# INTERNATIONAL STANDARD

# IEC 61076-4-113

First edition
2002-11

## Connectors for electronic equipment – Printed board connectors –

## Part 4-113: Detail specification for two-part connectors having 5 rows with a grid of 2,54 mm for printed boards and backplanes in bus applications

Reference number
IEC 61076-4-113:2002(E)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# CONNECTORS FOR ELECTRONIC EQUIPMENT – PRINTED BOARD CONNECTORS –

## Part 4-113: Detail specification for two-part connectors having 5 rows with a grid of 2,54 mm for printed boards and backplanes in bus applications

## FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 61076-4-113 has been prepared by subcommittee 48B: Connectors, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 48B/1247/FDIS | 48B/1283/RVD |

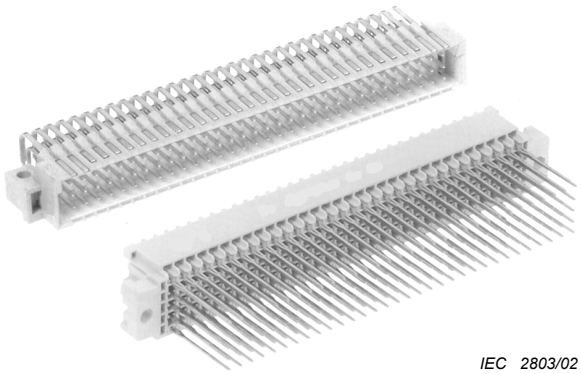
Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

# CONNECTORS FOR ELECTRONIC EQUIPMENT – PRINTED BOARD CONNECTORS –

## Part 4-113: Detail specification for two-part connectors having 5 rows with a grid of 2,54 mm for printed boards and backplanes in bus applications

| | |
|---|---|
| **IEC SC 48B: Connectors**<br>Electronic components of assessed quality in accordance with<br><br>- GENERIC SPECIFICATION IEC 61076-1<br>Generic specification IEC 61076-1 First edition:1995 | **IEC 61076-4-113**<br><br>Page 5 of 36 pages |
| See 3 for dimensions<br>  <br>*IEC 2803/02* | Two-part connectors for printed boards and backplanes, grid of 2,54 mm.<br><br>Connector with 160 contacts in 5 rows.<br><br>Rows a, b and c in compliance with IEC 60603-2, 3rd edition.<br>Rows z and d with 32 contacts each usable for standard application or for grounding.<br><br>Terminations:<br>Free board connector: Solder connections<br>Fixed board connector: Press-in, wire wrap and interface connections |

**Reference to IEC Guide 109: Environmental aspects**

IEC Guide 109 advocates the need to minimize the impact of a product on the natural environment throughout the product life cycle.

It is understood that some of the materials permitted in this standard and manufacturing and assembly procedures may have a negative environmental impact.

As technological advances lead to acceptable alternatives for these materials, they will be eliminated from the standard. Inappropriate manufacturing procedures should be replaced by a design for easy maintainability and disassembly.

# 1 General data

## 1.1 Recommended method of mounting

The contacts of free board connectors are provided for solder connections. The terminations of the free board connectors shall fit into holes in the printed board according to IEC 60326-3 and IEC 60326-5, located on a grid of 2,54 mm.

The contacts of fixed board connectors are provided for either press-in connections or press-in connections with an additional wire wrap and mating function.

The connector is fixed by means of the press-in terminations; fixing holes on the backplane are not necessary.

The distance of termination centre lines is 2,54 mm or a multiple of it. The terminations of the fixed board connectors are suited for backplanes having a grid dimension of 2,54 mm.

## 1.2 Ratings and characteristics

Rated voltage: Contact / contact for fully loaded connector.

**Table 1 – Rated voltage**

| Material group | Pollution degree | Rated voltage (V) |
|---|---|---|
| I, II, IIIa/b | 1 | 400 |
| II, IIIa/b | 2 | 32 |
| NOTE Reference is made to Table 11 of this specification, and to Table 4 of IEC 60664-1 listing the relation between creepage distances, pollution degree and material groups versus voltages r.m.s. | | |

| | |
|---|---|
| Current rating: | 1 A at 70 °C for fully loaded connector |
| Insulation resistance: | $\geq 10^{10}\ \Omega$ |
| Climatic category: | PL1: 55/125/56<br>PL2: 55/125/21 |
| Printed board thickness: | 1,6 mm to 2,4 mm for free board connector<br>1,6 mm to 6,4 mm for fixed board connector |
| Contact spacing: | 2,54 mm |

## 1.3 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 60068-1:1988, *Environmental testing – Part 1: General and guidance*
Amendment 1 (1992)

IEC 60068-2-54:1985, *Environmental testing – Part 2: Tests. Test Ta: Soldering – Solderability testing by the wetting balance method*

IEC 60097:1991, *Grid systems for printed circuits*

IEC 60326-3:1991, *Printed boards – Part 3: Design and use of printed boards*

IEC 60326-5:1995, *Printed boards – Part 5: Specification for single and double side printed boards with plated-through holes*

IEC 60352-1:1997, *Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance*

IEC 60352-5:2001, *Solderless connections – Part 5: Press-in connections – General requirements, test methods and practical guidance*

IEC 60512 (all parts)

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

IEC 60603-2:1995, *Connectors for frequencies below 3 MHz for use with printed boards – Part 2: Detail specification for two-part connectors with assessed quality, for printed boards, for basic grid of 2,54 mm (0,1 in) with common mounting features*

IEC 60664-1:2000, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

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*

IEC 61076-4:1995, *Connectors with assessed quality, for use in d.c. low frequency analogue and in digital high speed data applications – Part 4: Sectional specification – Printed board connectors*

IEC Guide 109:1995, *Environmental aspects – Inclusion in electrotechnical product standards*

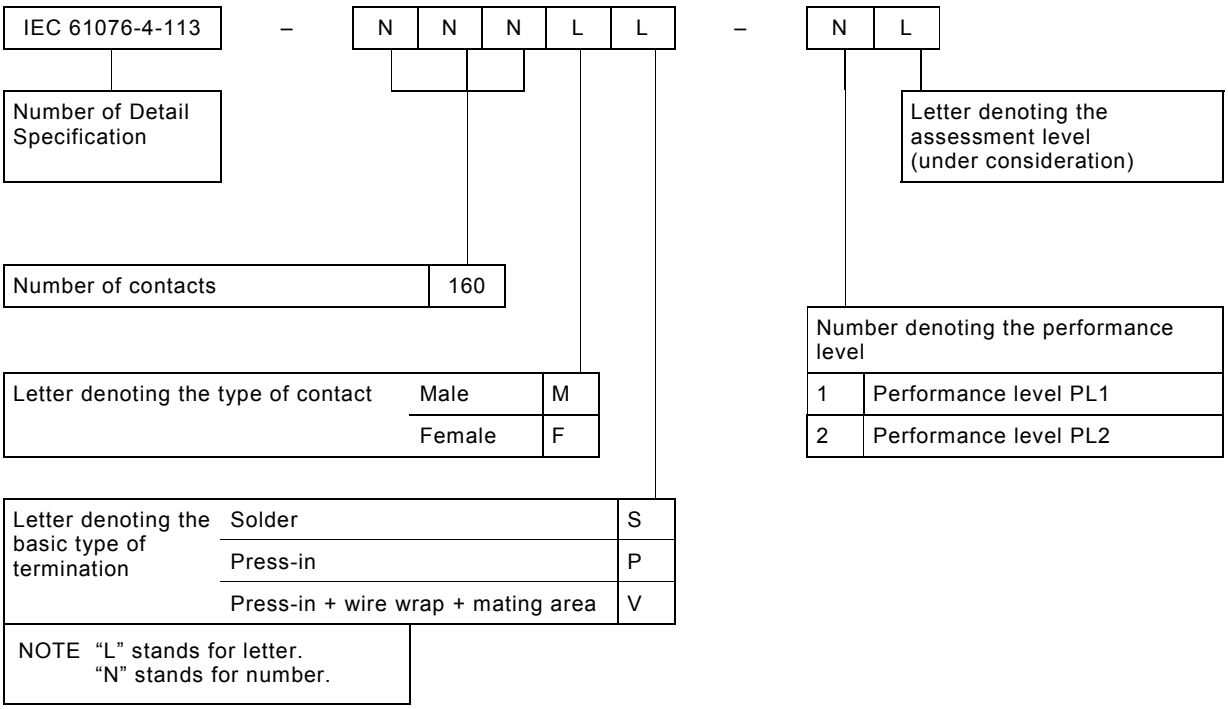
ISO 1302:2002, *Geometrical Product Specifications (GPS) –Indication of surface texture in technical product documentation*

### 1.4 Marking

The marking of the connector and the package shall be in accordance with 2.6 of IEC 61076-4.

### 1.5 IEC type designation

Connectors, connector bodies and contacts according to this standard shall be designated by the following system:




EXAMPLE Connector having 160 female contacts with press-in terminations, with performance level 2: IEC 61076-4-113 – 160FP – 2

### 1.6 Ordering information

To order connectors according to this detail specification, the type designation described in 1.5 shall be used.

## 2 Technical information

### 2.1 Definitions

For the purposes of this document the following definitions apply.

#### 2.1.1 Contacts and terminations

**press-in and mating function**
termination post, usually pressed-in into the backplane and emerging on the rear side as a male contact, to be connected to a free board or cable connector

**grounding**
rows z and d of free and fixed board connector used as shielding frames, i.e. connected to zero volts

**first make last break contact (FMLB)**
pre-leading male contacts which facilitate live insertion

### 2.2 Information on application

#### 2.2.1 Complete connectors (pairs)

#### 2.2.2 Fixed board connectors

Planarity before press-in operation into backplane according to 3.4.1 and after press-in into backplane according to 3.3.4.1.

#### 2.2.3 Free board connectors

Planarity before soldering into printed board according to 3.5.1 and after soldering into printed board according to 3.3.4.1.

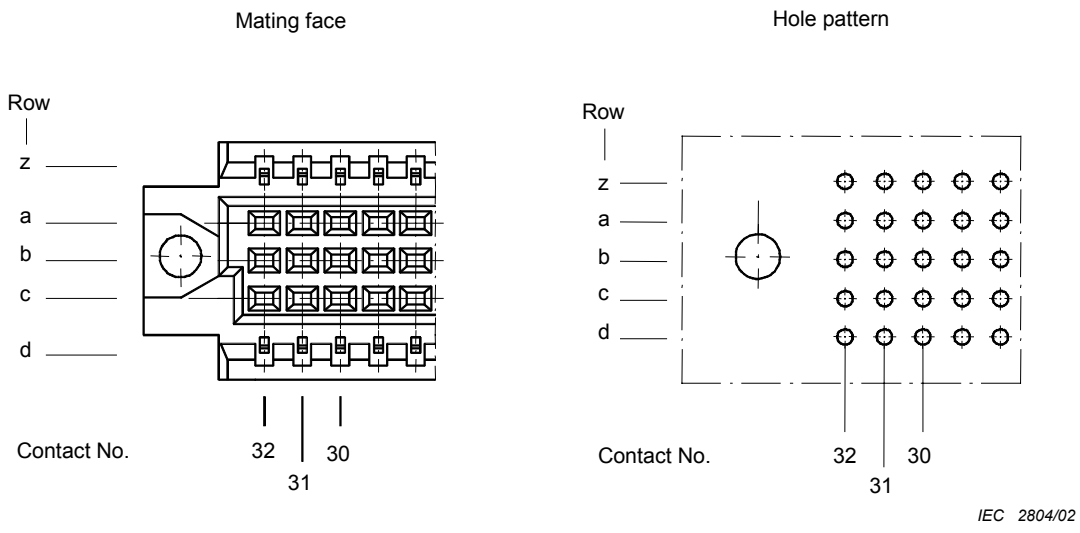
#### 2.2.4 Shielding/grounding

#### 2.2.5 Basic type of termination

| Identification letter | Basic type of termination | Length mm |
|---|---|---|
| S | 90° angled solder-pin for termination to a printed board with a thickness of 1,6 mm to 2,4 mm, hole diameter:<br>1 mm according to IEC 60326-3 | 2,9 ± 0,3 |
| P | Straight, solderless, compliant press-in connections for termination to a printed board with a thickness of 1,6 mm to 6,4 mm, hole diameter:<br>1 mm according to IEC 60326-5 | 5 |
| V | Straight, solderless, compliant press-in connections and additional wire wrap and mating area to be connected to a free board connector for termination to a printed board with a thickness of 1,6 mm to 6,4 mm, hole diameter:<br>1 mm according to IEC 60326-5 | 17 |

### 2.3 Contact arrangements

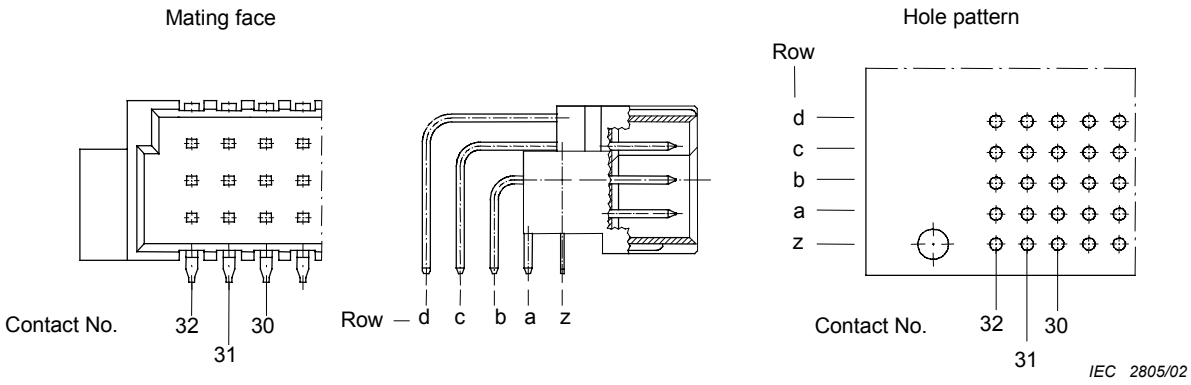
#### 2.3.1 Fixed board connectors




NOTE For mounting information see 3.6.1 (hole pattern)

**Figure 1 – Contact arrangements**

### 2.3.2 Free board connectors




NOTE For mounting information see 3.7.1 (hole pattern)

**Figure 2 – Contact arrangements**

## 3 Dimensional information

### 3.1 General

All dimensions are in millimetres.

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

The information about the bending in 3.4 and 3.5 is valid for the condition of delivery.

Dimensions not shown may be chosen according to common characteristics and intended use.

### 3.2 Isometric view and common features

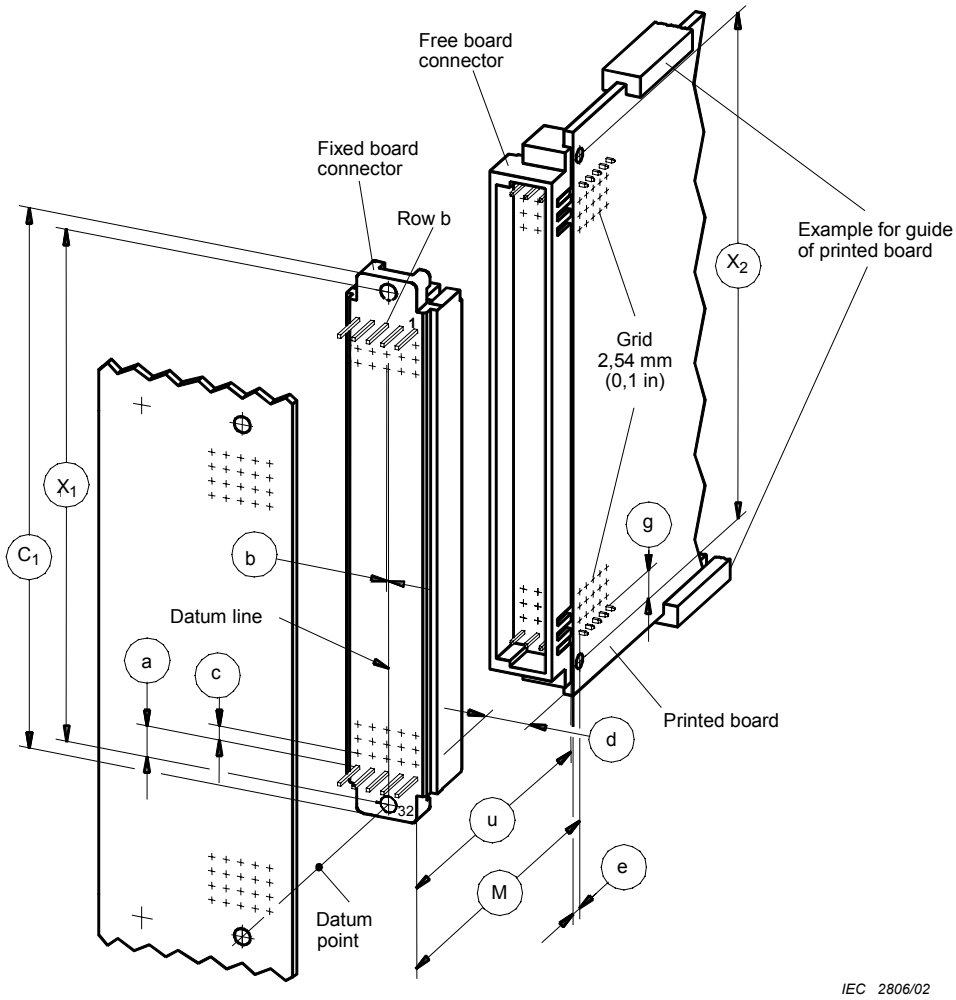



**Figure 3 – Isometric view**

**Table 2 – Isometric view and common features**

| Reference letter | Dimensions mm | Legend |
|---|---|---|
| $C_1$ | 95 | Maximum length of the fixed board connector |
| M | 17,2<br>15,6 | Range of electrical engagement, see 3.2.1 |
| $X_1$ | 90 | Distance between the two mounting holes of the fixed board connector |
| $X_2$ | 88,9 | Distance between the two mounting holes of the free board connector [a] |
| a | 5,63 | Distance between the datum point and a line through the centres of the termination No. 32 of the fixed board connector |
| b | 0,3 | Distance between datum line and a line through the centres of the termination row “b” of the fixed board connector |
| c | *n*x2,54 | Pitch of the termination of the fixed board connector |
| d | 3,55 | Distance between the datum line and the connector side of the printed board |
| e | 2,76 | Distance between the edge of the printed board and the first row of termination and the mounting holes for the free board connector |
| g | 5,08 | Distance between a mounting hole and the hole for the termination No. 1 or No. 32 of the free board connector |
| u | 14,2<br>12,4 | Range in which reliable contact is ensured, see 3.2.1 for mating information |

[a] The mounting holes are also located on the grid of 2,54 mm according to IEC 60097.

### 3.2.1 Depth dimensions

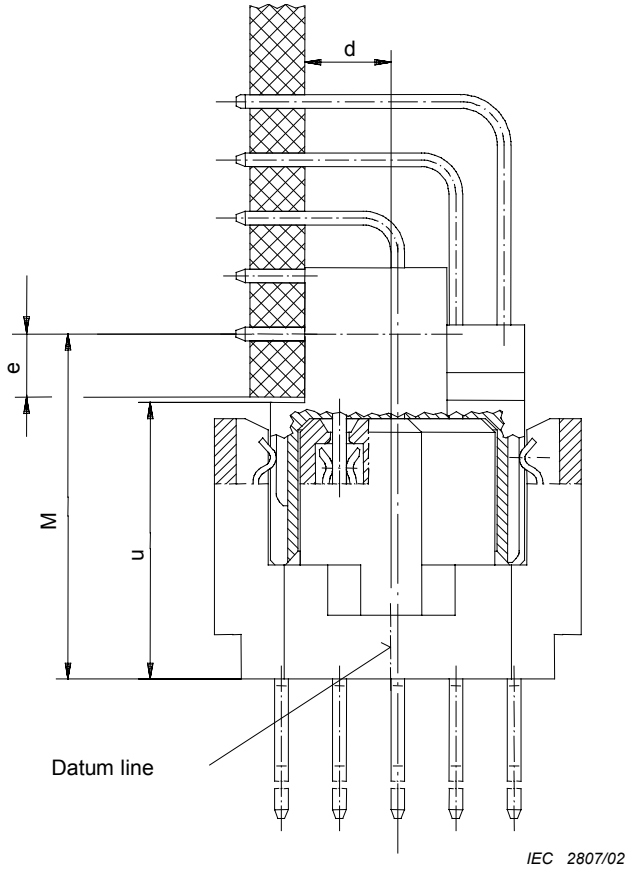


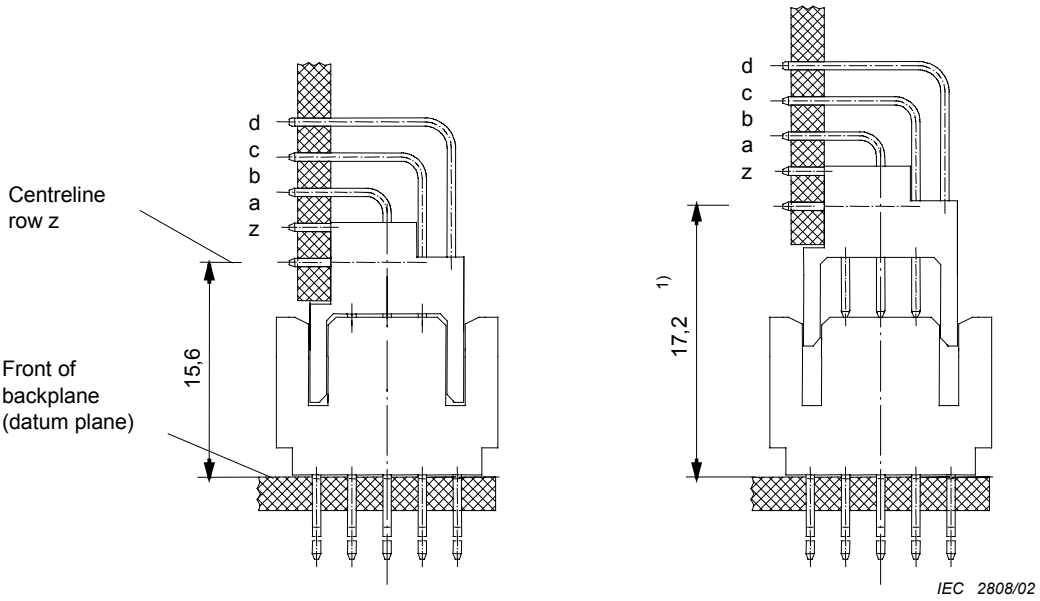

**Figure 4 – Depth dimensions**

**Table 3 – Depth dimensions**

| Reference letter | Dimension | Legend |
|---|---|---|
| M | 15,6 – 17,2 (18,7) | Range of electrical engagement [a] |
| d | 3,55 | Distance between datum line and connector side of the printed board |
| e | 2,76 | Distance between the edge of the printed board and the first termination row and the mounting holes for the free board connector |
| u | 12,4 – 14,2 (15,7) | Range in which reliable contact is ensured [a] |
| [a] Value in brackets for preleading pins in row d, position 1, 2, 31, 32. | | |

### 3.3 Engagement (mating) information

#### 3.3.1 Electrical engagement length




1) 18,7 for preleading contacts

**Figure 5 – Electrical engagement length**

#### 3.3.1.1 First contact point

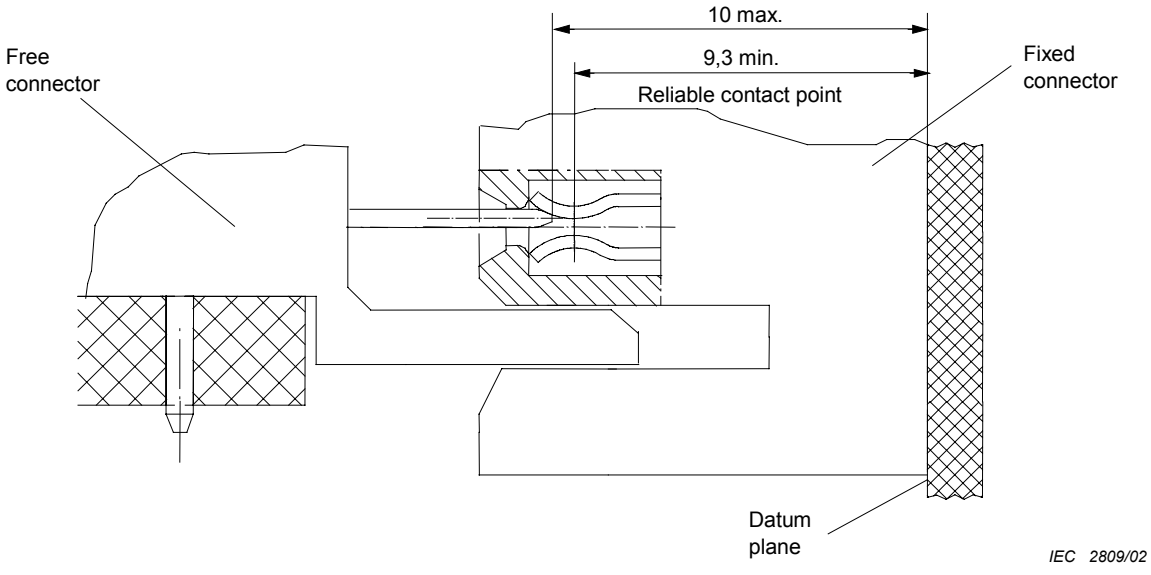



**Figure 6 – First contact point**

### 3.3.2 Perpendicular to engagement (mating) direction

The design of the free and fixed board connector must accept a misalignment of at least 1 mm in the transversal and longitudinal direction of the connectors. To achieve necessary alignment of both parts, one part of the connector pair is float mounted.

For fixed mounted connector pairs, the mounting tolerances must accordingly be kept in a sufficiently small range.

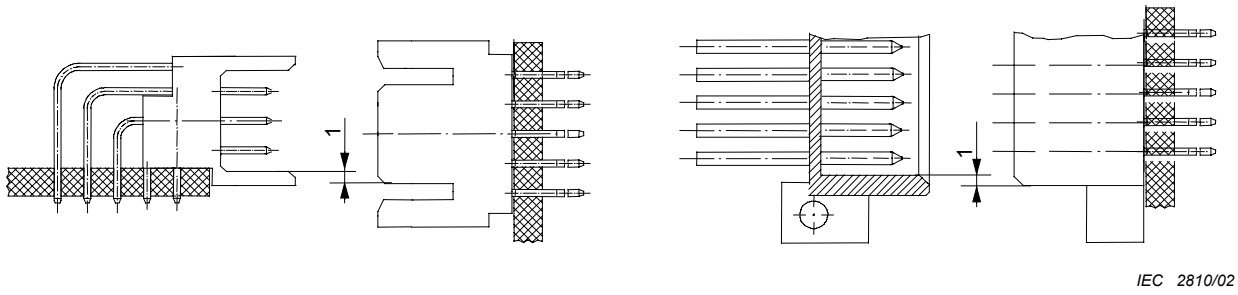



**Figure 7 – Perpendicular to engagement (mating) direction**

### 3.3.3 Inclination

The design of the free and fixed board connector must accept an initial angular misalignment of ±4° in longitudinal and ±2° transverse axis.

In the mated position the condition according to 3.3.1 must be met.

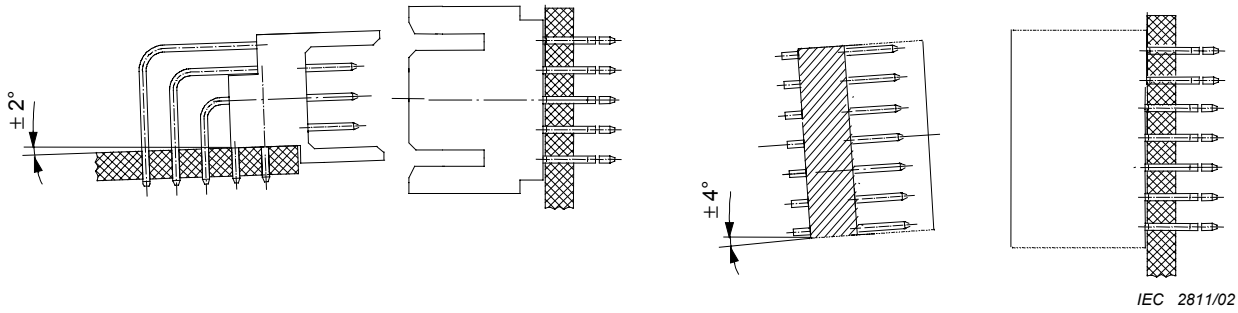
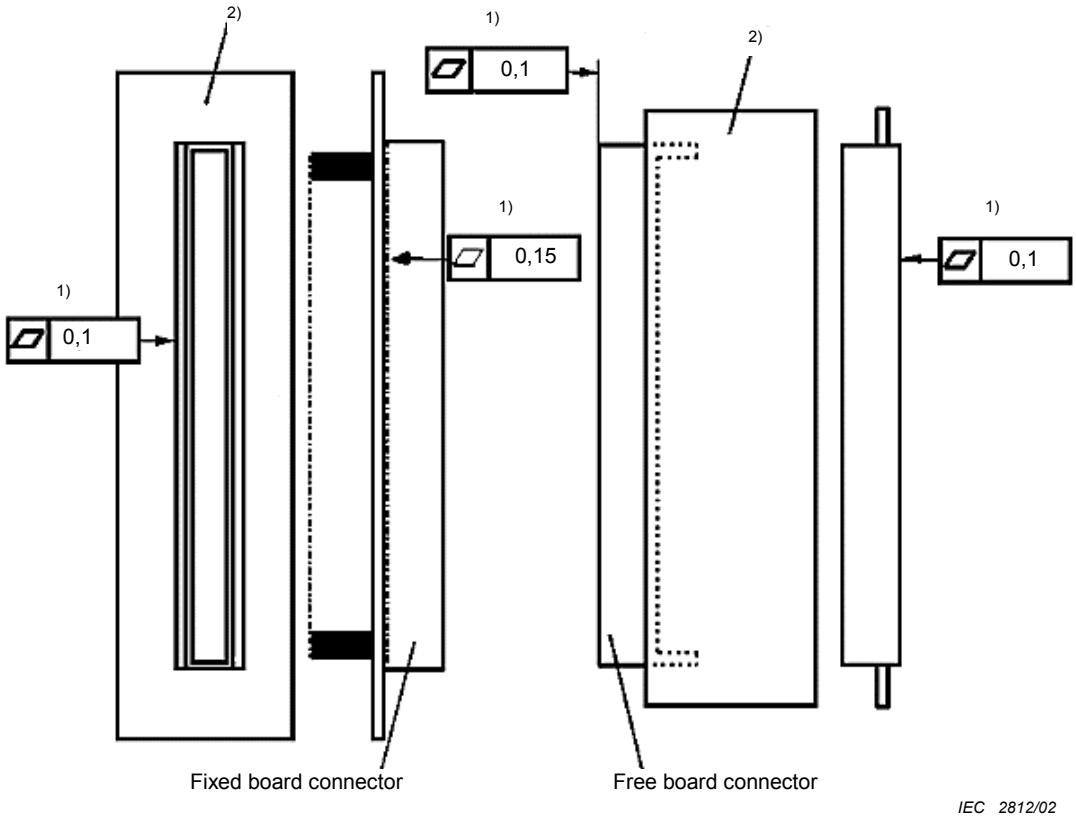



**Figure 8 – Inclination**

### 3.3.4 Planarity

The permissible bending and warpage of mounted connectors is shown in 3.3.4.1 In order to guarantee the function of the FMLB contact, the added concave and convex warpage of the mounted male and female connector must not exceed 0,25 mm.

#### 3.3.4.1 Planarity of mounted connectors




1) Valid for total height (concave and convex direction)

2) Bending of printed boards according to 5.1.6

**Figure 9 – Planarity of mounted connectors**

### 3.4 Fixed board connectors

#### 3.4.1 Dimensions

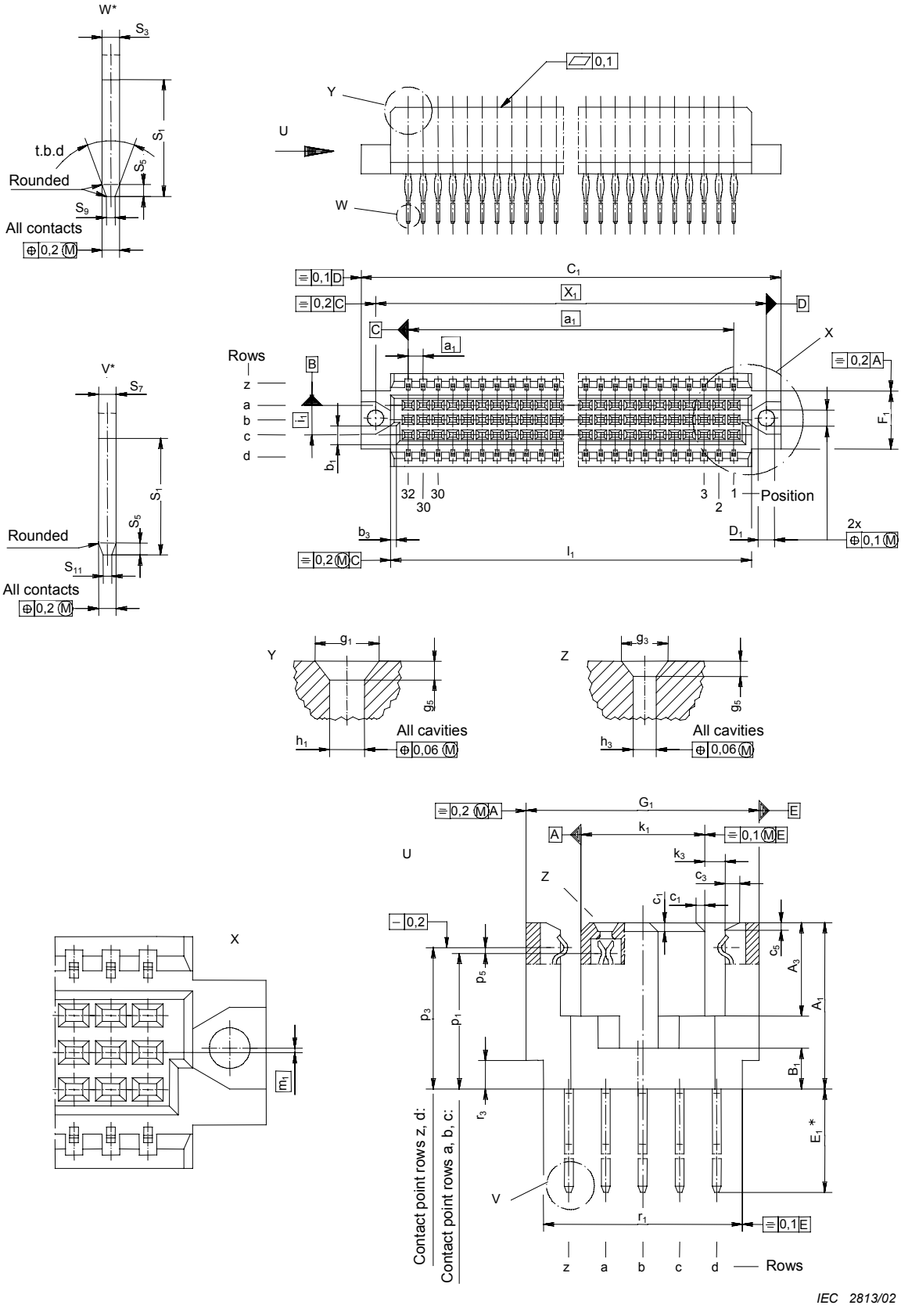



**Figure 10 – Fixed board connector dimensions**

**Table 4 – Fixed board connector dimensions**

| Reference letter | Dimension | | Reference letter | Dimension | | Reference letter | Dimension |
|---|---|---|---|---|---|---|---|
| A1 | 11,6 max. | | c1 | 0,7<br>0,6 | | p1 [a] | 9,3 min. |
| A3 | 6,5 min. | | c3 | 1 min. | | p3 [b] | 9,7 min. |
| B1 | 2,85<br>2,75 | | c5 | 0,65 min. | | p5 | 0,2 min. |
| C1 | 95 max. | | g1 | 2,2<br>2,1 | | r1 | 13,7 max. |
| D1 | 2,8 min. | | g3 | 1,7<br>1,6 | | r3 | 1,9 min. |
| E1 | 5<br>16,8/17,2 | | g5 | 0,5 min. | | s1 | 5,9<br>6,1 |
| F1 | 10,6<br>10,4 | | h1 | 1,25<br>1,20 | | s3 | 0,70<br>0,55 |
| G1 | 16 max. | | h3 | 0,85<br>0,80 | | s5 | 0,65<br>0,55 |
| X1 | 90 | | i1 | 2×2,54(=5,08) | | s7 | 0,61<br>0,56 |
| a1 | 31×2,54(=78,74) | | k1 | 8,5<br>8,4 | | s9 | 0,2 max. |
| a3 | 2,54 | | k3 | 1,5<br>1,4 | | s11 | 0,15 max. |
| b1 | 3,2<br>3,0 | | l1 | 85,0<br>84,8 | | | |
| b3 | 1,1<br>1,0 | | m1 | 0,3 | | | |

[a] Contact point rows a, b, c.

[b] Contact point rows z, d.

### 3.4.2 Terminations

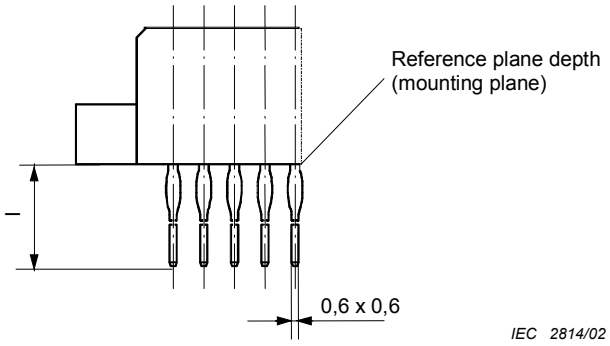



**Figure 11 – Terminations**

**Table 5 – Dimension of the termination**

| Type of termination | l<br>mm |
|---|---|
| P | 5 |
| V | 17 |

## 3.5 Free board connectors

### 3.5.1 Dimensions

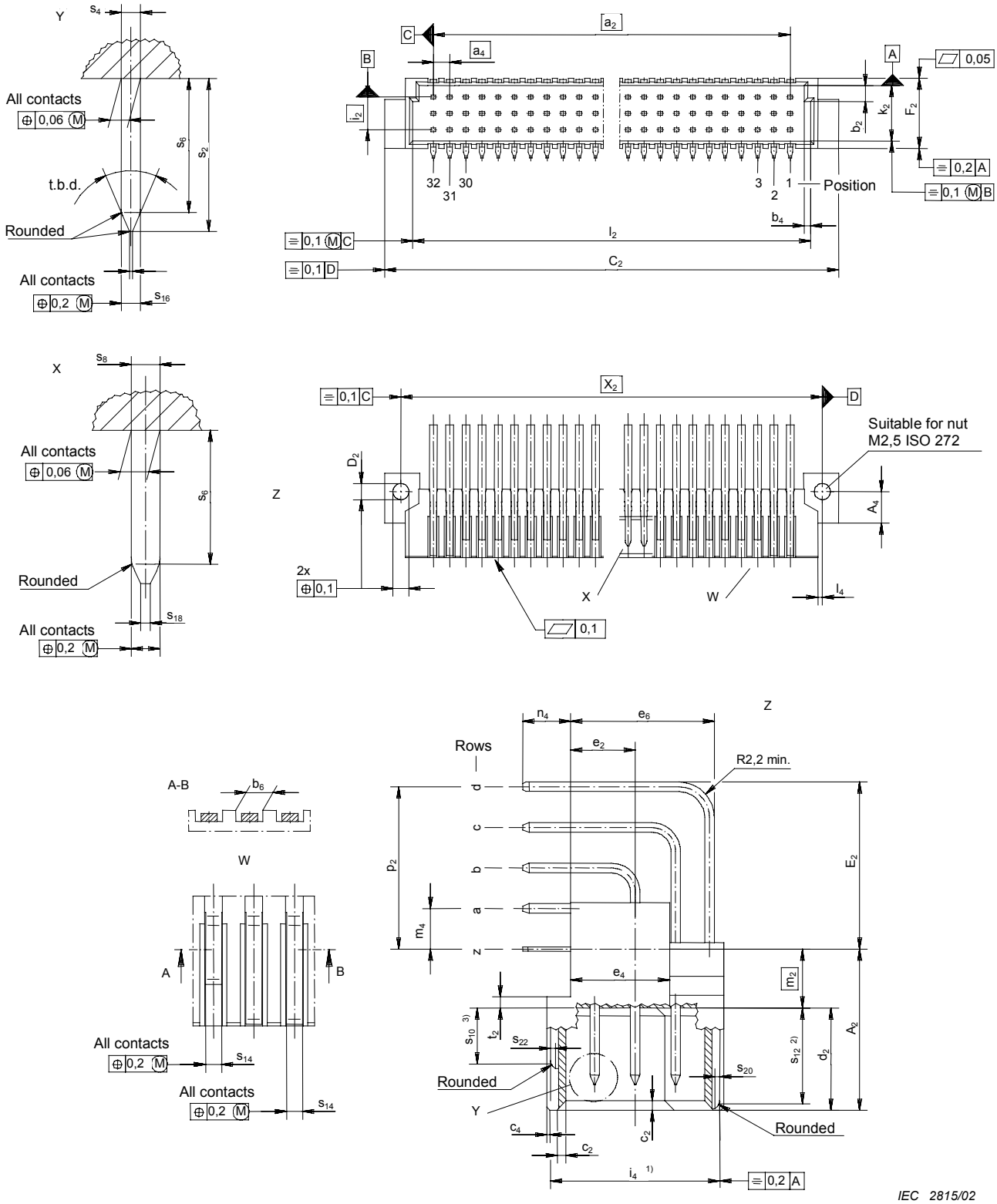



**Figure 12 – Free board connector dimensions**

**Table 6 – Free board connector dimensions**

| Reference letter | Dimension | | Reference letter | Dimension | | Reference letter | Dimension |
|---|---|---|---|---|---|---|---|
| A2 | 10,2<br>10,0 | | c4 | 0,2 min. | | p2 | 4×2,54(=10,16) |
| A4 | 5,4 max. | | d2 | 6,4<br>6,3 | | s2 | 5,0<br>4,8 |
| C2 | 94 max. | | e2 | 4,05<br>3,80 | | s4 | 0,61<br>0,56 |
| D2 | 2,5 min. | | e4 | 6,1<br>5,9 | | s6 | 4,4<br>4,2 |
| E2 | 10,6 max. | | e6 | 8,95 max. | | s8 | 0,70<br>0,55 |
| F2 | 11,1 max. | | i2 | 2×2,54(=5,08) | | s10 [c] | 4,0<br>3,8 |
| X2 | 88,9 | | i4 [a] | 10,6 min. | | s12 [b] | 5,8 min. |
| a2 | 31×2,54(=78,74) | | k2 | 8,7<br>8,6 | | s14 | 1,15<br>1,10 |
| a4 | 2,54 | | l2 | 85,4<br>85,2 | | s16 | 0,15 max. |
| b2 | 2,5<br>2,3 | | l4 | 0,6 min. | | s18 | 0,2 max. |
| b4 | 1,0<br>0,9 | | m2 | 3,75 | | s20 | 0,2 min. |
| b6 | 2,1 min. | | m4 | 2,54 | | s22 | 0,2 min. |
| c2 | 0,7<br>0,6 | | n4 | 3,2<br>2,6 | | t2 | 0,8<br>0,7 |

[a] Contact surface, contacts not protruding.
[b] Contact point row d position 1, 2, 31, 32, only.
[c] Contact point row d position 3 to 30 and row z position 1 to 32.

### 3.5.2 Terminations

The terminations shall be suitable for holes of a 1 mm nominal diameter in accordance with IEC 60326-3.

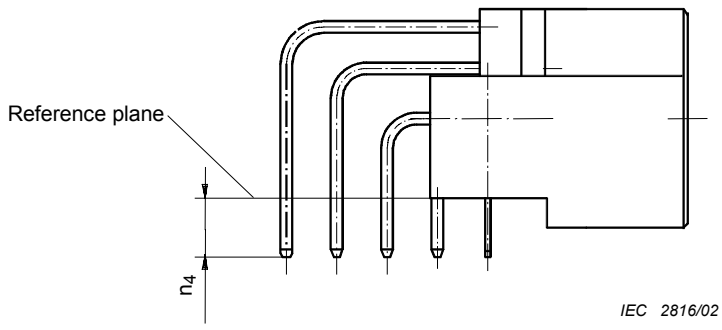
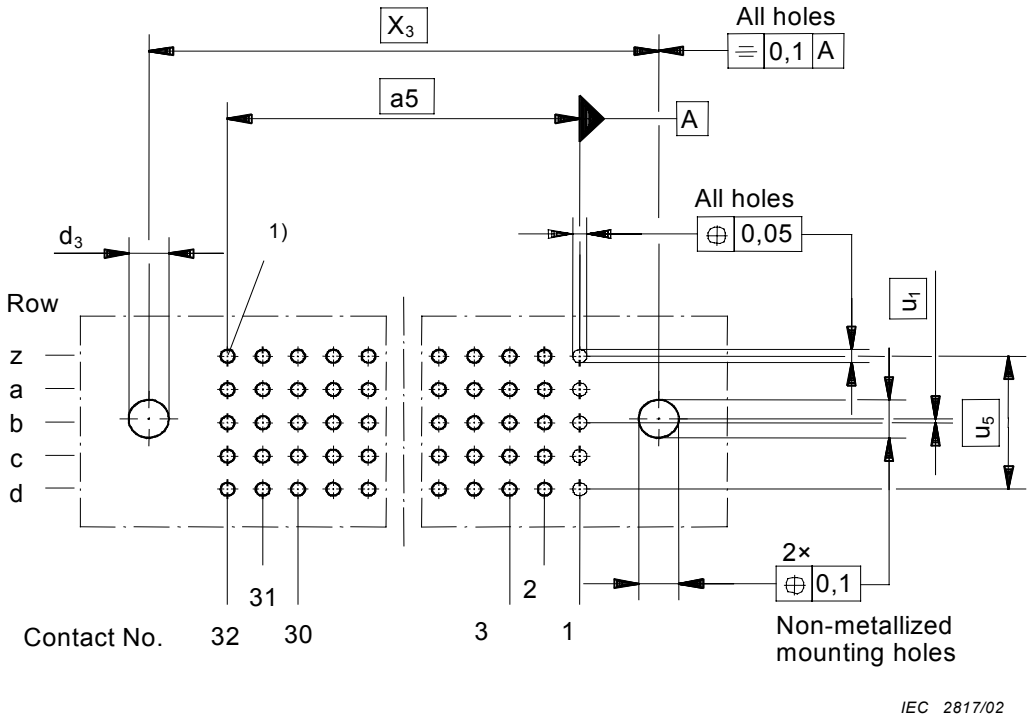



**Figure 13 – Terminations**

### 3.6 Mounting information for fixed board connectors

#### 3.6.1 Hole pattern on panels

Drawings: view on connector side of printed board.




NOTE All termination holes 1 mm nominal diameter and in accordance with IEC 60326-3

1) For press-in terminations, plated-through holes shall be used

**Figure 14 – Hole pattern on panels**

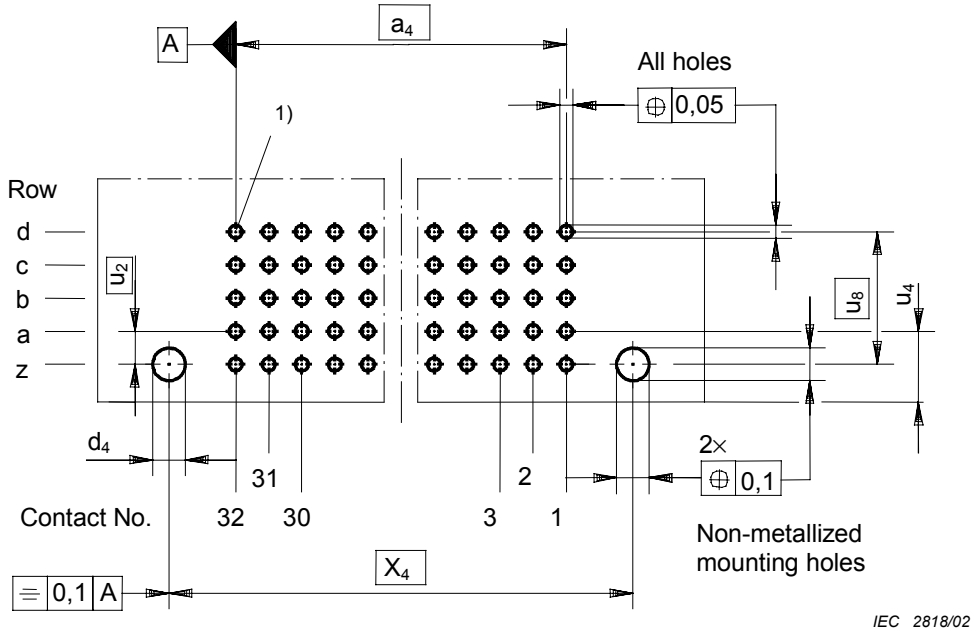
**Table 7 – Hole pattern on panels**

| | X3 | a5 | d3 | u1 | u5 |
|---|---|---|---|---|---|
| mm | 90 | 31×2,54(=78,74) | 2,9<br>2,8 | 0,3 | 4×2,54(=10,16) |

### 3.7 Mounting information for free board connectors

#### 3.7.1 Hole pattern on printed boards

Drawings: view on connector side of printed board.




NOTE All termination holes 1 mm nominal diameter and in accordance with IEC 60326-3

1) Plated-through holes are recommended

**Figure 15 – Hole pattern on printed boards**

**Table 8 – Hole pattern on printed boards**

| | X4 | a4 | d4 | u2 | u4 | u8 |
|---|---|---|---|---|---|---|
| mm | 88,9 | 31×2,54(=78,74) | 2,9<br>2,8 | 2,54 | 5,4<br>5,2 | 4×2,54(=10,16) |

### 3.8 Gauges

#### 3.8.1 Sizing gauges and retention force gauges

Material: hardened tool steel

$\sqrt{}$ = Surface roughness according to
ISO 1302: Ra = 0,25 µm maximum
0,15 µm minimum

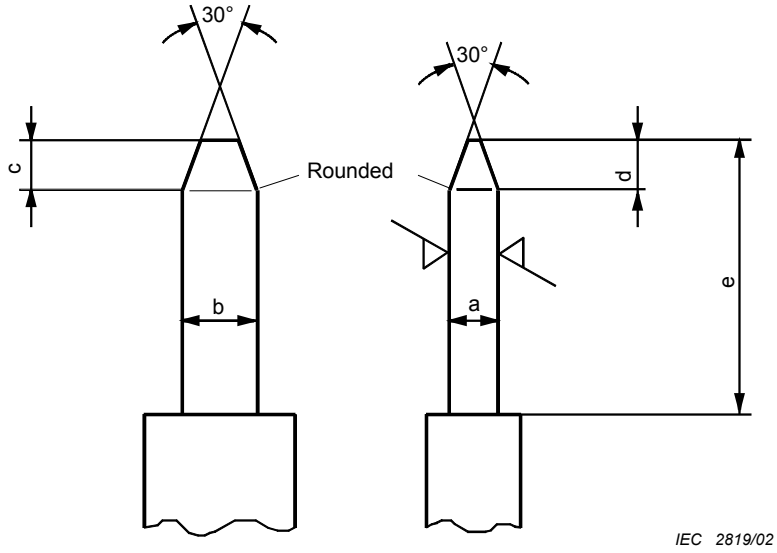



**Figure 16 – Gauge dimensions**

**Table 9 – Gauges**

| Rows a, b, c | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gauge** | **Mass** g | **Application** | **a** | | **b** | | **c** | | **d** | | **e** | |
| | | | mm | in | mm | in | mm | in | mm | in | mm | in |
| P11 | – | Sizing | 0,62<br>0,60 | 0,0244<br>0,0236 | 1,0<br>0,95 | 0,039<br>0,037 | 1,0 | 0,039 | 0,8 | 0,031 | 5 | 0,197 |
| P12 | $15^{+1}$ | Retention force | 0,56<br>0,54 | 0,0220<br>0,0213 | | | | | | | | |
| **Rows z, d** | | | | | | | | | | | | |
| P13 | – | Sizing | 1,32<br>1,30 | 0,052<br>0,051 | 0,95<br>0,90 | 0,037<br>0,035 | 1,0 | 0,039 | 0,8 | 0,031 | 5 | 0,197 |
| P14 | $15^{+1}$ | Retention force | 1,26<br>1,24 | 0,050<br>0,049 | | | | | | | | |

# 4 Characteristics

## 4.1 Climatic category

**Table 10 – Climatic category**

| Peformance level | Climatic category | Category temperature | | Damp heat, steady state | | |
|---|---|---|---|---|---|---|
| | | Lower °C | Upper °C | Temperature °C | Relative humidity | Days |
| 1 | 55/125/56 | –55 | 125 | 40 | 93 % | 56 |
| 2 | 55/125/21 | –55 | 125 | 40 | 93 % | 21 |

## 4.2 Electrical

### 4.2.1 Creepage and clearance distances

The permissible operating voltages depend on the application and on the applicable or specified requirements.

Therefore, the clearance and creepage distances are given as operating characteristics. In practice, reductions in creepage or clearance distances may occur due to the conductive pattern of the printed board or the wiring used and shall duly be taken into account.

**Table 11 – Minimum creepage and clearance distances**

| Minimum creepage and clearance distance [a] | | Distance mm | |
|---|---|---|---|
| | | Rows a, b, c | Rows z, d |
| Between contact rows | Creepage | 1,2 | 1,2 |
| | Clearance | 1,2 | 1,2 |
| Between adjacent contacts in the same row | Creepage | 1,2 | 1,0 |
| | Clearance | 1,2 | 1,0 |
| [a] Valid for unmated and mated condition. | | | |

### 4.2.2 Voltage proof

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

**Table 12 – Voltage proof**

| Contact arrangement according to 5.1.4 | Voltage proof |
|---|---|
| Contact/contact | 1 000 V r.m.s. |
| Contact/test panel | 1 500 V r.m.s. |

#### 4.2.3 Current-carrying capacity

Conditions: IEC 60512, test 5b
Standard atmospheric conditions
All contacts

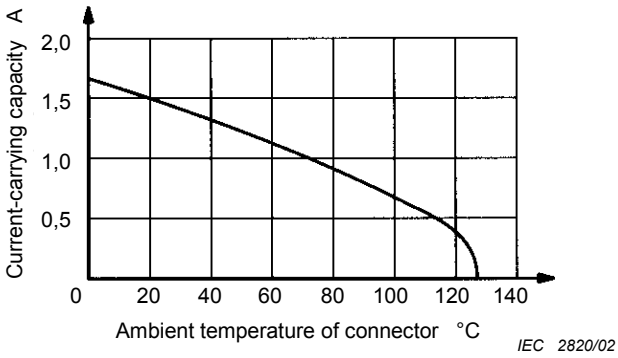



**Figure 17 – Current-carrying capacity**

#### 4.2.4 Contact resistance

Conditions: IEC 60512, test 2a
Standard atmospheric conditions
Mated connectors
Measuring points: see Figure 18

Contact resistance: All contact arrangements rows a, b, c ≤20 mΩ, rows d, z ≤30 mΩ

#### 4.2.5 Insulation resistance

Conditions: IEC 60512, test 3a: method B
Standard atmospheric conditions
Test voltage 100 V ± 15 V d.c.
Mated connectors

Insulation resistance: $\geq 10^{10}$ Ω

### 4.3 Mechanical

#### 4.3.1 Mechanical operation

Conditions: IEC 60512, test 9a
Standard atmospheric conditions
Maximum speed of operation: 10 mm/s

**Table 13 – Number of mechanical operations**

| Performance level | 1 | 2 |
|---|---|---|
| Operations | 500 | 250 |

#### 4.3.2 Insertion and withdrawal forces

Conditions: IEC 60512, test 13b
Standard atmospheric conditions.
Maximum speed 10 mm/min.

Force: Number of contacts × 1 N max.

#### 4.3.3 Contact retention in insert

Conditions: IEC 60512, test 15a

Standard atmospheric conditions.
The connector shall be unmated and mounted in a suitable fixation to hold the connector whilst the test is conducted.
All termination posts shall be free, in order to have no influence on the test. The force shall be applied axially to the contact, once in the mating and once in the unmating direction.

Requirement: The axial displacement, in both directions, shall be less than 0,2 mm while the force is applied, and less than 0,1 mm after the force has been removed.

**Table 14 – Contact retention in insert**

| Type of termination | | Mating direction | Unmating direction |
|---|---|---|---|
| S | 90 angled solder | 10 N min. | 50 N |
| P | Straight press-in | 5 N min. | 100 N |
| V | Straight press-in plus mating area | 5 N min. | 100 N |
| NOTE | Mating direction means that the force on the contact is applied in the same direction as during insertion. | | |

#### 4.3.4 Static load, transverse

Conditions: IEC 60512, test 8a
Standard atmospheric conditions
The connectors shall be unmated and mounted on a printed board
Application points according to 5.1.3.

Forces: F = 160 N

Requirements: After removal of the applied forces, there shall be no displacement of the connector on the printed board, likely to impair normal operation.

#### 4.3.5 Vibration (sinusoidal)

Conditions: IEC 60512, test 6d
Standard atmospheric conditions
Mated connectors
The fixed and free board connector shall be rigidly installed in a suitable fixation as specified in 5.1.2

Vibration severity: PL1: 10 Hz to 2 000 Hz and 1,5 mm or 20 *g*
PL2: 10 Hz to 500 Hz and 0,35 mm or 5 *g*

# 5 Test schedule

## 5.1 General

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

An “X” in the “Requirements” column of the following tables indicates that the test or conditioning shall be applied.

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, i.e. when unmating is necessary for a certain test, the same connectors as before shall be mated for the subsequent tests.

In the following text, a mated set of connectors 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 must have been stored for at least 24 hours in the non-inserted state under normal climatic conditions for testing as per IEC 60068-1.

The following specimens are necessary for the entire inspection and test sequence.

**Table 15 – Number of specimens**

| Test group | Number of specimens | |
|---|---|---|
| | Performance level | |
| | 1 | 2 |
| P | 34 | 28 |
| AP | 6 | 4 |
| BP | 8 | 4 |
| CP | 4 | 4 |
| DP | 4 | 4 |
| EP | 4 | 4 |
| FP | 4 | 4 |
| GP | 4 | 4 |

### 5.1.1 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.

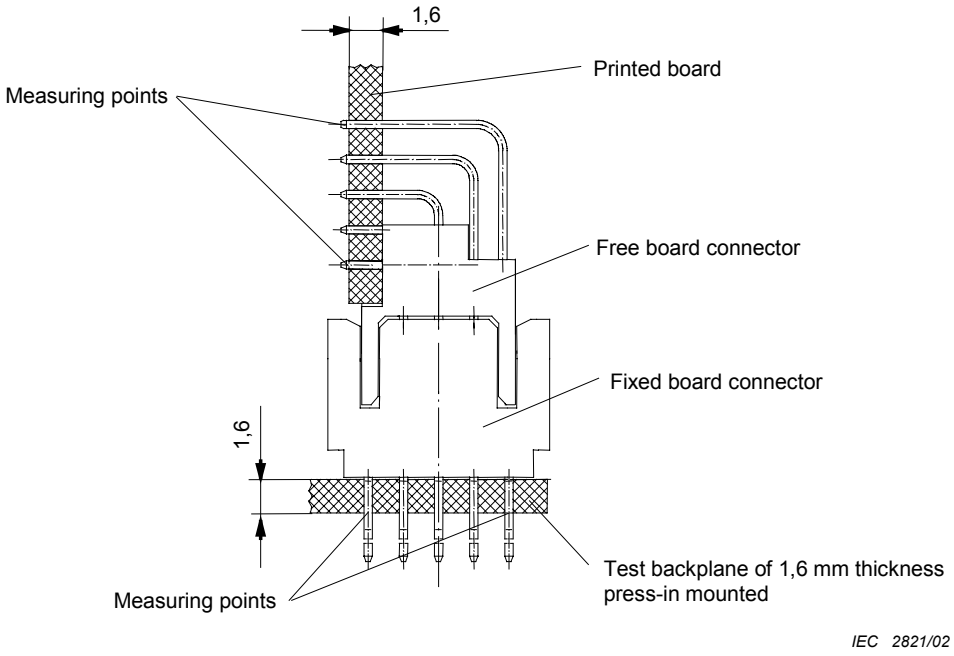



**Figure 18 – Measuring points**

### 5.1.2 Arrangement for dynamic stress tests

Conditions: IEC 60512, tests 6a, 6c and 6d

Fixed and free board connectors shall be rigidly installed in the fixation.

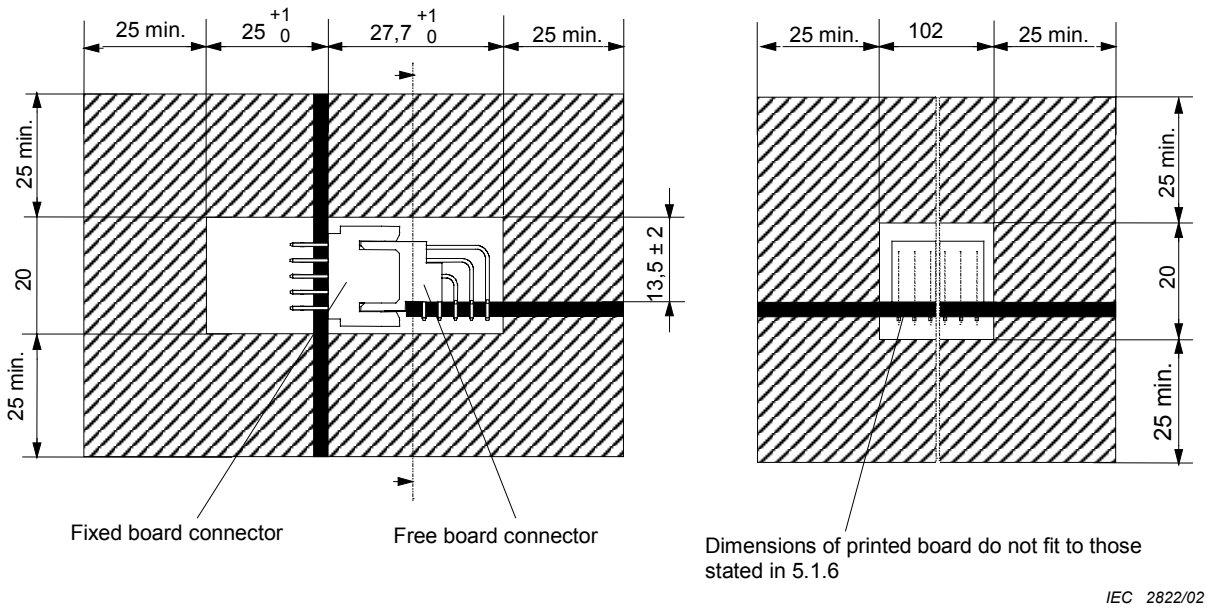



**Figure 19 – Dynamic stress test arrangement**

### 5.1.3 Arrangement for testing static load, axial

Conditions: IEC 60512, test 8b

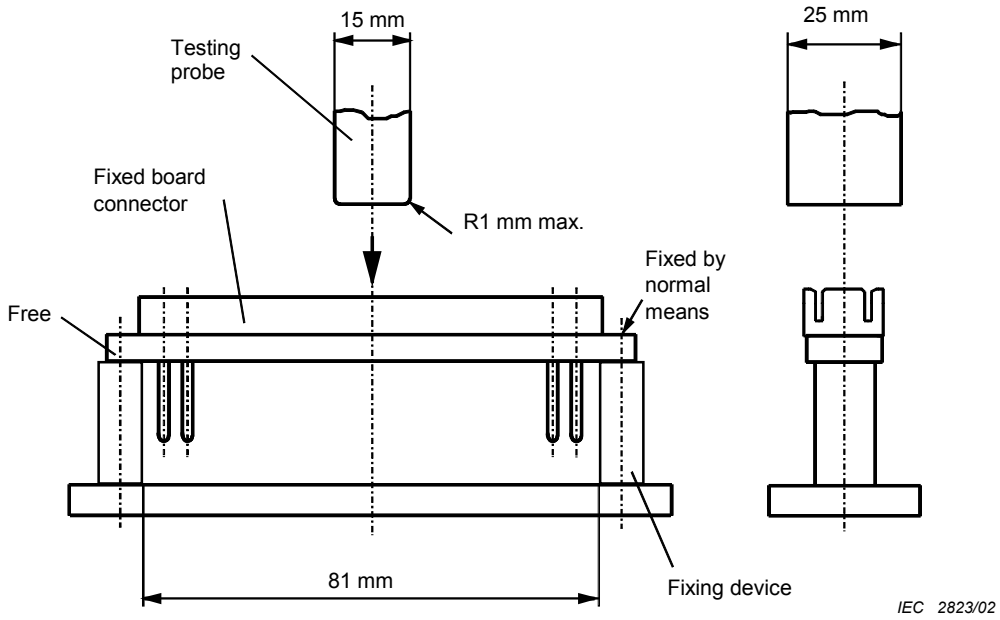



**Figure 20 – Arrangement for testing static load, axial**

### 5.1.4 Wiring arrangements for proof voltage and polarization voltage during damp heat test

Conditions: IEC 60512, tests 3a, 4a

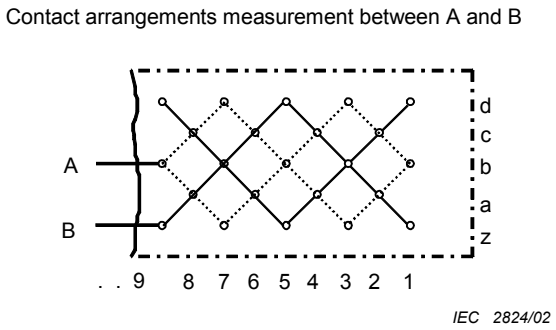



**Figure 21 – Wiring of specimen**

### 5.1.5 Arrangement for flammability test

Conditions: IEC 60512-9, test 20a

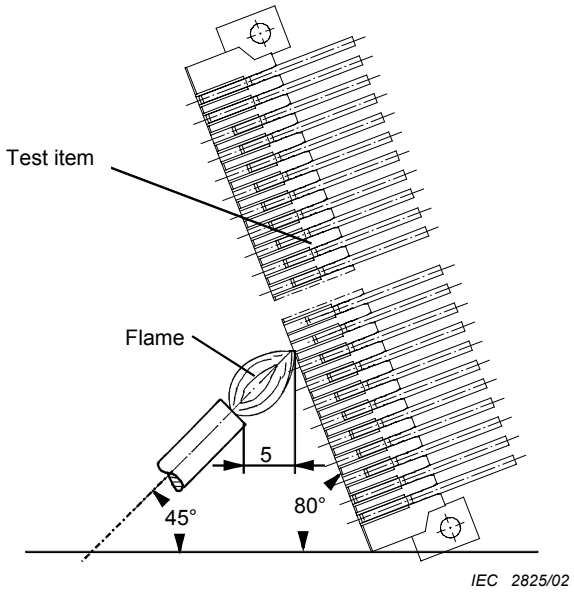
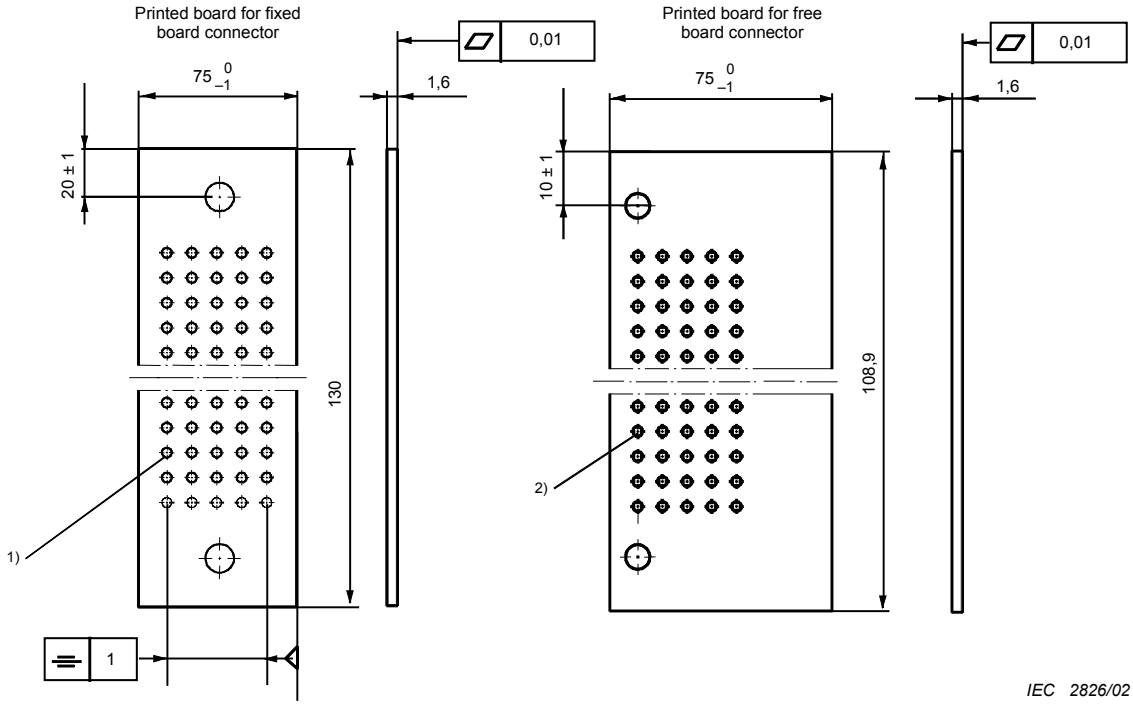



**Figure 22 – Arrangement for flammability test**

### 5.1.6 Test printed board for fixed and free board connectors




1) For dimension, see 3.6.1.

2) For dimension, see 3.7.1.

**Figure 23 – Test printed board for fixed and free board connectors**

### 5.2 Test schedule tables

#### 5.2.1 Preliminary group P

All specimens shall be subjected to the following tests in sequence.

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| P1 | General examination | | Unmated connectors | Visual examination<br>Dimensional examination | 1a | 1<br>2 | X<br>X | There shall be no defect that would impair normal operation |
| | | | | | 1b | 1<br>2 | X<br>X | The dimensions shall comply with those specified in clause 3, including creepage and clearance distances as specified in 4.2.1 |
| P2 | Polarizing method | 13e | Force to be applied:<br>1,5 × insertion force according to the maximum insertion forces in 4.3.2 | | | 1<br>2 | X<br>X | It shall be possible to correctly align and mate the appropriate mating connectors<br>It shall not be possible to mate the connectors in any other than the correct manner |
| P3 | | | Connection points according to 5.1.1<br>50 contacts per group | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| P4 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen according to 5.1.4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^{10}$ Ω |
| P5 | | | Contact/contact same measuring points as for P4 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2<br>(see Table 12) |

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

### 5.2.2 Group AP – Dynamic/climatic

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| AP1 | | | | Insertion and withdrawal forces | 13b | 1<br>2 | X<br>X | Requirements see 4.3.2 |
| AP2 | | | Female contacts only<br>20 contacts/specimen<br>Sizing and retention force gauge see 3.8.1 | Gauge retention force | 16e | 1<br>2 | X<br>X | Rows a, b, c: 0,15 N min.<br>Rows z, d: 0,15 N min. |
| AP3 | Vibration | 6d | Arrangement according to 5.1.2<br>10 Hz – 2 000 Hz<br>1,5 mm or 20 *g*<br>Sweep cycles: 10<br>Full duration: 6 h | Contact disturbance | 2e | 1 | X | 1 µs maximum |
| | | | 10 Hz – 500 Hz<br>0,35 mm or 5 *g*<br>Sweep cycles: 10<br>Full duration: 6 h | | | 2 | X | |
| | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a<br>or<br>2b | 1<br>2 | X<br>X | Rise in relation to initial values ≤15 mΩ |
| AP4 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP5 | Shock | 6c | Arrangement according to 5.1.2<br>Half sine<br>Shock acceleration:<br>490 m/s$^2$ (50 *g*)<br>Duration of impact: 11 ms | Contact disturbance | 2e | 1<br>2 | X<br>X | 1 µs maximum |
| | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rise in relation to initial values ≤15 mΩ |
| AP6 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP7 | Acceleration, steady state | 6a | Arrangement according to 5.1.2<br>Acceleration:<br>980 m/s$^2$ (100 *g*)<br>Duration: 5 min per axis<br>Axes: Both directions of the three major axes | | | 1<br>2 | X<br>X | |
| | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rise in relation to initial values ≤15 mΩ |

**Group AP – Dynamic/climatic** *(continued)*

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| AP8 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP9 | Rapid change of temperature | 11d | −55 °C to 125 °C<br>Mated<br>$t_1$: 30 min.<br>5 cycles | | | 1<br>2 | X<br>X | |
| AP10 | | | according to P4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^{10}$ Ω |
| AP11 | | | Contact/contact same measuring points as for P4 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2 (see table 12) |
| AP12 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP13 | Climatic sequence | 11a | | | | | | |
| AP 13.1 | Dry heat | 11i | 125 °C<br>Duration: 16 h<br>Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen | Insulation resistance at high temperature | 3a | 1<br>2 | X<br>X | $\geq 10^9$ Ω |
| AP 13.2 | Damp heat, cyclic, first cycle | 11m | Method 1<br>Recovery time 2 h<br>PL1: 55 °C<br>PL2: 40 °C | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP 13.3 | Cold | 11j | −55 °C<br>Duration: 2 h<br>Recovery time 2 h | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| AP 13.4 | Low air pressure | 11k | 30 kPa | Voltage proof | 4a | 1<br>2 | X<br>X | 300 V (r.m.s.) |
| AP 13.5 | Damp heat, cyclic, remaining cycles | 11m | Conditions according to AP 13.2<br>PL1: 5 cycles<br>PL2: 1 cycles | | | 1<br>2 | X<br>X | |
| AP14 | | | Connection points and conditions according to P4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^8$ Ω |
| AP15 | | | Connection points and conditions according to P3 | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| AP16 | | | Contact/contact conditions according to P5 | Voltage proof | 4a | 1<br>2 | X<br>X | 1 000 V (r.m.s.) |
| | | | Contact/test panel conditions according to P5 | | | | | 1 500 V (r.m.s.) |
| AP17 | | | | Insertion and withdrawal forces | 13b | 1<br>2 | X<br>X | Requirements, see 4.3.2 |
| AP18 | | | Unmated | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |

### 5.2.3 Group BP – Mechanical endurance

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No | PL | | |
| BP1 | | | Female contacts only<br>20 contacts/specimen<br>Sizing and retention force gauge see 3.8.1 | Gauge retention force | 16e | 1<br>2 | X<br>X | Rows a, b, c: 0,15 N min.<br>Rows z, d: 0,15 N min. |
| BP2 | Mechanical operation (half of the specified number of operations) | 9a | Speed 10 mm/s maximum<br>Rest 30 s (unmated) | | | 1 | X | 250 operations |
| | | | | | | 2 | X | 125 operations |
| BP3 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| BP4 | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| BP5 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen according to 5.1.4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^{10}$ Ω |
| BP6 | | | Contact/contact<br>same measuring points as for P4 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2<br>(see table 12) |
| BP7 | Climatic test | | | | | | | |
| BP7.1 | Corrosion, flowing mixed gas | 11g | Half mated/half unmated<br>Method 4 | | | 1 | X | 10 days |
| | | | | | | 2 | X | 4 days |
| BP8 | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| BP7 | Mechanical operation (remaining half of specified number of operations) | 9a | Speed 10 mm/s max.<br>Rest 30 s (unmated) | | | 1 | X | 250 operations |
| | | | | | | 2 | X | 125 operations |
| BP8 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| BP9 | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| BP10 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method A<br>8 contacts/specimen according to P4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^{10}$ Ω |
| BP11 | | | Contact/contact<br>same measuring points as for P4 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2<br>(see table 12) |

**Group BP – Mechanical endurance** *(continued)*

| Test phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| BP12 | | | Female contacts only<br>20 contact/specimen<br>Sizing and retention force gauge see 3.8.1 | Gauge retention force | 16e | 1<br>2 | X<br>X | The gauge shall be retained according to BP1 |
| BP13 | Static load, axial | 8b | Only fixed connectors arrangement according to 5.1.3<br>Rate of force increase: 10 N/s, duration: 10 s | | | 1<br>2 | X<br>X | 160 N |

### 5.2.4 Group CP – Moisture

| Test phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No | PL | | |
| CP1 | Damp heat, steady state | 11c | Unloaded<br>Polarizing voltage: 60 V d.c.<br>Recovery time: 2 h<br>Conditions according to 4.1 | | | 1 | X | 56 days |
| | | | | | | 2 | X | 21 days |
| CP2 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^8\ \Omega$ |
| CP3 | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max. |
| CP4 | | | Contact/contact conditions according to P5 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2 (see table 12) |
| CP5 | | | | Insertion and withdrawal forces | 13b | 1<br>2 | X<br>X | Requirements see 4.3.2 |
| CP6 | | | | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |

### 5.2.5 Group DP – Electrical load

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| DP1 | Mechanical operation (number of operations as specified for BP2) | 9a | Speed 10 mm/s (0,4 in/s) maximum<br>Rest 30 s (unmated) | | | 1 | X | 250 operations |
| | | | | | | 2 | X | 125 operations |
| DP2 | Electrical load and temperature | 9b | Duration: 1 000 h<br>Ambient temperature: 70 °C<br>Current load according to 4.2.3 | | | 1<br>2 | X<br>X | Temperature in centre of specimen maximum 125 °C |
| DP3 | | | Connection points according to 5.1.1<br>50 contacts | Contact resistance – millivolt level method according to P3 | 2a | 1<br>2 | X<br>X | Rows a, b, c: 20 mΩ max.<br>Rows z, d: 30 mΩ max |
| DP4 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen<br>see P4 | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^{10}$ Ω |
| DP5 | | | Contact/contact same measuring points as for P4 | Voltage proof | 4a | 1<br>2 | X<br>X | According to 4.2.2 (see table 12) |
| DP6 | | | | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |
| DP7 | | | Contact/contact conditions according to P4 | Partial discharge | 4b | 1<br>2 | X<br>X | 1 000 V (r.m.s.) |

### 5.2.6 Group EP – Mechanical resistivity

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| EP1 | Robustness of terminations | 16f | Fixed connectors<br>test Ua2<br>6 contacts/specimen | | | 1<br>2 | X<br>X | 20 N min. |
| EP2 | Contact retention in insert | 15a | Free connectors<br>6 contacts/specimen | | 1a | 1<br>2 | X<br>X | According to 4.3.3 and Table 14 |
| EP3 | Flammability needle flame | 20a | Test flame No. 1<br>Arrangement of specimen according to 5.1.5<br>Exposure time: 10 s | | | 1<br>2 | X<br>X | Post burning time: 10 s max. |
| EP4 | | | Unmated connectors | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |

### 5.2.7 Group FP – Chemical fluids

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| FP1 | Fluid resistance | 19c | Under consideration | | | 1<br>2 | X<br>X | |
| FP2 | | | | Insertion and withdrawal forces | 13b | 1<br>2 | X<br>X | Requirements see 4.3.2 |
| FP3 | | | Connection points according to 5.1.1<br>50 contacts per group | Contact resistance – millivolt level method | 2a | 1<br>2 | X<br>X | Limit values according to P3, maximum change in relation to initial values ≤15 mΩ |
| FP4 | | | Test voltage<br>100 V ± 15 V d.c.<br>Method B<br>8 contacts/specimen | Insulation resistance | 3a | 1<br>2 | X<br>X | $\geq 10^8$ Ω |
| FP5 | General examination | | See P1 | Visual examination | 1a | 1<br>2 | X<br>X | No damage likely to impair normal operation |

### 5.2.8 Group GP – Connections

| Test-phase | Test | | | Measurement to be performed | | Requirements | | |
|---|---|---|---|---|---|---|---|---|
| | Title | IEC 60512 Test No. | Severity or condition of test | Title | IEC 60512 Test No. | PL | | |
| GP1 | Press-in terminations | | Tests according to IEC 60352-5 | | | 1<br>2 | X<br>X | |
| GP2 | Wire wrap terminations | | Tests according to IEC 60352-1 | | | 1<br>2 | X<br>X | |
| GP3 | Solderability | | Tests according to IEC 60068-2-54 | | | 1<br>2 | X<br>X | |

**Standards Survey**

**The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!**

Customer Service Centre (CSC)

**International Electrotechnical Commission**
3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC**/CSC at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

Nicht frankieren
Ne pas affranchir

Non affrancare
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**A Prioritaire**

**RÉPONSE PAYÉE**

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**International Electrotechnical Commission**
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1211 GENEVA 20
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**Q1** Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.....

**Q2** Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

purchasing agent ❑
librarian ❑
researcher ❑
design engineer ❑
safety engineer ❑
testing engineer ❑
marketing specialist ❑
other.....

**Q3** I work for/in/as a: *(tick all that apply)*

manufacturing ❑
consultant ❑
government ❑
test/certification facility ❑
public utility ❑
education ❑
military ❑
other.....

**Q4** This standard will be used for: *(tick all that apply)*

general reference ❑
product research ❑
product design/development ❑
specifications ❑
tenders ❑
quality assessment ❑
certification ❑
technical documentation ❑
thesis ❑
manufacturing ❑
other.....

**Q5** This standard meets my needs: *(tick one)*

not at all ❑
nearly ❑
fairly well ❑
exactly ❑

**Q6** If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

standard is out of date ❑
standard is incomplete ❑
standard is too academic ❑
standard is too superficial ❑
title is misleading ❑
I made the wrong choice ❑
other .....

**Q7** Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

timeliness.....
quality of writing.....
technical contents.....
logic of arrangement of contents .....
tables, charts, graphs, figures.....
other .....

**Q8** I read/use the: *(tick one)*

French text only ❑
English text only ❑
both English and French texts ❑

**Q9** Please share any comment on any aspect of the IEC that you would like us to know:

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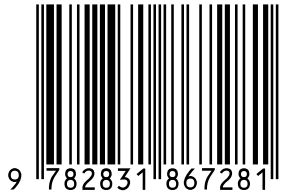


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