

INTERNATIONAL STANDARD

IEC
61076-3-001

QC 480201

First edition
1999-11

**Connectors for use in d.c., low-frequency
analogue and digital high-speed data applications –**

**Part 3-001:
Rectangular connectors with assessed quality –
Blank detail specification**

*Connecteurs pour applications analogiques en courant continu
et basse fréquence et pour applications numériques utilisant
des débits élevés pour le transfert des données –*

*Partie 3-001:
Connecteurs rectangulaires sous assurance de la qualité –
Spécification particulière cadre*



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Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary (IEV)*.

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment*, *Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONNECTORS FOR USE IN DC, LOW-FREQUENCY ANALOGUE AND DIGITAL HIGH-SPEED DATA APPLICATIONS –

Part 3-001: Rectangular connectors with assessed quality – Blank detail specification

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61076-3-001 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/791/FDIS	48B/820/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.

Annex A forms an integral part of this standard.

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

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

The committee has decided that this publication remains valid until 2004. At this date, in accordance with the committee's decision, the publication will be

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

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

In prior years, IEC subcommittee 48B had prepared detail specifications as part of a two-level document system. When the IECQ system was introduced, SC 48B was urged to consider changing to the four-level specification system as described in IEC Guide 102. This blank detail specification is part of that four-level document system.

This blank detail specification is a supplementary document to the sectional specification IEC 61076-3 and contains requirements for style, lay-out and minimum content of detail specifications. It is to be used in conjunction with the following publications: IEC 61076-1 and IEC 61076-3.

For the scope and definition of this blank detail specification, see 1.2.2 of IEC 61076-1 and 1.1 of IEC 61076-3.

Detail specifications not complying with these requirements shall not be considered as being in accordance with the IECQ system, nor shall they be so described.

The complete requirements for the rectangular connectors described herein should correspond to this blank detail specification and the current issues of IEC 61076-1 and IEC 61076-3.

In the preparation of detail specifications, the contents of 1.2.3 of IEC 61076-1 should be taken into account.

Guidance notes

The following pages give a recommended layout of a detail specification. The contents of this page give guidance on the information which should, wherever possible, be given on the front page of a detail specification (see IEC Guide 102).

For the scope and definition of a detail specification, see 1.2.3 of IEC 61076-1.

The numbers between brackets on the front page of the detail specification correspond to the following information.

Identification of the detail specification

- [1] The International Electrotechnical Commission or the national standards organization under whose authority the detail specification is drafted. It shall also be stated where the detail specification may be obtained.
- [2] The IECQ/IEC number of the detail specification and date of issue.
- [3] The IECQ/IEC number and issue number of the generic and the sectional specifications.
- [4] The national number of the detail specification, if it differs from the IECQ/IEC number.

Identification of the connector

- [5] A short description of the type of connector.
- [6] Information on the typical construction of the connector, for example, it should be stated whether the connector is suitable for mounting on printed boards.
- [7] Outline drawing, preferably of isometric or similar projection, from which the connector may be clearly identified.
- [8] Information on performance level(s) and assessment level(s) specified in the document.
- [9] Reference data on the most important properties, to allow comparison between the various connector types.

NOTE It may be convenient to give some of this information in tabular form.

[1]	IECQ/IEC Detail specification number [2]
Generic specification number Electronic components of assessed quality in accordance with: [3]	National number of detail specification (it is not necessary to use this if the IECQ/IEC number is identical) [4]
Outline drawing [7]	Product description [5]
	[6]
	[8]
	Performance level(s): Assessment level(s): Combination of performance levels and assessment levels:
	Reference data [9]
Information on the availability of components qualified to this detail specification is given in the qualified products lists.	

1 General information

1.1 Recommended method of mounting

For guidance on the application of these connectors in mechanical structures, see annex A of IEC 60917.

1.1.1 Number of contacts or contact cavities

1.2 Ratings and characteristics

Rated voltage	Current rating at 70 °C
Insulation resistance	Climatic category
Contact spacing	

Guidance notes

1.3 Reference documents

It may be necessary to refer to other documents in addition to those stated, in which case the list of related documents shall be extended beyond those referenced.

If standards are referenced which are already listed in IEC 61076-1 and IEC 61076-3, their reference shall not be repeated in 1.5 of the detail specification.

1.4 Marking

The marking of the connector and the package shall be in accordance with 2.6 of IEC 61076-3.

1.3 Reference documents

IEC 60068-2-60:1995, *Environmental testing – Part 2: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 61076-3:1999, *Connectors for use in d.c., low-frequency analogue and digital high speed data applications – Part 3: Rectangular connectors with assessed quality – Sectional specification*

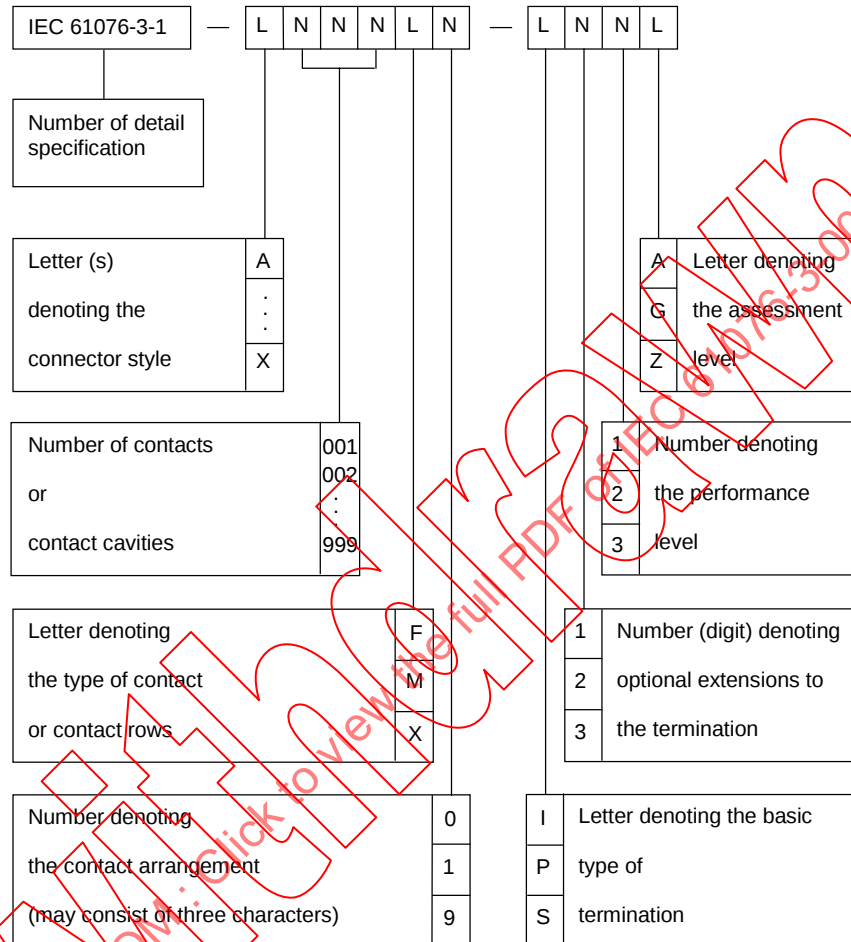
1.4 Marking

Guidance notes

1.5 IEC type designation

The designation shall be derived from 2.5 of IEC 61076-3.

Example:



1.6 Ordering information

For ordering connectors according to this detail specification, the type designation described in 1.6 shall be used.

1.5 IEC type designation

1.6 Ordering information

Guidance notes

2 Technical information

The detail specification shall contain information which contributes to a proper application of the connectors. It will also provide specificities for a better understanding of the detail specification.

2.1 Definitions

In addition to the terminology used in, and applicable to, the detail specification, as stated in 2.1 of IEC 61076-3, it is recommended that those definitions which are unique to the connectors specified be listed in the detail specification.

2.2 Survey of styles and variants

Should the detail specification be applicable to a range of styles and/or variants, a survey of the range covered shall be included in the form of a table in the detail specification. Table 1 may be amended to include additional and/or alternative details, if this is applicable, to describe the styles and variants.

NOTE Tables used in detail specifications are to be numbered in sequence. The numbering in this standard has been used as an example, and therefore numbered as "x".

2.3 Information on application

If required, rules and recommendations for the use of the connectors specified in the detail specification shall, unless sufficiently covered by dimensional information in clause 3, be listed for

2.3.1 Complete connectors (pairs)

2.3.2 Fixed connectors

2.3.3 Free connectors

NOTE The category of free connectors includes free coupler connectors. These connectors have coupling or latching hardware as an integral part of the connector. Information about the coupling hardware should be included, as necessary, in clauses 2, 3, and 5.

2 Technical information

2.1 Definitions

2.2 Survey of styles and variants

Table 1 – Styles and variants

Connector style and number of contacts	Style reference letter				

2.3 Information on application

2.3.1 Complete connectors (pairs)

2.3.2 Fixed connectors

2.3.3 Free connectors

Guidance notes

2.3.4 Accessories

When accessories provide an essential support to the application of the connectors, the features and use shall be outlined in the detail specification, where applicable.

2.3.4.1 Special contacts

In case special contacts are used in conjunction with the contacts specified in the detail specification, information on these contacts shall be presented for information only, given the fact that no detail specification of such contacts has been published. Special contacts are defined as usually removable contacts for high-current, high-voltage, RF, filter or FO applications.

2.3.4.2 Coding devices

When coding devices, which are not an integral part of the connector, are used, separate information shall be given in the detail specification.

2.3.4.3 Mounting devices

When mounting devices, which do not form an integral part of the connector, are recommended, information on these devices shall be presented in the detail specification for reference only.

2.3.5 Shielding/grounding

When shielding and/or grounding features, which cannot be considered as an integral part of the connector or an accessory, are offered, information shall be given in the detail specification.

2.3.6 Basic type of terminations

When different types of terminations are possible, information on use shall be presented in the detail specification in tabular form.

More detailed dimensional information may be provided by those parts of the detail specification which describe the dimensions of fixed and free board connectors.

If no significant differences occur between terminations of fixed and free connectors, the information may be included in this clause instead.

2.4 Contact arrangements

When different mechanical contact loading per connector insert is possible and influences the intended application of the connector, information shall be given in the detail specification, preferably in the form of drawings or tables.

These arrangements shall be specified by the appropriate combination of the IEC type designation specified in 1.7 of the detail specification.

2.3.4 Accessories

2.3.4.1 Special contacts

2.3.4.2 Coding devices

2.3.4.3 Mounting devices

2.3.5 Shielding/grounding

2.3.6 Basic type of terminations

2.4 Contact arrangements

Guidance notes

3 Dimensional information

In order to facilitate comparison of various specifications, a uniform presentation of drawing information is recommended in accordance with 2.7.1 of IEC 61076-1.

Drawings and dimensions shall cover

- a) isometric view showing the basic design including common characteristics of related connectors;
- b) fixed connectors;
- c) free connectors and/or board-edge of printed boards;
- d) mating information;
- e) accessories;
- f) mounting information for fixed connectors;
- g) mounting information for free connectors, if applicable;
- h) mounting information for connectors with accessories;
- i) testing gauges, probes and test panels.

3.1 General

It shall be stated in the detail specification if original dimensions are millimetres or inches.

It shall be stated in the detail specification if drawings are shown in first-angle or in third-angle projection.

The system of lettering shall be as described by 2.7.1.1 of IEC 61076-1.

The following statement shall be included in the detail specification:

The shape of the connectors may deviate from those given in the following drawings as long as the specified dimensions are not influenced.

Wherever practical, the same dimension letters shall be used for corresponding dimensions of fixed and free connectors.

3.2 Isometric view and common features

An isometric view shall be included and shall show the main characteristics of the design including common features, if applicable.

It is convenient to show the dimension reference, the dimension and the feature description in the form of a table (see table 2).

3 Dimensional information

3.1 General

The shape of the connectors may deviate from those given in the following drawings as long as the specified dimensions are not influenced.

3.2 Isometric view and common features

Table 2 – Isometric view and common features

Reference	Dimension	Feature description

Guidance notes

3.2.1 Common features

A description of all the common features relating to the style of connectors covered by the detail specification shall be included.

Data which could be specified includes

- a) datum point or datum line with reference to the datum;
- b) position of the mounting hole(s) of the fixed connector;
- c) position of the terminations of the fixed connector;
- d) position of the free or edge-socket connector;
- e) position of the mounting holes of the free connector or the terminations of an edge-socket connector;
- f) position of the printed board;
- g) position of the grid of the printed board.

3.2.2 Reference system

The detail specification shall state the coordination dimensions to allow for (modular) arrangement of the connector parts. When such reference system is based on guidelines for mechanical structures, it is recommended to refer to such information.

3.2.3 Height dimensions

When multiple connectors or connector modules are mounted onto a printed board, the height dimension to the backplane and the datum line of a subrack shall be stated in the detail specification.

3.2.4 Width dimensions

To show the width positioning of individual printed boards in relation to the datum line of the backplane, which is part of a mechanical structure, such dimensions shall be stated in the detail specification.

3.2.5 Depth dimensions

To provide essential information about the position of the edge of a printed board or the fixed connector versus the free connector, depth dimensions shall be stated in the detail specification.

3.2.1 Common features

3.2.2 Reference system

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

3.2.3 Height dimensions

3.2.4 Width dimensions

3.2.5 Depth dimensions

Guidance notes

3.3 Engagement (mating) information

Details of the limiting factors, within which correct engagement (mating) is ensured relates to dimensional data on the following:

3.3.1 Engaging (mating) direction

The range over which the specified contact resistance is ensured in the plug-in direction.

3.3.1.1 Contact levels and sequencing

Dimensional parameters of the different contact levels and their sequence, if applicable.

3.3.2 Perpendicular to the engaging (mating) direction

The maximum allowable displacement in the perpendicular direction which can be accommodated.

3.3.3 Inclination

The maximum allowable inclination in the longitudinal and transverse axes in the form of appropriate drawings and tables.

NOTE The specification may be given with the aid of drawings if this ensures clarity.

3.4 Fixed connectors

3.4.1 Dimensions

The detail specification shall include (an) outline drawing(s) of the fixed connector(s) showing the prime dimensions and associated geometrical tolerances.

For clarity the value of the dimensions may be included as tables which may be separated for those dimensions which are common to all styles/variants and those dimensions which are particular to styles/variants.

Details of marking of contact positions; within a row by numbers and marking of contact rows by letters shall be included in the drawing(s).

3.4.2 Terminations

The detail specification shall include termination length, width, thickness, and diagonal dimensions, as appropriate.

Dimensional details of the terminations (lengths, thicknesses, diagonals, etc.) and their intended application which may be specified by the appropriate combination of the IEC type designation specified in 1.5 of the detail specification.

3.3 Engagement (mating) information

3.3.1 Engaging (mating) direction

3.3.1.1 Contact levels and sequencing

3.3.2 Perpendicular to the engaging (mating) direction

3.3.3 Inclination

3.4 Fixed connectors

3.4.1 Dimensions

3.4.2 Terminations

Guidance notes

3.5 Free connectors

3.5.1 Dimensions

(An) outline drawing(s) with prime dimensional and geometrical tolerances shall be included in the detail specification.

3.5.2 Terminations

The detail specification shall include termination length, width, thickness, and diagonal dimensions, as appropriate.

3.6 Accessories

In cases where accessories may be used with the connectors, outline drawings with prime dimensions shall be included in the detail specification.

Accessories may take the form of optional mounting hardware, coding devices, shielded contacts, high current contacts, etc., which are not normally provided fitted to the connector.

Information on accessories may be presented as outline drawings with associated tabular data similar to that used for the connector dimensional details.

3.7 Mounting information for fixed connectors

3.7.1 Hole pattern on printed boards

The detail specification shall show a plan view drawing of the hole pattern required in the printed board and the position(s) and size of mounting hole(s) that are necessary to mount to the connector. It shall be stated from which side of the printed board the view is drawn.

A table of dimensions shall be included.

The plan view drawing shall use the same dimensional references as those used in 3.4.1 for the dimensions shown.

The hole sizes with tolerances shall be stated for both termination and mounting holes, together with appropriate geometrical tolerances.

Plated-through hole dimensions for press-in terminations shall be in accordance with IEC 60352-5.

The table of dimensions shall state the dimensions in the same order as that used in 3.4.1, wherever possible.

3.5 Free connectors

3.5.1 Dimensions

3.5.2 Terminations

3.6 Accessories

3.7 Mounting information for fixed connectors

3.7.1 Hole pattern on printed boards

Guidance notes

3.7.2 Mounting on panels

The detail specification shall show a plan view drawing of the required panel aperture and the position(s) and size of mounting hole(s).

The minimum sizes of the dimensions of the panel aperture shall be stated together with the relative position of the aperture to the mounting holes.

Where appropriate, dimensional references shall be the same as those used in 3.4.1.

3.8 Mounting information for free connectors

The detail specification shall show a plan view drawing of the hole pattern required in the printed board and the position(s) and size of the mounting hole(s) that are necessary to mount the connector.

The relationship of the hole pattern to the edge of the printed board shall be stated if appropriate.

It shall be stated from which side of the printed board the view is drawn.

A table of dimensions shall be included.

The plan view drawing shall use the same dimensional references as those used in 3.5.1 for the dimensions shown.

The hole sizes with tolerances shall be stated for both termination and mounting holes, together with appropriate geometric tolerances.

Plated-through hole dimensions for press-in terminations shall be in accordance with IEC 60352-5.

A table of dimensions shall be included and shall state the dimensions in the same order as that used in 3.5.1, wherever possible.

3.9 Gauges

3.9.1 Sizing gauges and retention force gauges

Drawings of the gauges required to size and measure the retention force of resilient contacts shall be included in the detail specification.

The drawings of the gauges shall specify the material to be used for the gauges, the minimum hardness value of the gauges, the surface according to ISO 1302, and the surface finish to be applied, if any.

The dimensions and tolerances stated shall include wear allowance.

Sizing gauges shall simulate the maximum conditions, retention force gauges shall simulate the minimum conditions.

The mass of the retention gauges shall be stated.

3.7.2 Mounting on panels

3.8 Mounting information for free connectors

3.9 Gauges

3.9.1 Sizing gauges and retention force gauges

Guidance notes

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

Where appropriate, drawings of the gauges required to conduct endurance testing and for measurement of engaging/separating forces or insertion/withdrawal forces shall be included in the detail specification. The drawings of the gauges shall specify the material to be used for the gauges, the surface according to ISO 1302, and the surface finish to be applied.

The gauges shall simulate nominal conditions.

3.9.3 Probes

Probe damage testing is intended to apply only to female contacts.

The test probe shall be specified in the detail specification in accordance with the requirements of test 16a of IEC 60512.

3.9.4 Contact resistance gauge

For edge-socket and other types of one-part connectors, the contact resistance measurement shall be made using a gauge made of copper alloy (or other appropriate material) of minimum thickness or a suitable printed board as defined in the detail specification.

A surface condition according to ISO 1302, and a suitable surface finish compatible with that of the contacts of the connector to be tested shall be specified.

3.9.5 Test panel (for voltage proof test)

The drawing of the test panel shall show the minimum allowable aperture, the mounting hole position(s) and size, and the panel thickness.

The panel shall be manufactured from an electrically conductive material which may have a suitable surface finish.

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

3.9.3 Probes

3.9.4 Contact resistance gauge

3.9.5 Test panel (for voltage proof test)

Guidance notes

4 Characteristics

To provide information on specified essential electrical and mechanical characteristics, preferred methods of tests and measurements are listed, additional characteristics may be added to the detail specification, when appropriate, for example in test group HP. See also clause 4 of IEC 61076-3.

4.1 Climatic category

The climatic category of the connector shall be stated in the detail specification, in accordance with 2.2 of IEC 61076-3.

The detail specification may contain more than one performance level, to which the climatic category is linked. The relationship may be clarified by showing the details in a table, for example:

Table 3 – Performance levels

Performance level	Climatic category	Temperature		Damp heat, steady state: number of days
		Lower °C	Upper °C	
1	55/125/56	–55	125	56
2	25/085/10	–25	85	10

4.2 Electrical characteristics

4.2.1 Creepage and clearance distances

These parameters are quoted in table 4 as an example. If these dimensions differ per connector style, a reference to such style shall be given. If it could occur in the application of the connectors that there is the possibility of a reduction of the creepage or clearance distances, then the following note shall be included in the detail specification:

Application information – The permissible rated voltage depends on the application or specified safety requirements. Reductions in creepage or clearance distances may occur due to the printed board or wiring used, and shall duly be taken into account.

A rated voltage is the value of the voltage, assigned to a connector by the manufacturer, to which operation and performance characteristics are referred. This value may be added to the table.

4.2.2 Voltage proof

The detail specification shall state

- that the connector shall be mounted to the test panel specified in 3.9.5;
- whether test method A, B or C is applicable;
- the d.c. or a.c. r.m.s. voltage that shall be applied, contact to contact, and contact to test panel.

The information may be presented in the form of a table.

4 Characteristics

4.1 Climatic category

Table 3 – Performance levels

Performance level	Climatic category	Temperature		Damp heat, steady state: number of days
		Lower °C	Upper °C	

4.2 Electrical characteristics

4.2.1 Creepage and clearance distances

Table 4 – Creepage and clearance distances

Connector style and number of contacts	Style reference letter(s)				
Minimum creepage and clearance distance					

Application information – The permissible rated voltage depends on the application or specified safety requirements. Reductions in creepage or clearance distances may occur due to the printed board or wiring used, and shall duly be taken into account.

4.2.2 Voltage proof

Condition: IEC 60512, test 4a.

Standard atmospheric conditions.

Guidance notes

4.2.3 Current-carrying capacity

The detail specification shall show a current-carrying capacity curve for the connector determined in accordance with the test procedure of test 5b of IEC 60512. The preparation of specimen, type and size of cable/wire bundle shall be as specified in 5.1.4.

As an alternative, one value of current at a stated temperature on the current-carrying capacity curve, together with the maximum operating temperature, may be stated in the detail specification. Derating values in tabular form are also permitted, providing a minimum of two points, including the ambient and the maximum temperatures, are given.

Important values, for example the current at 70 °C, shall be shown in a derating graph.

4.2.4 Contact resistance

The detail specification shall state if the measurement is to be taken with mated connectors or with a contact resistance gauge as specified in 3.9.4.

The detail specification shall state the maximum allowable value of the contact resistance in milliohms (mΩ). Initial resistance, resistance after testing and resistance including terminations (if applicable) shall be given. The connecting points shall be as specified in 5.1.1.

4.2.5 Insulation resistance

The detail specification shall state

- a) that the connector shall be mounted to the test panel specified in 3.9.5;
- b) whether test method A, B or C is applicable;
- c) the d.c. voltage that shall be applied, contact to contact, and contact to test panel;
- d) the minimum allowable value of insulation resistance, in megaohms (MΩ), initially and after testing.

The information may be presented in the form of a table, which shall be numbered in the appropriate sequence.

4.3 Mechanical characteristics

4.3.1 Mechanical operation

The detail specification shall state

- a) the frequency of the operations;
- b) the speed of the operations;
- c) the number of mechanical operations;
- d) any pause time, mated or unmated (deviation from the standard method).

If the detail specification contains more than one performance level, to which the number of mechanical operations is linked, the relationship may be clarified by showing the details in a table.

4.2.3 Current-carrying capacity

Conditions: IEC 60512, test 5b

All contacts

Values at 70 °C are shown in a derating graph.

4.2.4 Contact resistance

Conditions: IEC 60512, test 2a

Standard atmospheric conditions

4.2.5 Insulation resistance

Conditions: IEC 60512, test 3a

Standard atmospheric conditions

4.3 Mechanical characteristics

4.3.1 Mechanical operation

Conditions: IEC 60512, test 9a

Standard atmospheric conditions

Guidance notes

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

The detail specification shall state

- a) the maximum allowable value of the engaging (or insertion) force;
- b) the minimum allowable value of the separating (or withdrawal) force;
- c) the rate of engagement and separation.

Test 13a of IEC 60512, engaging and separating force measurement, is normally used when the connectors have a device that assists the engaging and separating operations.

Test 13b of IEC 60512, insertion and withdrawal force measurement, is normally used when the measurement is taken without the effect of any locking or similar devices.

Usually, the design of the connector determines whether test 13a or test 13b shall be specified in the detail specification.

4.3.3 Contact retention in insert

To assess the ability of the contact retaining system (if any) to withstand mechanical stresses during normal usage, a contact retention test shall be conducted.

The force to be applied and the maximum axial displacement after the force is removed shall be stated in the detail specification.

4.3.4 Polarizing method

To assess the capability of the polarizing method, if applicable, a test shall be conducted to check whether the polarizing method prevents the mismatching of incorrectly matched connector halves.

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

Conditions: IEC 60512, test 13a or test 13b

4.3.3 Contact retention in insert

Conditions: IEC 60512, test 15a

Standard atmospheric conditions

The measurement of axial displacement while force is applied is not required.

4.3.4 Polarizing method

Conditions: IEC 60512, test 13e

Standard atmospheric conditions

Guidance notes

5 Test schedule

5.1 General

Guidance with regard to the application of a basic (minimum), intermediate or full test schedule, the test phase numbers and the addition of tests, is given in 4.5 of IEC 61076-3.

When the sequence of the test phases in a test group according to 5.2 is not entirely appropriate for a particular type or style, the given sequence may be altered (see 4.5 of IEC 61076-3). This is to be specified in the detail specification.

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IEC 60068-1, and applicable parts of IEC 60512. The detail specification shall state to which connector styles the test sequence(s) is applicable. Most of the test programme may not be applicable to connectors without shells (housings).

The necessary number of specimens to perform the entire test sequence shall be given in tabular form in 6.1.1.

5.1.1 Arrangement for contact resistance measurement

The detail specification shall contain a pictorial representation of the mated connectors on which the points of connection for the measurement of contact resistance shall be shown.

5.1.2 Arrangement for dynamic stress tests

The detail specification shall contain a pictorial representation of the method of mounting, dimensions of printed boards, details of the clamping of wires, etc., to the mounting fixture.

5.1.3 Arrangement for testing static load, axial

The detail specification shall contain details of the method of mounting the fixed connector, the dimensions of the testing tool and the position of the testing tool relative to the connector.

5.1.4 Wiring of specimens

It shall be stated in the detail specification how the specimens shall be wired so that the selected method of test for insulation resistance, voltage proof and current-carrying capacity may be conducted. The wire size (or rating) and the type of insulation shall be stated.

For wiring of specimens for solderless termination tests, it shall be stated in the detail specification how the terminations shall be wired, in accordance with the relevant part of IEC 60352.

5 Test schedule

5.1 General

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

Unless otherwise specified, mated sets of connectors shall be tested. Care shall be taken to keep a particular combination of connectors together during the complete test sequence; when unmating is, for example, necessary for a certain test, the same connectors shall be mated for the subsequent tests.

In the following, a mated set of connectors is called a specimen.

5.1.1 Arrangement for contact resistance measurement

Conditions: IEC 60512, test 2a

The measurement of contact resistance shall be carried out on the number of contacts specified. Any subsequent measurements of contact resistance shall be made on the same contacts.

5.1.2 Arrangement for dynamic stress tests

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

5.1.3 Arrangement for testing static load; axial

Conditions: IEC 60512, test 8b

5.1.4 Wiring of specimens

Guidance notes

5.2 Test schedules

When a detail specification is applicable to connectors having more than one performance level (PL), the differing severity/conditions of test and/or requirements shall be entered in the test schedule tables under the appropriate test phase.

Example:

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
BP5	Mechanical operation	9a	Speed: 2 mm/s max. Rest: 10 s when mated			1	250 operations
						2	125 operations
						3	75 operations
BP6							

5.2.1 Basic (minimum) test schedule

When a basic (minimum) test schedule is applicable, the following tests and severities/conditions, similar to the full test schedule, will apply:

Test phases:

- 1 For applying tests 1a and 1b, the detail specification is required to specify
 - features to be checked,
 - gauging details, if applicable,
 - type and magnification power of measuring equipment,
 - deficiency criteria.
- 2.1 or 2.2 The choice between tests 2.1 and 2.2 depends on the design of the connector.
- 2.2 When a device is included that assists the engaging/separating operation, test 2.1 shall be selected. The maximum speed A has to be given for this test. 2 mm/s is a realistic value for this measurement.
- 3 The number of contacts to be measured shall be stated as B. The maximum allowed value of initial contact resistance, as specified in 4.2.4, shall be stated as C.
- 4 The voltage that shall be applied for the measurement of the insulation resistance, as specified in 4.2.5, shall be stated as D. The applicable test method shall be stated as E and applied to F contacts per specimen. The minimum allowed value of initial insulation resistance, as specified in 4.2.5, shall be stated as G.
- 5 Method H shall be used to test J contacts per specimen. The voltage that shall be applied for the testing of voltage proof, contact to contact, and contact to test panel, shall be stated as K and L respectively.
- 6.1 or 6.2 Where applicable, other appropriate connection tests shall be additional to, or replace the specified tests, for example tests of IEC 61076-3 or tests of the applicable parts of IEC 60352, such as test group GP of the full test schedule.

Guidance notes

5.2.2 Full test schedule

5.2.2.1 Test group P – Preliminary

P1 See test phase 1

P2 The minimum force to be applied shall be 1,5 times the maximum specified engaging force and shall be stated as M.

P3 See test phase 3

P4 See test phase 4

P5 See test phase 5

NOTE For P4 and P5, it is required to define the method and the number of contacts per specimen, to avoid full wiring of the connector.

5.2.2 Full test schedule

5.2.2.1 Test group P – Preliminary

All specimens shall be subject to the following tests.

Table 6 – Test group P

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
P1	General examination		See test phase 1	Visual examination Examination of dimensions and mass	1a 1b		See test phase 1
P2 ¹	Polarizing method	13e	Force to be applied M in N				
P3			See test phase 3	Contact resistance	2a		See test phase 3
P4			See test phase 4	Insulation resistance	3a		See test phase 4
P5			See test phase 5	Voltage proof	4a		See test phase 5

¹ If applicable.

Guidance notes

5.2.2.2 Test group AP – Dynamic/climatic

AP1.1 or AP1.2

See test phase 2.1 or 2.2.

AP2 This test is only applicable to resilient contacts having an elastic system ensuring the contact and intended for use with round male contacts. When applicable, the value of the bending moment to be applied shall be stated as N.

This test shall be applied to P contacts per specimen and shall be followed by the measurement of the gauge retention force.

If the test is not applicable, the measurement shall still be performed.

AP3 Solderability tests: a selection shall be made, based on the soldering process for which the terminations of the connector have been designed:

AP3.1 Solder connection method based on bath-soldering. The depth to which the terminations shall be immersed to the molten solder shall be stated as Q,

or

solder connection method based on iron-soldering. The size R is that of the soldering iron.

AP3.2 The resistance to soldering heat shall be tested during an immersion time of 10 s, unless otherwise specified as S in seconds;

or

the resistance to soldering heat shall be tested by applying a size R soldering iron;

or

AP3.3 Reference is made to the basic test schedule, test phase 6.2.

AP4 See test phase 5.

AP5 The axial force to be applied to the contacts shall be stated as T and the allowed displacement of the contact (if applicable) with the force removed shall be stated as V.

Directly following the test, a visual examination shall be conducted.

AP6 The value of acceleration to be applied during the test shall be stated as W and the total number of bumps, which shall be equally divided between the three axes during testing, shall be stated as X.

The maximum duration of the disturbance at Y in microseconds or nanoseconds shall be stated. Directly following the test, a visual examination shall be conducted and the contact resistance shall be measured (see 4.2.4).

The specimens shall be divided into a sufficient number of groups (see 6.1).

All connectors in each group shall undergo the tests specified for the relevant group.

Guidance notes

5.2.2.2 Test group AP – Dynamic/climatic

AP7 The minimum value and the maximum value of the frequency range to which connectors are to be subjected shall be stated as Z and A1 respectively.

The value of displacement amplitude and of acceleration amplitude shall be stated as B1 and C1 respectively, and for the endurance, by sweeping the number of cycles D1 in each direction.

The maximum duration of the disturbance as Y in microseconds shall be stated.

Directly following the test, a visual examination shall be performed and the contact resistance shall be measured (see 4.2.4).

AP8 The value of acceleration severity of a half-sine pulse shall be stated as E1, and the severity duration as F1.

The maximum duration of the disturbance as Y in microseconds shall be stated.

Directly following the test a visual examination shall be performed and the contact resistance shall be measured (see 4.2.4).

AP9 The value of acceleration severity of a half-sine pulse shall be stated as G1 and the severity duration as H1.

Directly following the test a visual examination shall be performed and the contact resistance shall be measured (see 4.2.4).

AP10 The lower category and upper category temperatures shall be stated as J1 and K1 respectively, also the duration of exposure $t_1 = L1$ in minutes at each temperature, and the number of M1 cycles for both low and high temperature. Following this test, insulation resistance, voltage proof and visual examination measurements shall be conducted.

AP11 The climatic sequence test consists of a number of tests and appropriate measurements as described in IEC 60512, test 11a, and shall be conducted on mated connectors.

AP11.1 The upper temperature shall be stated as N1 and the minimum allowed value of insulation resistance at the end of the exposure shall be stated in 4.2.5.

AP11.2 The temperature at which this test shall be conducted shall be stated as P1.

Test variant to be used Q1.

The test shall be followed by visual examination.

AP11.3 The lower temperature shall be stated as R1.

The test shall be followed by visual examination.

AP11.4 The chamber pressure at which the conditioning shall be conducted shall be stated as S1 and the period of conditioning shall be stated as T1, if other than 5 min.

This test shall be followed by a voltage proof test.

Guidance notes

5.2.2.2 Test group AP – Dynamic/climatic (continued)

5.2.2.3 Test group BP – Mechanical endurance

BP1 This test group starts with conducting the gauge retention test.

BP2 The number of operations, which shall be half of the total value specified in 4.3.1, shall be stated as V1.

The speed of operation and the period of rest, if any, shall be stated as W1 and X1 respectively.

In direct sequence, the following tests and measurements shall be conducted:

- visual examination;
- contact resistance;
- insulation resistance;
- voltage proof;
- polarizing method (only if applicable).

5.2.2.2 Test group AP – Dynamic/climatic (continued)

Table 7 – Test group AP (continued)

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
AP11.5	Damp heat cyclic, remaining cycles	11m	P1 in °C; variant Q1	Insulation resistance	3a		See test phase 4
				Voltage proof	4a		See test phase 5
				Contact resistance	2a or 2b		See test phase 1
AP12.1			See test phase 2.1	Engaging and separation forces	13a		See also 4.3.2
AP12.2			See test phase 2.2	or Insertion and withdrawal forces	13b		
AP13				Visual examination	1a		See test phase 1

5.2.2.3 Test group BP – Mechanical endurance

Table 8 – Test group BP

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
BP1				Gauge retention force	16e		For conditions, see 3.9.1. The gauge shall be retained
BP2	Mechanical operation (half of the specified number of cycles)	9a	V1 operations; speed W1 in mm/s maximum; rest time X1 in s	Visual examination	1a		See test phase 1
				Contact resistance	2a or 2b		See test phase 3
				Insulation resistance	3a		See test phase 4
				Voltage proof	4a		See test phase 5
				Polarizing method ¹	13e		See 4.3.4

¹ Measurement after BP2, if applicable.

Guidance notes

5.2.2.3 Test group BP – Mechanical endurance (continued)

BP3.1 Duration of Y1 in hours.

BP3.2 Test 11g of IEC 60512, flowing mixed gas corrosion test, is under consideration. Until a publication is available, it is possible to specify the test as in IEC 60068-2-60, method C, or to specify an appropriate test method in the annex. The period for which conditioning shall be applied shall be stated as Z1. The specimens shall be half-mated, half-unmated.

or

BP3.3 See AP11.

or

BP3.4 For printed board connectors, the polarizing voltage of A2 is not applicable. The period for which the conditioning shall be applied shall be stated as B2.

or

BP3.5 See AP11.5.

or

BP3.6 See AP11.1.

BP4 See BP2, but C2 number of operations, being the remainder of the total specified number of operations minus the tested number.

BP5 See AP2.

In the case that test 16a of IEC 60512, probe damage, is not applicable, the gauge retention force measurement shall still be performed.

BP6 The number of specimens to be subjected to the test shall be stated as D2 and the rate of increase of force as E2.

The force to be applied, the duration of application and the allowed deflection of the specimen shall be stated as F2, G2, and H2 respectively.

5.2.2.3 Test group BP – Mechanical endurance (continued)

Table 8 – Test group BP (continued)

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
BP3	Climatic tests:			Contact resistance	2a or 2b		See test phase 3
BP3.1	Corrosion, salt mist;	11f	Duration of Y1 in hours				
	or						
BP3.2	Flowing mixed gas corrosion test	11g	Z1 days; half mated half unmated				
	or						
BP3.3	Climatic sequence;	11a	See AP11				
	or						
BP3.4	Damp heat, steady state;	11c	Wired specimens polarizing voltage A2 in V B2 days				
	or						
BP3.5	Damp heat, cyclic;	11m	See AP11.5				
	or						
BP3.6	Dry heat	11i	See AP11.1				
BP4	Mechanical operation (remaining half of specified number of operations)	9a	See BP2, but C2 operations	Visual examination	1a		See test phase 1
				Contact resistance	2a or 2b		See test phase 3
				Insulation resistance	3a		See test phase 4
				Voltage proof	4a		See test phase 5
				Polarizing method	13e		See 4.3.7
BP5	Probe damage ¹	16a	See AP2	Gauge retention force	16e		See AP2
BP6	Static load, axial	8b	D2 specimens, Arrangement as in 5.1.3. Maximum rate of increase of force E2 in N/s Force F2 in N, duration G2 in s	Visual examination	1a		See test phase 1 A deflection of H2 maximum is acceptable

¹ If applicable; if not, measurement shall still be performed.

Guidance notes

5.2.2.4 Test group CP – Moisture

CP1 See notes on BP3.4, with a duration of J2 days.

In conjunction with this test, the following measurements shall be conducted:

- insulation resistance;
- voltage proof;
- contact resistance;
- engaging and separating or insertion and withdrawal forces;
- visual examination of unmated connectors.

5.2.2.5 Test group DP – Electrical load

DP1 See for conditions BP2, number of K2 operations.

DP2 The duration of conditioning shall be stated as L2 and the maximum load current as M2.

The temperature at which the test chamber shall be maintained shall be $(70 \pm 5) \%$ of the specified maximum operating temperature of the connector. After applying and increasing the current, the measured temperature N2 of the specimen shall not exceed 105 % of the specified maximum operating temperature.

This test shall be followed by a (hot) insulation resistance test which shall be measured in accordance with 4.2.5.

A voltage proof test shall also be conducted.

Visual examination shall be conducted on unmated connectors.

5.2.2.4 Test group CP – Moisture

Table 9 – Test group CP

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
CP1	Damp heat, steady state	11c	See BP3.4, but J2 days	Insulation resistance	3a		See test phase 4
				Voltage proof	4a		See test phase 5
				Contact resistance	2a or 2b		See test phase 3
				Engaging and separating forces or Insertion and withdrawal forces	13a 13b		See 4.3.2
				Visual examination	1a		See test phase 1

5.2.2.5 Test group DP – Electrical load

Table 10 – Test group DP

Test phase	Test			Measurement to be performed		Requirements	
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	PL	All connector styles
DP1	Mechanical operation (number of operations similar as specified in BP2)	9a	See BP2; but K2 operations				
DP2	Electrical load and temperature	9b	L2 in hours; contact load current: M2 in A maximum; recovery 2 h minimum; temperature sensor in centre of specimens				N2 in °C
				Contact resistance	2a or 2b		See test phase 3
				Insulation resistance	3a		See test phase 4
				Voltage proof	4a		See test phase 5
				Visual examination	1a		See test phase 1

Guidance notes

5.2.2.6 Test group EP – Mechanical resistivity

- EP1.1 The value of the force to be applied shall be stated as P2.
- EP1.2 A mechanical test for solderless terminations other than those covered by the connection methods of IEC 60352, shall be conducted.
- EP2 See AP5; if applicable, this test should be performed at the end of this test group sequence.
- EP3 See AP2.
- EP4 See 4.2.5.
- EP5 The duration of the conditioning shall be stated as Q2.
- EP6 The number of the specimens R2, duration of the application of the flame S2, the point of application of the flame (by a figure) and the maximum allowable burning time T2 shall be stated.

Where evidence may be presented to the satisfaction of the national supervisory inspectorate (NSI), confirming that the materials used in the manufacture of the connectors have been previously tested according to the specified test and have satisfactorily passed it, test phases EP5 and EP6 may be omitted.