

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Connectors for electronic equipment – Product requirements –
Part 3-104: Detail specification for 8-way, shielded free and fixed connectors
for data transmissions with frequencies up to 1 000 MHz**

**Connecteurs pour équipements électroniques – Exigences de produit –
Partie 3-104: Spécification particulière pour les fiches et les embases écrantées
à 8 voies pour la transmission de données à des fréquences jusqu'à 1 000 MHz**



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONNECTORS FOR ELECTRONIC EQUIPMENT –
PRODUCT REQUIREMENTS –****Part 3-104: Detail specification for 8-way, shielded free and fixed
connectors for data transmissions with frequencies up to 1 000 MHz**

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International Standard IEC 61076-3-104 has been prepared by sub-committee 48B: Connectors, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

This second edition of IEC 61076-3-104 cancels and replaces the first edition, published in 2003, and constitutes a technical revision.

Changes from the first edition of this standard (2003) include editorial changes throughout the standard and:

- 1) an increase of upper frequency from 600 MHz to 1 000 MHz;
- 2) changes to the characteristics clause (Clause 6) and test schedules clause (Clause 7) to align the document with test schedules of IEC 60603-7 series documents.

This bilingual version (2013-06) corresponds to the monolingual English version, published in 2006-07.

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

FDIS	Report on voting
48B/1678/FDIS	48B/1702/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 French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61076 series, under the general title *Connectors for electronic equipment – Product requirements*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

CONNECTORS FOR ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 1 000 MHz

1 General

1.1 Scope

This part of IEC 61076 establishes uniform specifications, type testing requirements and quality assessment procedures for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 1 000 MHz, and intended to be used within cabling for information and communications technology, home entertainment and multimedia. It contains a choice of all test methods and sequences, severity and preferred values for dimensions and characteristics.

1.2 Normative references

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

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

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

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60169-16, *Radio-frequency connectors. Part 16: R.F. coaxial connectors with inner diameter of outer conductor 7 mm (0.276 in) with screw coupling – Characteristic impedance 50 ohms (75 ohms) (Type N)*

IEC 60352 (all parts), *Solderless connections*

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

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

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality*

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

IEC 61156-2, *Multicore and symmetrical pair/quad cables for digital communications – Part 2: Horizontal floor wiring – Sectional specification*

IEC 61156-3, *Multicore and symmetrical pair/quad cables for digital communications – Part 3: Work area wiring – Sectional specification*

IEC 61156-4, *Multicore and symmetrical pair/quad cables for digital communications – Part 4: Riser cables – Sectional specification*

IEC 61156-5, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

IEC 61196, *Coaxial communication cables*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

EN 50289-1-14, *Communication cables – Specifications for test methods – Part 1-14: Electrical test methods – Coupling attenuation or screening attenuation of connecting hardware*

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

ITU-T G.117, *Transmission aspects of unbalance about earth*

ITU-T O.9, *Measuring arrangements to assess the degree of unbalance about earth*

2 Technical information

This detail specification covers connectors intended for use in cabling for information and communications technology, home entertainment and multimedia.

2.1 Terminology

2.1.1 General

The terminology used in and applicable to this specification is stated in 2.1 of IEC 61076-1. Some applicable terms are also covered in IEC 60512-1. (For definitions of terms used, refer to IEC 60050-581.)

2.1.2 Transmission performance categories

In this IEC standard, the term “category”, when used in reference to transmission performance, refers to those categories defined by ISO/IEC 11801:2002.

2.1.3 Interchangeability level

2.1.3.1 General

These connectors interchangeably insofar as the intermateability and interoperability requirements herein are ensured for mated connectors when individual connector halves are from different sources.

2.1.3.2 Intermateability

Intermateability is ensured by applying the “Go” and “No-Go” gauge requirements herein, and adherence to dimensional requirements herein.

2.1.3.3 Interoperability

Interoperability of different IEC 61076-3-104 connectors is assured by compliance with all transmission requirements when the connector is mated with the respective “test” connector as described in Annex C.

2.2 Groups of related connectors

Groups of connectors within a subfamily having common features. Typical examples are same type and range but different style. A group of related connectors is covered by a single detail specification.

Type: Connectors within a particular subfamily such as a multicontact connector with one, two or four pairs.

Range: The housing (shell) sizes and contacts arrangements within a type. For example, a housing containing one, two or four pairs.

Style: A particular connector within a type, for example fixed panel, PCB or free connector.

Variant: Variations within a type, style or range.

2.3 Interchangeability level

These connectors shall be fully interchangeable and intermateable. The mechanical and electrical characteristics shall be met whatever the source of the connector is. Elements of connecting hardware, e.g. plugs, sockets that terminate more than one cable are permitted.

The plug/socket interface may be constructed so as to permit the use of multiple modules e.g. 2×2 pairs or 4×1 pair plugs mated directly with a single 4 pairs socket.

2.4 IEC type designation

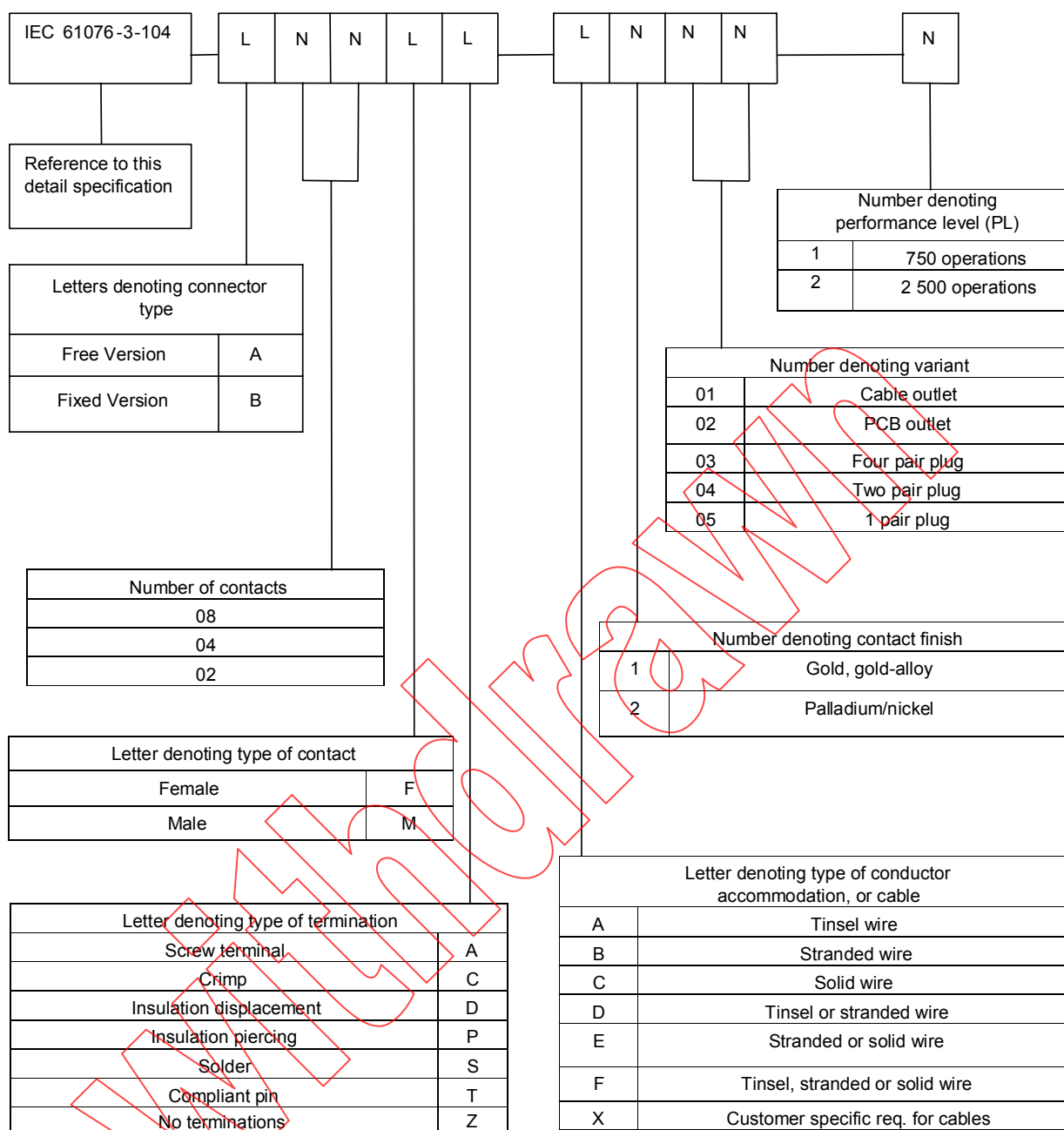
Connectors, connector bodies and connectors with pre-inserted contacts according to this detail specification shall be designated by the following system.

Connectors conforming to this standard shall be identified by the following indications and in the order given:

The letters "IEC".

The number denoting this detail specification.

The number of the detail specification (without dashes), being nine characters (e.g. IEC 610763104-B08S-C101-2 Shielded connector, fixed version B, having 8 female contacts, solder termination, solid wire, gold, cable outlet, 250 operations)).



Note: "L" stands for letter
"N" stands for number

3 Isometric views and common features

3.1 General

Original dimensions are in millimetres except where noted.

3.2 Isometric views

3.2.1 General

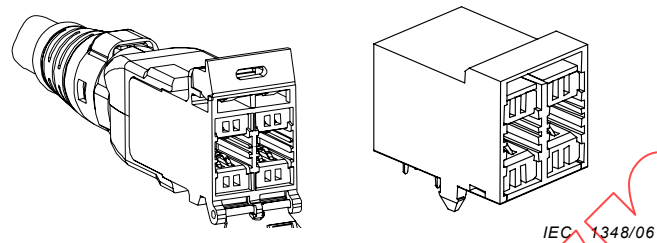


Figure 1 – Isometric view of cable and PCB fixed connectors

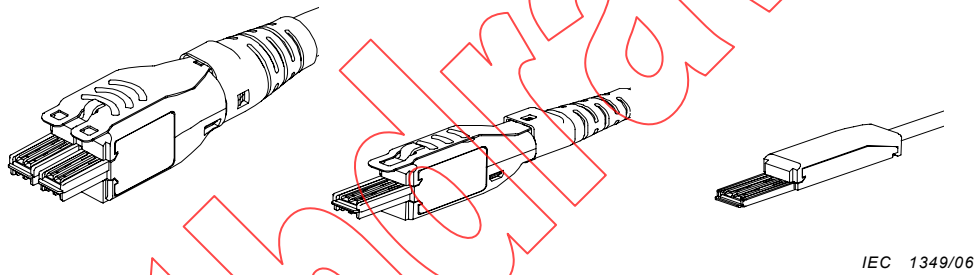


Figure 2 – Isometric view of 4, 2 and 1 pair free connectors

3.2.2 Fixed connector variant 01 (cable outlet) drawings

Third angle projection

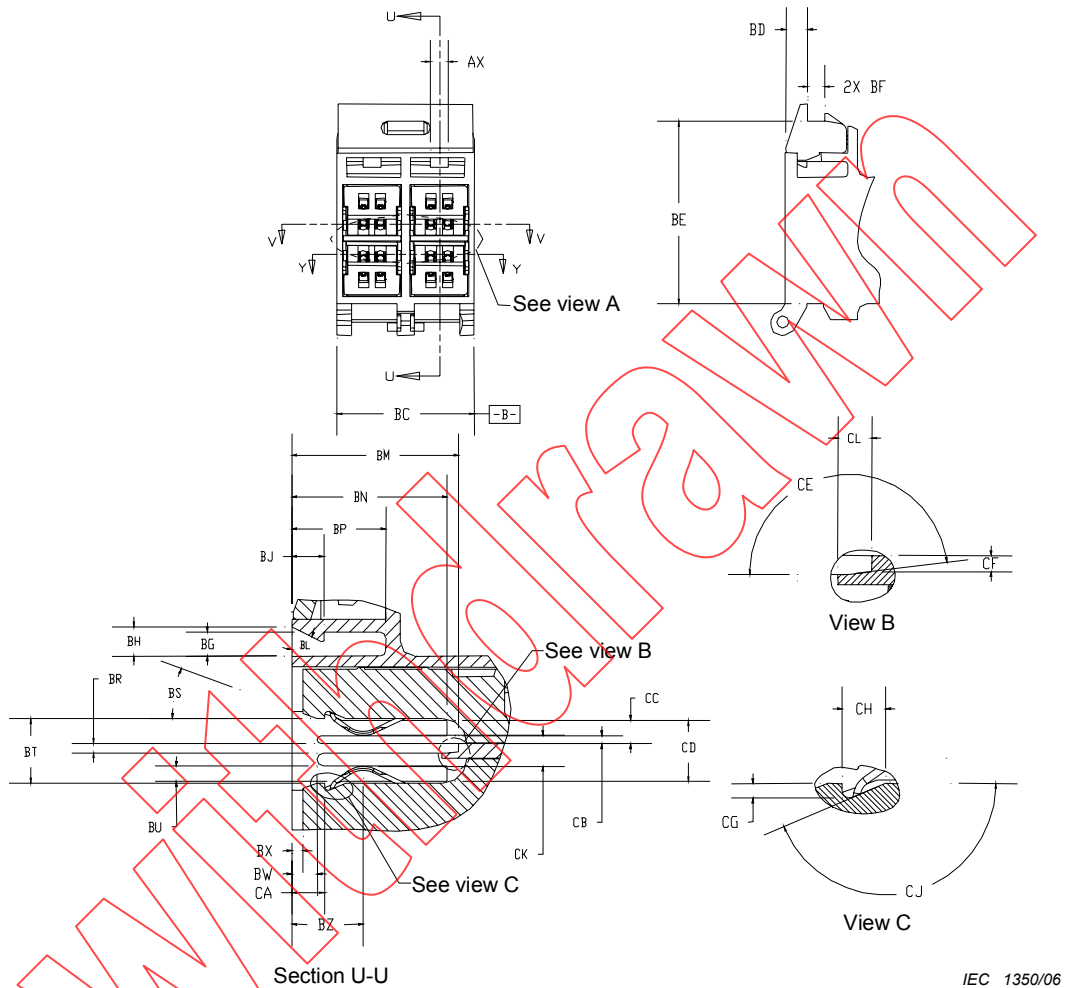


Figure 3 – Variant 01 drawing 1

Table 1 – Variant 01 drawing 1 dimensions*Dimensions in millimetres*

	Nominal	Maximum	Minimum
AX	1,91	1,98	1,83
BC	14,48	14,61	14,35
BD	2,39	2,54	2,24
BE	19,05	19,20	18,90
BF	1,78	1,85	1,70
BG	1,65	1,88	1,42
BH	2,03	2,18	1,88
BJ	2,26	2,34	2,18
BK	70	73	67
BL	63	66	60
BM	11,73	11,79	11,68
BN	10,92	11,00	10,85
BP	6,60	6,68	6,53
BR	0,66	0,71	0,61
BS	20	23	17
BT	4,55	4,80	4,29
BU	10,07	1,12	1,02
BW	1,78	1,85	1,70
BX	0,79	0,99	0,69
BZ	5,21	5,41	5,00
CA	2,31	2,59	2,03
CB	0,57	0,75	0,39
CC	1,61	1,66	1,56
CD	4,24	4,29	4,19
CE	7	8	6
CF	0,56	0,58	0,53
CG	0,51	0,58	0,43
CH	1,52	1,65	1,40
CJ	23	24	18
CK	2,16	2,46	1,85
CL	1,19	1,24	1,14

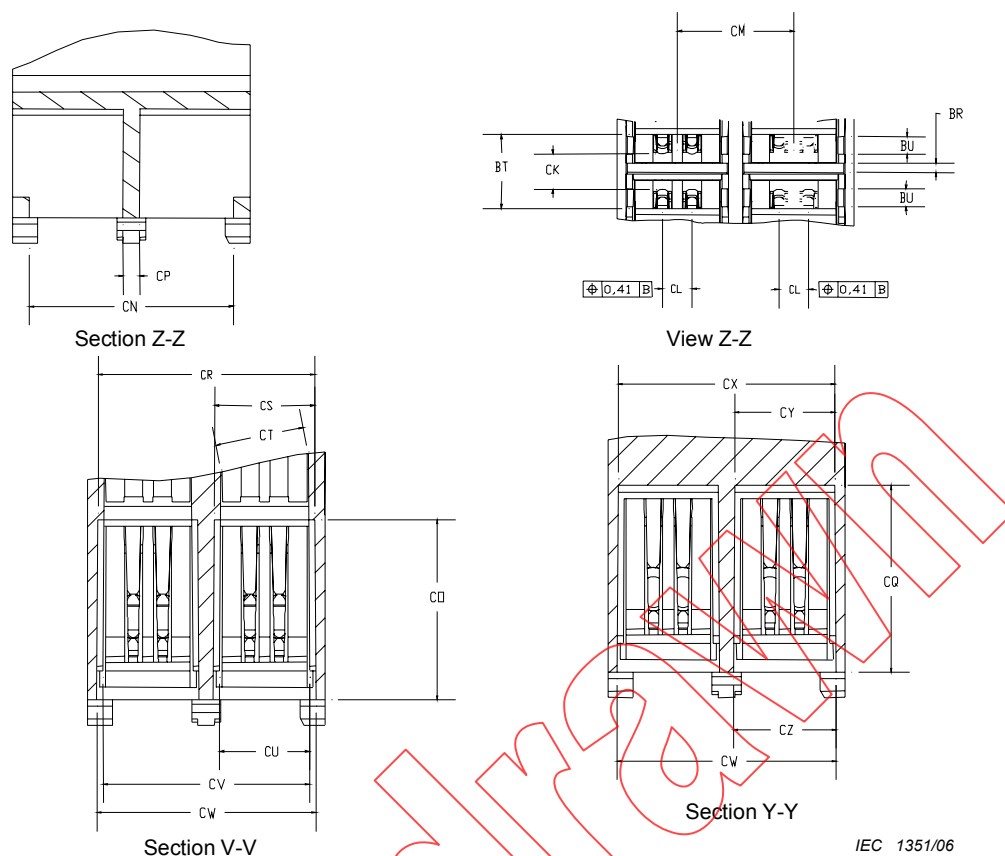


Figure 4 – Variant 01 drawing 2

Table 2 – Variant 01 drawing 2 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
CK	2,21	2,34	2,08
CL	1,78		
CM	7,11		
CN	12,45	12,57	12,32
CP	0,76	0,84	0,69
CR	13,21	13,26	13,16
CS	6,10	6,15	6,05
CT	5,33	5,38	5,28
CU	5,49	5,51	5,46
CV	12,60	12,65	12,55
CW	13,36	13,41	13,31
CX	13,21	13,26	13,16
CY	6,10	6,15	6,05
CZ	5,49	5,51	5,46
CQ	11,73	11,79	11,68
CO	10,92	11,00	10,85

3.2.3 Fixed connector variant 02, Printed Circuit Board (PCB) outlet drawing

Third angle projection

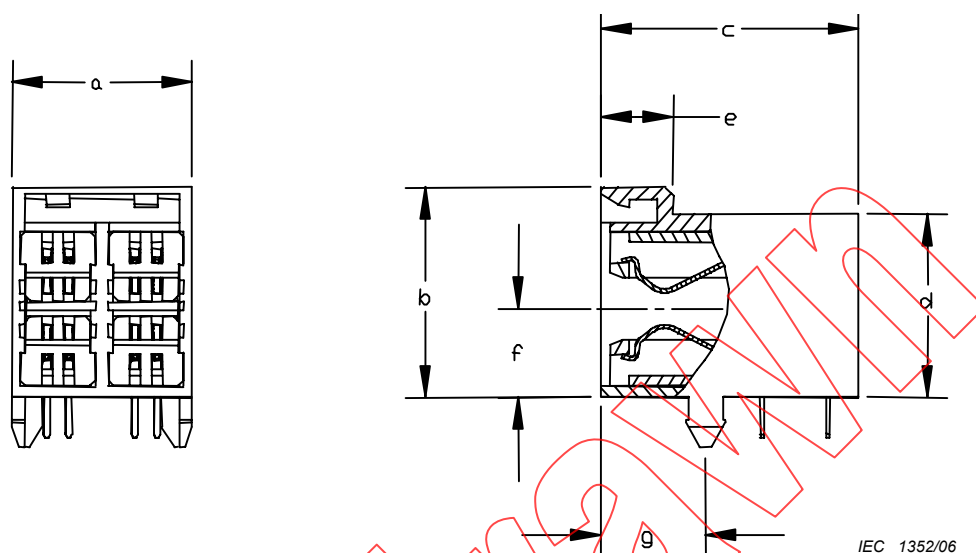


Figure 5 – Variant 02 drawing

Table 3 – Variant 02 drawing dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
A	14,48	14,55	14,40
B	15,75	15,88	15,62
C	20,78	20,85	20,70
D	13,72	13,84	13,59
E	5,84	5,97	5,72
F	6,63	6,73	6,53
G	8,46	8,53	8,38

NOTE See Figure 3 and 4 for internal dimensions.

3.2.4 Free connector (plug) dimensions

3.2.4.1 Free connector variant 03 (4-pair plug) drawings

Third angle projection

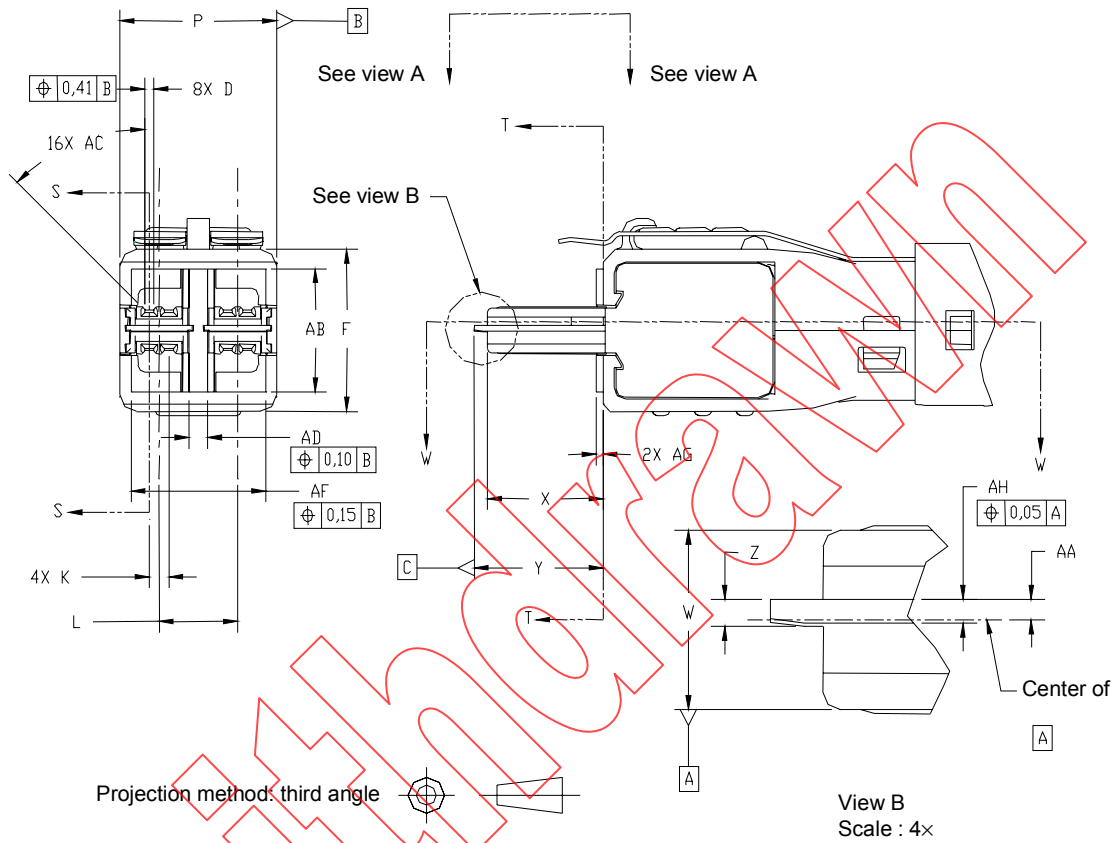


Figure 6 – Variant 03 drawing 1

Table 4 – Variant 03 drawing 1 dimensions*Dimensions in millimetres*

	Nominal	Maximum	Minimum
D ^a	0,81	0,86	0,76
F	14,73	14,88	14,58
K	1,78		
L	7,11		
P	14,22	14,35	14,10
W	4,06	4,11	4,01
X	10,49	10,67	10,31
Y	11,68	11,86	11,51
Z	0,61	0,64	0,58
AA	0,46	0,48	0,43
AB	11,18	11,48	10,87
AC	45	46	44
AD	1,70	1,75	1,65
AF	12,12	12,32	12,07
AG	0,64	0,71	0,56
AH	0,53	0,58	0,48
^a Dimension D is the same as ES in Figure 10 and GS in Figure 13.			

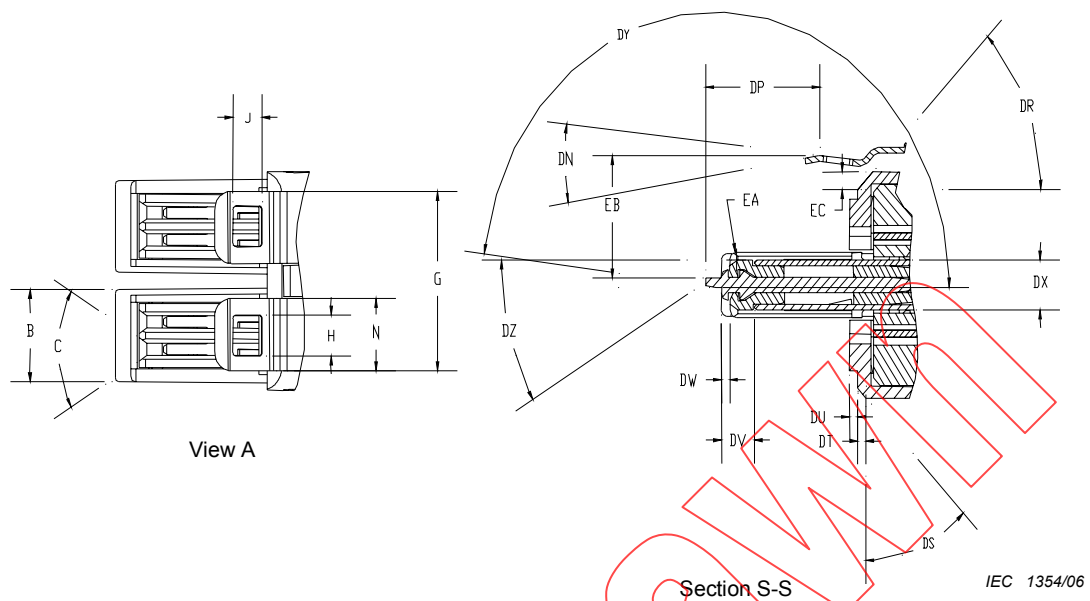


Figure 7 – Variant 03 drawing 2

Table 5 – Variant 03 drawing 2 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
B	5,99	6,05	5,94
C	60	62	58
G	11,68	11,81	11,56
H	2,67	2,74	2,59
J	2,26	2,39	2,13
N	4,70	4,80	4,60
DN	15	18	12
DP	9,12	9,45	8,79
DR	45	46	44
DS	45	46	44
DT	0,64	0,76	0,51
DU	0,64	0,71	0,56
DV	2,54	2,67	2,41
DW	0,64	0,76	
DX	3,25	3,48	3,02
DY	7	8	6
DZ	30	31	29
EA	R 0,51	R 0,66	R 0,38
EB	7,98		
EC	1,14	1,27	1,02

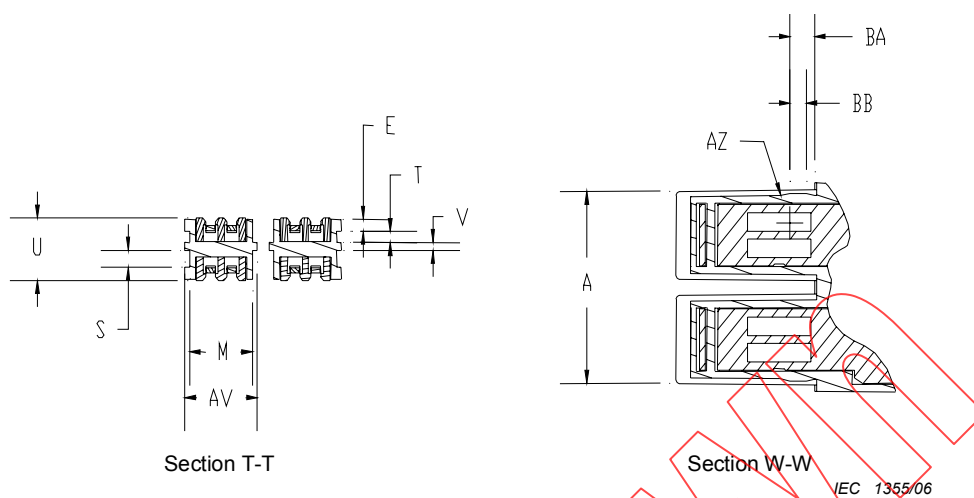


Figure 8 – Variant 03 drawing 3

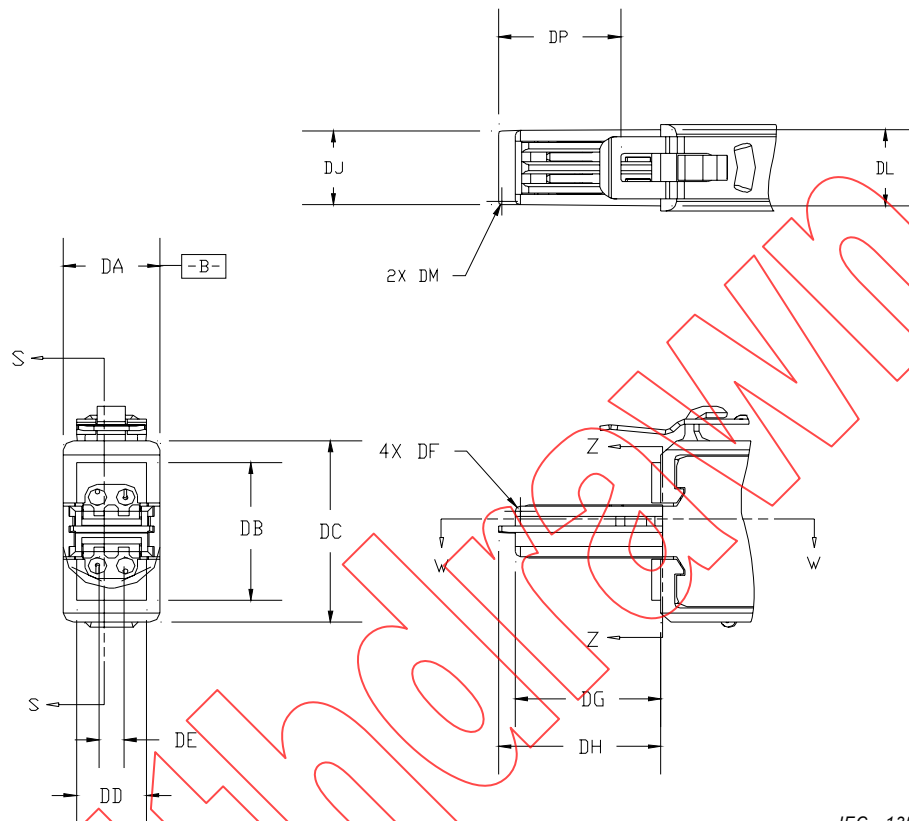
Table 6 – Variant 03 drawing 3 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
A	13,11	13,16	13,06
E	0,81	0,86	0,76
M	5,41	5,46	5,36
S	1,14	1,22	1,07
T	0,76	0,84	0,69
U	4,27	4,60	3,94
V	0,53	0,58	0,48
AV	6,20	6,25	6,15
AZ	R 2,03	R 2,11	R 1,96
BA	2,34	2,41	2,26
BB	1,37	1,55	1,19

3.2.4.2 Free connector variant 04 (2-pair plug) drawings

Third angle projection

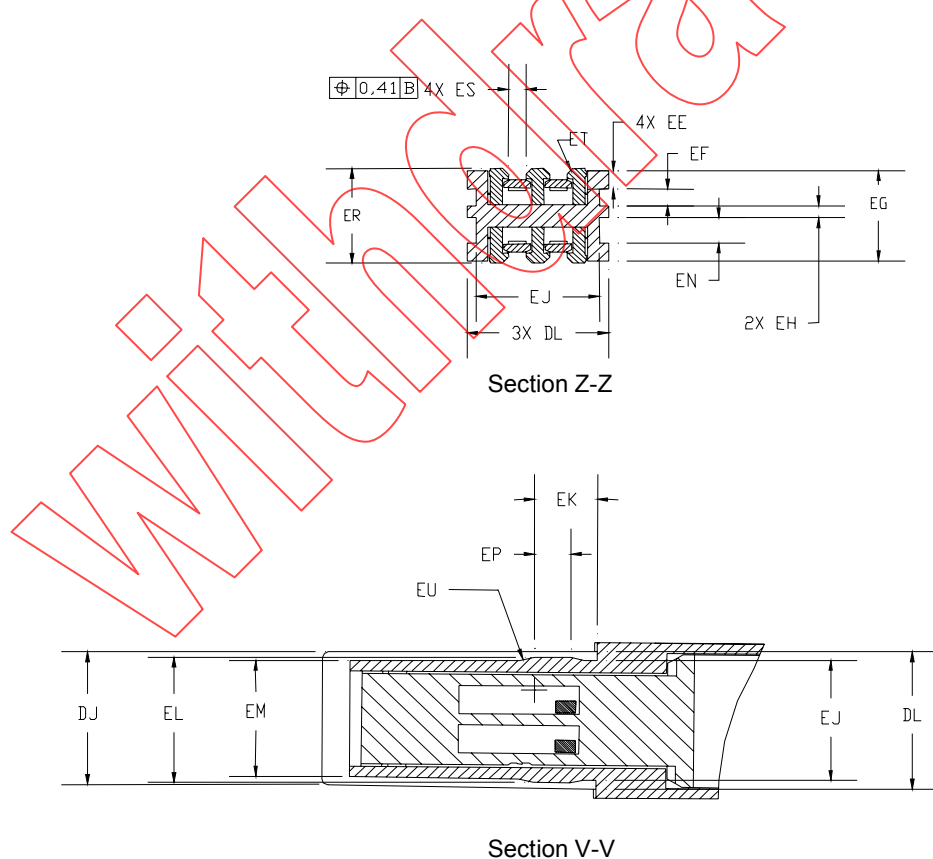


IEC 1356/06

Figure 9 – Variant 04 drawing 1

Table 7 – Variant 04 drawing 1 dimensions*Dimensions in millimetres*

	Nominal	Maximum	Minimum
DA	7,01	7,14	6,88
DB	11,18	11,48	10,87
DC	14,73	14,88	14,58
DD	5,08	5,21	4,95
DE	1,78	1,88	1,68
DF	R 0,38	R 0,46	R 0,30
DG	10,49	10,67	10,31
DH	11,68	11,86	11,51
DJ	5,99	6,05	5,94
DK	60	62	58
DL	6,20	6,25	6,15
DM	0,25	0,30	0,20



IEC 1357/06

Figure 10 – Variant 04 drawing 2

Table 8 – Variant 04 drawing 2 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
EE	0,81	0,86	0,76
EF	0,76	0,84	0,69
EG	4,06	4,11	4,01
EH	0,53	0,58	0,48
EJ	5,41	5,46	5,36
EK	2,34	2,41	2,26
EL	5,64	5,69	5,61
EM	5,23	5,28	5,16
EN	1,14	1,22	1,07
EP	1,37	1,55	1,19
ER	4,27	4,60	3,94
ES ^a	0,81	0,86	0,76
ET	45 X0,25	46 X0,38	44 X0,13
EU	R 2,03	R2,11	R1,96

^a Dimension ES is the same as D in Figure 6 and GS in Figure 13

3.2.4.3 Free connector variant 05 (1-pair plug) drawings

Third angle projection

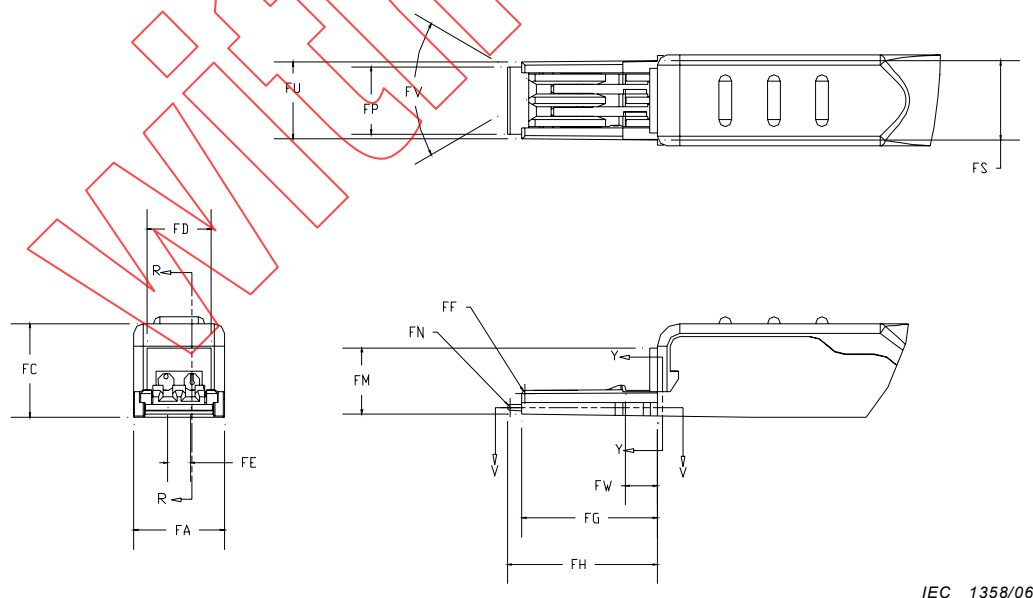


Figure 11 – Variant 05 drawing 1

Table 9 – Variant 05 drawing 1 dimensions*Dimensions in millimetres*

	Nominal	Maximum	Minimum
FA	7,11	7,19	7,06
FC	7,37	7,45	7,29
FD	5,08	5,21	4,95
FE	1,78		
FF	R 0,25	R0,33	R 0,18
FG	10,67	10,67	10,62
FH	11,81	11,81	11,71
FK	45	46	44
FL	1,14	1,27	1,02
FM	5,72	5,80	5,64
FN	R 0,23	R 0,31	R 0,15
FP	5,28	5,33	5,23
FR	R 0,25	R 0,33	R 0,18
FS	6,20	6,25	6,15
FU	6,02	6,11	5,93
FV	60	62	58
FW	2,36	2,49	2,24

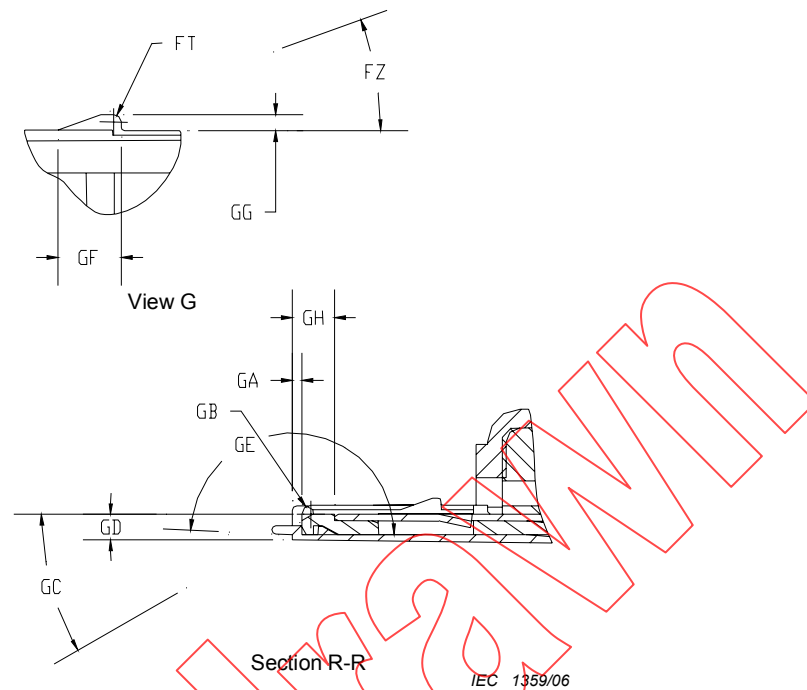


Figure 12 – Variant 05 drawing 2

Table 10 – Variant 05 drawing 2 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
FT	R 0,18	R 0,30	R 0,05
FZ	20	21	19
GA	0,66	0,76	0,56
GB	R 0,51	R 0,64	R 0,38
GC	30	31	29
GD	1,63	1,78	1,47
GE	177,5	178,5	176,5
GF	1,52	1,65	1,40
GG	0,38	0,46	0,30
GH	2,44	2,54	2,34

Third angle projection

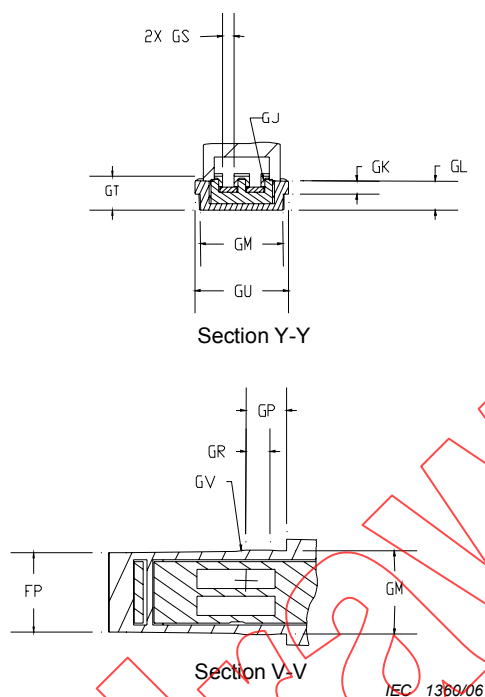


Figure 13 – Variant 05 drawing 3

Table 11 – Variant 05 drawing 3 dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
GJ	45 X0,25	46 X0,38	44 X0,13
GK	0,97	1,07	0,86
GL	2,11	2,21	2,01
GM	5,49	5,56	5,41
GP	2,34	2,41	2,26
GR	1,37	1,55	1,19
GS ^a	0,81	0,86	0,76
GT	2,13	2,34	1,93
GU	6,03	6,07	5,97
GV	R 2,03	R 2,11	R 1,96

^a Dimension GS is the same as D in Figure 6 and ES in Figure 10.

4 Terminations

4.1 General

A connector may include multiple terminations between the cable termination and the separable contact interface. These may include press-in (compliant pin) connections of jack springs into PCBs, for example. All terminations shall meet the relevant termination requirements.

If a type of solderless termination is used which is not covered by any IEC 60352 series specification, the supplier shall assure its reliability by performing similar tests, and demonstrating a similar level of performance, to those in IEC 60352.

Free connectors are intended to be terminated to cable to provide connector and cable assemblies. The connector type designation provides basic terminations concerning the type of conductor (tinsel, stranded, solid) to which the conductor may be applied, and the type of connection used (solder, insulation displacement, etc.). Specific details concerning wire gauge size, type and thickness of conductor insulation, size and shape of cordage or cable jacket, etc., are not intended to be part of this specification. Minor variations in a free connector's interior details to accommodate differing wire gauge sizes, outer jackets, etc., do not require the generation of new free connector specifications.

If the connector is able to be used with multiple cable types, the manufacturer shall assure that all connection points comply with the relevant IEC standards with each of the cable types.

4.2 Referenced termination types

4.2.1 General

If a type of solderless termination is used, which is covered by a IEC 60352 series specification, the supplier shall assure its reliability by performing tests and demonstrating a level of performance, according to the IEC 60352 series.

4.2.2 Insulation displacement terminations

Shall conform to IEC 60352-3 or IEC 60352-4.

4.2.3 Crimp terminations

Shall conform to IEC 60352-2.

4.2.4 Insulation piercing terminations

Shall conform to IEC 60352-6.

4.2.5 Compliant pin (press-in)

Shall conform to IEC 60352-5.

4.2.6 Spring clamp terminations

Shall conform to IEC 60352-7.

4.2.7 Non-referenced termination types

If a type of termination is used which is not covered by any IEC 60352 series specification, the supplier shall assure its reliability by performing similar tests, and demonstrating a similar level of performance, to those covered by IEC 60352 series.

4.2.8 Solder terminations

Solder terminations are not covered in the IEC 60352 series and are allowed.

4.3 Accessories

Accessories are not specified.

4.4 Mounting information for fixed connectors

4.4.1 General

Fixed connector mounting information is not specified.

4.4.2 Hole pattern on printed boards

Fixed connector printed board mounting is not specified.

4.4.3 Mounting on panels

Fixed connector mounting on panels is not specified.

4.5 Mounting information for free connectors

Mounting information for free connectors onto cables is not specified.

5 Gauges

5.1 General

Gauges shall be made according to the following requirements:

Material: tool steel, hardened.

√ = Surface roughness, according to ISO 1302.

Ra = 0,25 µm max. (10 µin max.).

A 0,01 mm (0,000 4 in) wear tolerance shall be applied.

Clearance shall be provided for connector contacts.

Annex A has additional information about using the gauges.

5.2 Fixed connector (outlet) gauges (see Table 12 for dimensions)

5.2.1 Fixed connector location "Go" gauge

Third angle projection

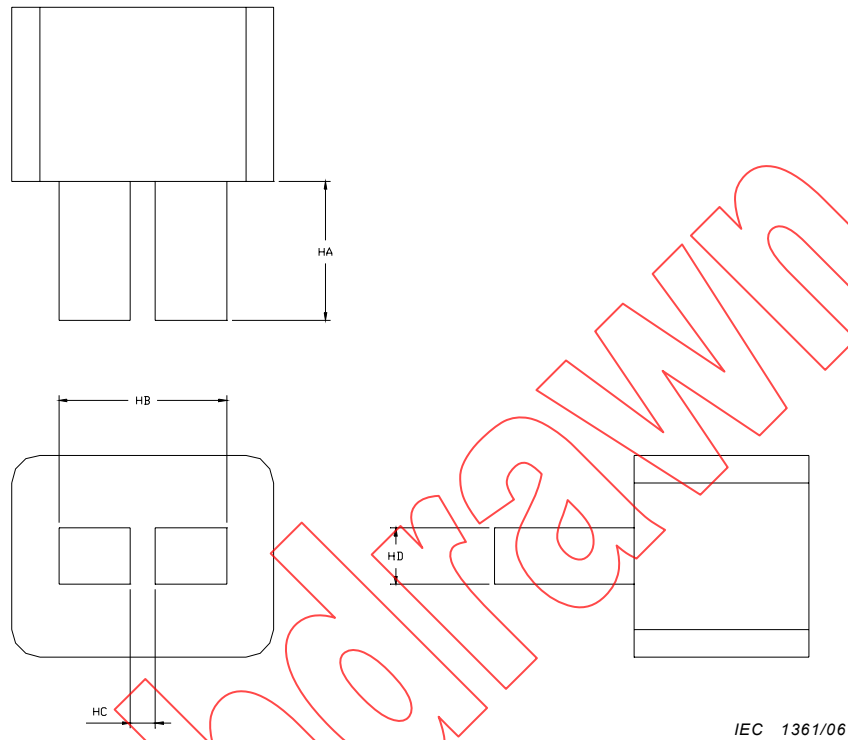


Figure 14 – Fixed connector location "Go" gauge

5.2.2 Fixed connector location "No-Go" gauge

Third angle projection

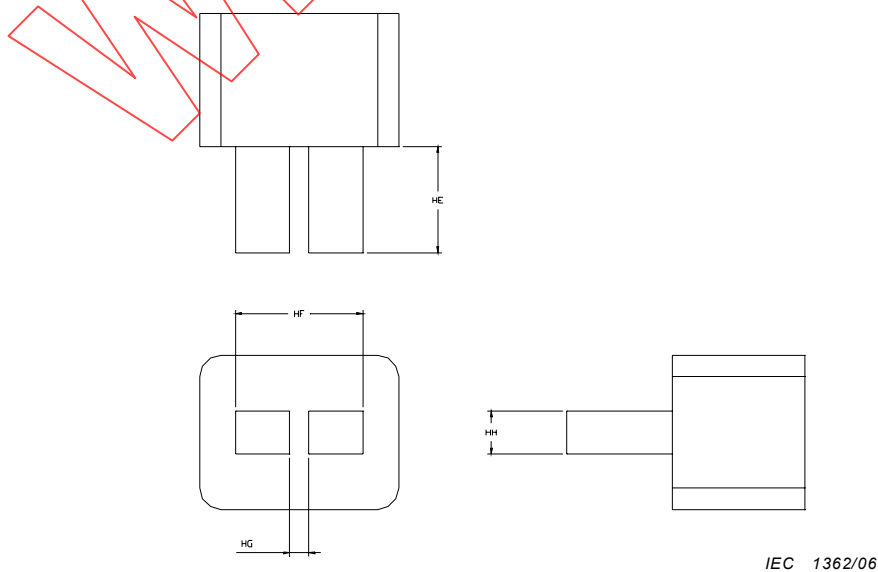


Figure 15 – Fixed connector location "No-Go" gauge

5.2.3 Fixed connector size "Go" gauge

Third angle projection

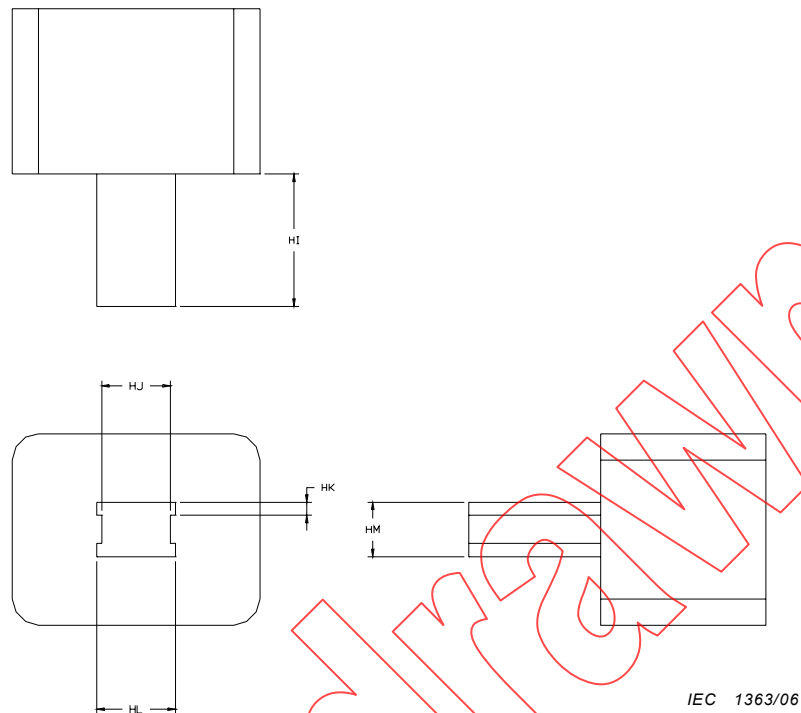
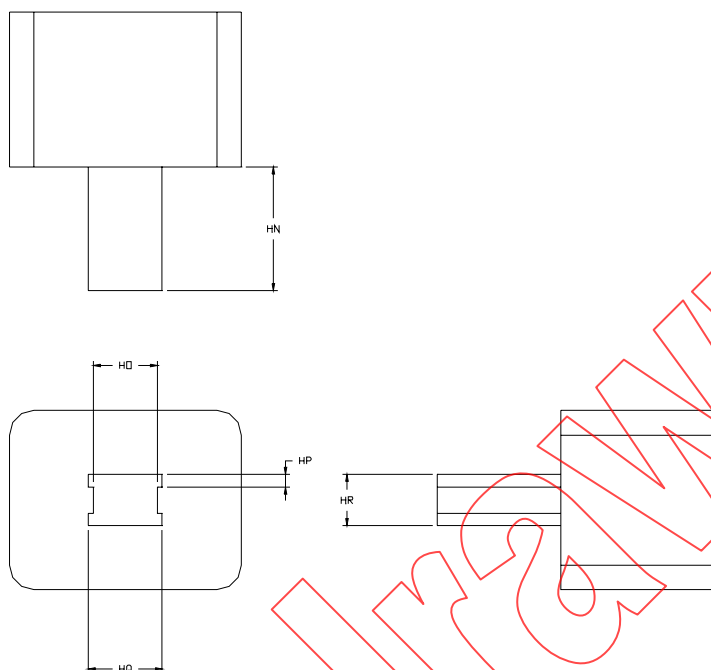


Figure 16 – Fixed connector size "Go" gauge

5.2.4 Fixed connector size "No-Go" gauge

Third angle projection



IEC 1364/06

Figure 17 – Fixed connector size "No-Go" gauge

Table 12 – Fixed connector (outlet) gauge dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
HA	10,16	10,21	10,11
HB	12,19	12,24	12,14
HC	1,60	1,604	1,60
HD	4,11	4,161	4,06
HE	10,16	10,21	10,11
HF	12,19	12,24	12,14
HG	1,39	1,396	1,39
HH	4,11	4,161	4,06
HI	10,16	10,21	10,11
HJ	5,28	5,28	5,28
HK	1,00	1,02	0,99
HL	6,04	6,09	5,99
HM	4,11	4,16	4,06
HN	10,16	10,21	10,11
HO	5,38	5,39	5,39
HP	1,00	1,016	0,99
HQ	6,04	6,09	5,99
HR	4,11	4,16	4,06

5.3 Free connector (plug) gauges (see Table 13 for dimensions)

5.3.1 Free connector location "Go" gauge

Third angle projection

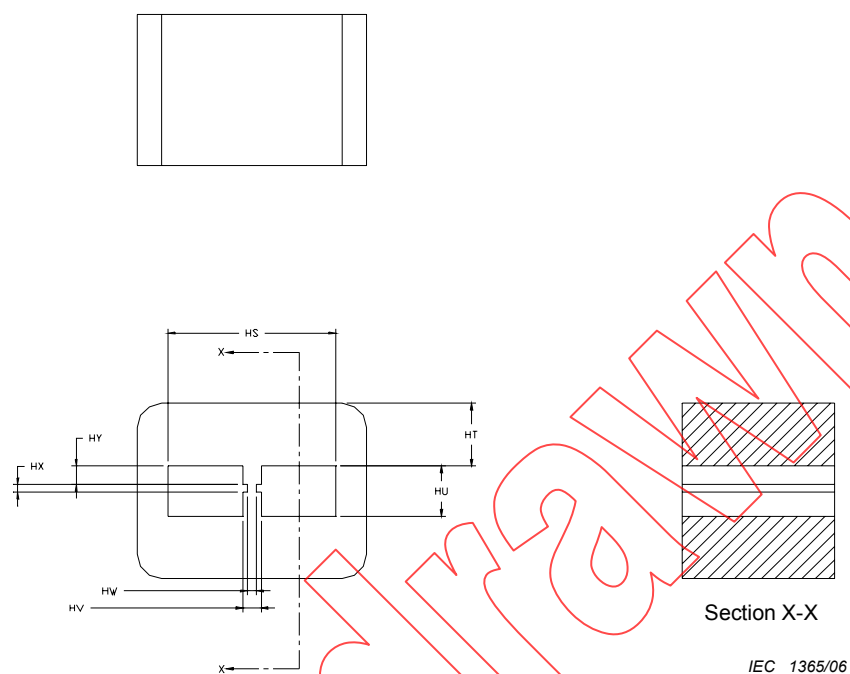


Figure 18 – Free connector location "Go" gauge

5.3.2 Free connector location "No-Go" gauge

Third angle projection

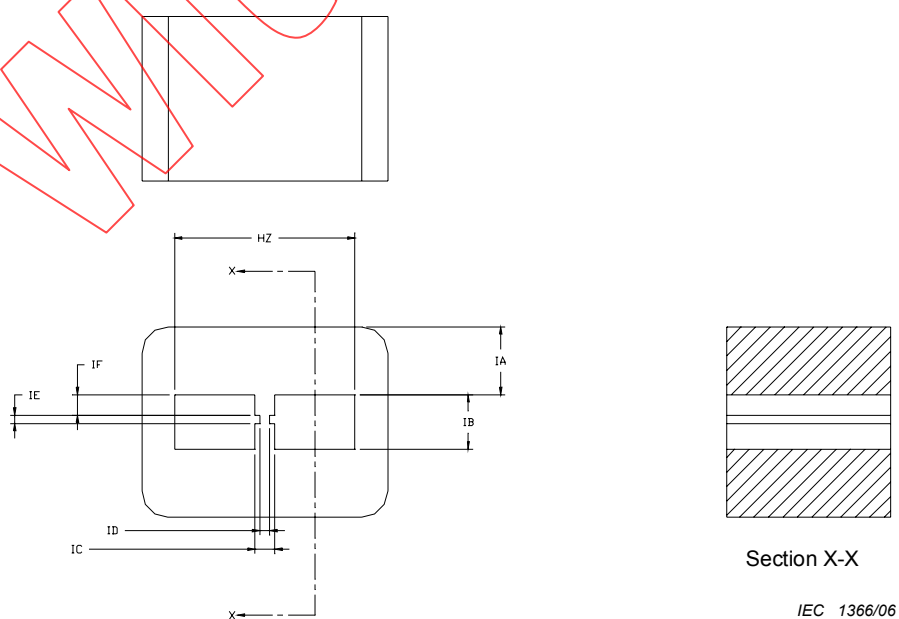


Figure 19 – Free connector location "No-Go" gauge

5.3.3 Free connector plug size "Go" gauge

Third angle projection

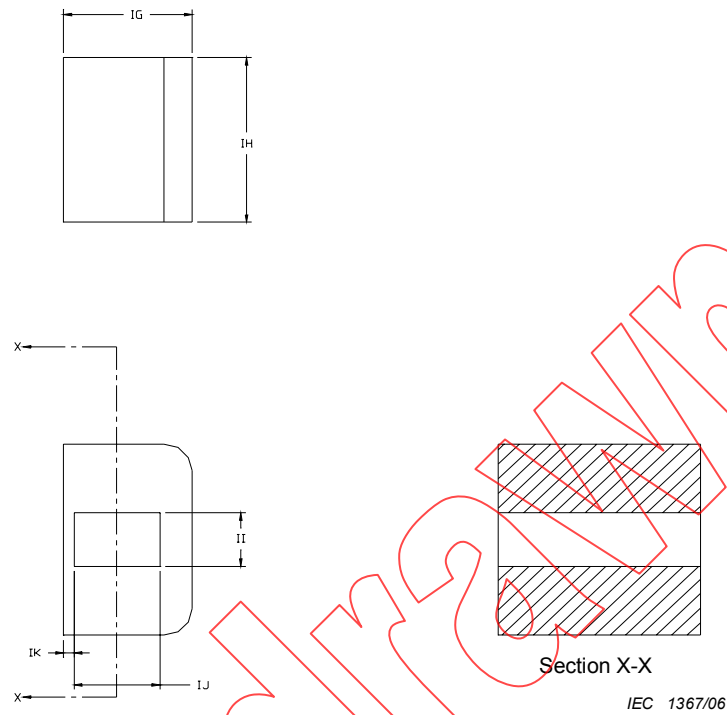


Figure 20 – Free connector size "Go" gauge

5.3.4 Free connector size "No-Go" gauge

Third angle projection

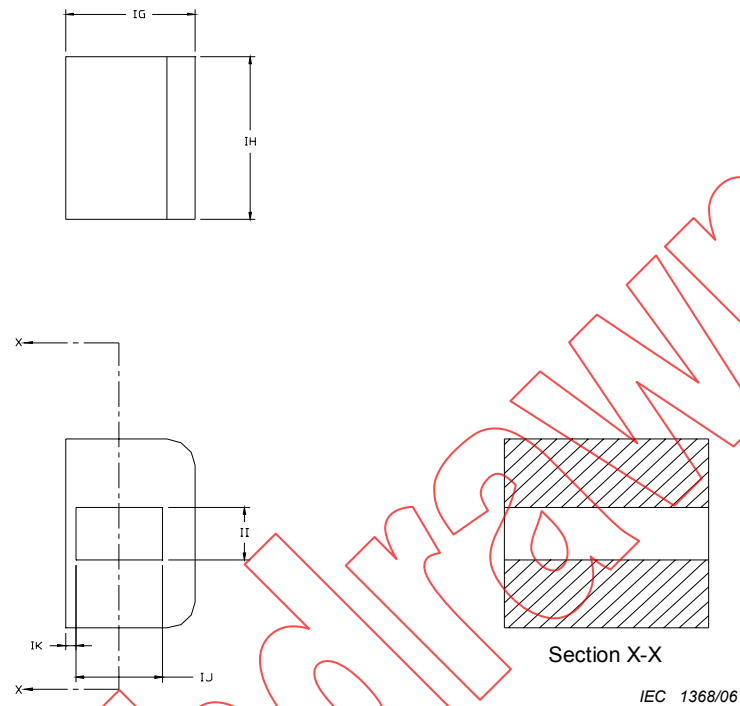


Figure 21 – Free connector size "No-Go" gauge

Table 13 – Free connector (plug) gauge dimensions

Dimensions in millimetres

	Nominal	Maximum	Minimum
HS	13,97	13,99	13,96
HT	5,26	5,27	5,25
HU	4,22	4,23	4,20
HV	1,55	1,57	1,57
HW	0,76	0,77	0,74
HX	0,64	0,65	0,62
HY	1,79	1,81	1,78
HZ	13,97	13,99	13,96
IA	5,26	5,27	5,25
IB	4,22	4,23	4,20
IC	1,76	1,76	1,75
ID	0,76	0,77	0,74
IE	0,64	0,65	0,62
IF	1,79	1,81	1,78
IG	9,53	9,55	9,52
IH	12,7	12,72	12,69
II	4,12	4,12	4,12
IJ	6,25	6,25	6,25
IK	0,76	0,78	0,75
IL	9,53	9,55	9,52
IM	12,7	12,72	12,69
IN	5,57	5,58	5,55
IO	4,12	4,12	4,12
IP	6,14	6,15	6,14
IQ	0,76	0,78	0,75
IR	0,87	0,88	0,85
IS	1,04	1,05	1,02

5.4 Test panels (see Table 14 for dimensions)

Test panels for panel mounted fixed connectors shall be as defined in Figure 22.

Third angle projection

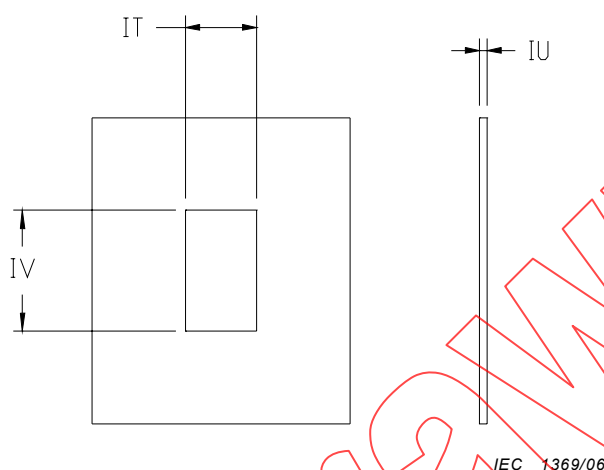


Figure 22 – Fixed connector panel

Table 14 – Fixed connector panel dimensions

	Nominal	Maximum	Minimum
IT	14,68	14,91	14,61
IU	1,57	1,65	1,50
IV	19,30	19,38	19,23

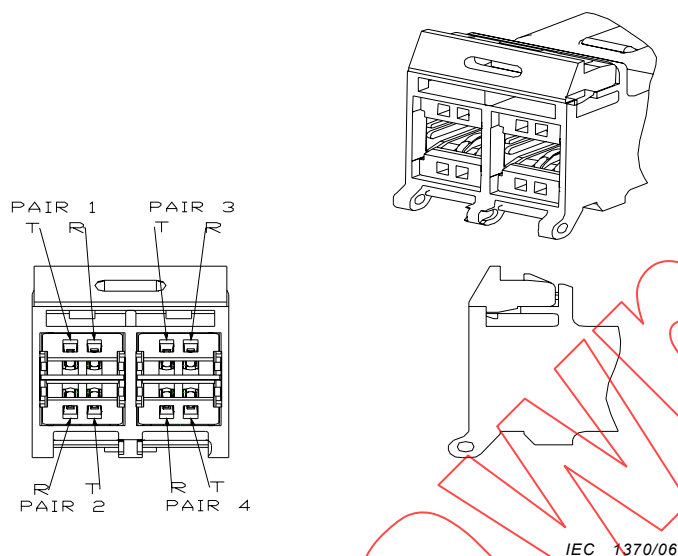
6 Characteristics

6.1 General

Compliance to the test schedules is intended to ensure the reliability of all performance parameters, including transmission parameters. Stable and compliant contact resistance is a good indication of the stability of transmission performance.

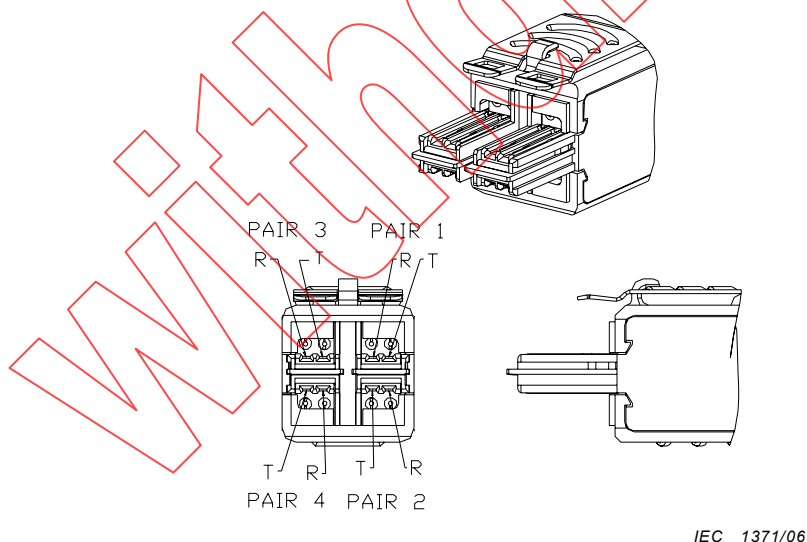
6.2 Pin and pair grouping assignment

For those specifications for which pin and pair groupings are relevant, the pin and pair grouping assignments shall be as shown in Figures 23 and 24, unless otherwise specified.



NOTE "T" stands for "Tip", "R" stands for "Ring".

Figure 23 – Isometric views fixed connector



NOTE "T" stands for "Tip", "R" stands for "Ring".

Figure 24 – Isometric views free connector 4 pair

6.3 Classification into climatic categories

The lower and upper temperatures and the duration of the damp heat, steady state test should, unless otherwise impractical, be selected from the preferred values stated in 2.3 of IEC 61076-1. The connectors are classified into climatic categories in accordance with the general rules given in IEC 60068-1. Table 15 specifies the preferred temperature range and severity of the damp heat steady state test.

Table 15 – Climatic categories – selected values

Climatic category	Lower temperature C	Upper temperature C	Damp heat steady state days
40/070/21	–40	70	21

6.4 Electrical characteristics

6.4.1 Creepage and clearance distances

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

Insulation co-ordination is not required for this connector; therefore, the creepage and clearance distances in 2.4 of IEC 61076-1 are reduced and covered by overall performance requirements.

Therefore, the creepage and clearance distances are given as operating characteristics of mated connectors.

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 16 – Creepage and clearance distances

Type	Minimum distance between contacts and chassis		Minimum distance between adjacent contacts	
	Creepage	Clearance	Creepage	Clearance
	mm	mm	mm	mm
A, B	1,40	0,51	0,36	0,36

6.4.2 Voltage proof

Conditions:

IEC 60512, Test 4a, Method A
Mated connectors

All variants:

1 000 V d.c. or a.c. peak, contact-to-contact
1 500 V d.c. or a.c. peak, contact-to-test panel or shield

6.4.3 Current carrying capacity

Conditions: IEC 60512, Test 5b
All contacts, connected in series

The current-carrying capacity of connectors in accordance with the requirements of 2.5 of IEC 61076-1 shall comply with the de-rating curve given in Figure 25.

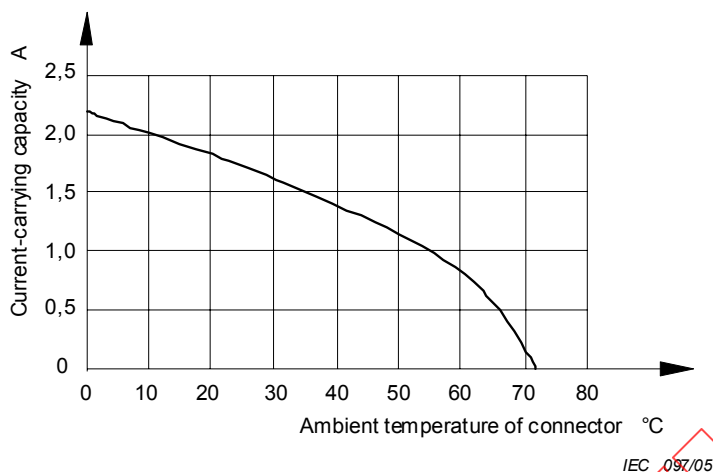


Figure 25 – Connector de-rating curve

6.4.4 Initial contact and shield resistance

Conditions:

IEC 60512, Test 2a
Mated connectors
All types: 20 mΩ max.

6.4.5 Input to output resistance

Conditions:

IEC 60512, Test 2a
Mated connectors
All types: 200 mΩ max.

6.4.6 Input to output resistance unbalance

Conditions:

IEC 60512, Test 2a
Mated connectors
All types: 50 mΩ max.

6.4.7 Insulation resistance

Conditions:

IEC 60512, Test 3a, Method A
Mated connectors
Test voltage: 100 V d.c.
All types: 500 MΩ min.

6.4.8 Transfer impedance

Conditions:

IEC 60512, Test 23c or Annex I
Mated connectors
All types: under study
 $0,05 \times f^{0,3} \Omega$ from 1 MHz to 10 MHz for future study (ffs)
 $0,01 \times f \Omega$ from 10 MHz to 80 MHz.
The values from 80 MHz to 1 000 MHz are ffs.

Where f is frequency in MHz.

6.5 Transmission characteristics

6.5.1 General

Category 7 performance level, respective to transmission characteristics, is determined according to specific test methods described in test group EP.

Category 7 transmission performance interoperability of independent fixed or free connectors is determined by tests conducted when they are mated with precision test fixtures given in Annex C.

All transmission performance requirements apply between the reference planes specified in Clause D.8.

NOTE f is the frequency expressed in MHz.

6.5.2 Insertion loss

Conditions:

Annex E, Insertion loss

Mated connectors, all pairs of contacts

All types: $\leq 0,02 \times \sqrt{f}$ (rounded to superior 0,1 dB) up to 1000 MHz

Where f is frequency in MHz

Insertion loss at frequencies that correspond to calculated values of less than 0,1 dB shall revert to a requirement of 0,1 dB maximum.

6.5.3 Return loss

Conditions:

Annex F, Return loss

Mated connectors, all pairs of contacts

All types: $68 - 20 \log(f)$ dB up to 1 000 MHz, not >30 dB

Where f is frequency in MHz

Return loss at frequencies that correspond to calculated values of greater than 30,0 dB shall revert to a minimum requirement of 30 dB.

6.5.4 Propagation delay

Conditions:

IEC 60512, Test 25d, Propagation delay

Mated connectors, all pairs of contacts

All types: $\leq 2,5$ ns

NOTE This characteristic does not need to be measured since it is achieved by design.

6.5.5 Delay skew

Conditions:

IEC 60512, Test 25d, Delay skew

Mated connectors, all pairs of contacts

All types: $\leq 1,25$ ns

NOTE This characteristic does not need to be measured, since it is achieved by design.

6.5.6 NEXT loss

Conditions:

Annex G, NEXT loss

Mated connectors, between all combinations of 2 pairs of contacts

All types: $102,4 - 15\log(f)$ up to 1 000 MHz

Where f is frequency in MHz.

NEXT at frequencies that correspond to calculated values of greater than 80 dB shall revert to a minimum requirement of 80,0 dB.

6.5.7 Power sum NEXT loss (for information only)

Conditions:

Mated connectors, each pair and all other pairs combined

All types: $99,4 - 15\log(f)$ up to 1 000 MHz

PS NEXT at frequencies that correspond to calculated values of greater than 77,0 dB shall revert to a minimum requirement of 77,0 dB.

NOTE This characteristic is achieved by compliance to NEXT (6.5.6) and there is no necessity to test.

6.5.8 FEXT loss

Conditions:

Annex H, FEXT loss

Mated connectors, between all combinations of 2 pairs of contacts

All types: $90 - 15\log(f)$ up to 1 000 MHz

Where f is frequency in MHz.

FEXT at frequencies that correspond to calculated values of greater than 65,0 dB shall revert to a minimum requirement of 65,0 dB.

For connectors, the difference between FEXT and ELFEXT is minimal. Therefore, connector FEXT requirements are used to model ELFEXT performance for links and channels.

6.5.9 Power sum FEXT loss (for information only)

Conditions:

Mated connectors, between all combinations of 2 pairs of contacts

All types: $87 - 15\log(f)$ up to 1 000 MHz

PS FEXT at frequencies that correspond to calculated values of greater than 62,0 dB shall revert to a minimum requirement of 62,0 dB.

For connectors, the difference between PS FEXT and PS ELFEXT is minimal. Therefore, connector PS FEXT requirements are used to model PS ELFEXT performance for links and channels.

NOTE This characteristic is achieved by compliance to FEXT (6.5.8) and there is no necessity to test.

6.5.10 Transverse conversion loss

Conditions: Annex J, Transverse conversion loss

Mated connectors.

All types: $66 - 20\log(f)$ dB up to 1 000 MHz

TCL at frequencies that correspond to calculated values of greater than 60,0 dB shall revert to a minimum requirement of 60,0 dB.

NOTE This requirement applies up to 100 MHz. Test methods for frequencies above 100 MHz are not yet fully stabilized.

6.5.11 Transverse conversion transfer loss

Conditions: Annex J, transverse conversion transfer loss

Mated connectors.

All types: $68 - 20\log(f)$ dB up to 1 000 MHz

Whenever the formula results in a value greater than 40 dB, the requirement shall revert to 40 dB.

NOTE This requirement applies up to 100 MHz. Test methods for frequencies above 100 MHz are not yet fully stabilized.

6.5.12 Coupling attenuation

Conditions: According to EN 50289-1-14, coupling attenuation test method

Mated connectors, all pairs of contacts

85 dB from 30 MHz to 100 MHz

$85 - 20\log(f/100)$ dB from 100,0 MHz to 1 000 MHz

Where f is frequency in MHz.

6.6 Mechanical

The following requirements apply to all variants

6.6.1 Mechanical operation

Conditions:

IEC 60512, Test 9a

Speed: 10 mm/s (0,4 in/s) maximum

Rest: 5 s minimum (unmated)

PL1: 750 operations

PL2: 2 500 operations

6.6.2 Effectiveness of connector coupling devices

Conditions:

IEC 60512, Test 15f

Mated connectors

All types: 50 N for 60 s minimum

6.6.3 Insertion and withdrawal forces

Conditions:

IEC 60512, Test 13b

Speed: 10 mm/s maximum

All types, insertion and withdrawal: 20 N maximum

7 Qualification approval test schedule

7.1 General

See Clause 5 of IEC 61076-1.

The detail specification shall state the test sequence (in accordance with detail specification), and the number of specimens for each test sequence (not less than four mated pairs).

Individual variants may be submitted to type tests for approval of those particular variants.

It is permissible to limit the number of variants tested to a selection representative of the whole range for which approval is required (which may be less than the range covered by the detail specification), but each feature and characteristic shall be proved.

The connectors shall have been processed in a careful and workmanlike manner, in accordance with good current practice.

Unless otherwise specified, mated sets of connectors shall be tested. For contact resistance measurements, care shall be taken to keep a particular combination of connectors together during the complete test sequence, that is, when unmating is necessary for a certain test, the same connectors shall be mated for subsequent tests.

7.2 Test procedures and measuring methods

The test methods specified and given in the relevant standards are the preferred methods but not necessarily the only ones that can be used. In case of dispute, however, the specified method shall be used as the reference method.

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

Where approval procedures are involved and alternative methods are employed, it is the responsibility of the manufacturer to satisfy the authority granting approval that any alternative methods which he may use give results equivalent to those obtained by the methods specified.

7.3 Preconditioning

Before the tests are made, the connectors shall be preconditioned under standard atmospheric conditions for testing as specified in IEC 60068-1 for a period of 24 hours unless otherwise specified by the detail specification.

7.4 Wiring and mounting of specimens

7.4.1 Wiring

Wiring of these connectors shall take into account wire diameter of the cables defined in IEC 61156-2, IEC 61156-3 and IEC 61156-4 as applicable. Where wiring and/or shielding of test specimens is required, the detail specification shall contain information suitable to comply with the selected methods of test.

7.4.2 Mounting

When mounting is required in a test, unless otherwise specified, the connectors shall be rigidly mounted on a metal plate or to specified accessories, whichever is applicable, using the specified connection methods, fixing devices and panel cut-outs as laid down in this specification.

7.5 Contact resistance measurement arrangement procedure

7.5.1 General

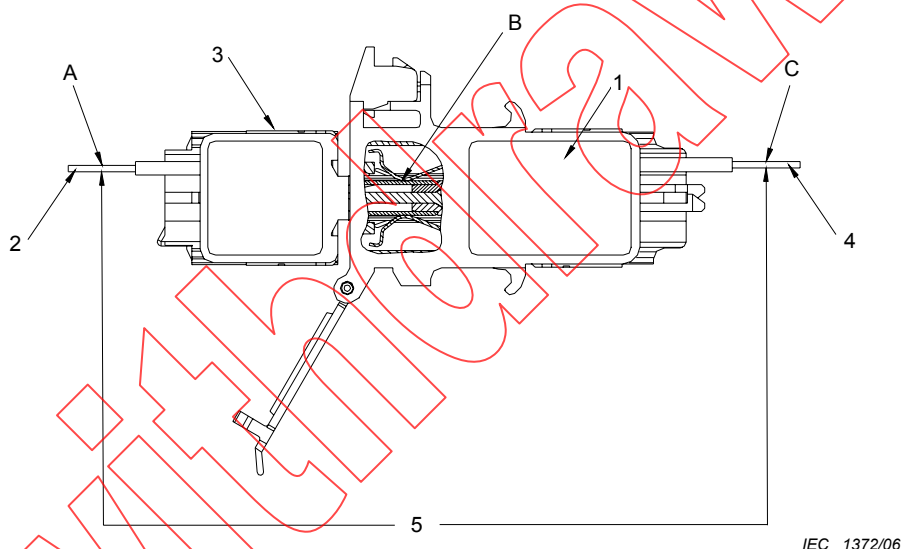


Figure 26 – Arrangement for contact resistance test

Notes for Figure 26

- 1 Fixed connector.
- 2 As short as practical (except for vibration test CP1 see 7.3).
- 3 Free connector.
- 4 As short as practical (except for vibration test CP1 see 7.3).
- 5 Contact resistance measurement points.

7.5.2 Test procedure for contact resistance measurement

- a) Determine the bulk resistance of the fixed connector between points A and B of Figure 26 by calculation or by measurement. This resistance is noted R_{AB} .
- b) Determine the bulk resistance of the free connector between points B and C of Figure 26 by calculation or by measurement. This resistance is noted R_{BC} .

- c) Measure the total mated connector resistance between points A and C, following the requirements and procedures of IEC 60512, Test 2a. This resistance is noted R_{AC} .
- d) Calculate the contact resistance by subtracting the sum of the bulk resistance of the fixed and free connectors from the total mated connector resistance.

$$\text{Contact resistance} = R_{AC} - (R_{ABI} + R_{BCI})$$

where I indicates initial value.

7.6 Arrangement for dynamic stress tests (test phase CP1)

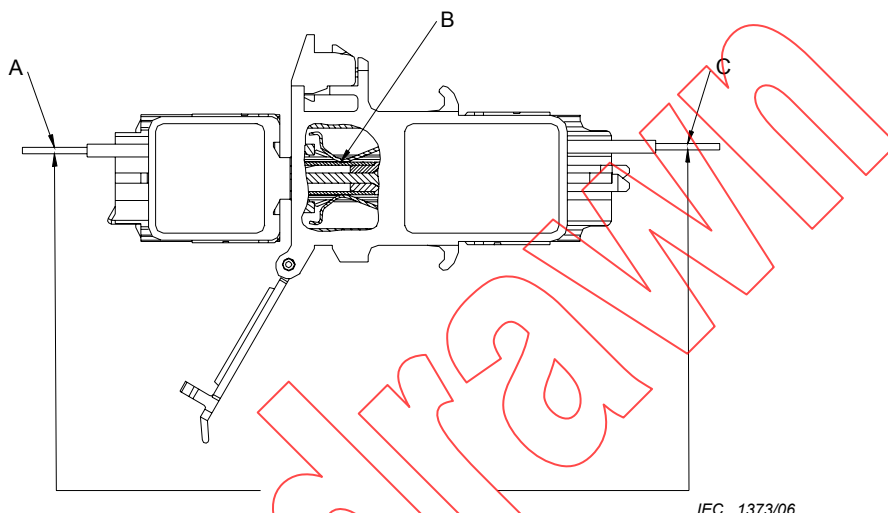


Figure 27 – Arrangement for dynamic stress

7.7 Test schedules

The test parameters required shall not be less than those listed in Clause 6.

7.7.1 Basic (minimum) test schedule

Not applicable.

7.7.2 Full test schedule

7.7.2.1 General

The detail specification shall call for the following tests and shall specify the characteristics to be examined and the requirements to be fulfilled.

For a complete test sequence, 52 specimens are needed (5 groups of 10 and 1 group of 2). The group of 2 shall be for transmission testing, group EP.

7.7.2.2 Test group P preliminary

All specimens shall be subjected to the following tests given in Table 17. All the test group specimens shall be subjected to the preliminary group P tests in the following sequence.

The specimens shall then be divided into the appropriate number of groups. All connectors in each group shall undergo the following tests as described in the detail specification and in the sequence given, unless the detail specification requires alteration of the sequence of tests or adds new tests to verify additional connector characteristics.

The tests in Tables 18 through 23 specify the characteristics to be checked and the requirements to be fulfilled.

Table 17 – Test group P

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
P 1	General examination	1		Visual examination	1a	There shall be no defects that would impair normal operation
				Examination of dimensions and mass	1b	The dimensions shall comply with those specified in the detail specification
P 2	Polarization					
P 3	Contact resistance		Measurement points as in Figure 26 All contacts/specimens	Millivolt level method or contact resistance – specified test current method	2a	Contact resistance = 20 mΩ maximum Shield resistance = 20 mΩ maximum
P 4			100 V 15 V d. c.	Insulation resistance	3a	500 MΩ minimum
P 5			Contact/contact Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak
			All contacts to test panel Method A Mated connectors			1 500 V d.c. or a.c. peak

7.7.2.3 Test group AP

Table 18 – Test group AP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
AP 1	Insertion and withdrawal forces	13b	Connector locking device depressed			Insertion force 20 N max Withdrawal force 20 N max
AP 2	Effectiveness of connector coupling device	15f	Rate of load application 44,5 N/s maximum			50 N for 60 s $\pm$ 5 s
AP 3	Rapid change of temperature	11d	–40 °C to 70 °C Mated connectors 25 cycles $t = 30$ min Recovery time 2 h			
AP 4			Test voltage 100 V 15 V d.c. Method A Mated connectors	Insulation resistance	3a	500 M Ω minimum
AP 5			Measurement points as in Figure 26 All contacts/specimens	Contact and shield resistance	2a	20 m Ω max change from initial
AP 6			Contact/contact: Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1 500 V d.c. or a.c. peak
AP 7			Unmated connectors	Visual examination	1a	There shall be no defects that would impair normal operation
AP 8	Damp heat, cyclic	11m	21 cycles low temperature 25 °C high temperature 65 °C cold subcycle –10 °C humidity 93 % Half of the samples in mated state Half of the samples in unmated state			
AP 9			Measurement points as in Figure 26 All Contacts/Specimens	Contact and shield resistance	2a	20 m Ω maximum change from initial
AP 10	Insertion and withdrawal forces	13b	Connector locking device depressed			Insertion force 20 N max Withdrawal force 20 N max

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
AP 11	Effectiveness of connector coupling device	15f	Rate of load application 44,5 N/s maximum			50 N for 60 s $\pm$ 5 s
AP 12			Unmated connectors	Visual examination	1a	There shall be not defects that would impair normal operation
AP 13	Solderability		As applicable			
AP 14	Resistance to soldering heat		As applicable			
AP 15			See Note Contact/contact: Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1 500 V d.c. or a.c. peak
NOTE Do not perform step AP 15 if solderability and resistance to soldering heat were not performed.						

Withdrawn

7.7.2.4 Test group BP

Table 19 – Test group BP

Test phase	Test			Measurement to be performed		
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	Requirements
BP 1	Locking device mechanical operations		2 <i>N</i> operations – see mechanical operations			See Annex B
BP 2	Mechanical operations	9a	<i>N</i> /2 operations – see mechanical operations. Speed 10 mm/s. Rest 5 s (when unmated). Locking device inoperative			<i>N</i> is: PL1 = 750 PL2 = 2500
BP 3	Flowing mixed gas corrosion	11g	4 days Half of the samples in mated state Half of the samples in unmated state		11g	
BP 4			Measurement points as in Figure 26 All contacts/specimen	Contact and shield resistance	2a	20 mΩ maximum change from initial
BP 5	Mechanical operations	9a	<i>N</i> /2 operations see mechanical operations. Speed 10 mm/s Rest 5 s (when unmated) Locking device inoperative			
BP 6			Measurement points as in Figure 26 All contacts/specimen	Contact and shield resistance	2a	20 mΩ maximum change from initial
BP 7			100 V 15 V d.c. Method A Mated connectors	Insulation resistance	3a	500 MΩ minimum
BP 8			Contact/contact: Method A Mated connectors	Voltage proof	4a	1 000 V d.c. or a.c. peak
			All contacts to test panel: Method A Mated connectors			1 500 V d.c. or a.c. peak
BP 9				Visual examination	1a	There shall be no defects that would impair normal operation