IEC 63171-1

Edition 2.0 2024-04

INTERNATIONAL STANDARD

Connectors for electrical and electronic equipment –
Part 1: Detail specification for 2-way, shielded or unshielded, free and fixed connectors – Mechanical mating information, pin assignment and additional requirements for Type 1 (copper LC style)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –

Part 1: Detail specification for 2-way, shielded or unshielded, free and fixed connectors – Mechanical mating information, pin assignment and additional requirements for Type 1 (copper LC style)

FOREWORD

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IEC 63171-1 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Information on obtaining a license agreement was updated.
b) Connector characteristics and test requirements were aligned with IEC 63171:2021 where applicable.

c) Added requirements for Polarizing method (5.6.4) and Dynamic stress (5.6.5) to align with IEC 63171:2021.

d) Added test group BP – Moisture (6.7.3.4) to align with IEC 63171:2021.

The text of this International Standard is based on the following documents:

Draft	Report on voting
48B/3062/FDIS	48B/3083/RVD

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

The language used for the development of this International Standard is English.

A list of all parts in the IEC 63171 series, published under the general title *Connectors for electrical and electronic equipment*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The IEC 63171 series is a set of International Standards covering shielded or unshielded free and fixed connectors for balanced single-pair data transmission with current carrying capacity.

IEC 63171 is the general requirements and tests part (general specifications) of the whole series.

Subsequent parts, such as this Part 1, identified as IEC 63171 followed by a dash and a progressive number starting with 1, are the product detail specifications of this series and do not duplicate information given in this document, but list only additional requirements.

Each subsequent part is identified by a type of connector covered with the same number identifying the part. Some parts can describe more embodiments, with different connectors geometries (rectangular, circular), sharing the core element and the relevant features.

For the complete specifications regarding a connector of this series, both the general specification and the relevant detail specification are therefore required.

For the qualification of a connector of this series, both the general specification and the relevant detail specification shall be met.

Figure 1 shows the interrelation of the standards.

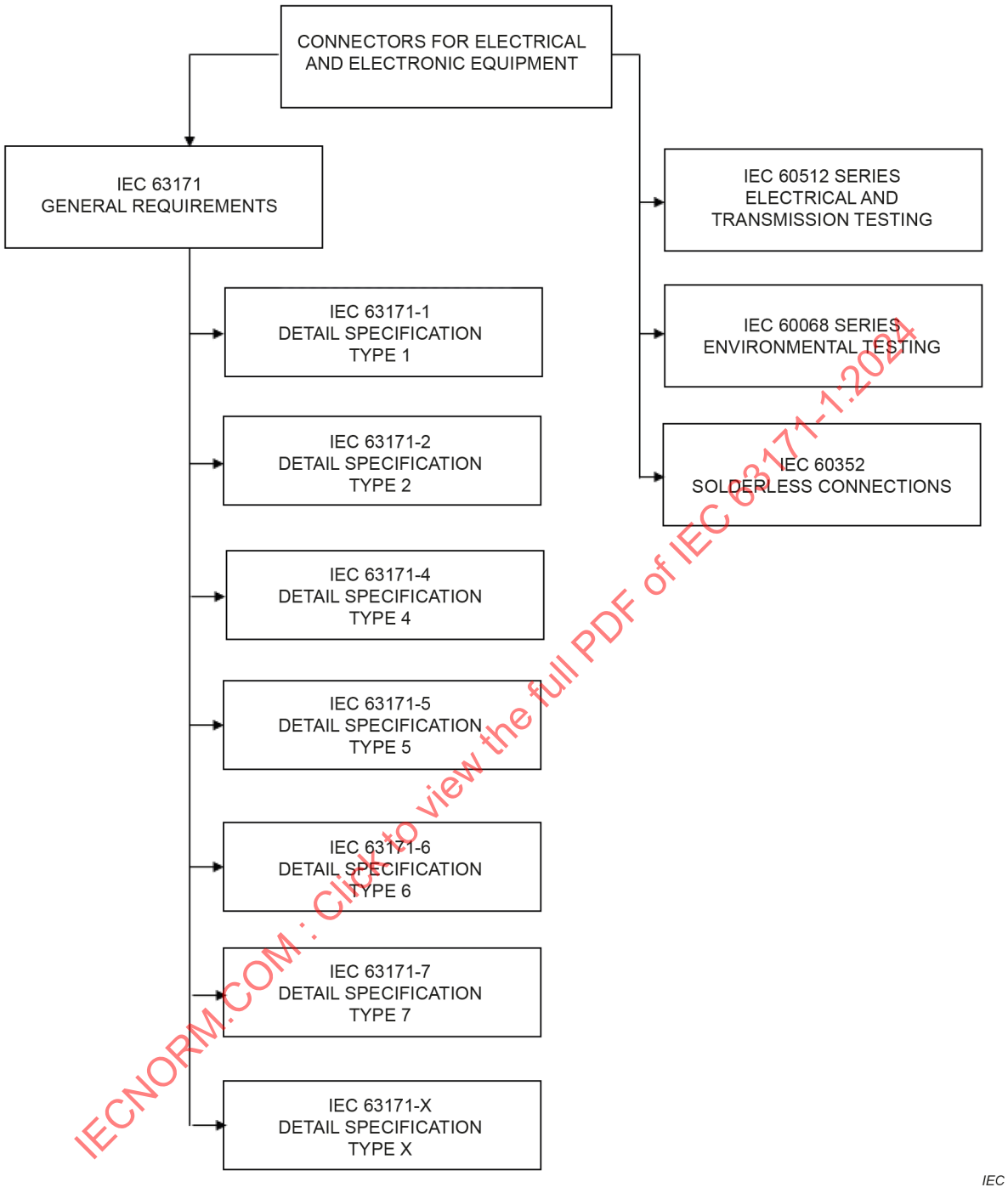


Figure 1 – Relationships between the IEC 63171 series and its related references

NOTE The project for Type 3 connectors detail specification was cancelled.

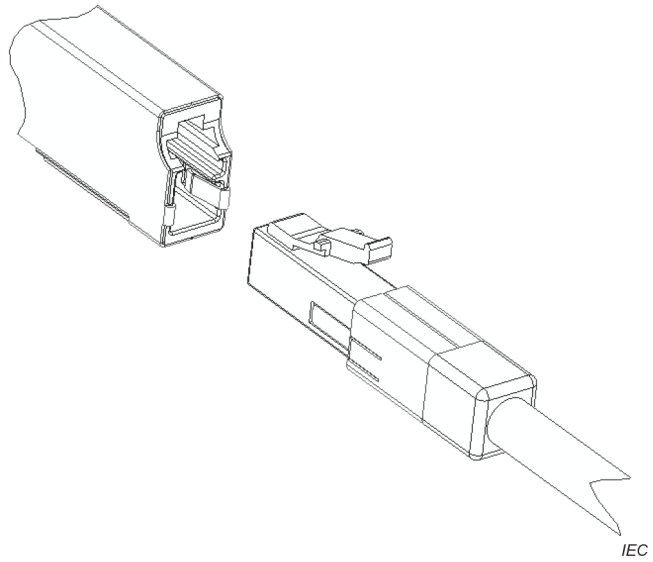
International Electrotechnical Commission	IEC 63171-1 Ed2
Subcommittee 48B: Electrical connectors	
 View showing typical fixed and free connectors	Two-way, free and fixed connectors for balanced single-pair data transmission with frequencies up to 600 MHz and with current carrying capacity up to 2,0 A at 60 °C. Fixed connectors are mounted on printed circuit board or bulkhead, the free connector is terminated on shielded or unshielded wire.

Figure 2 – Connector overview

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –

Part 1: Detail specification for 2-way, shielded or unshielded, free and fixed connectors – Mechanical mating information, pin assignment and additional requirements for Type 1 (copper LC style)

1 Scope

This part of IEC 63171 covers two-way, shielded or unshielded, free and fixed connectors known as Type 1, for balanced single-pair data transmission with frequencies up to 600 MHz and with current carrying capacity up to 2,0 A at 60 °C.

It specifies the common dimensions, and provides the mechanical, electrical, signal integrity, and environmental characteristics, the reliability specifications and corresponding tests for these connectors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-581:2008, *International Electrotechnical Vocabulary (IEV) – Part 581: Electromechanical components for electronic equipment*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60512-1:2018, *Connectors for electrical and electronic equipment – Tests and measurements – Part 1: Generic specification*

IEC 61754-20:2012, *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 20: Type LC connector family*
IEC 61754-20:2012/AMD1:2022

IEC 63171:2021, *Connectors for electrical and electronic equipment – Shielded or unshielded free and fixed connectors for balanced single-pair data transmission with current-carrying capacity – General requirements and tests*

ISO/IEC 11801-1:2017, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581, IEC 60512-1 and IEC 63171 apply, as well as the following.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
copper LC style
electrical connector having similar form factor to the LC fibre optic connectors according to IEC 61754-20, the two being not intermateable

Note 1 to entry: The addition "copper" is used to distinguish between the two styles of connectors.

Note 2 to entry: The Type 1 connectors are also known as "copper LC style".

4 Common features and typical connector pair

4.1 Mating information

4.1.1 General

Dimensions are given in millimetres. Drawings are shown in third-angle projection. The shape of connectors may deviate from those given in Figure 2 through Figure 6 as long as the dimensions specified are not changed (see also Table 1 through Table 3).

Figure 4 and Figure 6 show the shielded connector variants.

Unshielded connectors shall conform to the specified fixed and free connector mating dimensions of shielded connectors shown in Figure 4, except for dimensions R, S, T and AN, and in Figure 6, except for dimensions AU, AV, and AW, the exceptions being related to the shield.

Unshielded connectors shall comply with IL, RL, TCL, and TCTL transmission requirements in 6.7.3.8 and their data sheets shall indicate the specific requirements of this document to which they comply.

4.1.2 Interoperability

Interoperability of connectors from different sources that comply to this document is assured as a pre-requisite by compliance with the specified interface dimensions (intermateability) and by the relevant signal integrity tests specified, once connectors from different source are specified for the same categories (A, B or C) as specified in IEC 63171.

Type 1 (copper LC style) shielded and unshielded connectors are interoperable for their transmission performance and can be exchanged; although the shielded versions have improved alien crosstalk and coupling attenuation properties.

The design of these copper LC style connectors contains features in both the free and fixed connectors that prevent intermateability with a standard LC fibre optic connector according to IEC 61754-20. The key featured in the fixed connector, as shown in Figure 4c), prevents the insertion of an LC fibre optic free connector. The height of the free connector, shown in Figure 6b) (dimension AY), prevents its insertion into an LC fibre optic fixed connector.

4.1.3 Contacts – Mating conditions

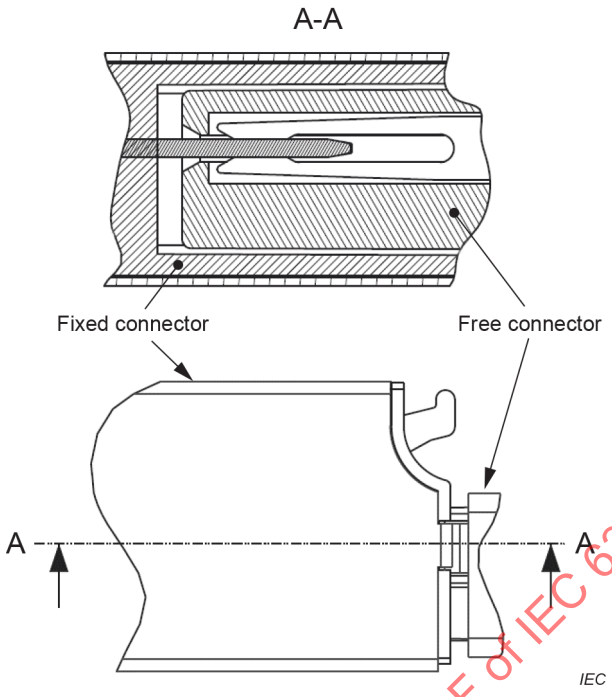
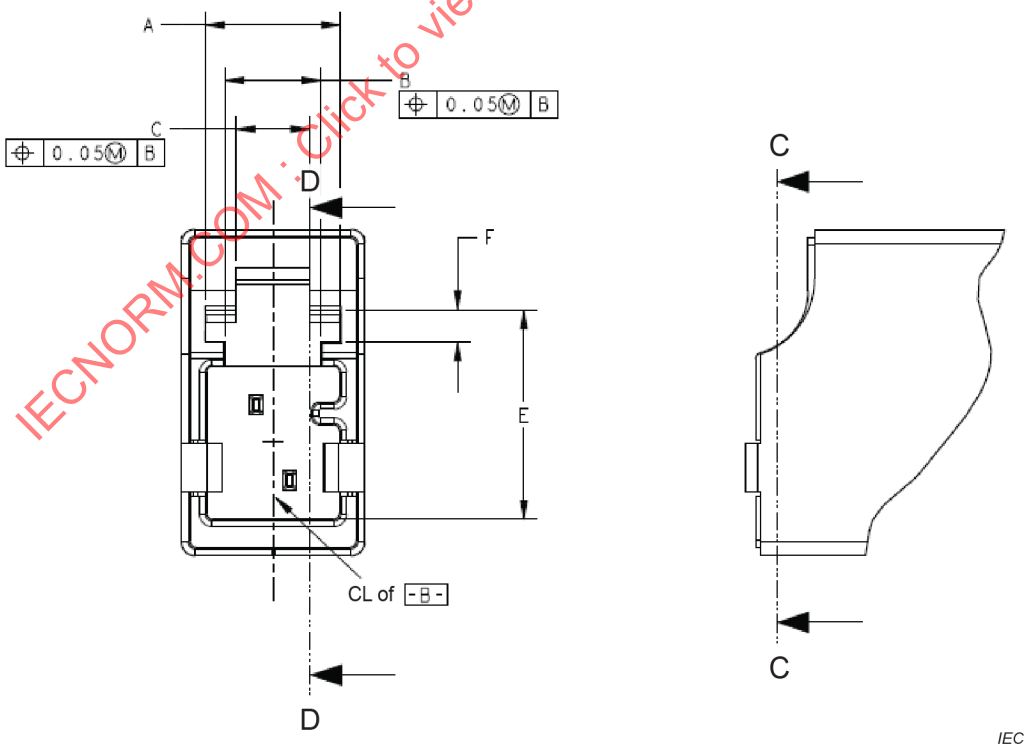


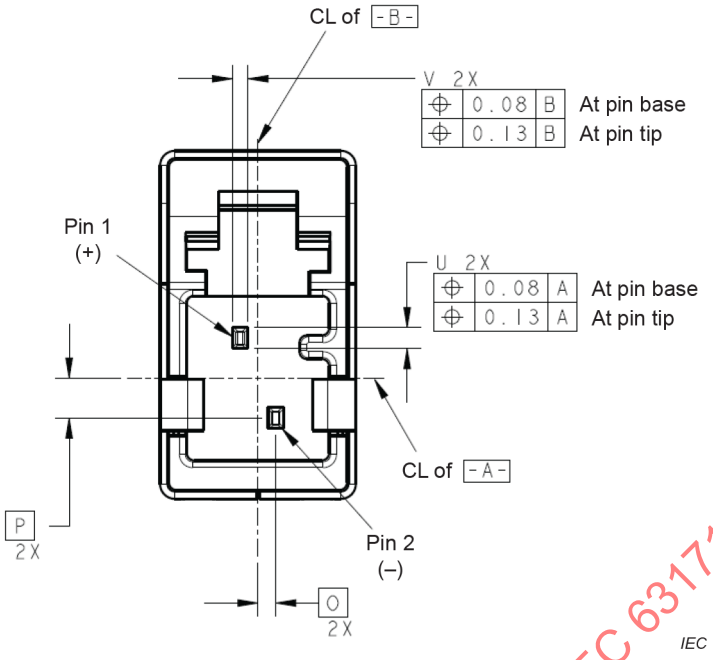
Figure 3 – Mated fixed and free Type 1 connectors

4.1.4 Fixed connector

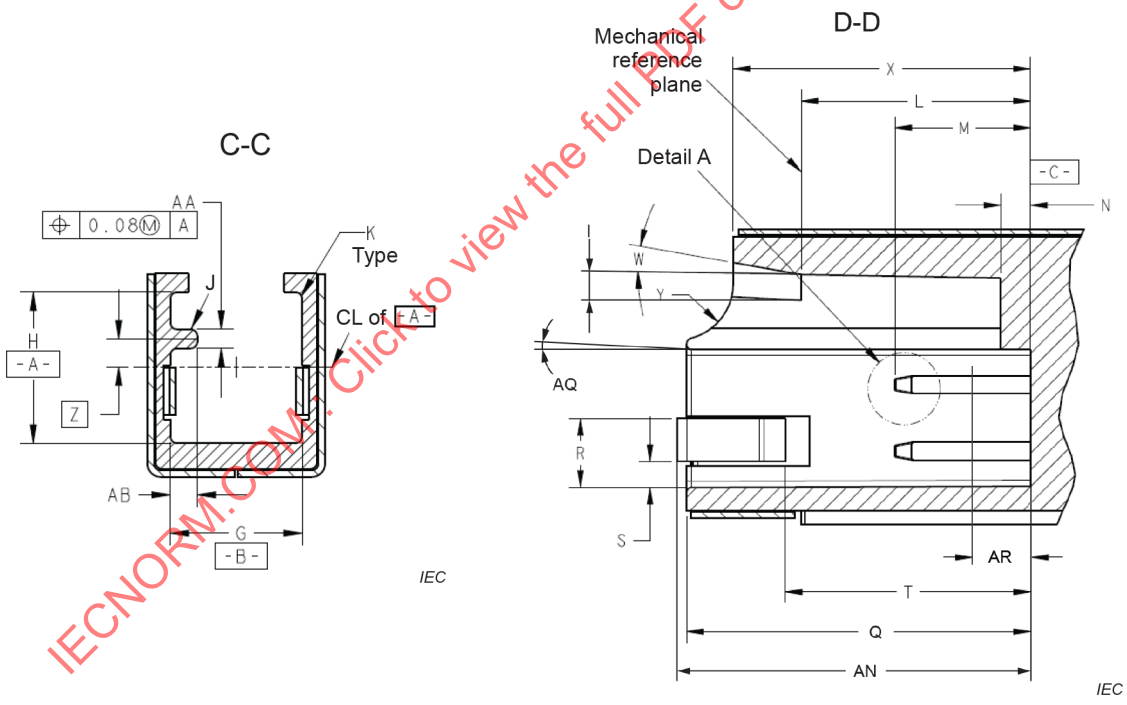
Dimensions in millimetres



a) Fixed connector



b) Pin detail



c) Section views of fixed connector

Figure 4 – Fixed Type 1 connector

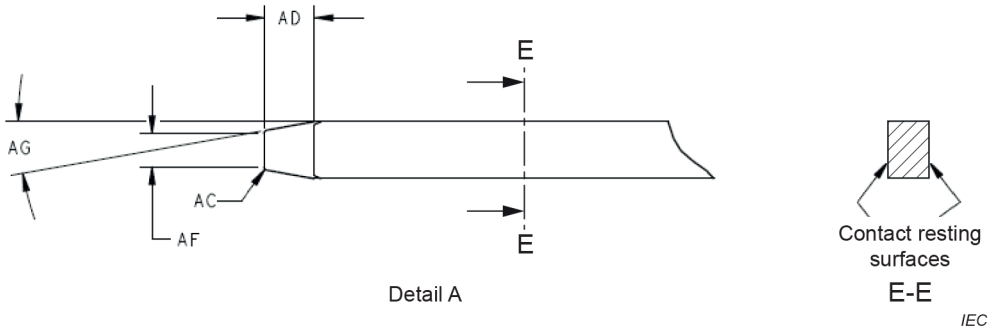
Table 1 – Dimensions for Figure 4a), Figure 4b) and Figure 4c)

Dimensions in mm

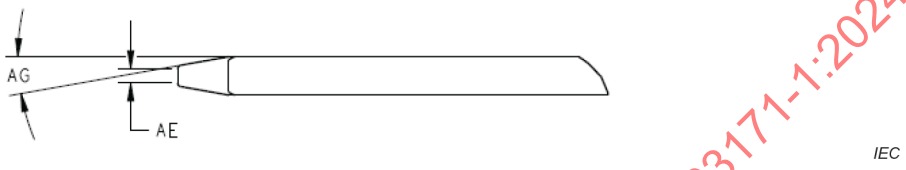
Reference	Dimensions			Notes
	Minimum	Nominal	Maximum	
A	4,5	4,8	-	
B	3,4	3,45	3,5	
C	2,6	2,65	2,7	
D	[a]			
E	7,55	7,6	7,65	
F	1,1	1,15	1,2	
G	4,65	4,7	4,75	
H	5,55	5,6	5,65	
I	1,0	1,05	1,1	-
J	0,3	-	-	Radius
K			0,3	Radius
L	9,2	9,3	9,4	
M	5,4	5,5	5,6	
N	1,1	1,2	1,3	
O		0,6		Basic dimension
P		1,35		Basic dimension
Q	13,85	13,95	14,05	
R		-	2,7	Shield contact area*
S	1,2			Shield contact area*
T	-	-	10	Shield contact area*
U	0,71	0,76	0,81	At base of pin
V	0,50	0,51	0,52	At base of pin
W	15,0°			
X	11,9	12,0	12,1	
Y	2,2	2,3	2,4	Radius
Z		1,05		Basic dimension
AA	0,65	0,7	0,75	
AB	0,85	0,90	0,95	
AN	-	-	15,0	*
AQ	-	-	0,2°	Draft angle
AR	2,20	-	-	Contact resting point

* refers to shielded connectors only.

[a] Care shall be taken that all shield contacts of the fixed connector always make contact with the shield contacts of the free connector in the worst-case condition to ensure reliable performance.



a) Pin side view



b) Pin bottom view

Figure 5 – Fixed Type 1 connector pin detail (detail A from Figure 4c) section D-D)

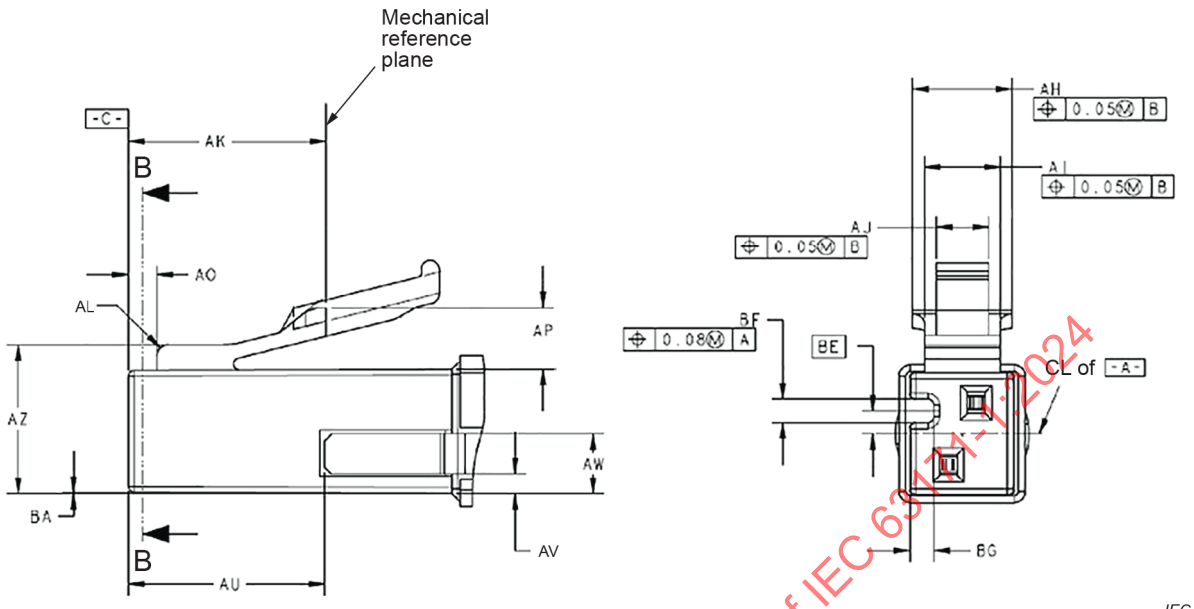
Table 2 – Dimensions for Figure 5

Dimensions in mm

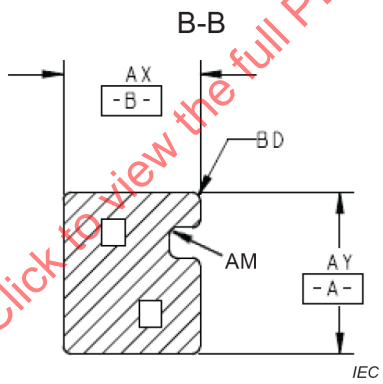
Reference	Dimensions			Notes
	Minimum	Nominal	Maximum	
AC	0,03	-	-	Radius (typical)
AD	0,6	0,7	0,8	
AE			0,4	Reference
AF			0,6	Reference
AG	9,5°	10°	10,5°	Typical

4.1.5 Free connector

Dimensions in millimetres



a) Free Type 1 connector



b) Section B-B view of free connector

Figure 6 – Free Type 1 connector

Table 3 – Dimensions for Figure 6a) and Figure 6b)

Dimensions in mm

Reference	Dimensions			Notes
	Minimum	Nominal	Maximum	
AH	4,2	4,3	4,4	
AI	3,2	3,25	3,35	
AJ	2,2	2,3	2,4	
AK	8,5	8,6	8,7	
AL	0,4	0,5	0,6	Radius
AM			0,3	Radius
AO	1,1	1,2	1,3	
AP	2,7	2,8	2,9	
AU	-	-	8,5	Shield contact area*
AV	-	-	0,8	Shield contact area*
AW	2,7	-	-	Shield contact area*
AX	4,42	4,47	4,52	Applicable to entire surface
AY	5,32	5,37	5,42	Applicable to entire surface
AZ	6,5	6,55	6,6	
BA	0°	0,1°	0,2°	Draft angle
BD	0,3	-	-	Radius
BE	-	1,05	-	Basic dimension
BF	0,95	1,0	1,05	
BG	0,9	1,0	1,05	

* refers to shielded connectors only.

5 Characteristics

5.1 General

Conformance to the test schedules shall ensure the reliability of all performance parameters, including transmission parameters, over the range of operating climatic conditions.

5.2 Pin assignment

Pin assignment of Type 1 connectors shall be as indicated in Figure 4b).

5.3 Classification into climatic category

The temperature range and climatic category shall be compatible with ISO/IEC 11801-1 classification of a $M_1I_1C_1E_1$ environment. This is achieved by the climatic category 10/090/21 as defined in IEC 60068-1.

The damp heat, steady state test required by this climatic category is satisfied by either test group AP (AP8) or test group GP (GP2).

The dry heat test at UCT 90 °C required by this climatic category is satisfied by test group EP (EP1) at 70 °C with the electrical load likely to produce the UCT within the test specimens.

5.4 Electrical characteristics

5.4.1 Creepage and clearance distances

See 5.4.1 of IEC 63171:2021.

The creepage and clearance distances given in Table 4 apply as operating characteristics for mated connectors according to this document.

Table 4 – Creepage and clearance distances

Dimensions in mm

Minimum distance between contacts and chassis		Minimum distance between adjacent contacts	
Creepage	Clearance	Creepage	Clearance
1,40	0,51	0,40	0,40

5.4.2 Voltage proof

According to 5.4.2 of IEC 63171:2021.

Except 1 500 V DC or AC peak; all contacts connected together to shield (if applicable).

5.4.3 Current-temperature derating

According to Level I of 5.4.3 of IEC 63171:2021.

5.4.4 Initial contact resistance – interface only

According to 5.4.4 of IEC 63171:2021.

5.4.5 Input to output DC resistance

According to 5.4.5 of IEC 63171:2021.

5.4.6 Input to output DC resistance unbalanced

According to 5.4.6 of IEC 63171:2021.

Except all types 50 mΩ maximum.

5.4.7 Initial insulation resistance

According to 5.4.7 of IEC 63171:2021.

Except test voltage 100 V DC and all types 500 MΩ minimum.

5.5 Transmission characteristics

5.5.1 General

According to category B of 5.5.1 of IEC 63171:2021.

5.5.2 Insertion loss (IL)

According to category B of 5.5.2 of IEC 63171:2021.

5.5.3 Return loss (RL)

According to category B of 5.5.3 of IEC 63171:2021.

5.5.4 Propagation delay

According to of 5.5.4 of IEC 63171:2021.

5.5.5 Transverse conversion loss (TCL)

According to category B of 5.5.5 of IEC 63171:2021.

5.5.6 Transverse conversion transfer loss (TCTL)

According to category B of 5.5.6 of IEC 63171:2021.

5.5.7 Transfer impedance (shielded only)

According to 5.5.7 of IEC 63171:2021.

5.5.8 Coupling attenuation

According to environmental description E1 of 5.5.8 of IEC 63171:2021.

Except minimum coupling attenuation ≥ 100 – 20 log() dB from 0,1 MHz to 1 250 MHz. Whenever the formula results in a value greater than 75 dB, the requirement shall revert to 75 dB.

5.5.9 Power sum alien (exogenous) NEXT

According to category B of 5.5.9 of IEC 63171:2021.

5.5.10 Power sum alien (exogenous) FEXT

According to category B of 5.5.10 of IEC 63171:2021.

Except in Table 7 minimum PS AFEXT dB shielded limit is 120-20 log(f).

5.6 Mechanical characteristics

5.6.1 Mechanical operation

According to Mating Performance Level MPL750 of 5.6.1 of IEC 63171:2021.

5.6.2 Effectiveness of connector coupling devices

According to connector style Latch of 5.6.2 of IEC 63171:2021.

5.6.3 Insertion and withdrawal forces

According to connector style Latch of 5.6.3 of IEC 63171:2021.

5.6.4 Polarizing method

According to 5.6.4 of IEC 63171:2021.

5.6.5 Dynamic stress

According to 5.6.5 of IEC 63171:2021.