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Adhesives — Test methods for isotropic electrically conductive adhesives —

Part 7: Environmental test methods

Adhésifs — Méthodes d'essai pour adhésifs à conductivité électrique isotrope —

Partie 7: Méthodes d'essai environnemental

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

ISO 16525 consists of the following parts, under the general title *Adhesives — Test methods for isotropic electrically conductive adhesives*:

— *Part 1: General test methods*

— *Part 2: Determination of electric characteristics for use in electronic assemblies*

— *Part 3: Determination of heat-transfer properties*

— *Part 4: Determination of shear strength and electrical resistance using rigid-to-rigid bonded assemblies*

— *Part 5: Determination of shear fatigue*

— *Part 6: Determination of pendulum-type shear impact*

— *Part 7: Environmental test methods*

— *Part 8: Electrochemical migration test methods*

— *Part 9: Determination of high-speed signal-transmission characteristics*

Adhesives — Test methods for isotropic electrically conductive adhesives —

Part 7: Environmental test methods

SAFETY STATEMENT — Persons using this part of ISO 16525 should be familiar with normal laboratory practice. This part of ISO 16525 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory conditions.

IMPORTANT — Certain procedures specified in this part of ISO 16525 might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This part of ISO 16525 specifies the environmental test methods (cold, dry heat, damp heat and change of temperature) for isotropic electrically conductive adhesives used in the surface assembly of printed circuit boards of electronic devices.

2 Normative references

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

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 472, *Plastics — Vocabulary*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

IEC 60068-1, *Environmental testing — Part 2: General and guidance*

IEC 60068-2-1, *Environmental testing — Part 2: Tests — Test A: Cold*

IEC 60068-2-2, *Environmental testing — Part 2-2: Tests — Test B: Dry heat*

IEC 60068-2-14, *Environmental testing — Part 2-14: Tests — Test N: Change of temperature*

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

IEC 60068-2-67, *Environmental testing — Part 2: Tests — Test Cy: Damp heat, steady-state, accelerated test primarily intended for components*

IEC 61249-2-7, *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*

IEC 62137-1-1, *Surface mounting technology — Environmental and endurance test methods for surface mount solder joint — Part 1-1: Pull strength test*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 291, ISO 472 and IEC 60068-1 and the following apply.

3.1
four-probe resistance measuring method
technique with four probes, using two lead wires to supply an electric current to a specimen and the other two to detect voltage drop due to contact resistance in the specimen

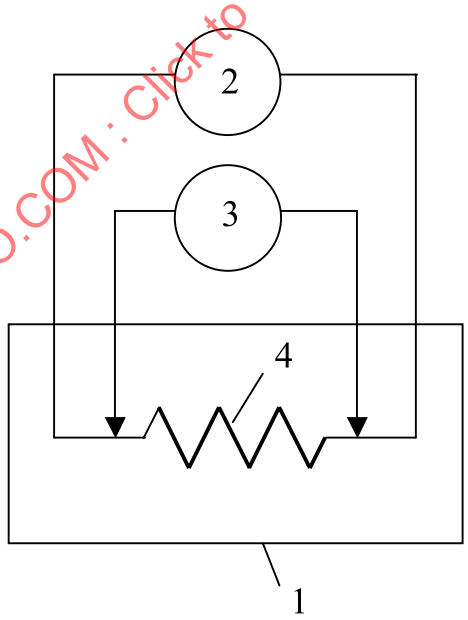
3.2
daisy chain
wiring scheme used to measure the durability of electrical connections between bonded portions of component terminals and copper land grid patterns on the substrate

Note 1 to entry: In a daisy chain, components are connected on a circuit board in series using an isotropic electrically conductive adhesive.

4 Apparatus and test board

4.1 Chamber, capable of maintaining the specified temperature and humidity in an effective space. To maintain uniform temperature and humidity, forced air circulation may be used. For a test that involves a change in temperature, one or two baths may be used.

4.2 Ohmmeter, capable of measuring electrical resistance. A specified DC (or AC) current source and a voltmeter in the four-probe measurement circuit shown in Figure 1 shall be used in combination. When monitoring the resistance of a large number of test circuit boards in series, an ohmmeter made of current source and a voltmeter, which can carry out a four-probe resistance measurement, may be combined with a scanner that switches measurement channels for each test circuit board.



Key

1	test circuit boards	3	voltage meter
2	current sources	4	measured resistance

Figure 1 — Test apparatus of four-probe measurement circuit

4.3 Tensile strength apparatus, as specified in ISO 527-1, which can apply compressive or tensile force to the specimen. The crosshead speed shall be between 5 mm/min and 30 mm/min.

4.4 Shearing jig. When using a leadless component, such as a chip resistor, a shearing jig with a tip diameter of 0,5 mm as specified in IEC 60068-2-21 shall be used.

4.5 Pulling jig. When using a gull wing-type lead as a test component, such as QFP, a pulling jig as specified in IEC 62137-1-1 shall be used. The test circuit board shall be fixed to a block with an inclination of 45°.

4.6 Microscope, simple, with magnification from 50x to 250x and a light that illuminates the specimen at luminance around 2 000 lux shall be used.

4.7 Test board, consisting of a glass fabric-based epoxy resin copper-clad laminate as specified in IEC 61249-2-7, unless otherwise specified in the product specifications. When using alternative boards, materials that do not degrade with temperature should be used. Mechanical deformation and board damage should be avoided. At a temperature of 125 °C or higher, ceramic (aluminia) boards should preferably be used.

4.8 Test components, containing short circuits. Components and the wires of the board shall be connected alternately to make a daisy chain, which links all the bonded portions of adhesives to be tested. It is preferable that the test component be identical to the actual ones in the structure.

5 Preparation of test circuit board

Preparation of a test circuit board is specified as follows.

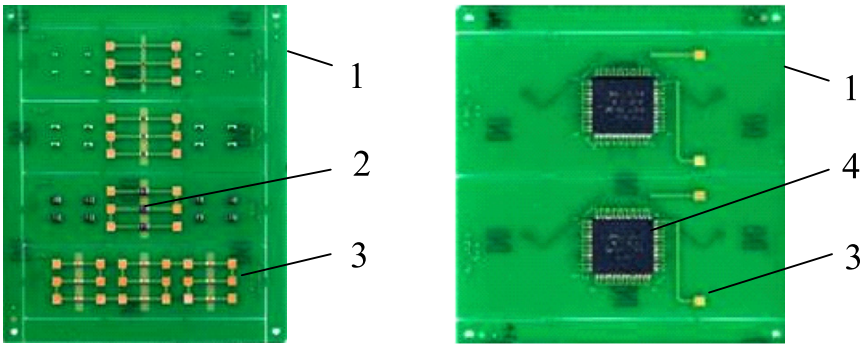
a) Isotropic electrically conductive adhesive

In terms of general behaviour and procedure, a paste-type isotropic electrically conductive adhesive containing an organic binder (generally, a heat-curing resin) in which metal particles or flakes are dispersed shall be used.

b) Preparation

An isotropic electrically conductive adhesive shall be applied to the test circuit board using screen-printing and the test components shall be placed on it. For the application and curing of the adhesives, follow the adhesive manufacturer's recommendations. If the manufacturer's recommendations do not refer to the cure schedule, curing should be carried out at 150 °C for 30 min in the atmosphere.

NOTE To make a test circuit board, place components at the centre of the test circuit to be bonded. An example is shown in Figure 2. The position of the components on the test circuit board can be altered to an extent unless the test is not affected upon agreement between the delivering and receiving parties.



Key

1	test circuit boards	3	measuring pad
2	chip resistance	4	quad flat package

Figure 2 — Example of the position of components

c) Visual inspection

Visual inspection or microscopic inspection shall be carried out to check the appearance and finishing.

6 Tests

6.1 Test items and conditions

Degrees of severity are described in terms of test temperature and time and are specified in the product specifications. The recommended test conditions shall be selected from among those shown in Table 1. The test temperature should not exceed the glass transition temperature of the specimen component. Test conditions specified in IEC 60068-2 shall be used.

Table 1 — Test items and conditions

Item	Normative reference	Test condition	Test time
Cold	IEC 60068-2-1	−25 ± 3 °C −40 ± 3 °C −55 °C ± 3 °C	500 h 1 000 h
Dry heat	IEC 60068-2-2	+85 ± 2 °C +100 ± 2 °C +125 ± 2 °C	500 h 1 000 h
Damp heat, steady state	IEC 60068-2-67	+85 ± 2 °C, 85^{+2}_{-3} %	500 h 1 000 h
Change of temperature	IEC 60068-2-14 Na	-40^{+0}_{-10} °C / $+85^{+15}_{-0}$ °C -40^{+0}_{-10} °C / $+100^{+15}_{-0}$ °C -40^{+0}_{-10} °C / $+125^{+15}_{-0}$ °C	500 cycles 1 000 cycles

6.2 Procedure

The test procedure is specified as follows.

a) Initial measurement