BS EN 60352-8:2011

BSI Standards Publication

Solderless connections

Part 8: Compression mount connections – General requirements, test methods and practical guidance

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National foreword

This British Standard is the UK implementation of EN 60352-8:2011. It is identical to IEC 60352-8:2011.

The UK participation in its preparation was entrusted to Technical Committee EPL/48, Electromechanical components and mechanical structures for electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 48B/2223/FDIS, future edition 1 of IEC 60352-8, prepared by SC 48B, Connectors, of IEC TC 48, Electromechanical components and mechanical structures for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60352-8 on 2011-03-17.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2011-12-17
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-03-17

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60352-8:2011 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-581	2008	International Electrotechnical Vocabulary - Part 581: Electromechanical components for electronic equipment	-	-
IEC 60068-1 + A1	1988 1992	Environmental testing - Part 1: General and guidance	EN 60068-1	1994
IEC 60512	Series	Connectors for electronic equipment - Tests and measurements	EN 60512	Series
IEC 60512-1	-	Connectors for electronic equipment - Tests and measurements - Part 1: General	EN 60512-1	-
IEC 60512-1-100	-	Connectors for electronic equipment - Tests and measurements - Part 1-100: General - Applicable publications	EN 60512-1-100	-
IEC 61249-2-7	2002	Materials for printed boards and other interconnecting structures - Part 2-7: Reinforced base materials, clad and unclad - Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad	EN 61249-2-7 + corr. September	2002 2005

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INTRODUCTION

This part of IEC 60352 includes requirements, tests and practical guidance information.

Two test schedules are provided:

A basic test schedule applies to compression mount connections which conform to all of the requirements given in Clause 4.

A full test schedule applies to compression mount connections which are part of a new component and have already passed the basic test schedule or to connections of the same kind which do not fully comply with the requirements of Clause 4.

Requirements given in Clause 4 are derived from experience with successful applications of such compression mount connections.

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

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

As technological advances lead to acceptable alternatives for these materials, they will be eliminated from the standard.

SOLDERLESS CONNECTIONS –

Part 8: Compression mount connections – General requirements, test methods and practical guidance

1 Scope and object

This part of IEC 60352 is applicable to compression mount connections with metallic spring contacts for use in telecommunication equipments and in other electronic devices employing similar techniques.

Information on materials and data from industrial experience are included in addition to the test procedures to provide electrically stable connections under prescribed environmental conditions.

The object of this part of IEC 60352 is to determine the suitability of compression mount connections under specified electrical, mechanical and atmospheric conditions and to provide a means of comparing test results when the tools used to make the connectors are of different designs or manufacture.

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

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

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

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

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

IEC 61249-2-7:2002, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

3 Terms and definitions

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

3.1
compression mount connection
solderless connection between a compression mount contact and a contact pad which is established by a continuous compression force

3.2
compression mount contact
conductive element in a compression mount connector which makes contact with its corresponding contact pad on a printed wiring board to provide an electrical path

3.3
contact pad (land)
conductive element on a printed wiring board which makes contact with its corresponding compression mount contact of a connector to provide an electrical path

NOTE Usually the contact area on devices such as on semiconductors is called “land”.

3.4
stiffener
component used to provide resistance against warpage of a printed wiring board

3.5
locating pin
guiding element equipped with a connector body or a printed wiring board for accurate positioning of the connector on the printed wiring board by mating with its corresponding locating slot (or hole)

3.6
locating slot (or locating hole)
guiding element equipped with a printed wiring board or a connector body to accommodate a locating pin

4 Requirements

4.1 General

The connections are made in accordance with the connector manufacturer’s instructions.

4.2 Mounting tools

Mounting tools for a compression mount connector on a printed wiring board shall be specified in the detail specification.

When a screw driver is used, torque shall be specified in the detail specification. If any special tools are required, tooling instructions shall be provided by the manufacturer.

4.3 Compression mount contact

4.3.1 Materials

Suitable contact materials satisfying the test and requirements of this standard shall be used.

4.3.2 Design features

Contact force of the compression mount connection shall be such that the connector meets all the relevant requirements of this standard.

4.3.3 Surface finishes

Finishes used on metallic elements of the connector shall be such that the connector meets all the relevant requirements of this standard.

4.4 Connector body

4.4.1 Materials

Suitable connector body materials satisfying the test and requirements of this standard shall be used.

4.4.2 Design features

A connector body shall be provided with a locating pin(s), slot(s) or hole(s) that allows the connector to be positioned on the printed wiring board accurately. Dimensions and location of pin(s), slot(s) or hole(s) shall be specified in the detail specification.

4.5 Printed wiring board

4.5.1 Materials

The materials of a printed wiring board shall be in accordance with IEC 61249-2-7.

4.5.2 Design features

The thickness of a printed wiring board shall be specified in the detail specification. The dimensions and layout of contact pads (lands) shall be specified in the detail specification. A printed wiring board shall be provided with a locating slot(s), hole(s) or pin(s), and the dimensions of those shall be specified in the detail specification.

4.5.3 Surface finishes

Contact pads (lands) of a printed wiring board shall be plated free from contamination and corrosion visible to the unaided eye.

4.6 Stiffener

If required, stiffener shall be specified in the detail specification.

5 Tests

5.1 General

5.1.1 Standard conditions for testing

Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing, as specified in IEC 60512-1.

The ambient temperature and the relative humidity at which the measurements are made shall be stated in the test report.

In case of dispute about test results, the test shall be repeated at one of the referee conditions of IEC 60068-1.

5.1.1.1 Preconditioning

Where specified, specimens shall be preconditioned under the standard atmospheric conditions for a period of 24 h, as specified in IEC 60512-1.

5.1.1.2 Recovery

Where specified, the specimens shall be allowed to recover under the standard atmospheric conditions for a period of 1 h to 2 h after conditioning.

5.1.2 Mounting of the specimen

The specimen shall consist of the connector including compression mount connections and a printed wiring board, unless otherwise specified.

When mounting is required in a test, the connector shall be mounted using the normal mounting method.

5.2 Test and measuring methods

5.2.1 General examination

5.2.1.1 Visual examination

The test shall be carried out in accordance with test 1a: Visual examination, IEC 60512-1-1. The visual examination test shall be carried out with magnification approximately five times.

Specimens shall be examined to ensure that the applicable requirements given in 4.3 to 4.6 have been met.

5.2.1.2 Examination of dimension

The test shall be carried out in accordance with test 1b: Examination of dimension and mass, IEC 60512-1-2.

Specimens shall be examined to ensure that the applicable requirements given in 4.3 to 4.6 have been met.

5.2.2 Mechanical tests

5.2.2.1 Mechanical operation

The test is to examine the successful mounting of compression mount contacts against mechanical stress during the mounting process of the compression mount connectors on a printed wiring board.

The test shall be carried out in accordance with test 9a: Mechanical operation, IEC 60512-5. Mounting and un-mounting method shall be specified in the detail specification.

A printed wiring board used for the test shall have contact pads that can make contact with the contacts of a connector under test.

Unless otherwise specified in the detail specification, mechanical operation shall be conducted for three cycles.

The same printed wiring board shall be used throughout the whole test, and the connector shall be always positioned at the same location on the printed wiring board.

NOTE This may be achieved e.g. by means of suitable locating slots or pins on the two mating parts (printed wiring board and connector).

5.2.2.2 Vibration

The test shall be carried out in accordance with test 6d: Vibration, IEC 60512-6-4.

The specimen shall be firmly held on a vibration table.

A suitable test arrangement for testing shall be defined in the detail specification. Unless otherwise specified in the detail specification, test severities given in Table 1 shall be applied.

Table 1 – Vibration, preferred test severities

Range of frequency	10 Hz to 55 Hz	10 Hz to 500 Hz	10 Hz to 2 000 Hz
Full duration	2,25 h	6 h	7,5 h
Displacement amplitude below the cross-over frequency	0,35 mm	0,35 mm	1,5 mm
Acceleration amplitude above the cross-over frequency	–	50 m/s^2	200 m/s^2
Directions	Three axes	Three axes	Three axes
Number of sweep cycles per direction	10	10	10

During the test, contact disturbances shall be monitored in accordance with test 2e: Contact disturbance, IEC 60512-2-5. Contact disturbance shall not exceed 1 μs, unless otherwise specified in the detail specification.

5.2.2.3 Shock

The test shall be carried out in accordance with test 6c: Shock, IEC 60512-6-3.

The specimen shall be firmly held on a test table.

Unless otherwise specified in the detail specification the following test severities shall apply.

– Shock acceleration: 300 m/s^2
– Duration of impact: 11 ms
– Wave form: Half-sine or saw-tooth
– Number of shocks: Three shocks in two directions along three axes (total 18 shocks)

A suitable test arrangement shall be defined in the detail specification.

During the test, contact disturbances shall be monitored in accordance with test 2e: Contact disturbance, IEC 60512-2-5. Contact disturbance shall not exceed 1 μs, unless otherwise specified in the detail specification.

5.2.3 Electrical tests

5.2.3.1 Contact resistance

The test shall be carried out in accordance with test 2a: Contact resistance - millivolt level method, IEC 60512-2-1.

Contact resistance shall be measured between measuring points as shown in Figure 1.

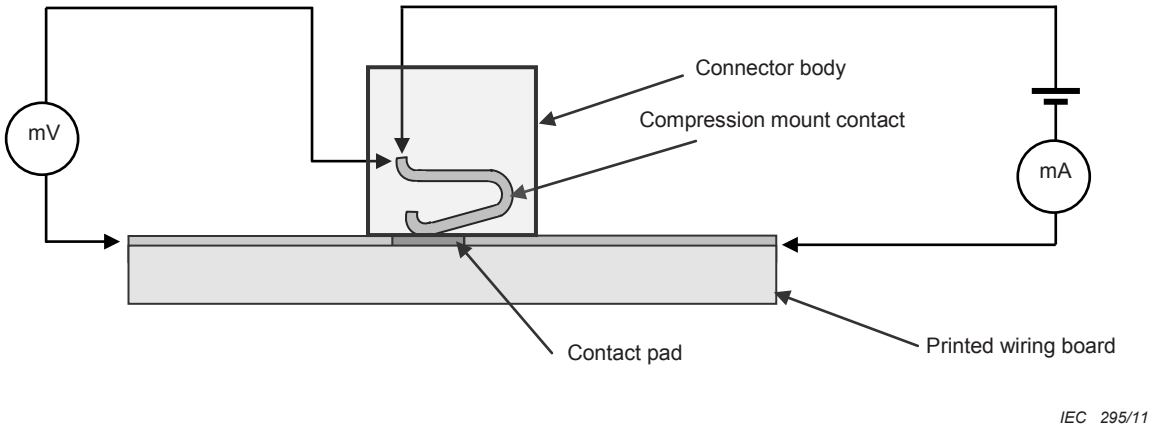

Figure 1 – Wiring arrangement for contact resistance test

5.2.3.2 Current carrying capacity

The test shall be carried out in accordance with test 5b: Current carrying capacity, IEC 60512-5-2.

Test condition shall be specified in the detail specification.

5.2.4 Climatic tests

5.2.4.1 Dry heat

The test shall be carried out in accordance with test 11i: Dry heat, IEC 60512-11-9.

The connectors shall be mounted on the printed wiring board and subjected to the test.

Unless otherwise specified, following conditions shall be applied.

– Dry heat, test temperature: 105 °C
– Duration of exposure: 300 h or 1 000 h

5.2.4.2 Flowing mixed gas corrosion

The test shall be carried out in accordance with test 11g: Flowing mixed gas corrosion test, IEC 60512-11-7.

Unless otherwise specified, following conditions (Method 1) shall be applied.

– Mixed gases: H_2S 100 ± 20 (10^{-9} vol/vol)
SO_2 500 ± 100 (10^{-9} vol/vol)
– Duration of exposure: 10 days

The connectors shall be mounted on the printed wiring board and subjected to the test.

If necessary, intermediate measurements shall be specified in the detail specification.

5.2.4.3 Sand and dust

The test shall be carried out in accordance with test 11h: Sand and dust, IEC 60512-11-8.

Test conditions and contents of the test sand shall be specified in detail specification.

The connectors shall be mounted on the printed wiring board and subjected to the test.

After the test, sand and dust shall be removed from the specimens by shaking, wiping or brushing to prevent the effects of moisture but no blower or suction devices shall be used to remove the sand and dust that has ingressed into specimens.

5.2.4.4 Rapid change of temperature

The test shall be carried out in accordance with test 11d: Rapid change of temperature, IEC 60512-6.

The connectors shall be mounted on the printed wiring board and subjected to the test.

Unless otherwise specified in the detail specification, the following conditions shall apply:

– Low temperature T_A: –55 °C (LCT)
– High temperature T_B: 85 °C (UCT)
– Duration of exposure: 30 min
– Number of cycles: 5

5.2.4.5 Damp heat, cyclic

The test shall be carried out in accordance with test 11m: Damp heat, cyclic, IEC 60512-11-12.

Test conditions shall be specified in detail specification.

The connectors shall be mounted on the printed wiring board and subjected to the test.

5.2.4.6 Damp heat, steady state

The test shall be carried out in accordance with test 11c: Damp heat, steady state, IEC 60512-11-3.

During the test, the connector shall not be mounted on the printed wiring board. The printed wiring board shall be kept in the standard atmospheric condition.

Unless otherwise specified, following conditions shall be applied.

– Temperature: 40 °C
– Relative humidity: 93 %
– Durations of exposure: 10 days

5.3 Test schedule

5.3.1 General

Where the requirements of the test sequence for a connector, employing these connections, include all or part of the test requirements of this specification, duplication of testing shall be excluded.

The basic test schedule is intended to apply to specific and basic requirements for compression mount connections.

The full test schedule is intended to apply to connectors which have passed basic test.

Prior to testing, specimens shall be prepared. Each specimen shall consist of connector including compression mount connection and printed wiring board.

Each termination shall consist of a compression mount contact and one contact pad (land), unless otherwise specified by the detail specification.

Minimum 100 terminations are applied to the basic test.

After the basic test, those terminations shall be divided into four groups A to D. Minimum 20 terminations should be tested on each group. All terminations of each group shall undergo all the tests specified for each group.

5.3.2 Basic test schedule

5.3.2.1 General

Where the basic test schedule is applicable, specimens shall be subjected to the Test group P according to 5.3.2.1.

5.3.2.2 Test group P – Basic test

All specimens shall be subjected to the tests in Table 2.

A minimum of 10 specimens shall be used.

Table 2 – Group P – basic test

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
P1	General examination		Unmounted connectors and printed wiring boards	Visual examination	1a	No defects that would impair normal operations
			Contacts Contact pads on printed wiring board	Examination of dimensions	1b	The dimensions shall comply with detail specification
P2			Max voltage: 20 mV in open circuit	Contact resistance	2a	In accordance with detail specification

5.3.3 Full test schedule

5.3.3.1 General

Where the full test schedule is applicable, all specimens which passed basic test shall be subjected to Groups A through D.

5.3.3.2 Test group A – Corrosion test

The number of specimens shall be specified in the detail specification.

Table 3 – Group A – corrosion test

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
A1	Mechanical operation	9a	In accordance with detail specification			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
A2	Dry heat	11i	105 °C, 300 h			
A3	Flowing mixed gas	11g	H_2S: 100 ± 20 (10^{-9} vol/vol) SO_2: 500 ± 100 (10^{-9} vol/vol) Durations: 10 days			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
A4	General examination		Unmounted connectors and printed wiring boards	Visual examination	1a	No defects that would impair normal operations

5.3.3.3 Test group B – Mechanical test

The number of specimens shall be specified in the detail specification.

Table 4 – Group B – mechanical test

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
B1	Mechanical operation	9a	In accordance with detail specification			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
B2	Sand and dust	11h	In accordance with detail specification			
B3	Vibration	6d	see Table 1	Contact disturbance	2e	1 μs max.
B4	Shock	6c	Shock acceleration 300 m/s² Duration of impact 11 ms Three shocks in two directions along 3 axes (total 18 shocks)	Contact disturbance	2e	1 μs max.
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
B5	General examination		Unmounted connectors and printed wiring boards	Visual examination	1a	No defects that would impair normal operations

5.3.3.4 Test group C – Climatic test

The number of specimens shall be specified in the detail specification.

Table 5 – Group C – climatic test

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
C1	Mechanical operation	9a	In accordance with detail specification			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
C2	Sand and dust	11h	In accordance with detail specification			
C3	Rapid change of temperature	11d	–55 / 85 / 5 cycles			
C4	Damp heat, cyclic	11m	50 cycles			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
C5	General examination		Unmounted connectors and printed wiring boards	Visual examination	1a	No defects that would impair normal operations

5.3.3.5 Test group D – Current carrying capacity test

The number of specimens shall be specified in the detail specification.

Table 6 – Group D – current carrying capacity test

Test phase	Test			Measurement to be performed		Requirements
	Title	IEC 60512 Test No.	Severity or condition of test	Title	IEC 60512 Test No.	
D1	Dry heat	11i	105 °C, 1 000 h			
			Max voltage: 20 mV in open circuit	Contact resistance	2a	15 mΩ max. change from initial value
D2	Current carrying capacity	5b	Electrical load should be referred in detail specification Ambient temperature 70 °C			Temperature inside the connector shall not exceed 100 °C.

6 Practical guidance

6.1 Advantages for compression mount connection

Compression mount connection is a solderless connection method that has a simple structure with the compression mount contact and printed wiring boards or semiconductor devices.

The design advantages are as follows:

– replaceable for its end of life or for occasional repair;
– possibility of higher density connection arrangement on a printed wiring board than the other existing solderless connections, because no through holes or any special process are required.

Also the connection has a potential of less limitation of trace design on printed wring boards for high speed transmission.

The advantages for high speed transmission are as follows:

– suitable trace design can be matched with characteristic impedance of a connector;
– stubs of transmission lines can be minimized, because no long terminals are required.

The design of the test board used in testing will have a significant effect on the measured performance of the connector. Therefore, if comparing connectors of different design, the test boards used should be as similar as practical. Any performance differences noted between connector designs should take into consideration the possible effect of different test board designs used.

Figure 2 shows an example of the implementation of a compression mount connection within a connector, and the associated attachment to a printed wiring board.

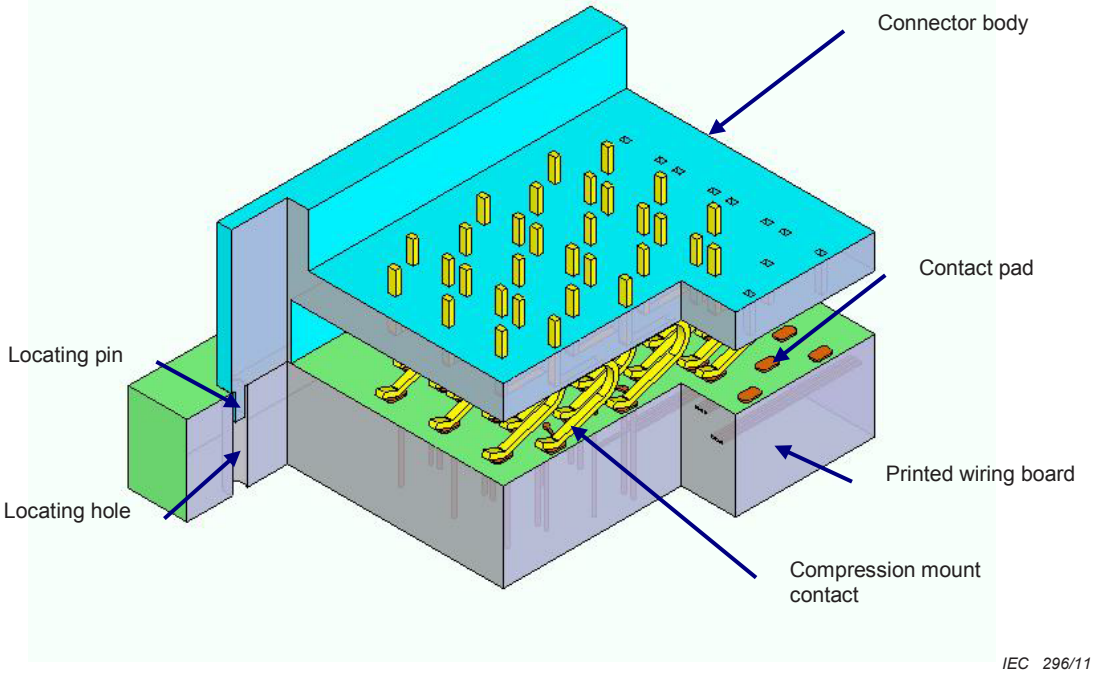

Figure 2 – An example of compression mount connection within a connector

6.2 Current-carrying capacity

In a printed board the tracks used for power are major sources of heat generation due to electric heating effects. Care shall be given to the following which influence current carrying capacity:

– contact material conductivity;
– track cross-section;
– contact surface finish;
– spacing of power lines;
– heat transference to the ground plane.

6.3 Compression mount contact

The contact force maintains the compression mount connection. A larger contact force may attain a lower contact resistance, but the contact pad and the contact itself may be damaged. The contact should be designed to get the appropriate contact force.

Minimum required design normal force is affected by many factors including plating system, contact base metal ability to resist stress relaxation, and the ability of the connector body and contact design to minimize the transfer of forces which would cause relative motion between the contact and contact pads. Further, the minimum design normal force shall take into consideration the potential loss of normal force over the life of the contact due to stress relaxation. In the case of gold alloy plating systems, a typical end of life contact normal force would be 10 cN. However, the actual required value may be more or less depending on other design factors.

Material and finishes should be selected to ensure performance of connections. The small size of contacts in compression mount connectors limits the level of normal force which can be achieved. Therefore, the use of noble metal plating systems such as gold alloy over nickel or palladium alloy over nickel is recommended.

6.4 Connector housing and printed wiring board

6.4.1 General

In the design of compression mount connection, care should be taken as follows:

– design a connector housing of enough strength against warpage by contact force;
– creepage and clearance distance of contact pads or lands.

6.4.2 Connector housing

A connector housing should be designed to cover the connection area for protection against a corrosive atmosphere and dust. The closed gap of the housing and the printed wiring board are expected to reduce invasion of the corrosive gas or the dust into the connectors.

The insulating materials of the connector housing should be with a low dielectric constant and a low dissipation factor (tan δ) for the high-speed transmission characteristics of the connector.

The connector housing should be designed stiff enough to withstand the reaction force generated by the contacts installed in the connector housing.

6.4.3 Printed wiring board

The contact pads (lands) and traces on the printed wiring board should be designed with care of clearance distance. Usually contact pads (lands) are arranged on flat area of printed wiring board. Therefore the clearance distance, insulation resistance and voltage proof should be specified in the detail specification.

The stiffener may be used to prevent warpage of printed wiring board and should be used (when required) according to the instruction of the connector manufacturer.

The dimensions of the contact pad should be chosen to accommodate a certain degree of misalignment between a compression mount contact and a contact pad. Arrangement of contact pads and holes needed should be specified by the connector manufacturer.

Bibliography

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

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
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