

INTERNATIONAL STANDARD

IEC
61076-4-108

QC 480301XX0009

First edition
2002-02

Connectors for electronic equipment –

Part 4-108:

**Printed board connectors with assessed quality –
Detail specification for cable-to-board connectors,
with a modular pitch of 25 mm and integrated
shielding function, applicable for transverse
packing density of 15 mm, having a basic grid
of 2,5 mm in accordance with IEC 60917-1**



Reference number
IEC 61076-4-108:2002(E)

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Annex A (informative) Shielding effectiveness

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CONNECTORS FOR ELECTRONIC EQUIPMENT –**Part 4-108: Printed board connectors with assessed quality –
Detail specification for cable-to-board connectors, with a modular pitch
of 25 mm and integrated shielding function, applicable for transverse
packing density of 15 mm, having a basic grid of 2,5 mm
in accordance with IEC 60917-1**

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International Standard IEC 61076-4-108 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/1122/FDIS	48B/1170/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.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated when a new edition is prepared.

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annex A is for information only.

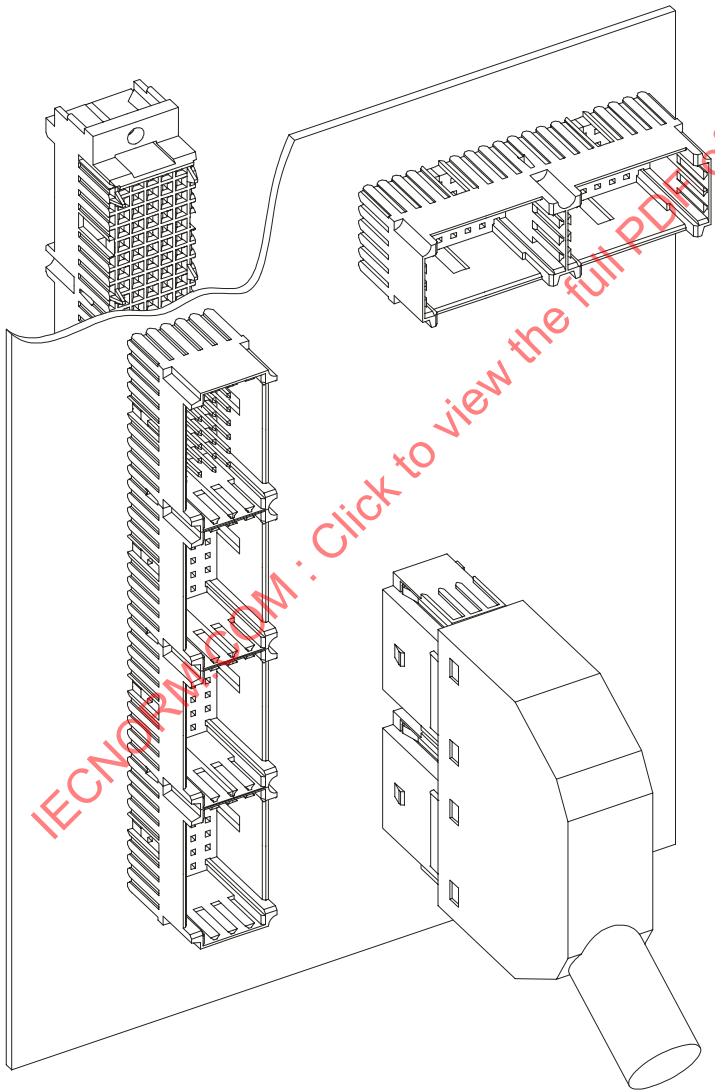
The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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

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CONNECTORS FOR ELECTRONIC EQUIPMENT –

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IEC SC 48B – Connectors Specification available from: IEC Central Office or from the addresses shown on the inside cover. ELECTRONIC COMPONENTS OF ASSESSED QUALITY DETAIL SPECIFICATION in accordance with IEC 61076-1:1995.	IEC 61076-4-108 QC 480301XX0009
 IEC 395/02	Cable connector system, – 15 mm mounting pitch –, for printed boards and backplanes, grid of 2,5 mm in accordance with IEC 60917-1, integrated shielding function. Modular, five row connector, with shielding, ground contacts and coding features. Fixed board connectors 50 mm to 250 mm length Free cable connectors, 25 mm to 100 mm length. Performance levels (PL): 1, 2 Assessment level: G

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

1 General data

This specification describes adapter connectors of modular metric construction in conformance with IEC 60917-1.

Interface connectors and cable connectors are used to make the electrical connection between a closed functional unit, for example a subrack, and its environment. The modular construction and the various connector styles enable a suitable connector to be used in equipment practices for electronic equipment such as data systems, communications technology, telecommunications engineering and safety and security systems, power engineering and automation technology.

Throughout this specification all dimensions are in millimetres.

1.1 Recommended method of mounting

The connectors are used for connecting a printed board to a cable (see also figure 1).

The connectors are matched to the 2,5 mm contact grid. They can be mounted in an existing grid coordinate system horizontally or vertically or overlapping from module to module or from subrack to subrack. Care shall be taken to ensure that the contact areas of the male contacts match the position of the female contacts. The engaging areas of the male contacts on the rear of a backplane correspond to the male contact dimensions according to IEC 61076-4-100.

NOTE In view of the large number of different mounting and application options, the contact quality between male and female contacts must be guaranteed.

In the case of a subrack, for example, there are three mounting options:

- a) Rear of the backplane
- b) Module side of the backplane
- c) Front of the module

Fixed connectors:

For application on the rear of a backplane, a male connector body (preferably of flanged construction) is pushed over the rear plug-in connections of male contacts which have already been pressed in, for example over the terminals of a male connector according to IEC 61076-4-100, and secured in position.

For use on the module side of a backplane, a male connector body can be mounted in the same way over press-in male contacts.

Apart from flange mounting, the male connector body can also be fixed unsupported or directly to the male contacts.

For application on the side of a module or at the rear of a backplane, an interface male connector (preferably without flange) can be pressed into metal-plated holes in the backplane.

For application at the front of a module, a male connector body shall be equipped with male contacts which are mounted, for example pressed in, on the module printed board with terminals bent at right angles.

Free connectors:

The female connector equipped with female contacts is secured in a connector housing at which the cable is mounted with strain relief. The shielding braid of a cable shall be conductively connected to the connector housing consisting of shielded metal caps. The individual wires of a cable shall be connected at the female contacts directly by means of crimped or insulation displacement connections.

1.1.1 Maximum number of contacts

Fixed board connector

Table 1 – Maximum number of contacts – fixed connector

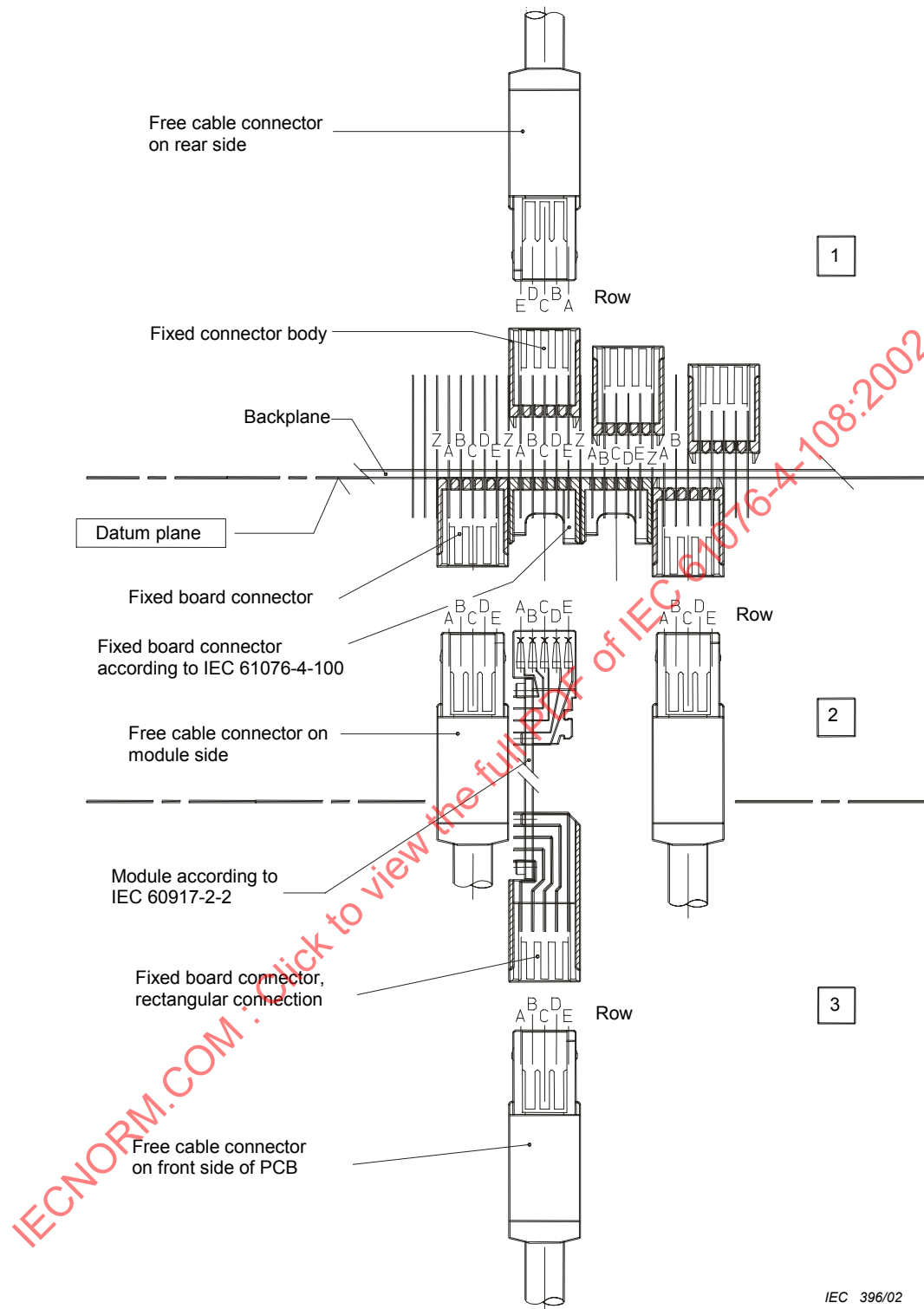
System units (Height = Coordination dimension)	1 SU (25)	2 SU (50)	4 SU (100)	9 SU (225)	10 SU (250)
Styles (see 2.2.1.1)	J	B;P;K	D;L;R	G;U	H;V
Signal contacts	41	82	164	369	410
Ground contacts	4	8	16	36	40

Free cable connector

Table 2 – Maximum number of contacts – free cable connector

System units (Height = Coordination dimension)	1 SU (25)	2 SU (50)	4 SU (100)
Styles (see 2.2.1.1)	A	B	D
Signal contacts	41	82	164
Ground contacts	4	8	16

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Installation options:

- 1 Rear of the backplane
- 2 Module side of the backplane
- 3 Front of the module

Figure 1 – Recommended installation

1.2 Ratings and characteristics

Proof voltage:	contact/ground > 750 V r.m.s. (according to table 15)		
Current rating: (at 70 °C)	2,1 A (grid 2,5 mm × 2,5 mm)		
	2,2 A (grid 2,5 mm × 5 mm “chess”)		
	2,7 A (grid 5 mm × 5 mm)		
Insulation resistance:	10 ⁴ MΩ		
Climatic category:	PL1: 40/100/56		
	PL2: 40/100/21		
Printed board thickness:	Backplane 1,6 mm to 4,5 mm		
	Plug-in unit 1,6 mm to 3,2 mm		
Metal-plated hole:	0,94 mm – 1,09 mm		
Contact gap:	2,5 mm × 2,5 mm		
Shielding effectiveness:	4 contacts/25 mm	Style: A (1 SU) : 10 dB	(at 300 MHz)
	(arrangement 4, table 7)	B (2 SU) : 14 dB	(at 300 MHz)
		D (4 SU) : 20 dB	(at 300 MHz)

1.3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61076. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61076 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

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

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

IEC 60352-2:1990, *Solderless connections – Part 2: Solderless crimped connections – General requirements, test methods and practical guidance*
Amendment 1:1996

IEC 60352-3:1993, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-5:1995, *Solderless connections – Part 5: Solderless press-in connections – General requirements, test methods and practical guidance*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

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

IEC 60512-1-100:2001, *Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications*

IEC 60917-1:1998, *Modular order for the development of mechanical structures for electronic equipment practices – Part 1: Generic standard*

IEC 60917-2-2:1994, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2: Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 61076-1:1995, *Connectors with assessed quality for use in d.c., low-frequency analogue and 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 digital high-speed data applications – Part 4: Sectional specification – Printed board connectors*

IEC 61076-4-001:1996, *Connectors with assessed quality for use in d.c., low-frequency analogue and digital high-speed data applications – Part 4: Printed board connectors – Section 001: Blank detail specification*

IEC 61076-4-100:2001, *Connectors for electronic equipment – Part 4-100: Printed board connectors with assessed quality – Detail specification for two-part connector modules having a grid of 2,5 mm for printed boards and backplanes*

ISO 1302:1992, *Technical drawings – Method of indicating surface texture*

1.4 Marking

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

Marking examples (according to 1.5)

Fixed board connector

Style 4 SU male connector, male contacts equipped in “chess” pattern, press-in termination with rear plug-up cable connection, with ground contacts, surface of the signal and ground contacts gold-plated, meeting performance level 1 and assessment level G:

IEC 61076-4-108 – R088M – 24 – R1 – 1 – 1G

Free cable connector

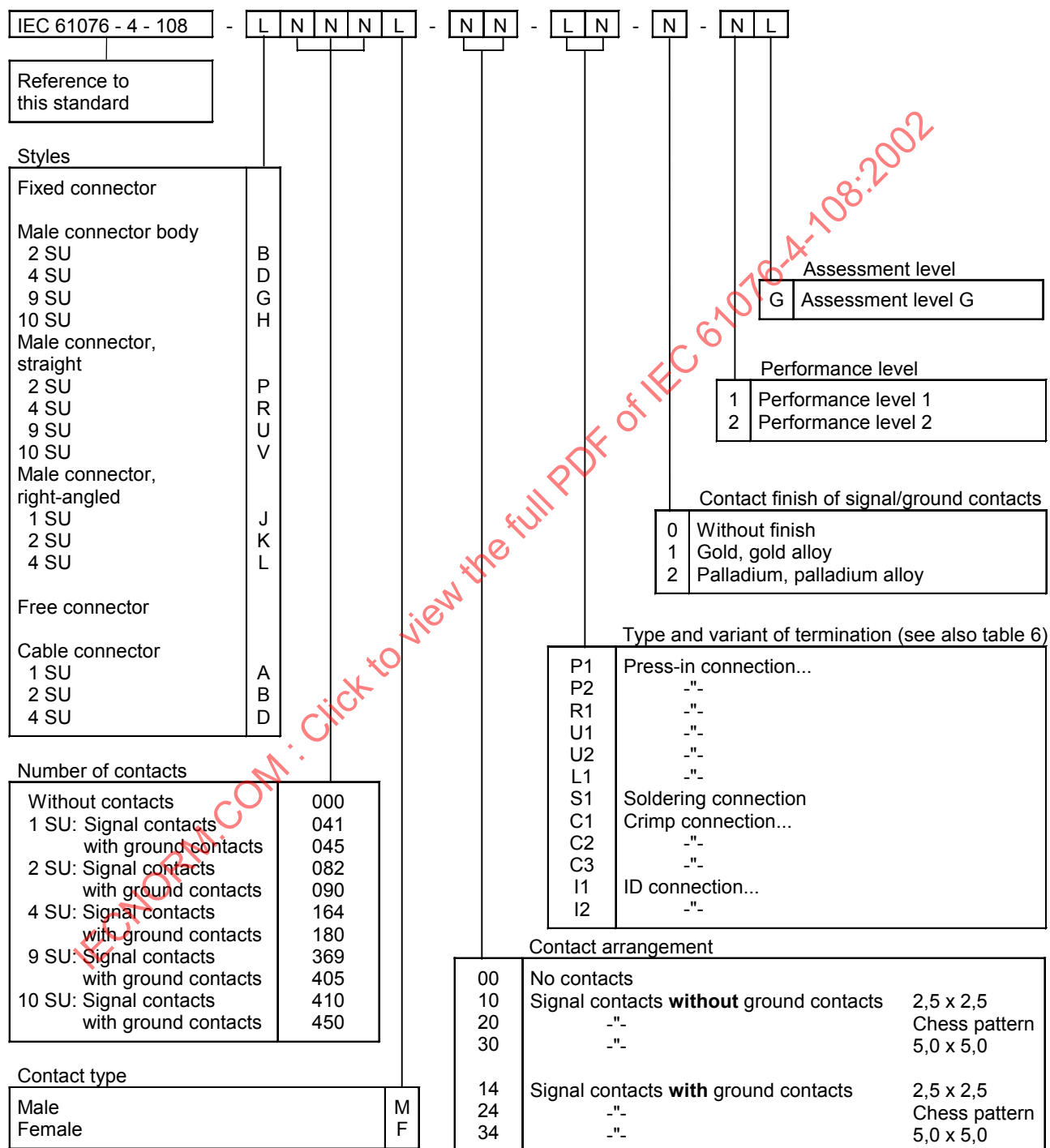
Style 1 SU female contacts equipped in 2,5 mm × 2,5 mm grid pattern, without ground contacts, surface of the signal contacts palladium alloy, cable with solid conductors, with crimp termination (AWG 30 – 24), meeting performance level 2 and assessment level G:

IEC 61076-4-108 – A041F – 10 – C3 – 2 – 2G

1.5 IEC type designation

The designation of plug-in connectors shall be defined as follows in accordance with this standard:

L stands for letter, N stands for number.



1.6 Ordering information

For ordering connectors according to this detail specification, the IEC type designation described in 1.5 shall be used.

2 Technical information

2.1 Definitions

2.1.1 Mechanical features

2.1.1.1

system unit (SU)

modular pitch of 25 mm, which is the basis for the design of all mechanical features

2.1.1.2

mounting code

special marks on the connector housings simplify correct installation of male connectors (fixed connectors) or male connector bodies and contact equipment in the case of cable connectors (free connectors).

2.1.2 Contacts and terminations

2.1.2.1

engaging range

the minimum to maximum distance between the reference planes of the fixed and free connectors, within which reliable contact making is guaranteed

2.1.2.2

equipment grid

the equipment grid can be freely selected within the basic grid of 2,5 mm × 2,5 mm. The male/female contacts can be arranged according to the application. A system unit (SU) can be equipped with a maximum of 41 signal contacts and a maximum of four ground contacts.

2.1.2.3

standard equipment

full grid: contact arrangement in which all grid positions are equipped.

chess pattern grid: contact arrangement in which the grid positions are equipped alternately like the squares on a chess board.

2.1.2.4

rear plug-up contact

termination post, usually being pressed-in into the backplane and provided at the rear of the backplane with a contact area, to which a free connector (cable connector) can be connected

2.1.2.5

press-in shoulders

areas of the male contact, by means of which the contact can be pressed into the backplane

2.1.3 Engagement sequence

2.1.3.1

contact range

range of all contacts which engage/separate simultaneously, within the limits of the required reliable engaging range

2.1.3.2

engaging cycles

an engaging cycle comprises the engaging/separating process for a connector

2.1.3.3**first possible contact point**

depth dimension of the first point on the female contact, which can possibly be touched by the incoming male contact

2.1.3.4**contact point**

depth dimension of the point on the female contact, from where the specified contact resistance with the incoming male contact is met

2.1.4 Mechanical coding, locking**2.1.4.1****coding devices**

accessories allowing pairs of connectors to be assigned to each other non-reversible, i.e. only connector pairs equipped with matching coding devices can mate. Mating of pairs with different coding is reliably prevented.

2.1.4.2**180° polarization**

housing parts of the fixed and free connector have a 180° polarization to prevent incorrect insertion

2.1.4.3**locking**

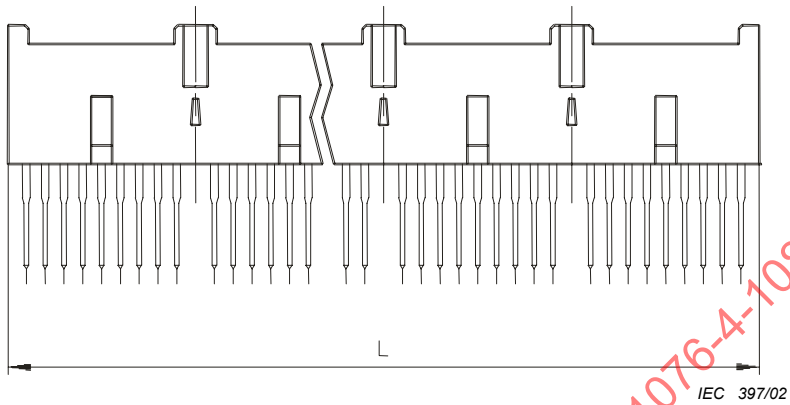
protrusions on the side of the housing of the free cable connector used for latching in the male connector body of the fixed board connector

2.2 Surveys of styles and variants**2.2.1 Styles of connectors****2.2.1.1 Survey of connector style designations****Table 3 – Connector style designations**

(System units)	(1 SU)	(2 SU)	(4 SU)	(9 SU)	(10 SU)
Styles					
Printed board connectors					
Male connector body	–	B	D	G	H
Male connector, straight connection	–	P	R	U	V
Male connector, right-angled connection	J	K	L	–	–
Cable connectors	A	B	D	–	–

2.2.1.2 Fixed board connectors

Table 4 – Styles – fixed connectors

				
Male connector (without flange)	P	R	U	V
Length L (coordination dimension)	50	100	225	250

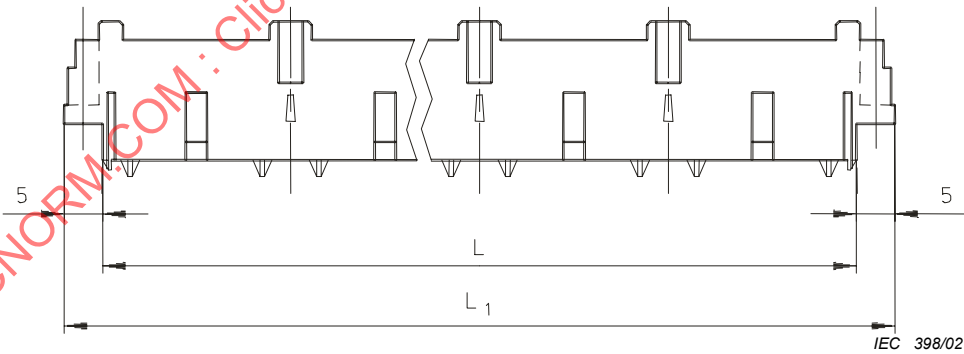
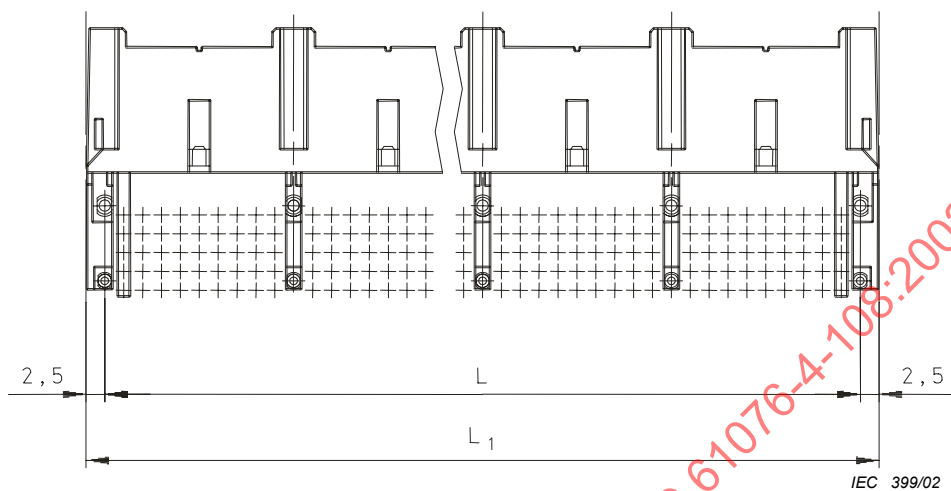
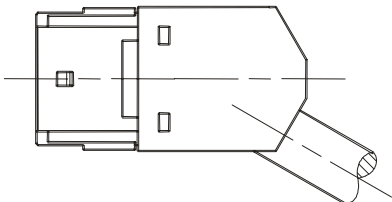
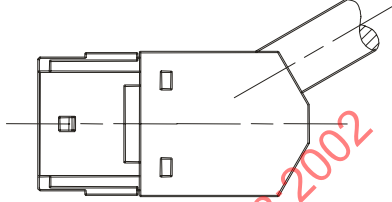
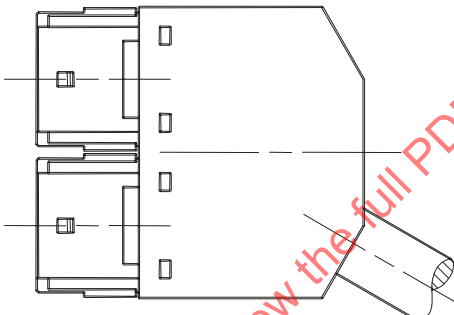
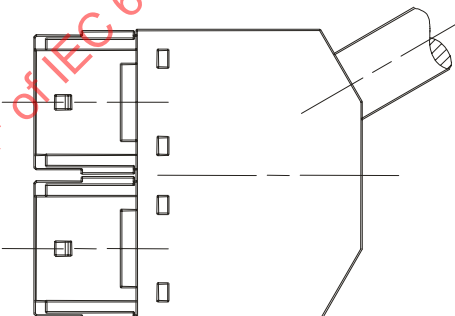
				
Male connector body (with flange)	B	D	G	H
Length L (coordination dimension)	50	100	225	250
Length $L_1 = L + 2 \times 5$ (coordination dimension)	60	110	235	260

Table 4 (continued)

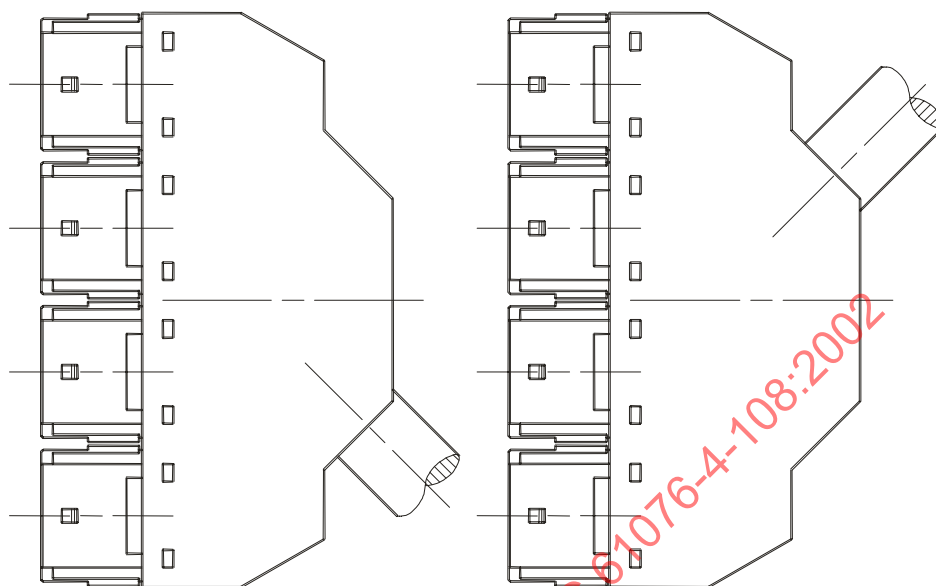
Male connector for front installation	J	K	L
Length L (coordination dimension)	25	50	100
Length $L_1 = L + 2 \times 2,5$ (coordination dimension)	30	55	105

2.2.1.3 Free cable connectors

Table 5 – Styles – free connectors

Style (Height)	Cable outlet	
	Bottom	Top
A (25)		 <i>IEC 400/02</i>
B (50)		 <i>IEC 401/02</i>

D
(100)



IEC 402/02

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2.2.2 Survey of termination variants

Table 6 – Termination variants

		Basic type of termination	Variant	Lengths (see also 3.4.2)
Male contact	P	Press-in connection for plated through-hole Ø 1 mm, straight, according to IEC 60352-5	P1	4,5 mm
			P2	6,0 mm
	R	Press-in connection for plated through-hole Ø 1 mm, straight, with rear plug-up connection according to IEC 60352-5	R1	14,0 mm / 15,75 mm (standard / premating)
	U	Press-in connection for plated through-hole Ø 1 mm, straight, with rear plug-up and wrap connection according to IEC 60352-5	U1	17,75 mm / 19,5 mm (standard / premating)
			U2	21,5 mm / 23,25 mm (standard / premating)
	L	90° angled press-in connection for plated-through hole Ø 1 mm, according to IEC 60352-5	L1	3 mm
	S	90° angled solder connection according to IEC 60352-1	S1	3 mm

		Basic type of termination	Variant	Wire gauges
Female contact	C	Crimp connection according to IEC 60352-2	C1	1 × stranded wire: 0,14 mm ² to 0,35 mm ² (AWG 26 to AWG 22)
			C2	1 × stranded wire: 0,05 mm ² to 0,14 mm ² (AWG 30 to AWG 26)
			C3	1 × solid wire: Ø 0,25 mm to 0,50 mm (AWG 30 to AWG 24)
	I	Insulation displacement connection according to IEC 60352-3	I1	Stranded wire: 0,09 mm ² to 0,14 mm ² (AWG 28 to AWG 26) Solid wire: Ø 0,25 mm to 0,40 mm (AWG 30 to AWG 26)
			I2	Stranded wire: 0,22 mm ² to 0,35 mm ² (AWG 24 to AWG 22) Solid wire: Ø 0,40 mm to 0,63 mm (AWG 26 to AWG 22)

2.3 Information on application

2.3.1 Connector pairs

Description

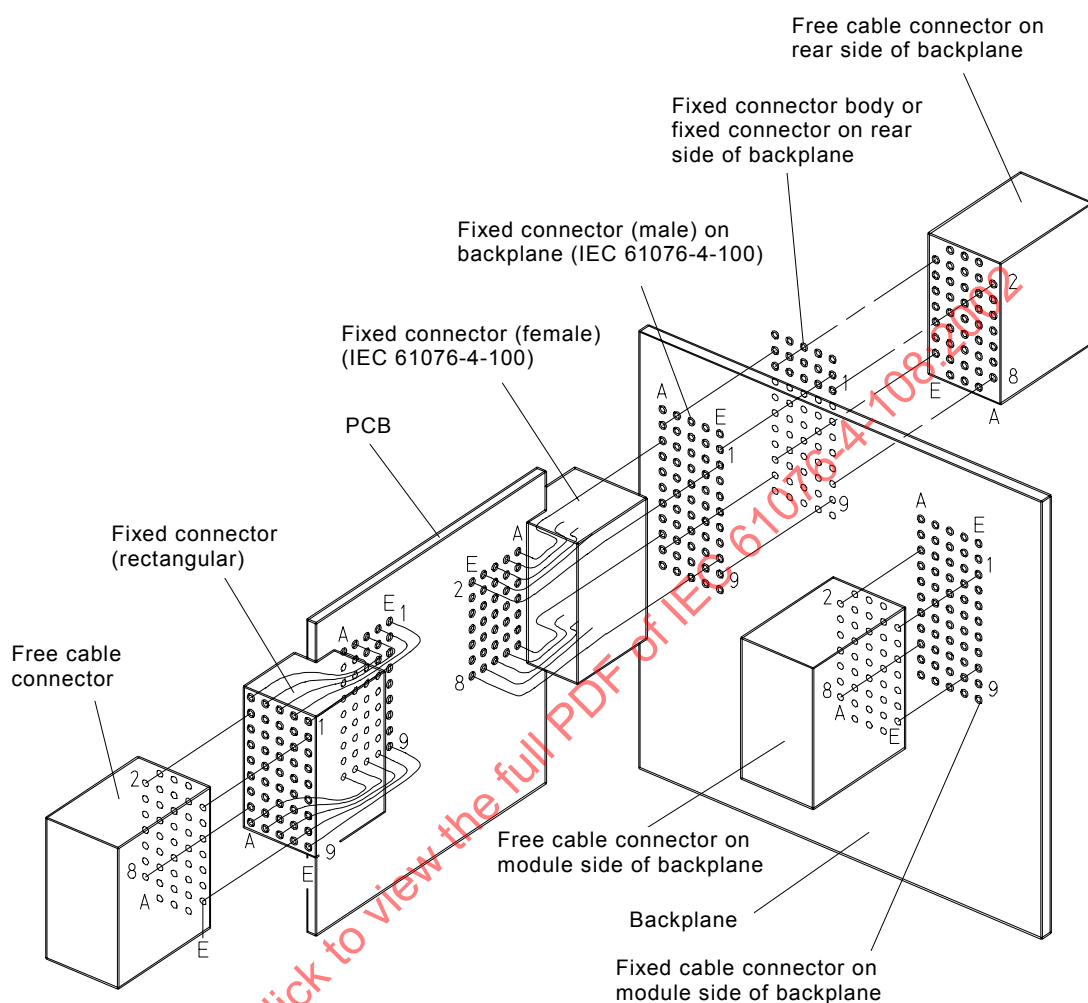
Male connectors or male connector bodies connected to the rear contact areas of male contacts shall be arranged in any position – horizontally or vertically – in the backplane of a subrack.

The male connector bodies are subdivided into individual SU areas into which the various cable connector types – mounted side by side – can be plugged. In the plugged-in position, the cable connectors engage in the male connector bodies.

Contact designation

The methods of mounting described in 1.1 and shown in figure 1 allow the use of connectors in opposite mating directions. The contact designation (rows and position) shall be designated in the viewing and mating direction onto the module side of the backplane and assigned to the individual components in this way (male contacts in the backplane). When a cable connector is inserted on the rear of a backplane, the contact row designation of the male connector or male connector body is – theoretically – reversed. This “reversal” of the contact row designation shall be taken into account in the electrical assignment between fixed board connector and free cable connector at the rear of the backplane. See also figure 2.

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IEC 403/02

Figure 2 – Method of numbering contacts

2.3.2 Fixed board connectors

Mounting

Male connector bodies are generally pushed onto a suitable connection area of the male contacts which are pressed into the backplane, for example a male connector according to IEC 61076-4-100. They can be fixed to the subrack, the backplane or to the pressed-in male contacts directly; the requirements of the test schedule shall be guaranteed. The male connector bodies shall be provided with visual indications in the form of different outside contours, for example in the area of the lateral walls of the male connector body to ensure installation in the correct position in a male contact field. In case of direct fixing to the male contacts – in the full grid contact arrangement – the male contact geometry according to IEC 61076-4-100 shall be observed.

Mounting position

The male connectors or male connector bodies can be mounted primarily in the vertical position, but also horizontally, for example in a full grid of 2,5 mm. The smallest mounting pitch is 15 mm.

Mounting of a male connector body at the rear of a backplane:

The depth stop for setting the correct contact engaging range shall be guaranteed by male contacts in the area of the lateral walls of the male connector body (see also 3.4.2).

Mounting of a male connector body on the module side of a backplane:

The male connector body is flush-mounted. Premating male contacts shall be used to ensure the correct contact engaging range.

Connector styles without a flange can be installed side by side flush – without loss of pitch. Overlapping connection of modules and subracks is possible, for example at the rear of a backplane.

Contact levels and sequencing

Reliable contacting between the fixed and free connector shall be guaranteed by the contact level which is defined in the engaging areas of the various male contact lengths, for example by a depth stop in the male connector body.

Different contact levels should be staggered by at least 1,75 mm in order to ensure an electrically reliable engaging sequence.

2.3.3 Free cable connectors

Mounting

Cable connectors are usually delivered as separate piece parts, consisting primarily of one or more female connector bodies, female contacts, single-section or multi-section housing and a cable clamp, together with an insertion and extraction tool. When assembling a plug-in cable, these parts shall always be combined to form a complete cable connector using suitable tools and the manufacturer's instructions. Care shall be taken to ensure that the completed cable connector fulfils the specified requirements.

Polarization

The sides of the receptacle shall have polarized contours, which prevent a wrong engagement in the male connector body.

Engaging sequence

The first possible contact point between the female and male contacts during the connection process shall comply with the requirements of 3.5.2.

2.3.4 Accessories

2.3.4.1 Special contacts

Four shielding/ground contacts shall be arranged along the sides or at the corners of the female connector body. These contacts connect a fully shielded female connector housing with the male contacts of a fixed board connector.

2.3.4.2 Coding devices

Description

All slots of a printed board connector can be coded. Each SU partition of a male connector body shall have nine possible coding positions. The coding device is a plastic element which is inserted in grooves on the female connector body.

Mounting

At least two coding grooves of a female connector body shall be closed with coding devices and the associated coding keys on the male connector body shall be removed. The coding devices shall, if possible, be placed on the two outer sides of a cable connector.

Blocking

Coded slots on a printed board connector shall reliably prevent a cable connector being inserted and any electrical connection being made.

Optical identification for mounting position:
right: vertical
above: horizontal mounting

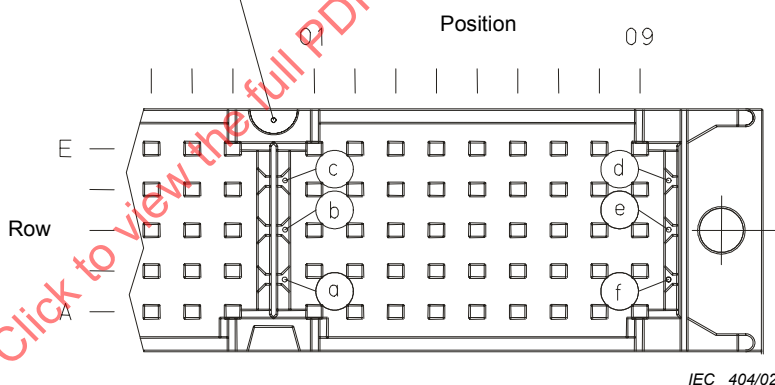


Figure 3 – Designation of the coding keys

2.3.4.3 Installation aids

Removal of the coding keys from printed board connectors shall be performed with a simple tool.

2.3.5 Shielding and grounding

For shielding/grounding purposes, the ground potential shall be routed from the shielding of a cable via a conductive shield housing of the cable connector and four female contacts at the corners of the female connector body to four male contacts in the backplane which are electrically connected to a shielding/grounding layer.

The shield/ground contacts are at grid positions A1, A9, E1, E9 of a SU partition (see also arrangement 4, table 7).

2.3.6 Basic styles of the connections

The cable connector system is specified for use primarily in conjunction with the male contact types described in IEC 61076-4-100.

2.4 Survey of contact arrangements

Table 7 – Contact arrangements

Arrangement	1 2,5 mm × 2,5 mm full grid	Signal contacts 2 Chess pattern grid	3 5 mm × 5 mm grid	Ground contacts 4
Styles (System units)				
A (1 SU)	41	22	12	4
B (2 SU)	82	44	24	8
D (4 SU)	164	88	48	16
G (9 SU)	369	198	108	36
H (10 SU)	410	220	120	40
○ Signal contacts □ Ground contacts x Male contact ¹⁾				
¹⁾ If the male connector body is situated on the rear of the backplane (see also figure 1, 1.1) on male contacts according to IEC 61076-4-100, the male contacts in position rows 10, 20, 30 ... 90 (styles B, D, G, H) are used for supporting the male connector body and ensure the defined engaging range. Electrical connections can only be made to these contacts on the module side (see also 2.3.2 and 3.4.2).				

3 Dimensional information

A standard drawing method is used, as described in clause 3 of IEC 61076-4-001 in order to make it easier to compare different specifications.

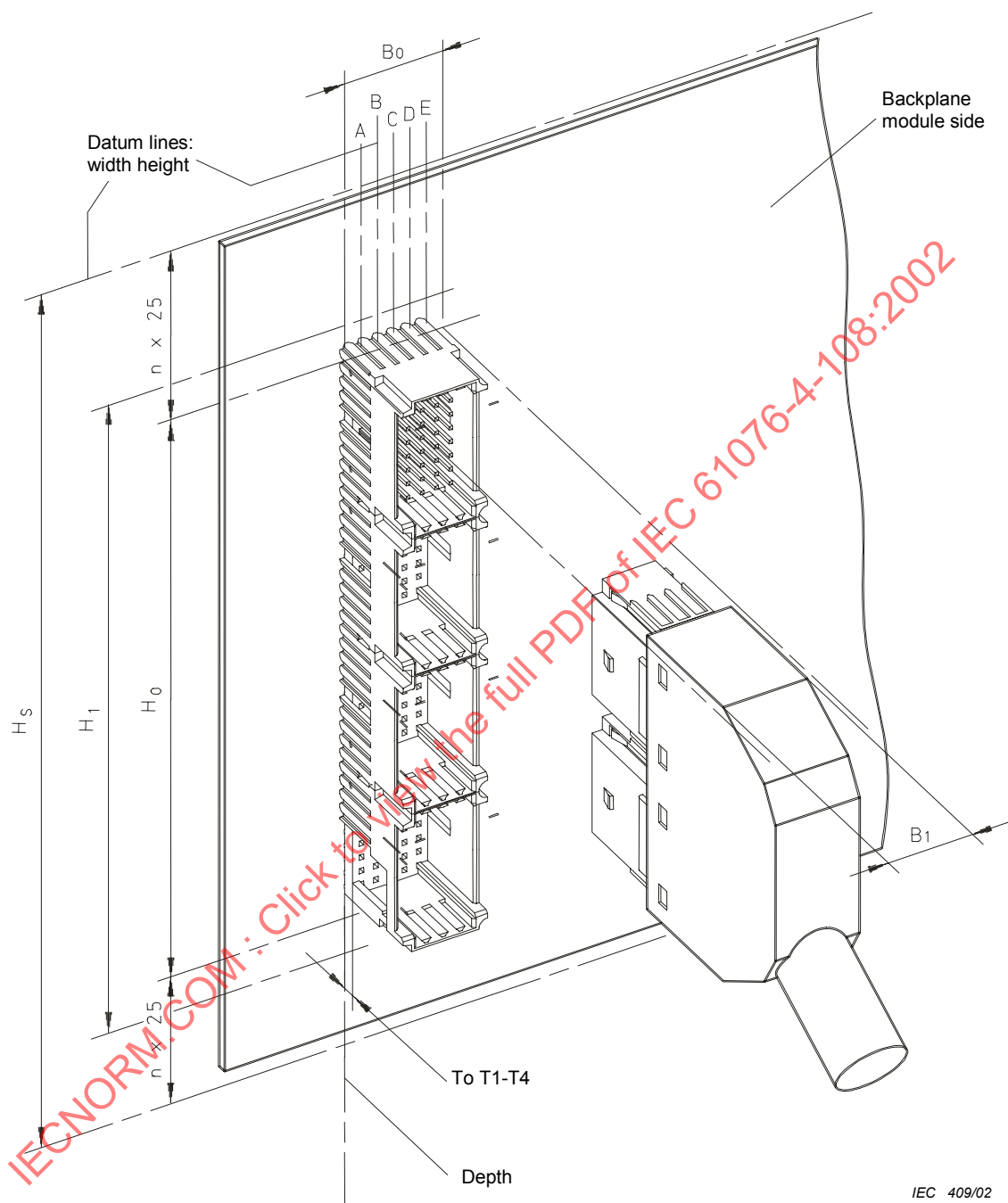
3.1 General

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

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

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3.2 Isometric view and common features



IEC 409/02

Figure 4 – Coordination dimensions in metric equipment practice

3.2.1 Common features

Table 8 – Coordination dimensions and common features in metric equipment practice

Dimension		Feature description
H_S		Coordination dimension (subrack) (see also IEC 60917-2-2)
H_0	$= n \times 25$	Maximum height (pitch)
H_1	$= n \times 25 + 2 \times 5$	Maximum height with fixing flange
B_0	$= 15$	Maximum width (pitch)
B_1	$= 14,8$	Maximum width (cable connector)
T_0	$= 2,50$	Depth ¹⁾ (module side of the backplane)
T_1	$= 4,60$	
T_2	$= 7,55$	
T_3	$= 11,30$	
T_4	$= 15,05$	Depth ¹⁾ (rear of the backplane)
		Male contact type U1/U2 ²⁾
		Male contact type U3/U4 ²⁾
		Male contact type U5/U6 ²⁾ (see also 3.4.2)
n	$= 1; 2; 3; \dots$	Integral factor

¹⁾ Distance between the base of the male connector body and the reference level of the backplane

²⁾ Male contact in accordance with IEC 61076-4-100.

3.2.2 Reference system

The cable connector system can be used in any kind of electronic equipment practice, but throughout this specification, the reference system is the 25 mm metric equipment practice according to IEC 60917-2-2.

All coordination dimensions are based upon the 0,5 mm modular grid and the 2,5 mm and 25 mm mounting pitches specified in IEC 60917-1.

3.2.3 Height dimensions

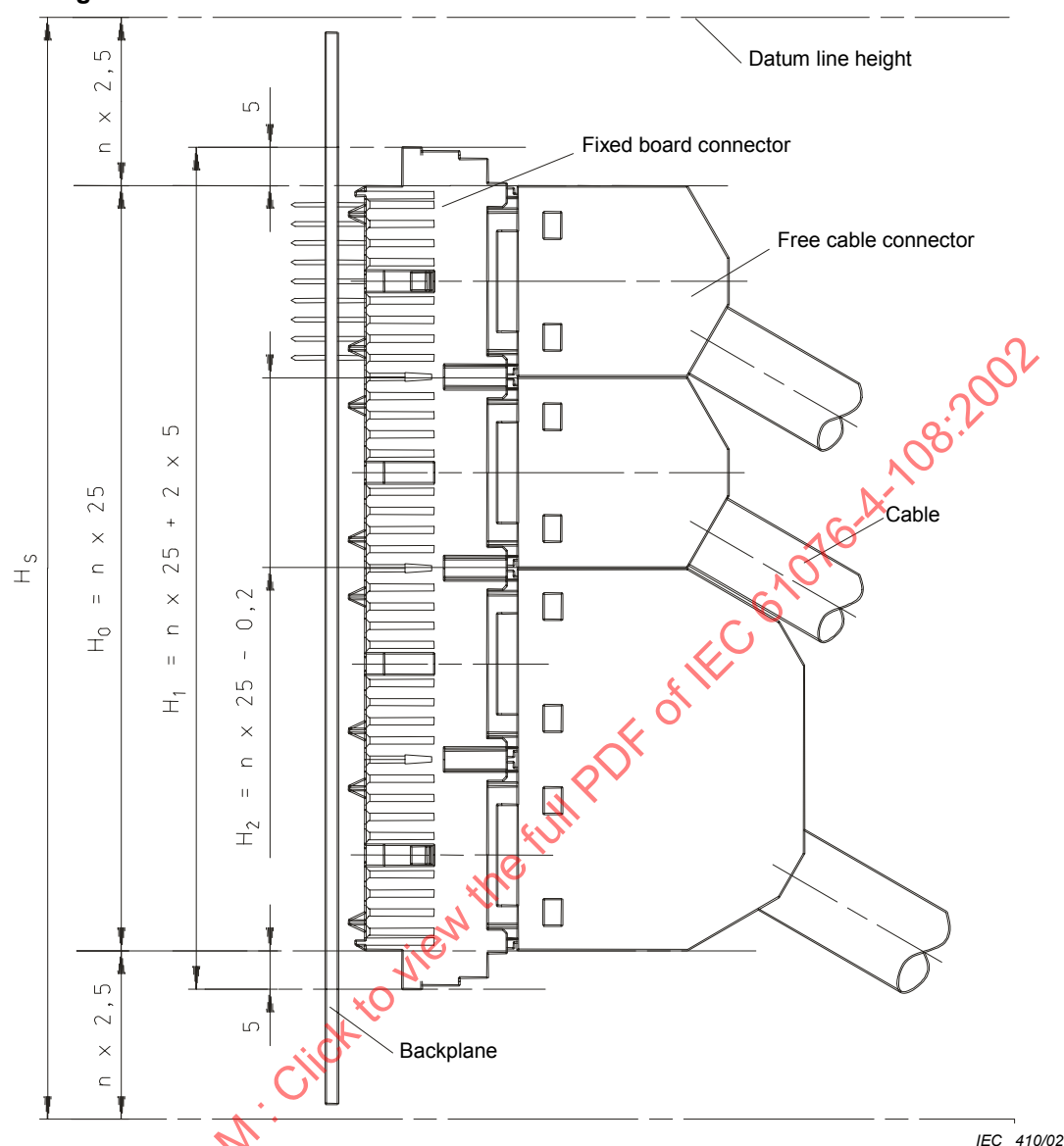
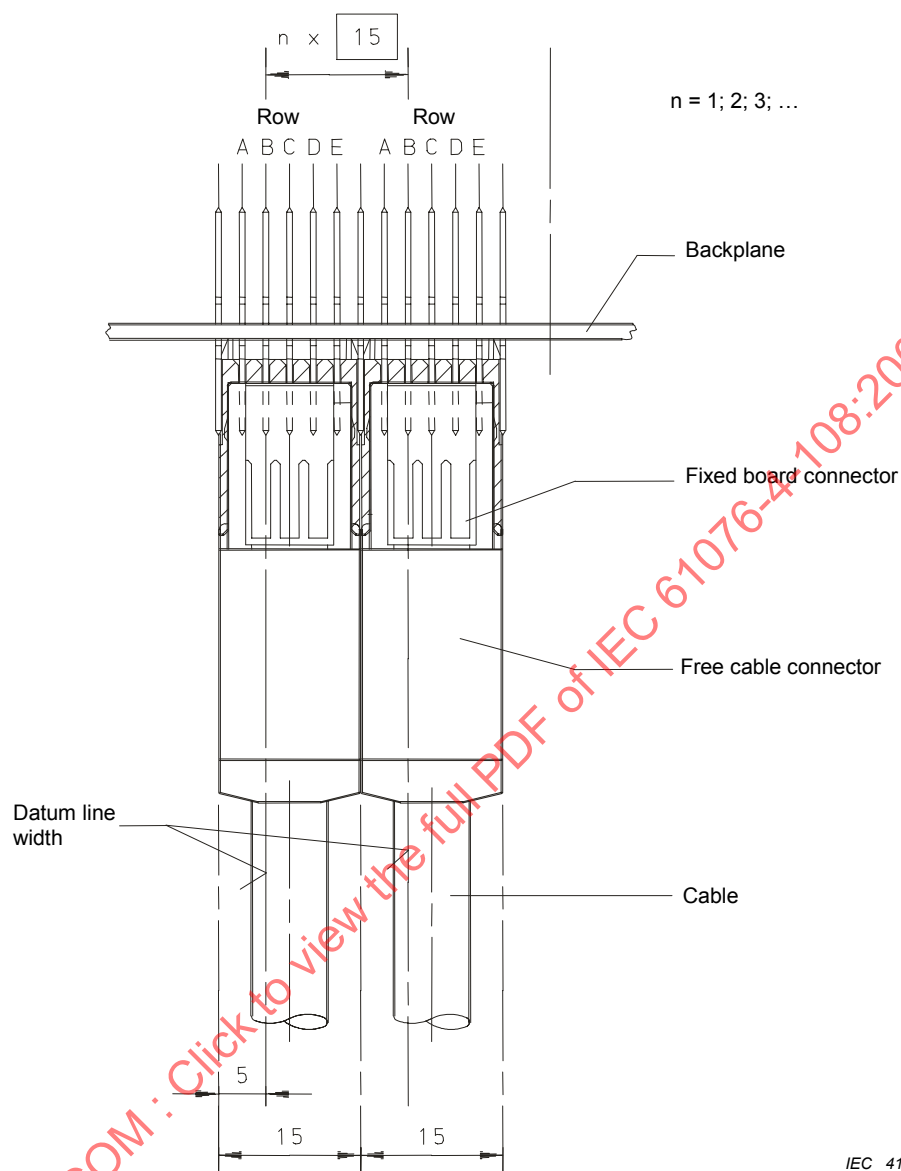


Figure 5 – Height dimensions

Table 9 – Height dimensions

Styles (System units)	A (1 SU)	B (2 SU)	D (4 SU)	G (9 SU)	H (10 SU)
H_s = Coordination dimension (Subrack height)	See IEC 60917-2-2				
H_0 = Pitch Style without flange	–	50	100	225	250
H_1 = Pitch Style with flange	–	60	110	235	260
H_2 = maximum cable connector height	24,8	49,8	99,8	–	–
n = 1; 2; 3;					

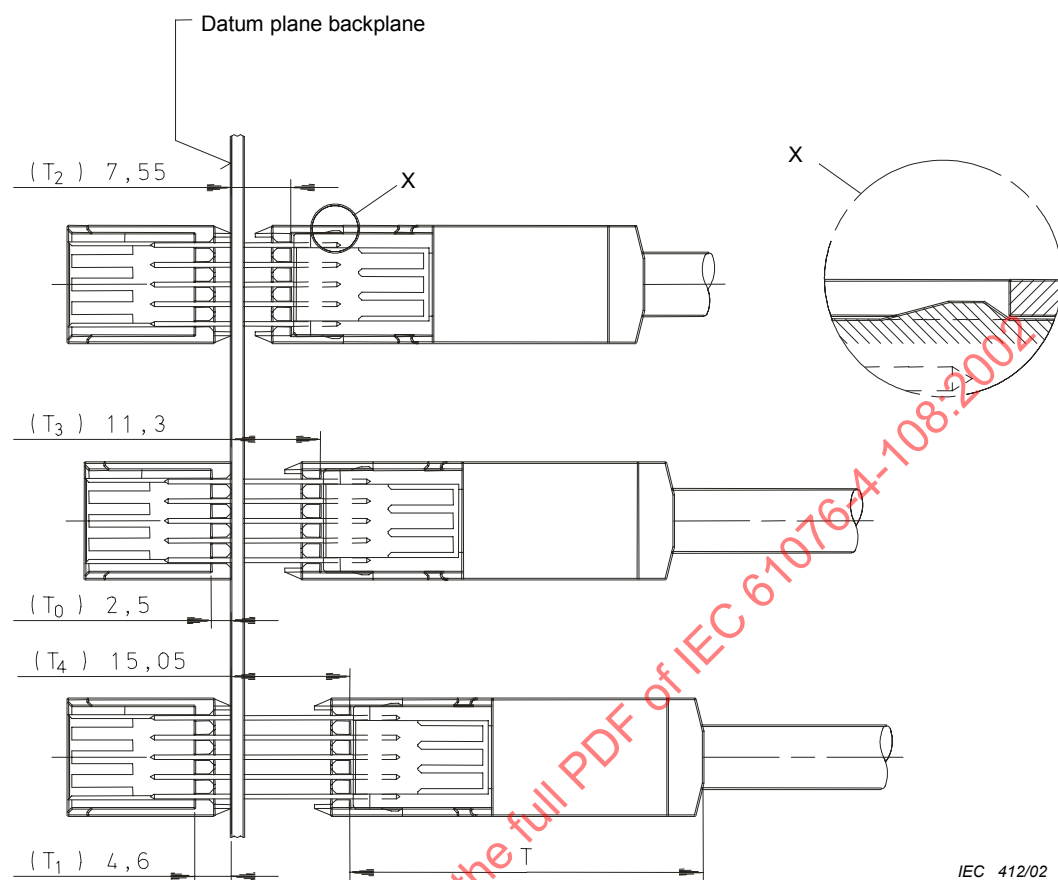
3.2.4 Width dimensions



IEC 411/02

Figure 6 – Width dimensions

3.2.5 Depth dimensions



IEC 412/02

Figure 7 – Depth dimensions

Table 10 – Depth dimensions

Style (System units)	A (1 SU)	B (2 SU)	D (4 SU)
Depth T (maximum depth of the housing)	46	57	61
T ₀ ; T ₁ ; T ₂ ; T ₃ ; T ₄ = Distance between the base of the male connector body and the reference plane of the backplane			

3.3 Mating information

3.3.1 Engaging direction

The specified contact resistance shall be maintained on the pair of connectors when all locking latches of the cable connector are engaged in the male connector body during insertion.

3.3.2 Perpendicular to engaging direction

Not applicable.

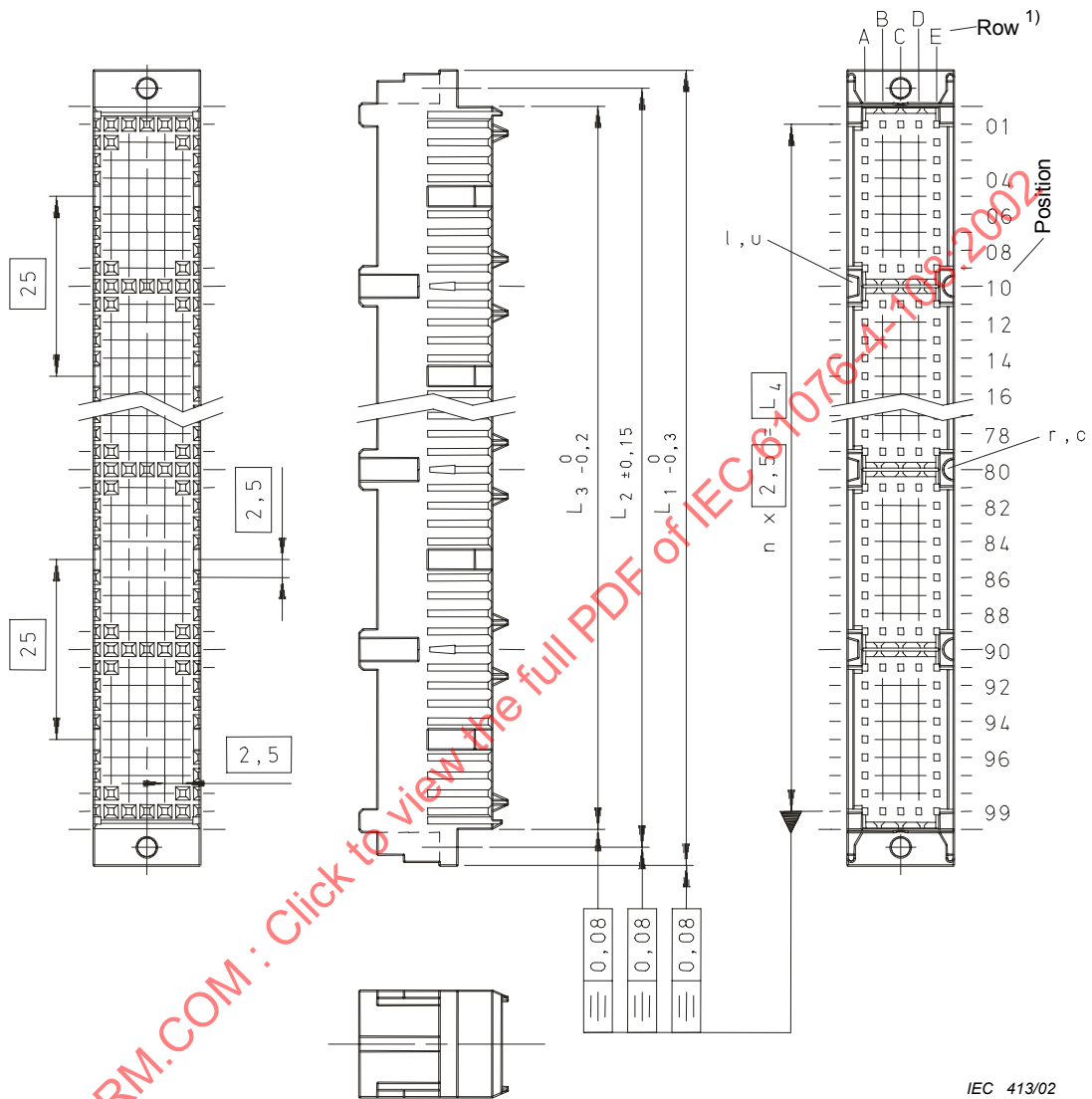
3.3.3 Inclination

Not applicable.

3.4 Fixed board connectors

3.4.1 Dimensions of board connectors

3.4.1.1 Male connector body (with flange)



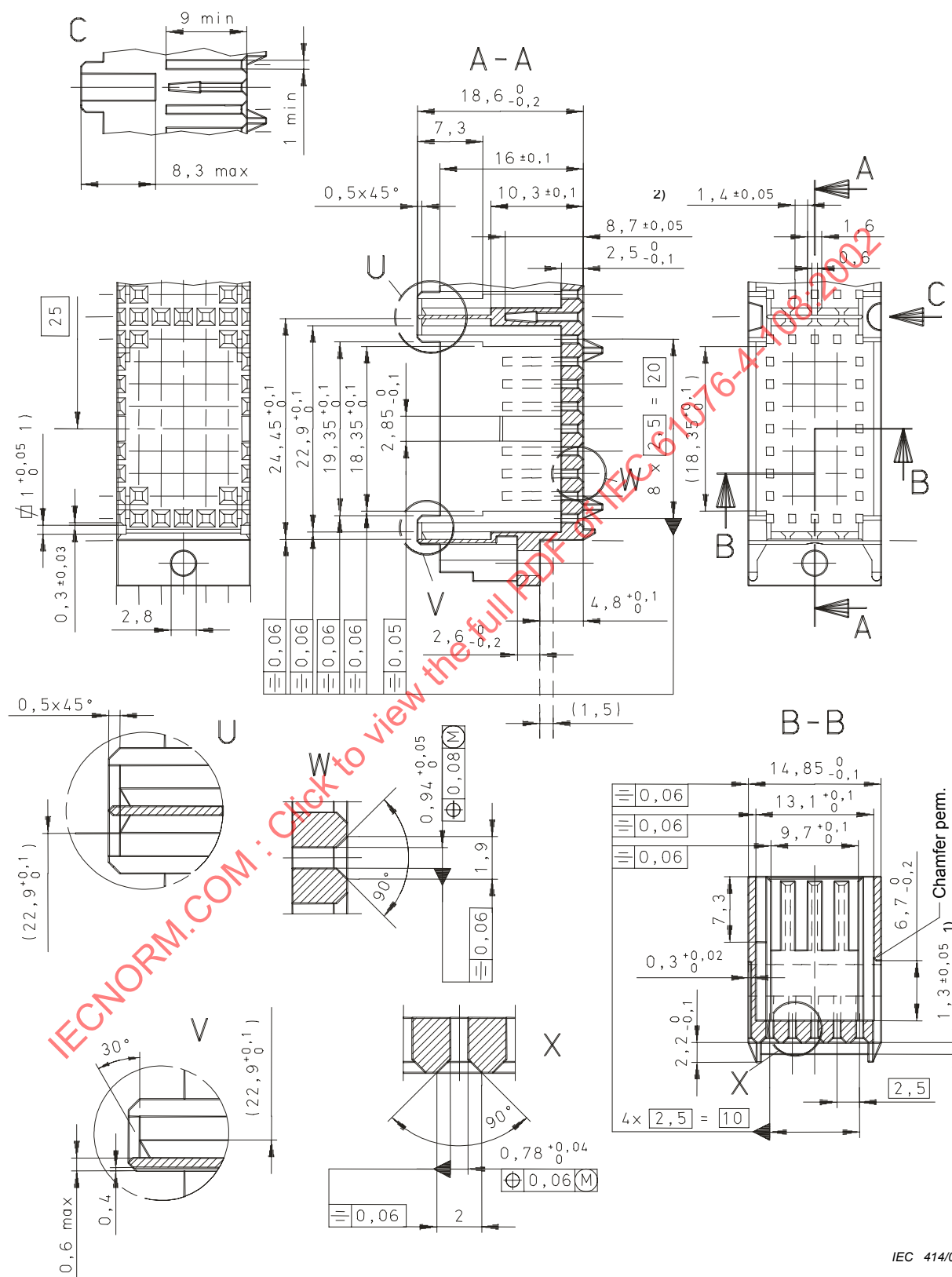
Optical code:
 r, l On the right or left in the case of vertical mounting.
 o, u Above or below in the case of horizontal mounting.
 1) View onto the module side of the backplane, see also 2.3.1, figure 2.

Figure 8 – Male connector body

Table 11 – Male connector body / male connectors (length dimensions) (see also figure 9)

Style (System units)	B; P (2 SU)	D; R (4 SU)	G; H (9 SU)	H; V (10 SU)
Length L_1	60	110	235	260
L_2	55	105	230	255
L_3	50	100	225	250
L_4	45	95	220	245
n	18	38	88	98

3.4.1.2 Details, cross-sections

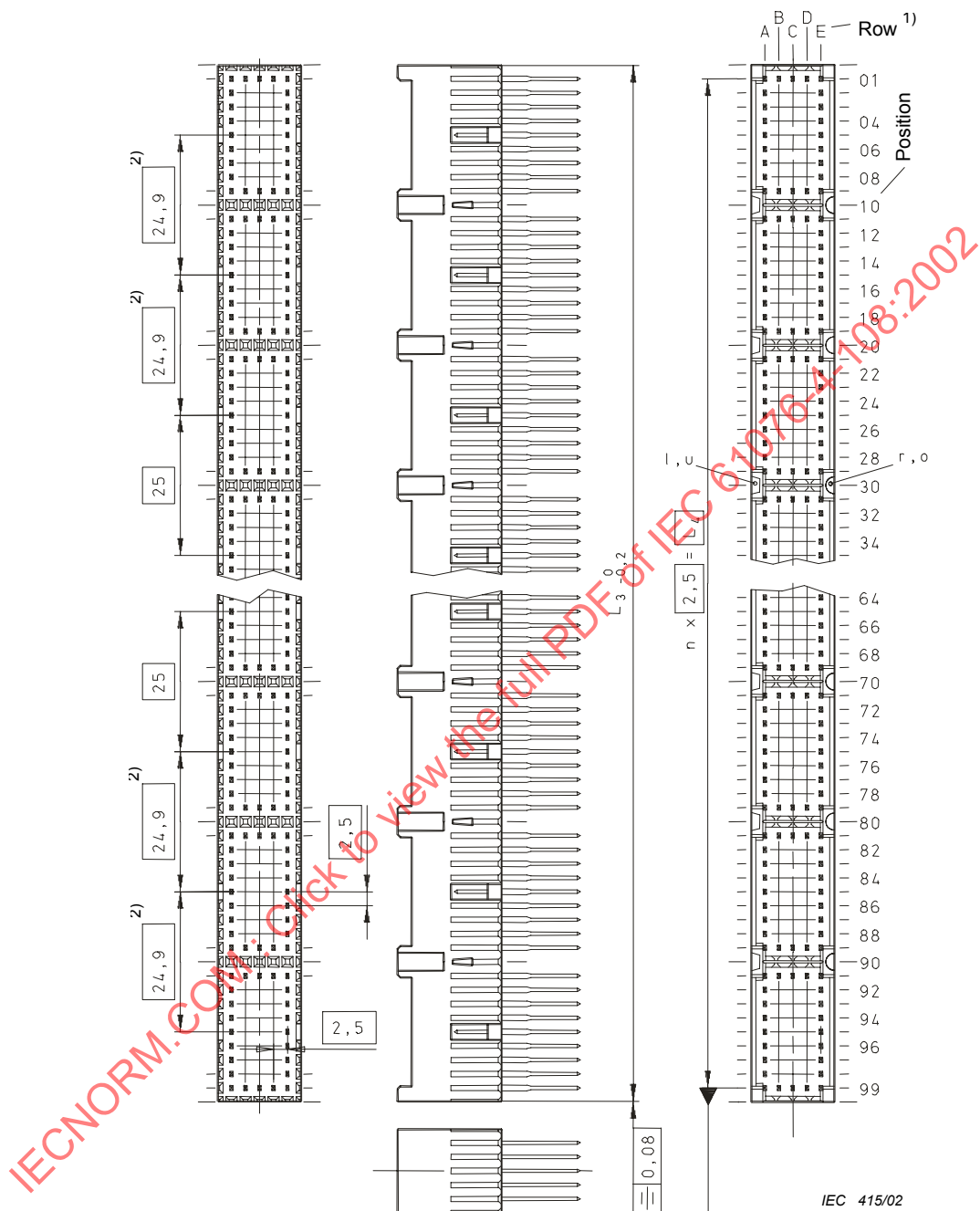


1) Clearance and creepage distance requirement.

2) Acceptance of male contacts on the rear of a backplane which acts as "depth stop" in order to guarantee the engaging length of the male contact.

Figure 9 – Details, cross-sections

3.4.1.3 Male connectors (without flange)



Optical code:

r, l On right or left in the case of vertical mounting.

o, u Above or below in the case of horizontal mounting.

L3, L4 See table 11.

1) View onto the module side of the backplane, see also 2.3.1, figure 2.

2) **24,9** Middle of the SU ranges for cable connector compartment in the outer SU ranges.

Figure 10 – Male connectors

3.4.1.4 Details, cross-sections

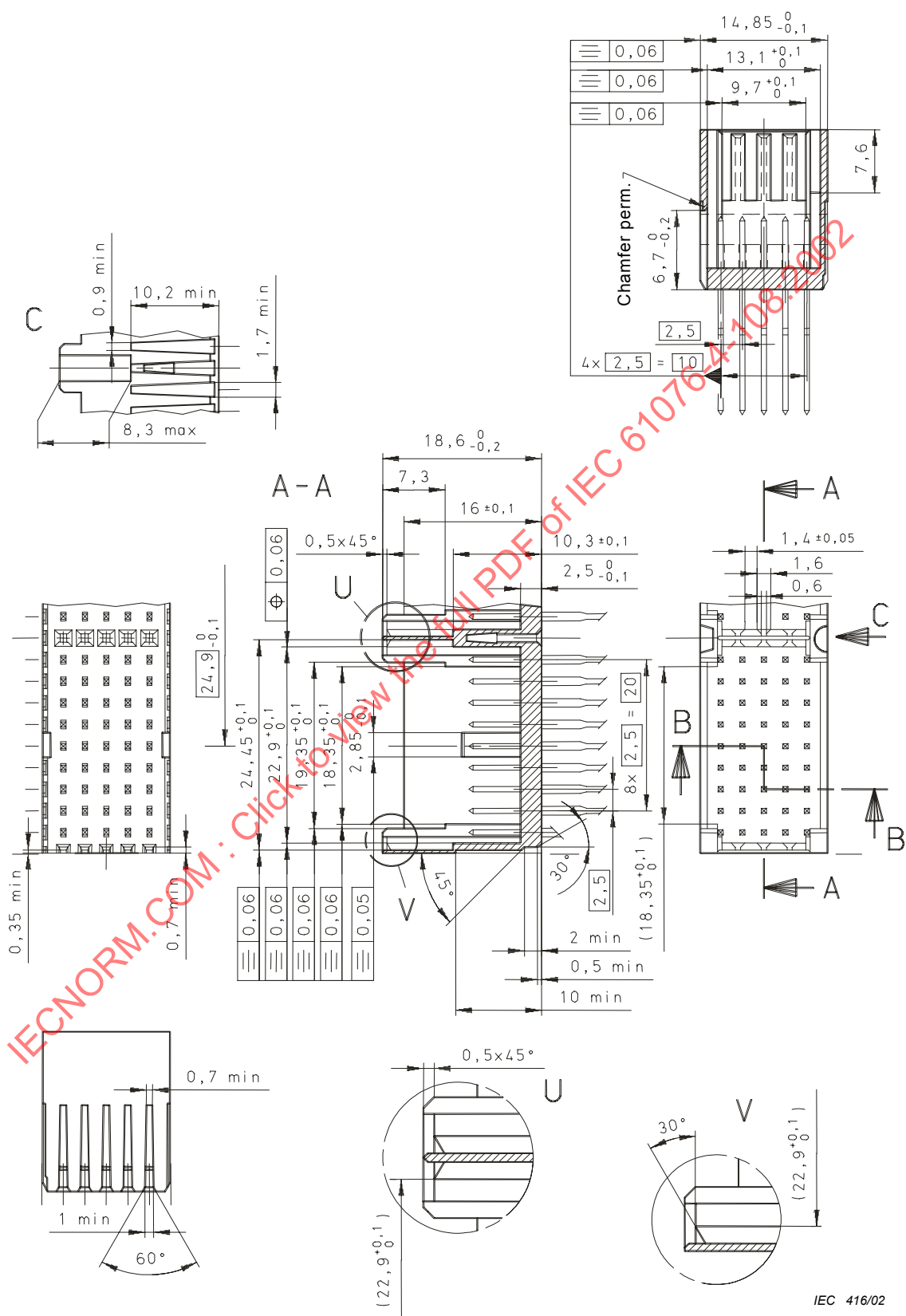
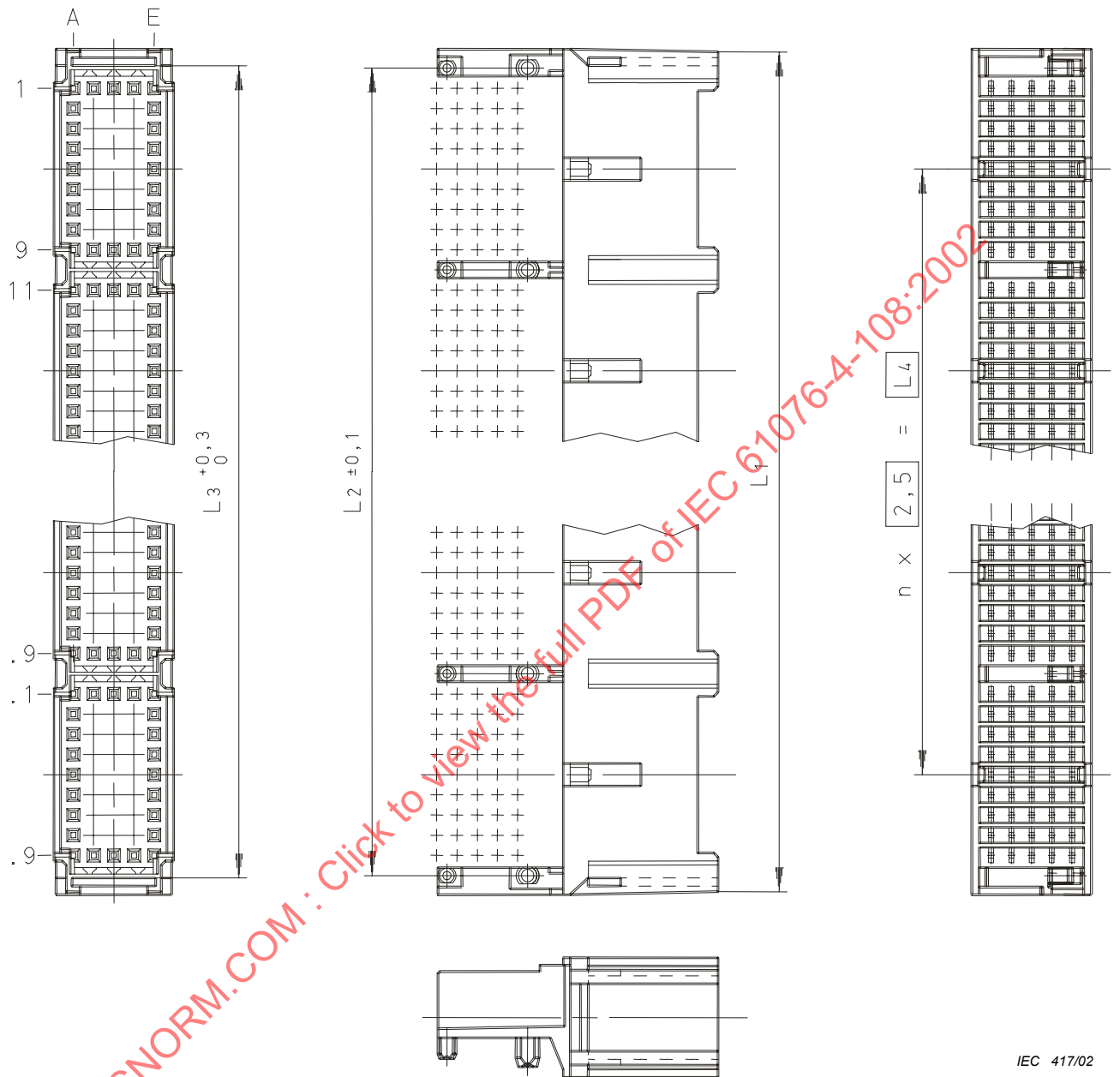


Figure 11 – Details, cross-sections

3.4.1.5 Male connectors for front mounting



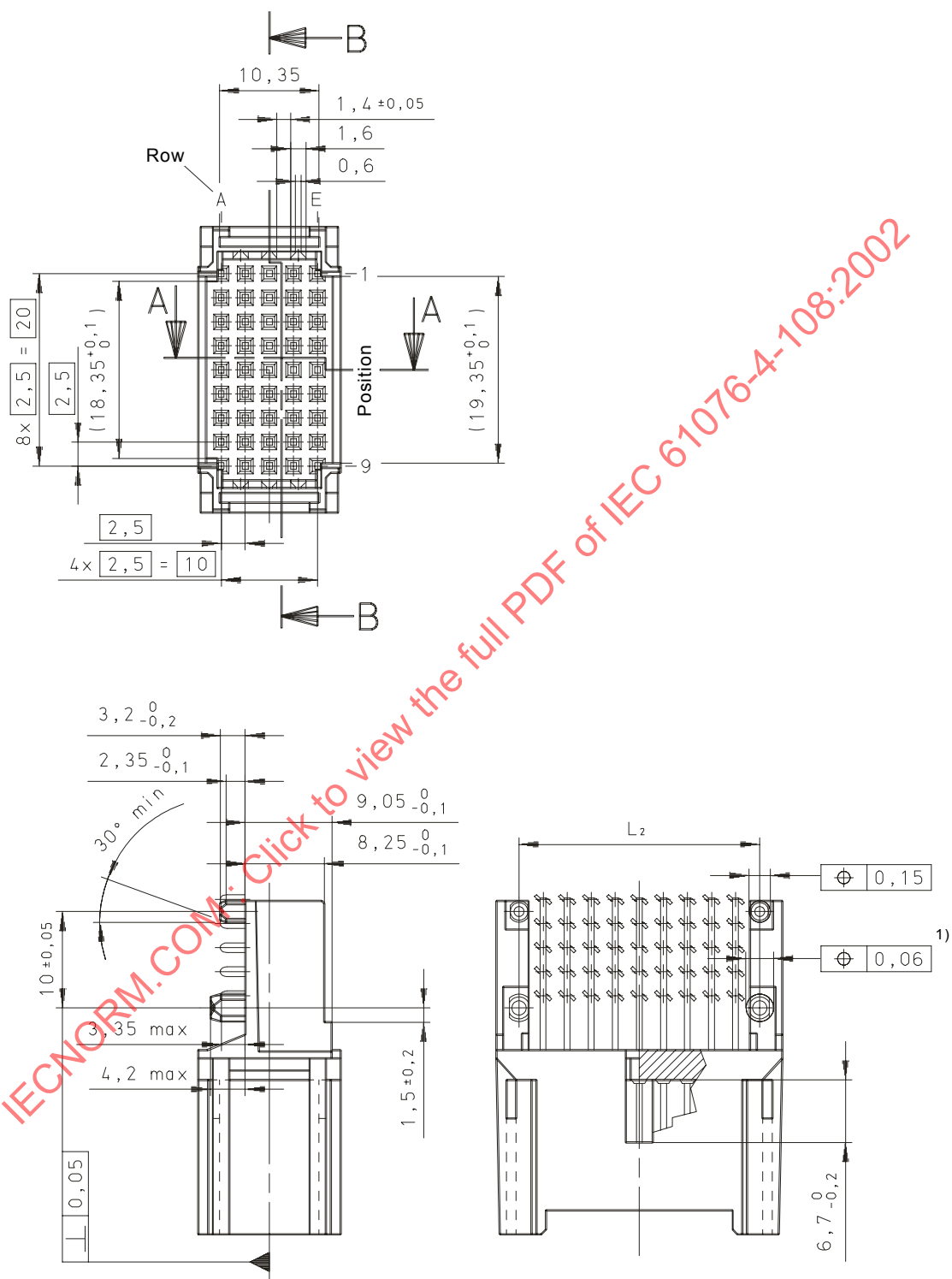
IEC 417/02

Figure 12 – Male connectors for front mounting

Table 12 – Male connectors for front mounting (length dimensions)

Style (System units)	J (1 SU)	K (2 SU)	L (4 SU)
Length L ₁ maximum	29,9	54,9	104,9
L ₂	25	50	100
L ₃	25,6	50,6	100,6
L ₄	–	25	75
n	–	10	30

3.4.1.6 Details, cross-sections (figures 13 and 14)

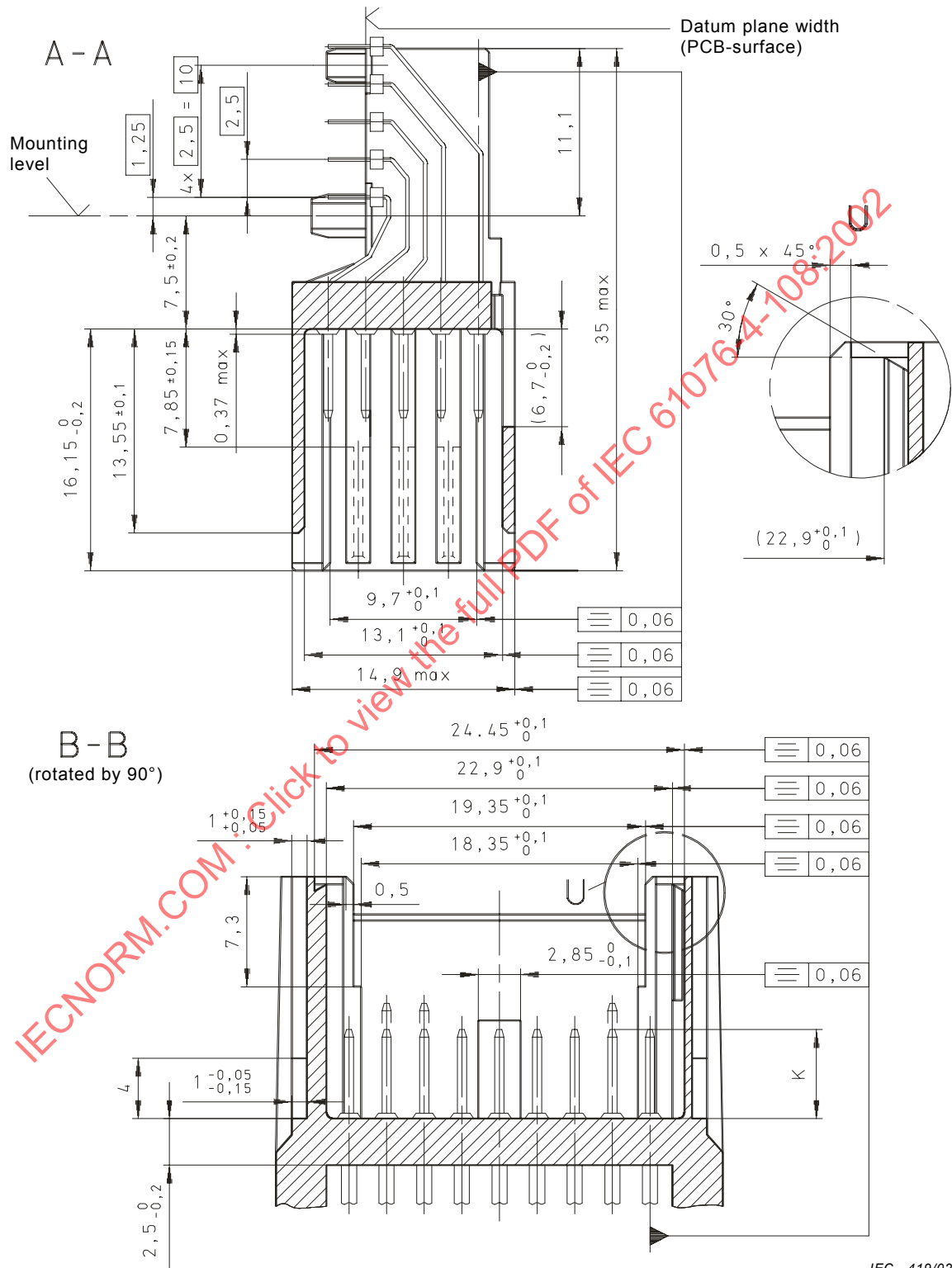


IEC 418/02

1) Style A and B = 0,06 mm; Style D = 0,08 mm

Figure 13 – Details

3.4.1.7 Details, cross-sections (continued)



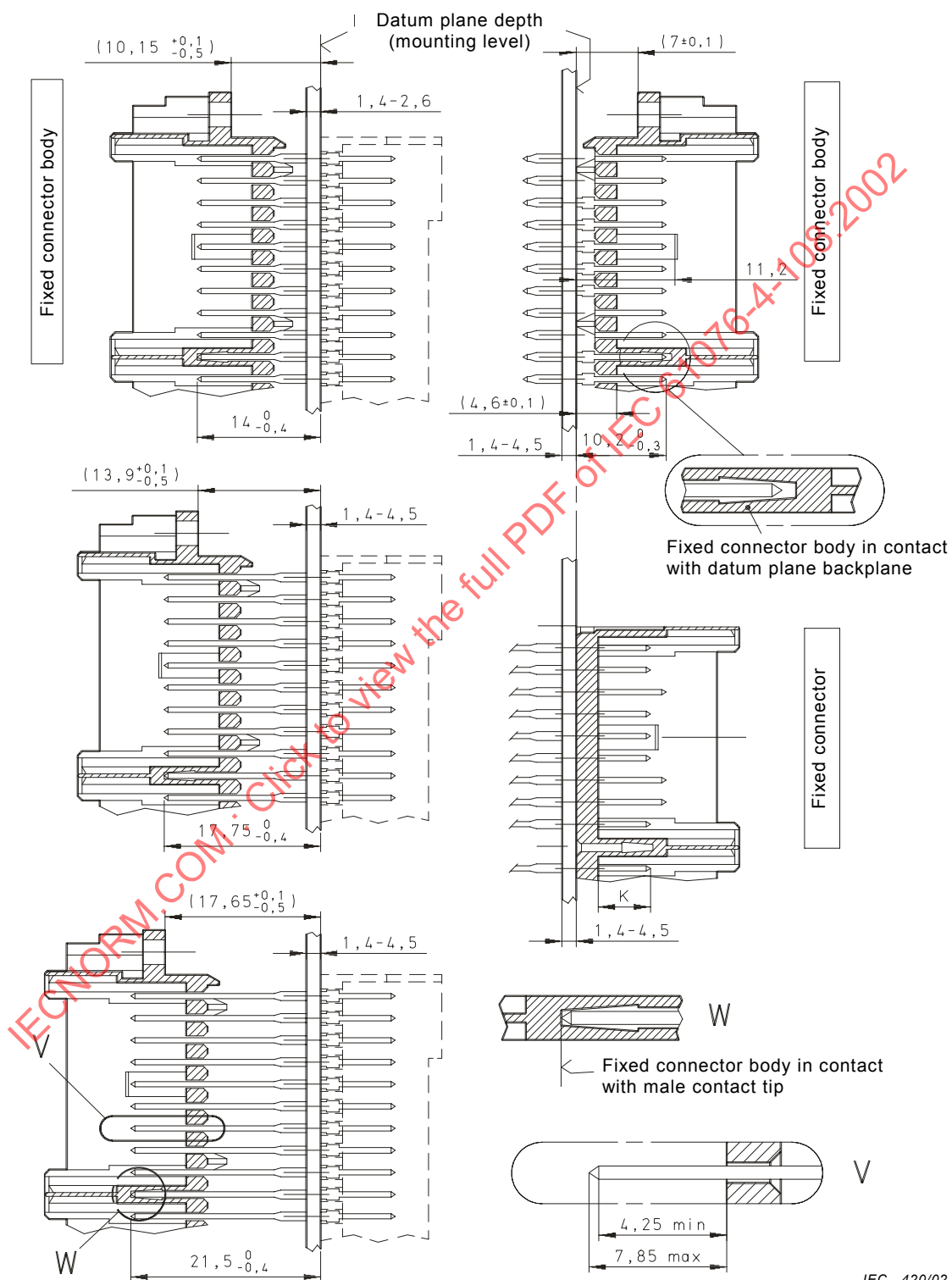
IEC 419/02

K: see 3.4.2.2.

Figure 14 – Cross-sections

3.4.2 Dimensions of male contacts

3.4.2.1 Mounting in the backplane, styles P, R, U, for example on male contacts according to IEC 61076-4-100

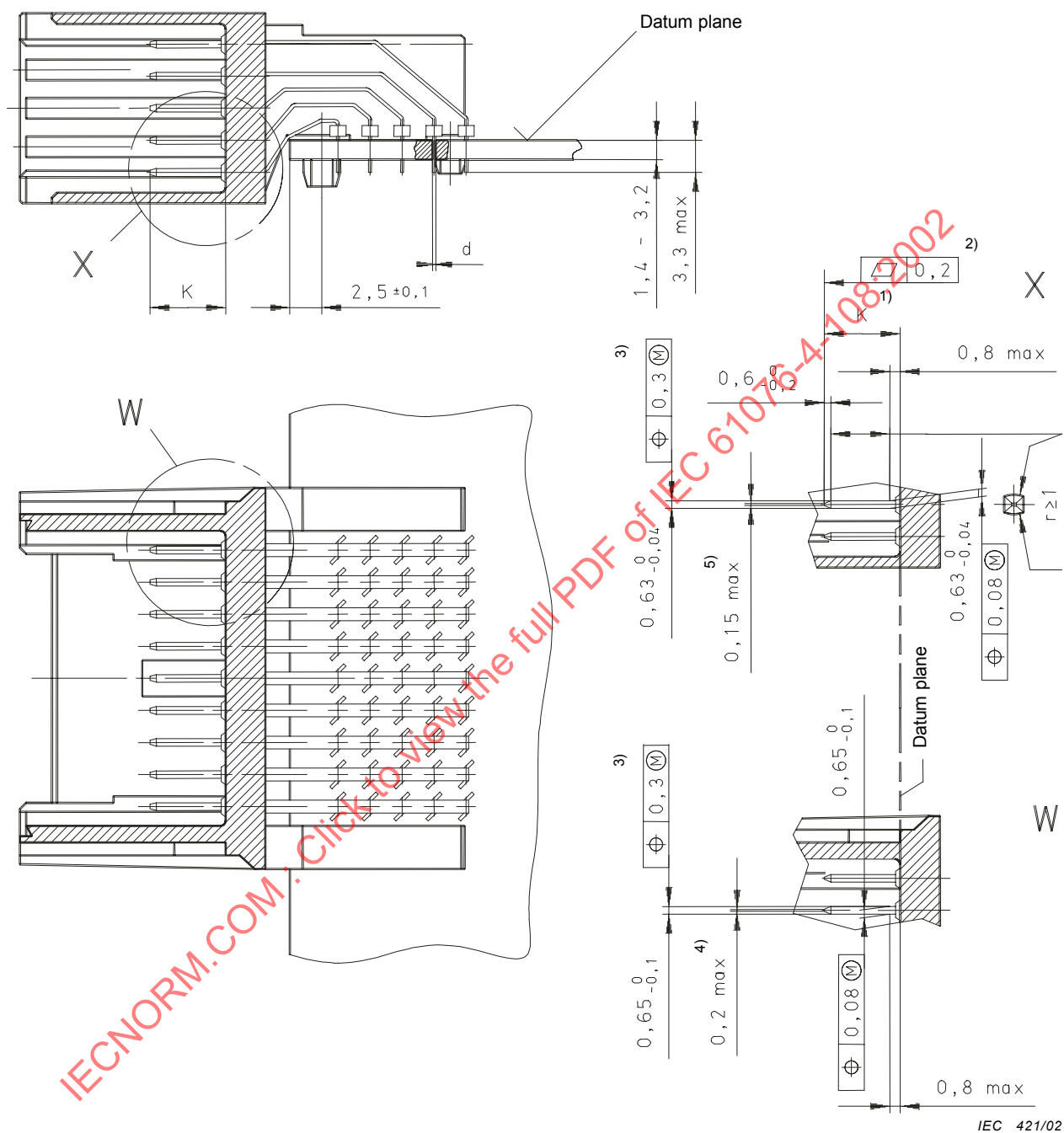


IEC 420/02

K: see 3.4.2.2.

Figure 15 – Dimensions of male contacts (backplane)

3.4.2.2 Mounting on the front, connection types L,S



NOTE d = $1,0 + 0,09/-0,06$ mm for press-in connection according to IEC 60352-5.
d = $1,0 \pm 0,10$ mm for solder connection according to IEC 60326-3.

- 1) Dimension $K_{0/-0,4}$ Standard male contact: 6,05 mm
Premating male contact: 7,80 mm.
- 2) Tolerance for all male contacts with equal length.
- 3) Referred to grid $n \times 2,5$ mm.
- 4) Option: R 0,25 maximum.
- 5) Option: R 0,15 maximum.

Figure 16 – Dimensions of the male contacts (front)

3.5 Free cable connectors

3.5.1 Dimensions of cable connectors

3.5.1.1 Style A

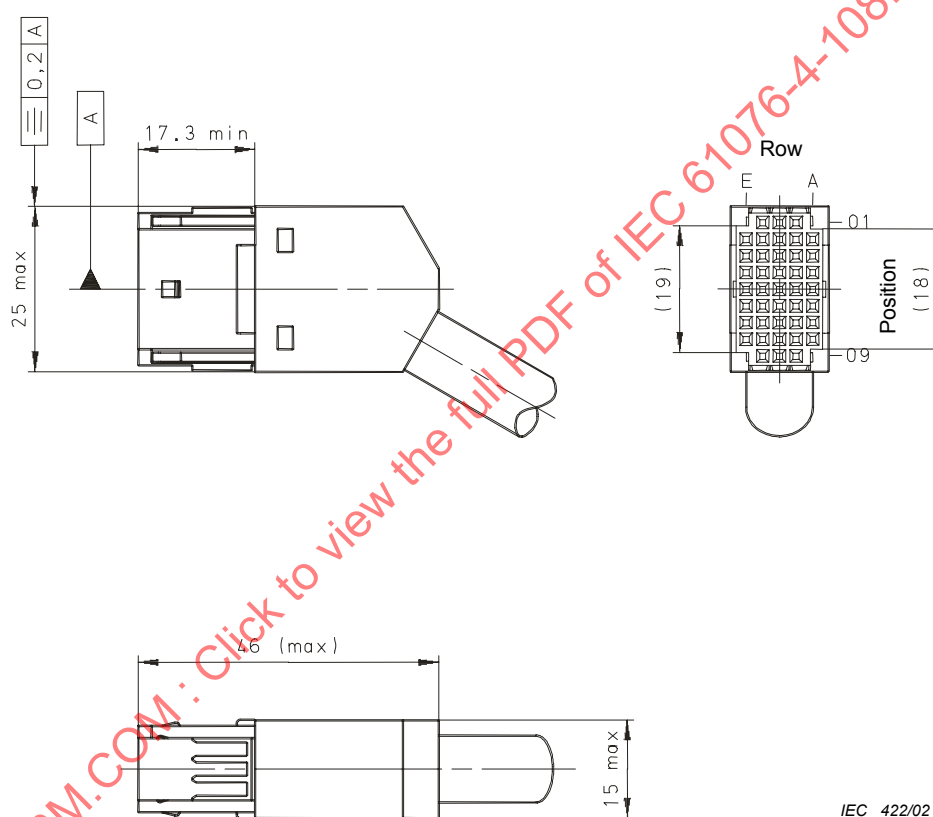
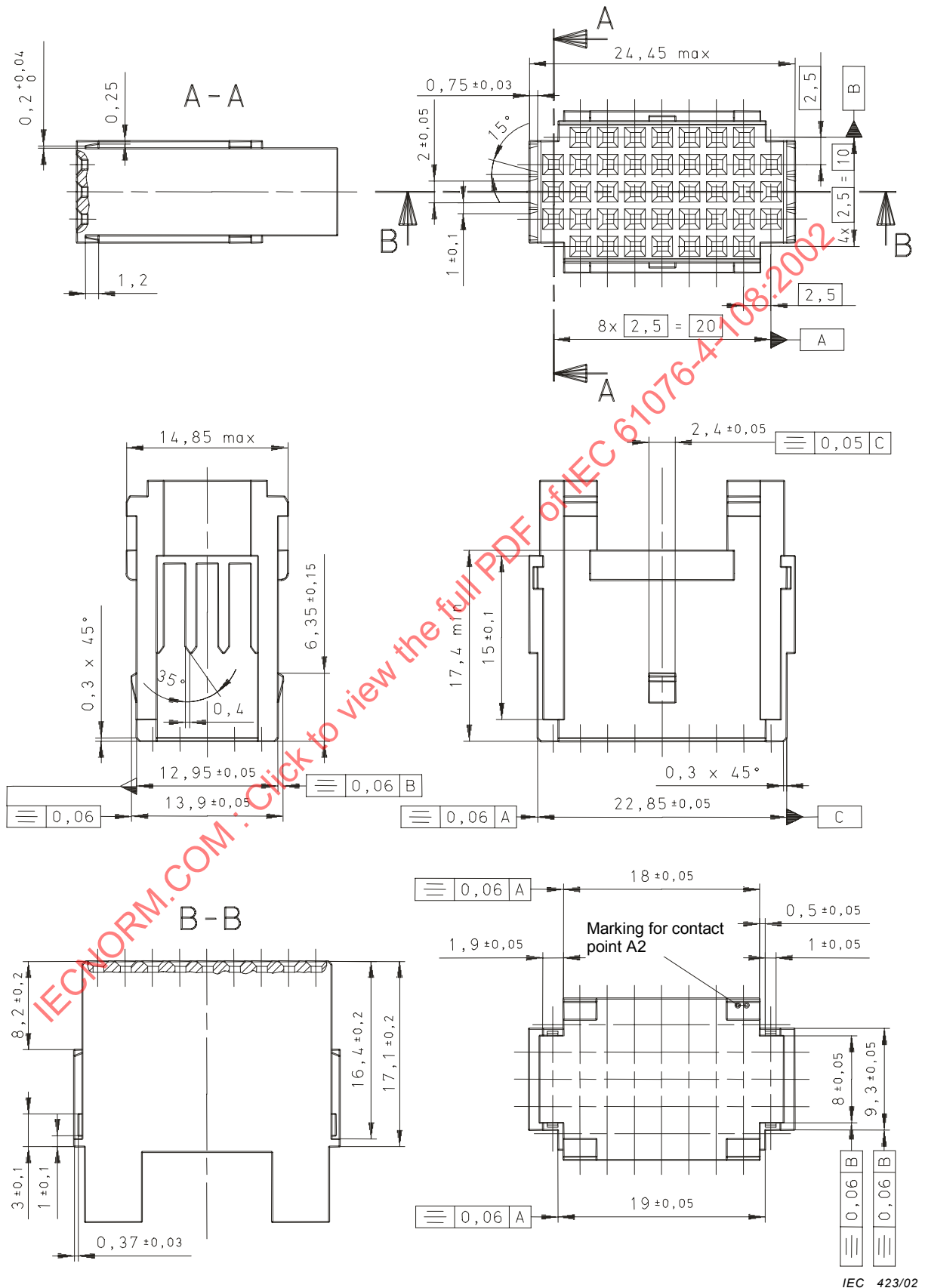


Figure 17 – Dimensions of style A

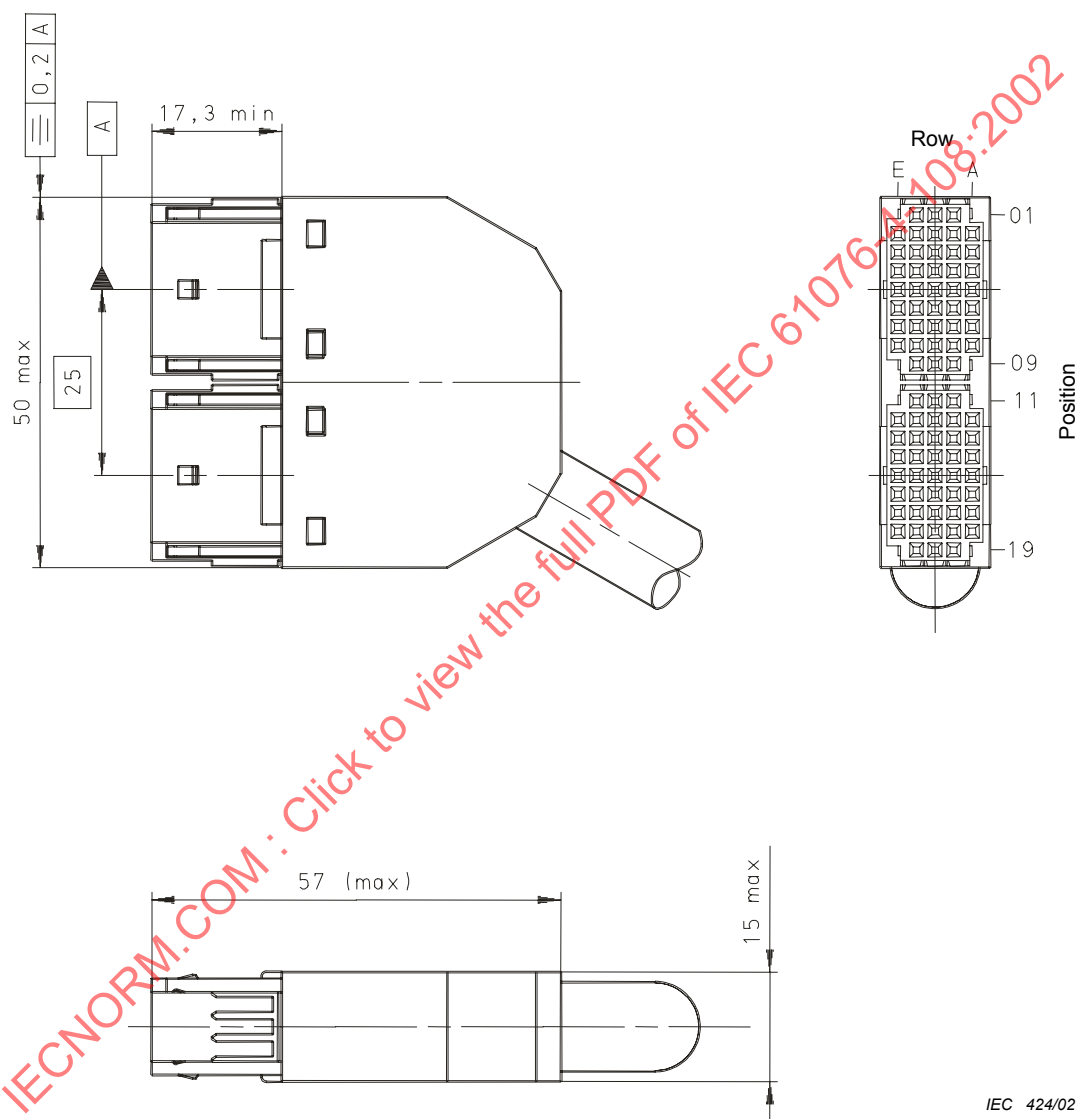
3.5.1.2 Details, cross-sections



IEC 423/02

Figure 18 – Details, cross-sections

3.5.1.3 Style B

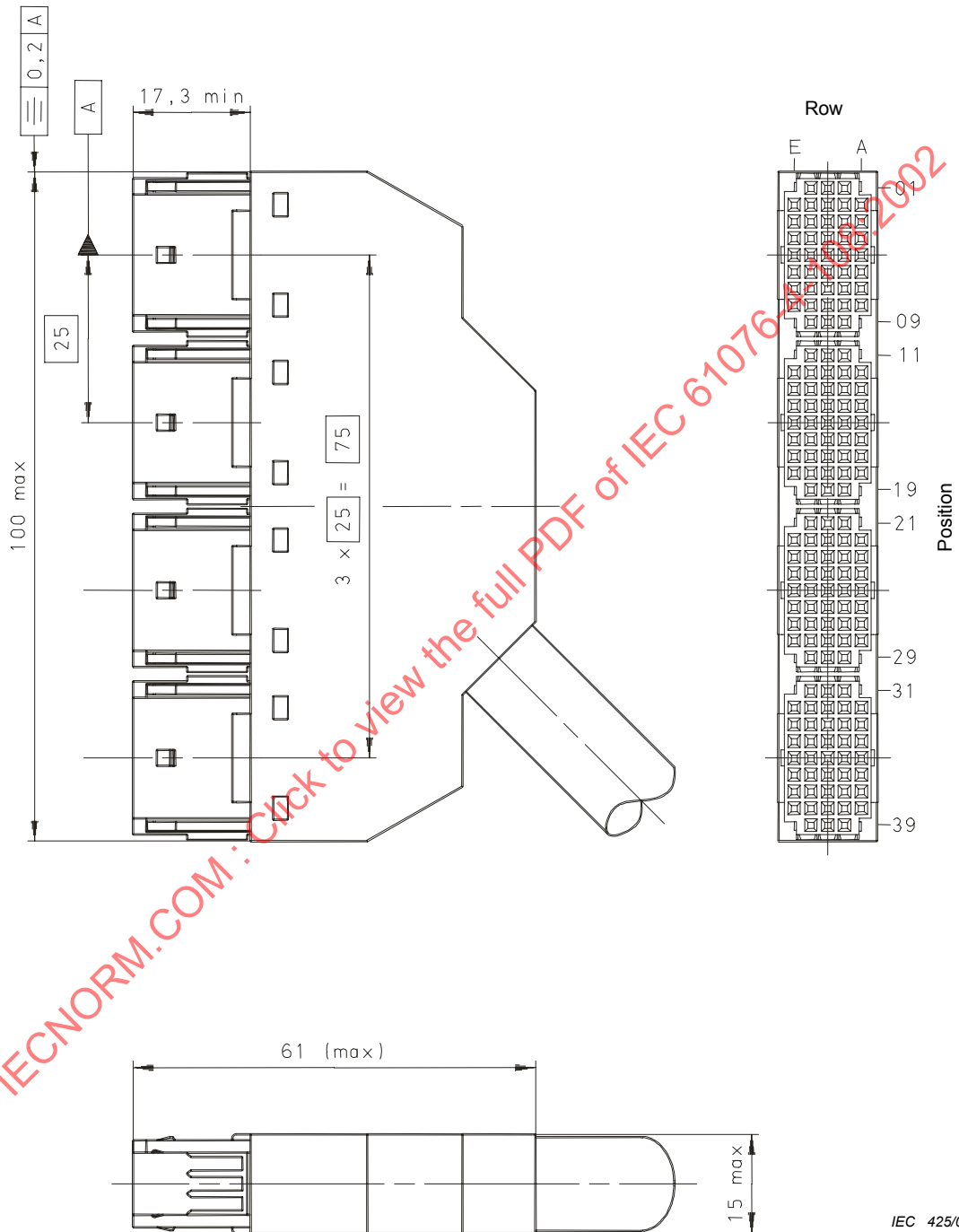


IEC 424/02

NOTE For missing dimensions, see 3.5.1.2.

Figure 19 – Dimensions of style B

3.5.1.4 Style D



IEC 425/02

NOTE For missing dimensions, see 3.5.1.2.

Figure 20 – Dimensions of style D

3.5.2 Dimensions of female contacts

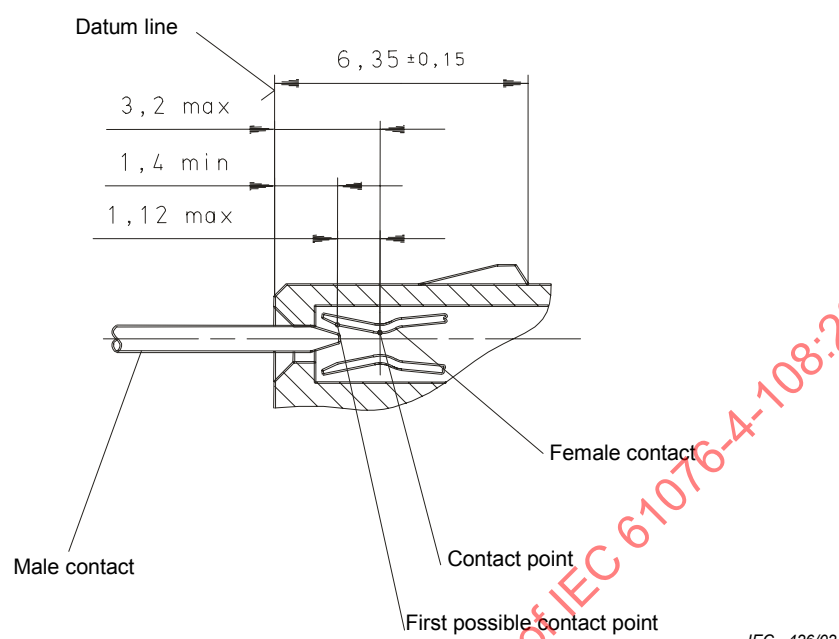


Figure 21 – Position of the contact point

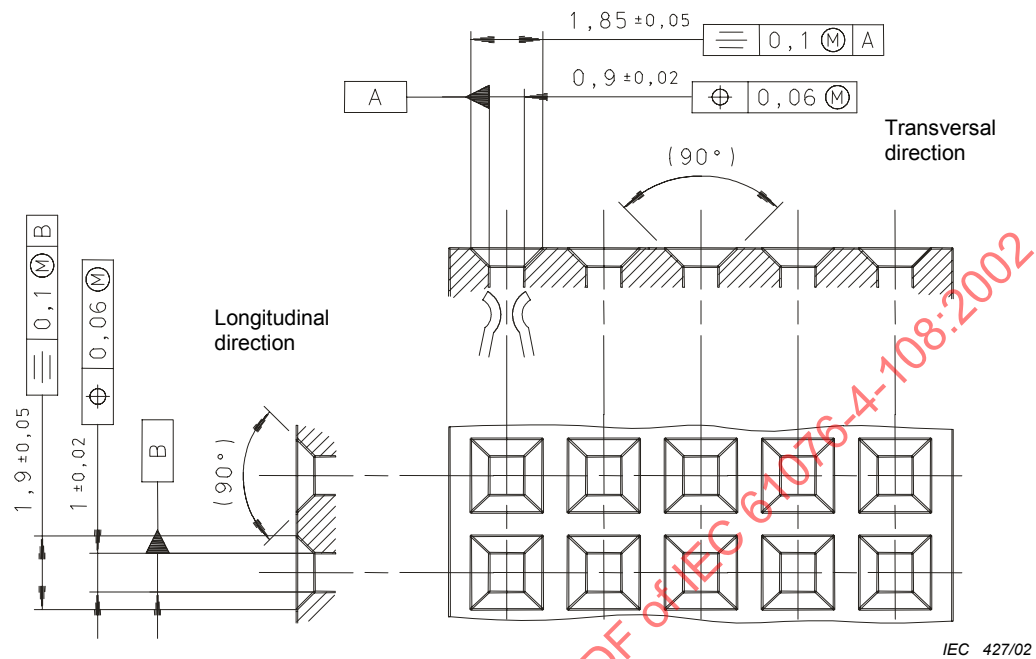


Figure 22 – Dimensions of contact guidance cone

3.6 Accessories

3.6.1 Coding devices

The coding grooves on the cable connector housing are closed by coding devices. For dimensions of the coding grooves, see 3.5.1.2. The coding key on the male connector body shall be removed according to the corresponding coding. For dimensions of the coding key, see 3.4.1.2.

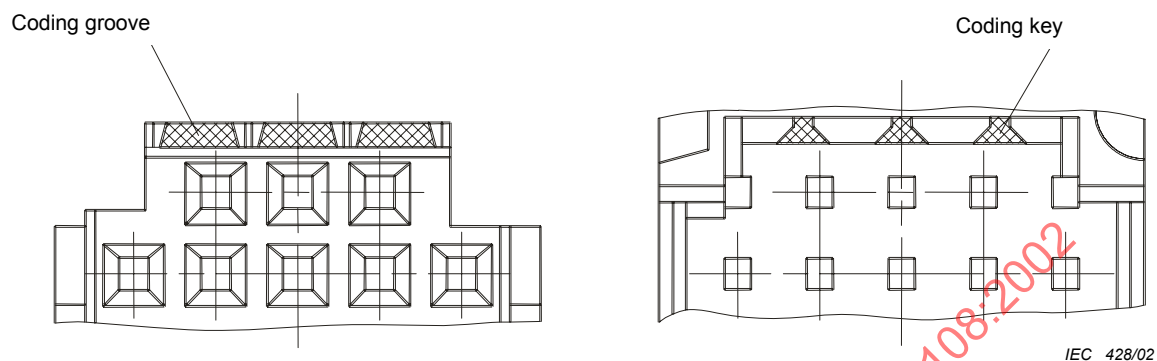


Figure 23 – Coding devices

3.6.2 Shielding / ground contact

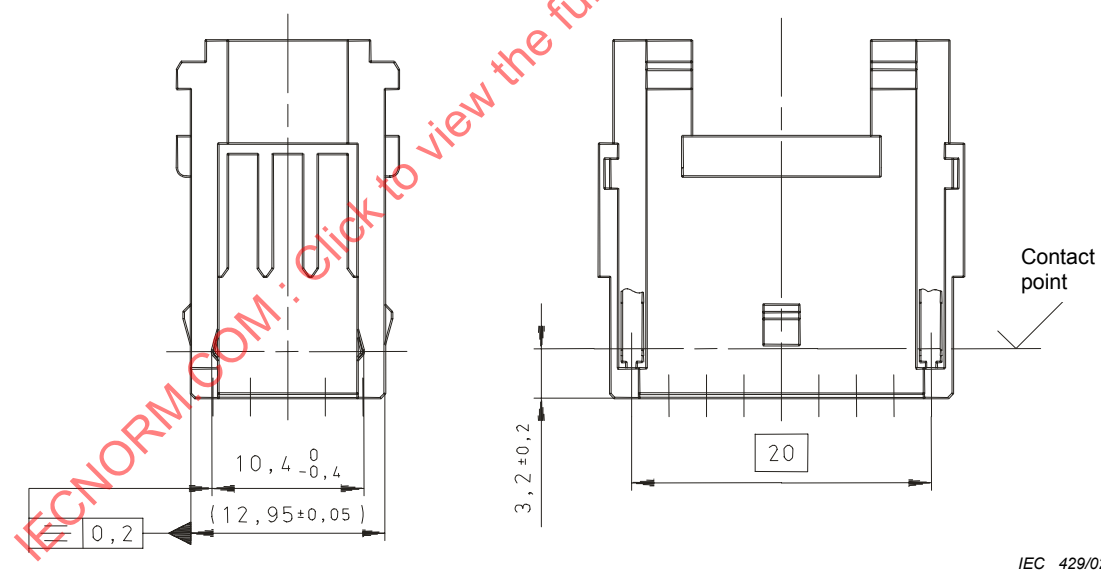
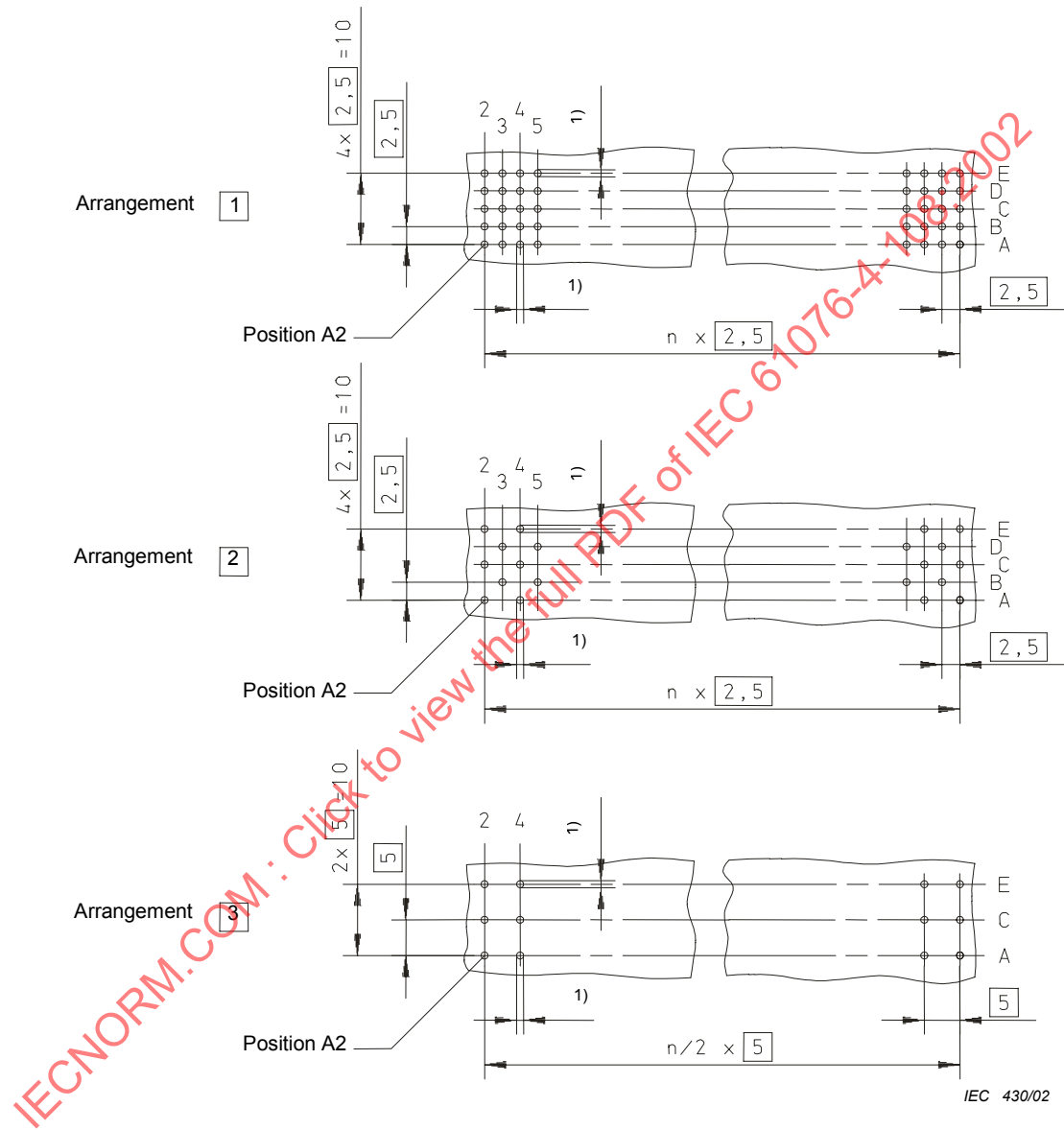


Figure 24 – Shielding / ground contacts

3.7 Mounting information for fixed board connectors

3.7.1 Hole pattern on backplane

View onto component side of the printed board



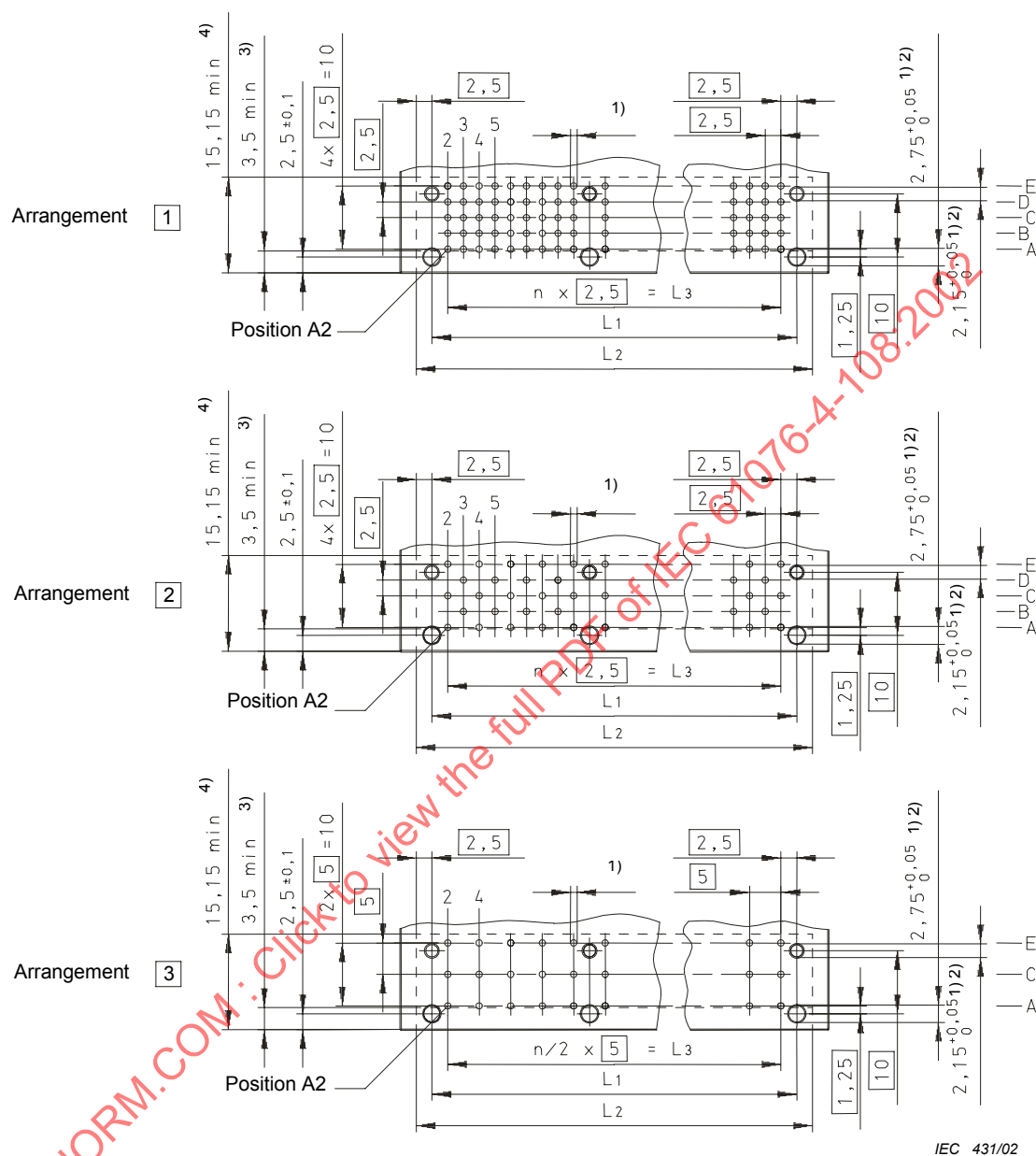
1) $\varnothing 0,1$ All holes, hole diameter see 3.4.2.2.

System units	Style	n	n x 2,5
2 SU	B, P	18	45
4 SU	D, R	38	95
9 SU	G, U	88	220
10 SU	H, V	98	245

Figure 25 – Hole pattern on backplane

3.7.2 Hole pattern on printed board (front)

View onto component side of the printed board



IEC 431/02

- 1)  all holes, hole diameter see 3.4.2.2.
- 2) Not plated-through holes.
- 3) Conductor paths not permissible.
- 4) Mounting space.

System units	Style	L_1	L_2	n	L_3
1 SU	J	25	30	8	20
2 SU	K	50	55	18	45
4 SU	L	100	105	38	95

Figure 26 – Hole pattern on printed board

3.8 Mounting information for free cable connectors

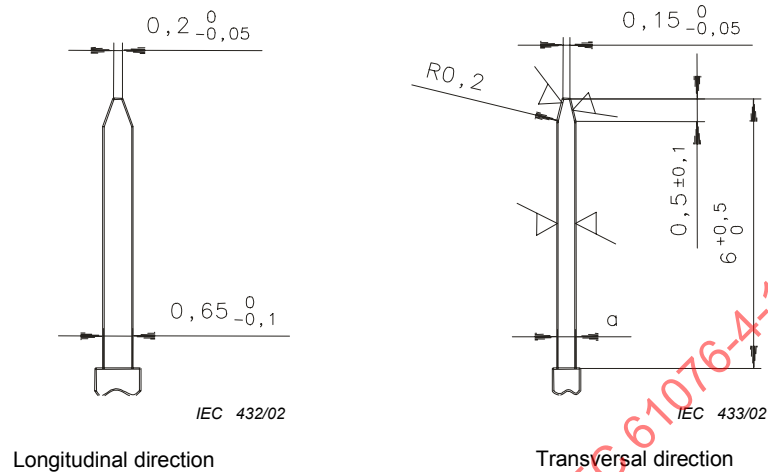
Not applicable.

3.9 Gauges

Material: tooling steel, hardened.

Surface roughness according to ISO 1302: $R_a = 0,15 \mu\text{m}$ to $0,25 \mu\text{m}$.

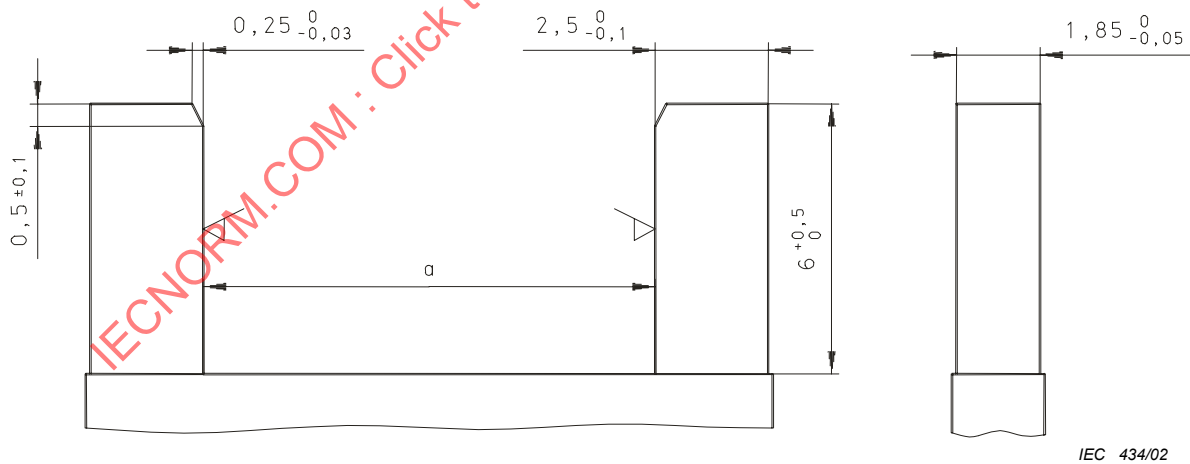
3.9.1 Sizing and retention force gauges



Application	a (mm)	Mass (g)
Sizing	0,64 ... 0,63	–
Retention force	0,60 ... 0,59	16 ... 15

Figure 27 – Sizing and retention force gauges

3.9.2 Test gauge for shield / ground contact



Application	a (mm)	Mass (g)
Retention force	9,70 ... 9,68	15 ... 16

Figure 28 – Test gauge for shield / ground contact

4 Characteristics

4.1 Climatic categories

Table 13 – Climatic categories

Performance level	Climatic category	Temperature category		Damp heat, steady state Days
		Lower °C	Upper °C	
1	40/100/56	–40	100	56
2	40/100/21	–40	100	21

4.2 Electrical

4.2.1 Creepage and clearance distances

Table 14 – Creepage and clearance distances for different contact arrangements

	Contact arrangement	1 2,5 mm × 2,5 mm full grid	2 Chess pattern grid	3 5,0 mm × 5,0 mm grid
Contact/contact	Male connector, straight connection	1,4	2,1	3,9
	Male connector, angled connection	0,8	1,2	3,2
	Cable connector	1,2	1,5	3,7
Contact/ground		2,2		

NOTE The creepage and clearance distances are characteristic values for the connectors. Reductions of the creepage and clearance distances due to the printed board and/or wiring must be taken into account separately.

4.2.2 Voltage proof

Conditions: IEC 60512, Test 4a
Standard atmospheric conditions
Mated connectors
Only unfixed specimens
Wiring arrangement according to 5.1.4
Method B

Table 15 – Voltage proof for different contact arrangements

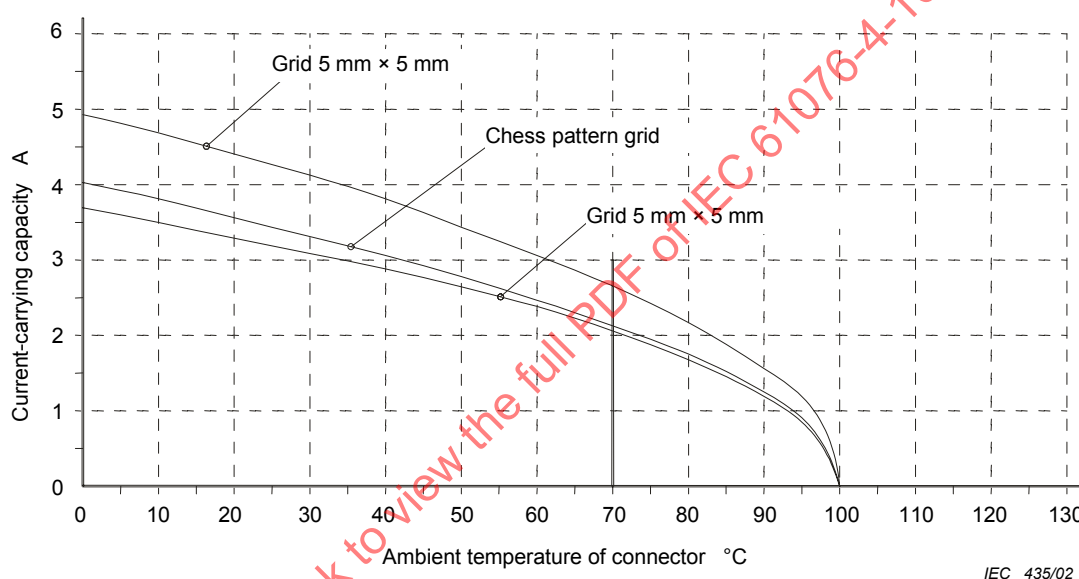
Contact arrangement see 2.4	1 2,5 mm × 2,5 mm full grid	2 Chess pattern grid	3 5,0 mm × 5,0 mm grid
Contact/contact	>1 000 V	>1 200 V	>1 500 V
Contact/ground	>750 V		

4.2.3 Current-carrying capacity

Conditions: IEC 60512, Test 5b
Standard atmospheric conditions
All signal contacts loaded

Table 16 – Current-carrying capacity for different contact arrangements

Contact arrangement see 2.4	1 2,5 mm × 2,5 mm full grid	2 Chess pattern grid	3 5,0 mm × 5,0 mm grid
Contact/contact	2,1 A at 70°	2,2 A at 70°	2,7 A at 70°
Wire gauge 0,14 mm ²	0,4 A at 70°	0,5 A at 70°	0,6 A at 70°



IEC 435/02

NOTE The current-carrying capacity can vary according to the type of cable connected. Values are for a typical wire gauge of 0,14 mm², see table 16.

Figure 29 – Current-carrying capacity curve

4.2.4 Initial contact resistance

Conditions: IEC 60512, Test 2a
Standard atmospheric conditions
Mated connectors
Connecting points as specified in 5.1.1

Requirement: All contacts 30 mΩ maximum

4.2.5 Initial insulation resistance

Conditions: IEC 60512, Test 3a
Standard atmospheric conditions
Mated connectors
Test voltage 100 V d.c.

Requirement: All contact arrangements 10⁴ MΩ minimum

4.3 Mechanical

4.3.1 Mechanical operation

Conditions: IEC 60512, Test 9a
 Standard atmospheric conditions
 Maximum speed of operation: 10 mm/s
 Rest: 30 s (unmated)

Table 17 – Number of mechanical operations

Performance level	1	2
Operations	250	120

4.3.2 Engaging and separating forces

Conditions: IEC 60512, Test 13a
 Standard atmospheric conditions
 Rate of engagement and separation: 10 mm/s maximum

Table 18 – Engaging and separating forces

Style	A	B	C
Engaging force max. N	50	100	200

NOTE The total engaging and separating force is the sum of all acting forces: latching in housing, signal and ground contacts. Separating force < engaging force.

4.3.3 Contact retention in insert

Conditions: IEC 60512, Test 15a
 Standard atmospheric conditions
 Unmated connectors
 Test force axial in both directions

Requirement: The allowed displacement of the contacts after removal of the test force:
 0,1 mm maximum
 Test force: 10 N

4.3.4 Static load, transverse

Conditions: IEC 60512, Test 8a
 Standard atmospheric conditions
 Engaging points and forces according to 5.1.3

Requirement: After loading, there shall be no detectable displacement or damage which might impair normal operation.

4.3.5 Withdrawal force with gauge

Conditions: IEC 60512, Test 16e
 Testing of the signal and ground contacts
 Withdrawal force gauges, see 3.9.1 and 3.9.2

Requirement: Retention of the gauge

4.3.6 Vibration (sinusoidal)

Conditions: IEC 60512, Test 6d
Standard atmospheric conditions
Mated connectors
The fixed and free connector shall be rigidly secured in a fixture (see 5.1.2).

Table 19 – Vibration

Performance level	Severity	Requirement
PL 1	10 Hz to 2 000 Hz and 1,5 mm or 200 m/s ² 8 cycles in each direction Duration 2 h/axis, in three axes	Duration of contact disturbance 1 µs max.
PL 2	10 Hz to 500 Hz and 0,35 mm or 50 m/s ² 10 cycles in each direction Duration 2 h/axis, in three axes	Duration of contact disturbance 1 µs max.

4.3.7 Shock

Conditions: IEC 60512, Test 6c
Standard atmospheric conditions
Mated connectors
The fixed and free connector shall be rigidly secured in a fixture (see 5.1.2).

Table 20 – Shock

Performance level	Severity	Requirement
PL 1 and PL 2	Shock acceleration 500 m/s ² Duration of impact 11 ms Five shocks in two directions/axis, in three axes	Duration of contact disturbance 1 µs max.

4.3.8 Polarizing method

Conditions: IEC 60512, Test 13e
The fixed connector shall be mounted on a suitable printed board.
It shall not be possible to insert the free connectors in any way except the correct way.
Loading in the insertion direction: 150 N / SU range
Requirement: In the blocked state, no electrical contact shall be made.
There shall be no damage that might impair normal operation.

4.3.9 Mechanical coding

Conditions: IEC 60512, Test 13e
The fixed connector shall be mounted on a suitable printed board.
At least two coding elements equipped
Loading in the engaging direction: 50 N / coding element
Test voltage for test 2: 100 V d.c.
Test 1: Coding keys match.
Requirement: The coding elements shall not prevent normal engaging of the connectors.
Test 2: Coding keys do not match.
Requirement: In the blocked state it shall not be possible to insert the cable connector mechanically. There shall be no damage which might impair the function.

4.3.10 Latching force in male connector body

Conditions: IEC 60512, Test 15f

The fixed connector shall be mounted on a suitable printed board.
A tensile force F shall be applied to the pulling loop at one free connector without contact insert and cable until the connectors part.

Loading: 20 times in the pulling direction

Requirement: Force F: 15 N minimum per 1 SU length of the plug-in connector.

There shall be no damage that might impair normal operation.

There shall be no displacement of the male connector body.

4.3.11 Cable clamp resistance to cable rotation

Conditions: IEC 60512, Test 17b

The cable connector shall be inserted firmly in a fixture. A tensile force F shall be applied at the cable end in the direction of the cable axis.

Force F	4 N
Number of rotations	2×50
Speed	30 r.p.m.
Cable length	about 300 mm

Requirement: There shall be no damage that might impair normal operation.

4.3.12 Cable connector drop test

Conditions: IEC 60512, Test 7b

The cable connector shall be secured at the cable end to a fixture that can be rotated to various positions (in steps of 45°).

Drop height	750 mm
Ground	Concrete with PVC
Sequence of positions	$8 \times 45^\circ$
Number of tests	5 in each position.

Requirement: There shall be no damage that might impair normal operation.

4.4 Electromagnetic compatibility (EMC)**4.4.1 Shielding effectiveness**

Conditions: Test procedure described in annex A

Frequency range 30 MHz to 1 000 MHz

Grounding according to 2.3.5, contact arrangement 4, table 7

Requirement: Screening attenuation value at 300 MHz

10 dB (Style A, 1 SU)
14 dB (Style B, 2 SU)
20 dB (Style D, 4 SU)

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.

A test value or an "x" in the "requirements" column of the following tables indicates the tests to be performed or the requirements for the particular type and performance level.

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 60068-1.

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 again for the subsequent tests.

In the following test schedule, a mated pair of a fixed board connector and a free cable connector connected to a cable is called a "specimen".

When the initial tests have been completed, all specimens are divided up according to the test groups. Before testing commences, the connectors shall have been stored for at least 24 h in the non-inserted state under normal climatic conditions for testing as per IEC 60068-1.

The following number of specimens is necessary for the entire inspection and test sequence.

Table 21 – Specification of the test groups

Test groups		P	AP	BP	CP	DP	EP	FP	GP	HP
Performance level	1	32	6	8	4	4	4	–	6	To be defined
	2	26	4	4	4	4	4	–	6	To be defined

5.1.1 Arrangement for contact resistance measurement

Conditions: IEC 60512, Test 2a

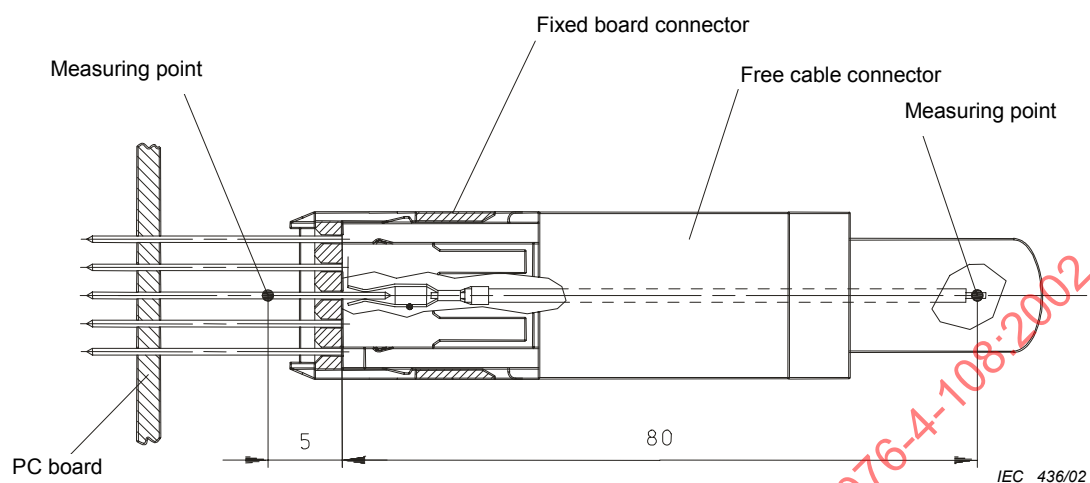
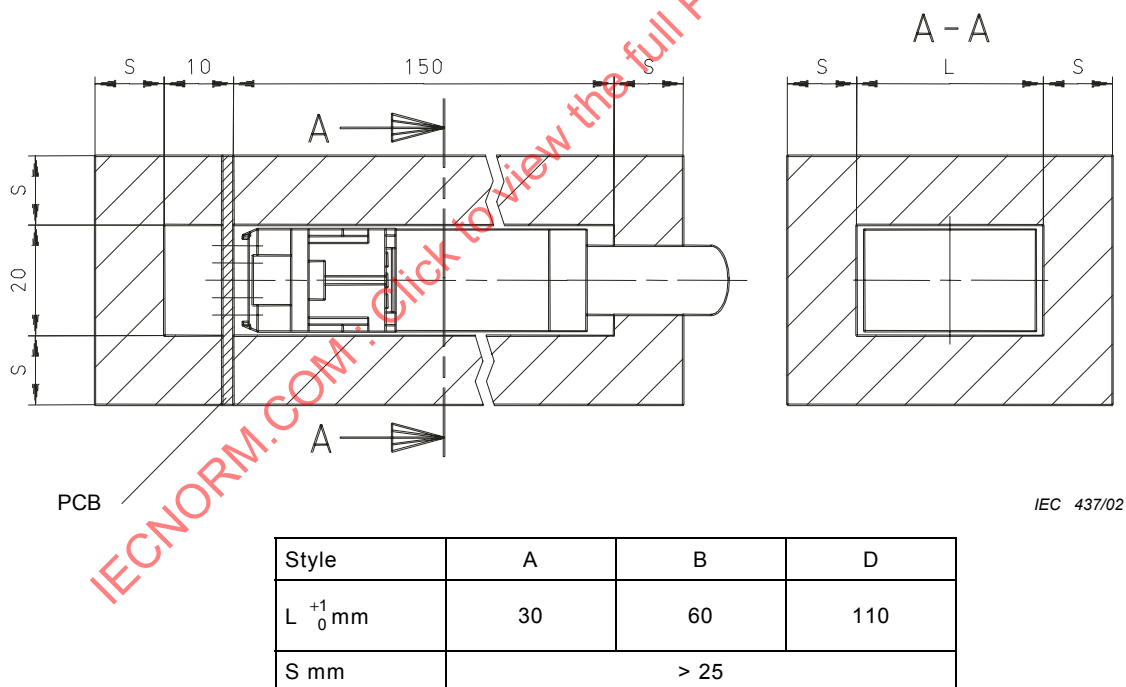


Figure 30 – Points of connection for contact resistance measurement

5.1.2 Arrangement for dynamic stress tests

Conditions: IEC 60512, Tests 6c and 6d



NOTE Cable can be mechanically relieved.

Figure 31 – Fixture for dynamic stress tests