a
Standard atmospheric conditions
Measuring points, see Figure 8

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 8 shows a contact resistance arrangement.

Dimension in millimetres

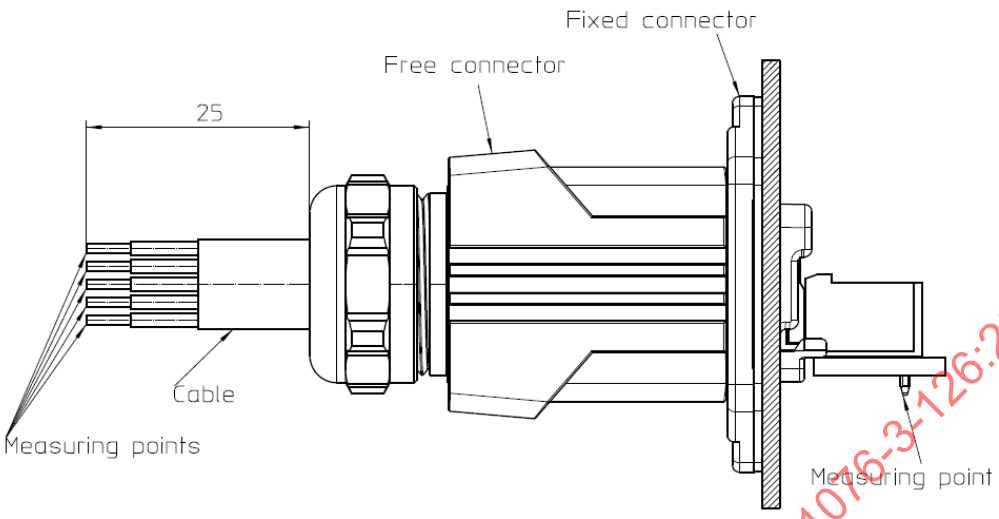


Figure 8 – Contact resistance arrangement

7.1.5 Arrangement for dynamic stress tests

Conditions: IEC 60512-6-1, Test 6a, IEC 60512-6-2, Test 6b, IEC 60512-6-3, Test 6c and IEC 60512-6-4, Test 6d.

Figure 7 shows a dynamic stress test arrangement.

7.1.6 Arrangement for testing static load, axial

Conditions: IEC 60512-8-2, Test 8b

7.1.7 Wiring of specimens

The terminations shall be wired, in accordance with the relevant part of IEC 60352. For screw-type or screwless-type connection tests, also the relevant requirements of IEC 60999-1 should be duly taken into account.

7.2 Test schedules

7.2.1 Basic (minimum) test schedule (Table 11)

Table 11 – Basic tests

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition test	Title	IEC 60512 test No.	PL	All connector styles
1	General examination	1	Unmated connectors	Visual examination Examination of dimensions and mass	1a 1b		There shall be no defect that would impair normal operation The dimensions including contact sequence, creepage and clearance shall comply with those specified
2.1 or 2.2	Engaging and separating forces		Speed: A (mm/s)maximum	Engaging and separating forces or Insertion and withdrawal forces	13a 13b		See 6.5.3
3	Contact resistance		Connection points as in 7.1.4	Contact resistance	2a or 2b		5 mΩ maximum
4	Insulation resistance		Test voltage 500 V ± 15 V d.c. Method A	Insulation resistance	3a		10^8 Ω minimum
5	Voltage proof		Method H	Voltage proof	4a		See Table 8 There shall be no breakdown or flashover
6.1 or 6.2	Soldering Other applicable connection method	12 Series [1)]		Contact resistance including termination	2a or 2b		5 mΩ maximum

[1)] If the connector features solder terminations, the appropriate test(s) and condition(s) shall be selected from IEC 60512. In case of solderless terminations, other appropriate connection tests shall be additional to, or replace, the specified tests, for example tests of IEC 61076-3, or tests of the applicable parts of IEC 60352, such as test group GP of the full test schedule.

7.2.2 Full test schedule

7.2.2.1 General

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

Contact resistance measurements and insulation resistance/voltage proof measurements shall be performed on different contacts. It is permissible to prepare separate connectors for each.

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

In Table 12 below, the minimum number of contacts shall be satisfied; for example if a connector has only 4 contacts, there shall be 8 connectors for test group AP, to satisfy the minimum number of contacts under test.

Table 12 – 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	3	3	3	3
Number of contacts	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped	Each specimen fully equipped

For the full test schedule, 30 specimens are needed (10 groups of 3). Within each group, only 2 of the 6 specimens shall be subjected to the IPX5 and IPX7 tests. The same specimens are used for both tests against ingress of water, water jets, IPX5, and temporary immersion, IPX7. Two additional specimens shall be used for the dust-tight test, IP6X.

7.2.2.2 Test group P – Preliminary

The specimens shall consist of the complete connector assembled together.

All specimens shall be subjected to the test group P – preliminary tests in the sequence detailed in the following. Table 13 shows the test group P.

The specimens shall then be divided into the appropriate number of groups. All connectors in each group shall undergo the following tests as described in this detail specification and in the sequence given.

The test parameters required shall not be less than those listed. The following tests specify the characteristics to be checked and the requirements to be fulfilled.

Table 13 – Test group P

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirement All connector styles
P1	General exami-nation	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 the relevant figure of Clause 5.
P2	Polarizing method	13e	Not applicable			
P3				Contact resistance	2a	10 mΩ maximum
P4			Test voltage500 V ± 15 V d.c. Method A8 contacts/specimen	Insulation resistance	3a	Min 10^8Ω
P5			Contact/contact: Method A mated connectors	Voltage proof	4a	See Table 8 There shall be no breakdown or flashover
			All contacts to test panel: Method A mated connectors			See Table 8 and IEC 60664-1

7.2.2.3 Test group AP – Dynamic/climatic

Table 14 shows the test group AP.

Table 14 –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 6.5.3	Insertion and withdrawal forces	13b	See 6.5.3
AP2	Gauge retention force		Female contacts only 3 contacts/specimen sizing and retention force gauge See Table 14, 2.1	Engaging and separating forces	16e	Not applicable
AP3	Vibration	6d	10 Hz–500 Hz 0,35 mm or 50 m/s^2 3 axis 10 swaps each axis	Contact disturbance	2e	Duration of disturbance 1 µs max.
				Contact resistance – Millivolt level method	2a	Rise in relation to initial values 5 mΩ max.
				Visual examination	1a	There shall be no defect that would impair normal operation
AP4	Shock	6c	Arrangement according to Figure 7 Half sine shock acceleration 490 m/s^2 (50 g) Duration of impact: 11 ms 6 shocks per axis 3 positive axis 3 negative axis	Contact disturbance	2e	Duration of disturbance 1 µs max.
				Contact resistance – Millivolt level method	2a	Rise in relation to initial values 5 mΩ max.
				Visual examination	1a	There shall be no defect that would impair normal operation
AP5	Rapid change of temperature	11d	–25 °C to 70 °C, t = 30 min, 5 cycles	Contact resistance-Millivolt level method	2a	Rise in relation to initial values 5 mΩ max.
				Insulation resistance	3a	10^8 Ω min.
				Voltage proof	4a	See Table 8 There shall be no breakdown or flashover
				Visual examination	1a	There shall be no defect that would impair normal operation

Table 14 *(continued)*

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
AP6	Climatic sequence	11a				
AP6.1	Dry heat	11i	Temp.: 70 °C Duration: 16 h	Insulation resistance at high temperature	3a	10^8 Ω min.
AP6.2	Damp heat, cyclic, first cycle	11m	Method Db Temp.: 40 °C Recovery time: 2 h	Visual examination	1a	There shall be no defect that would impair normal operation
AP6.3	Cold	11j	Temp.: –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 5 mΩ max.
				Insulation resistance	3a	10^8 Ω min.
				Voltage proof	4a	See Table 8 There shall be no breakdown or flashover
				Insertion and withdrawal forces	13b	See 6.5.3
				Visual examination	1a	There shall be no defect that would impair normal operation
AP7	Impacting water	14g				
AP7.1	IP code second charac-teristic numeral		See IEC 60529	IEC 60529:1989, Test 14.2.5 and Test 14.2.7		No leakage on contacts
AP7.2	IP code first characteristic numeral		Dust IP6X Test 6 Table 7, see IEC 60529	IEC 60529:1989, Table 7		IP6X no deposit of dust on contacts [a]

Table 14 *(continued)*

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
AP7.3				Contact resistance – Millivolt level	2a	Rise in relation to initial values 5 mΩ max.
					2b	
				Insulation resistance	3a	10^8 Ω min.
				Voltage proof	4a	See Table 8 There shall be no breakdown or flashover
				Insertion and withdrawal forces	13b	See 6.5.3
AP8				Visual examination	1a	There shall be no defect that would impair normal operation
AP9	Polarizing method	13e				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 than the correct manner
[a] It is allowed to perform AP7.2 with an additional specimen, extending the total number of specimen by 1.						