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Environmental testing –
Part 2-83: Tests – Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

Essais d'environnement –
Partie 2-83: Essais – Essai Tf: Essai de brasabilité des composants électroniques pour les composants pour montage en surface (CMS) par la méthode de la balance de mouillage utilisant de la pâte à braser

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Part 2-83: Tests – Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

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CONTENTS

FOREWORD ... 4
INTRODUCTION ... 6
1 Scope ... 8
2 Normative references ... 8
3 Terms and definitions ... 8
4 Test ... 9
4.1 General description ... 9
4.2 Test methods ... 9
5 Preconditioning ... 9
6 Preparation ... 10
6.1 Solder paste ... 10
6.2 Test jig plate ... 10
6.3 Specimen holder ... 10
7 Quick heating method ... 10
7.1 Equipment ... 10
7.2 Test jig plate ... 11
7.3 Preparation ... 12
7.4 Test condition ... 12
7.4.1 Test temperature ... 12
7.4.2 Feed of solder paste and immersion condition ... 13
7.4.3 Immersion and withdrawal conditions for test specimen ... 14
7.5 Test procedure ... 14
7.6 Presentation of the result ... 15
7.7 Characterisation parameter examples ... 15
8 Synchronous method ... 16
8.1 Equipment ... 16
8.2 Test jig plate ... 17
8.3 Synchronous fixture ... 17
8.4 Preparation ... 17
8.5 Test condition ... 17
8.5.1 Test temperature ... 17
8.5.2 Feed of solder paste and immersion condition ... 17
8.5.3 Immersion and withdrawal conditions for the test specimen ... 17
8.6 Test procedure ... 17
8.7 Presentation of the results ... 18
8.8 Characterisation parameter examples ... 19
9 Temperature profile method ... 19
9.1 Equipment ... 19
9.2 Test jig plate ... 19
9.3 Preparation ... 20
9.4 Test condition ... 20
9.4.1 Test temperature ... 20
9.4.2 Feed of solder paste and immersion condition ... 21
9.4.3 Immersion and withdrawal conditions for test specimen ... 21
9.5 Test procedure ... 21

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https://standards.iteh.ai/catalog/standards/sist/d4d97129-e4e2-40eb-8810-
be92bbb5df7b/iec-60068-2-83-2011

9.6 Presentation of the result ... 22
9.7 Characterisation parameter examples ... 23
Annex A (normative) Equipment for the quick heating and synchronous method ... 24
Annex B (informative) Reading of the output data and correction of the result in the quick heating test ... 25
Annex C (normative) Test equipment for the temperature profile method ... 28
Annex D (informative) Reading of the output data and correction of the result in the temperature profile test ... 29
Annex E (informative) Caveats / Notes ... 32
Bibliography ... 36

Figure 1 – Examples of the quick heating method test equipment ... 11
Figure 2 – Example of test jig plate for quick heating and synchronous method ... 12
Figure 3 – Example of the temperature profile ... 13
Figure 4 – Example of applying solder paste to a test jig plate ... 14
Figure 5 – Typical output shape of signal in the quick heating method ... 15
Figure 6 – Example of synchronous method test equipment ... 16
Figure 7 – Example of synchronous fixture ... 17
Figure 8 – Typical output shape of signal in the synchronous method ... 18
Figure 9 – Example of the system for temperature profile method test equipment ... 19
Figure 10 – Example of the temperature profile ... 20
Figure 11 – Example of applying solder paste to a test jig plate ... 22
Figure 12 – Typical output shape of signal in the temperature profile method ... 23
Figure B.1 – Typical wetting force changes in quick heating method ... 26
Figure B.2 – Example of correction of the initial time of wetting (F_a is larger than $0{,}5F_{1,max}$) ... 27
Figure B.3 – Example of correction of the initial time of wetting (F_a is $0{,}5F_{1,max}$ or less) ... 27
Figure D.1 – Typical output forms for profile temperature test ... 30
Figure D.2 – The case when an extruding force ($1{,}1F_{max}$ or larger) is generated immediately after the beginning of wetting ... 31
Figure E.1 – Explanation diagram of test procedure for the quick heating method ... 33
Figure E.2 – Explanation diagram of test procedure for synchronous method ... 34
Figure E.3 – Showing the wetting force (pull) of some solder pastes ... 34
Figure E.4 – Explanation diagram of the test procedure for the temperature profile method ... 35

Table 1 – Specification of the test jig plate for quick heating and synchronous method ... 11
Table 2 – Recommended test conditions of the quick heating and synchronous method for rectangular SMD ... 14
Table 3 – Specification of the test jig plate of the temperature profile method ... 20
Table 4 – Recommended test conditions of the temperature profile method for rectangular SMD ... 21

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IEC 60068-2-83:2011
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ENVIRONMENTAL TESTING –

Part 2-83: Tests – Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

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International Standard IEC 60068-2-83 has been prepared by IEC technical committee 91: Electronics assembly technology.

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

FDIS	Report on voting
91/975/FDIS	91/992/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.

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

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

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INTRODUCTION

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a) EU patent 0920488.4 "Synchronous test method for assessing soldering pastes"[1]

   Gen3 Systems LTD

   Unit B2

   Armstrong Mall

   Farnborough GU14 0NR

   United Kingdom

b) JP Patent 2630712 "Testing method of characteristics of solder paste and the equipment for the test"

   Malcom Co., Ltd

   4-15-10 Honmachi, Shibuya-ku

   Tokyo, 151-0071

   Japan

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c) Patent JP 3789041 "Solderability measuring apparatus"

   Patent JP 3552061 "Solderability tester and solderability test method"

   Patent JP 3498100 "Method and device for testing solderability and microcrucible for testing"

   Patent JP 3153884 "Measuring device for soldering performance of cream solder"

   Tarutin Kester Co., Ltd.

   2-20-11 Yokokawa,

   Sumida-ku

   Tokyo, 130-0003

   Japan

d) Sony Corporation

   1-7-1 Konan Minato-ku

   Tokyo 108-0075

   Japan

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[1] Status of patent: Pending.

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ENVIRONMENTAL TESTING –

Part 2-83: Tests – Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

1 Scope

This part of IEC 60068 provides methods for comparative investigation of the wettability of the metallic terminations or metallized terminations of SMDs with solder pastes.

Data obtained by these methods are not intended to be used as absolute quantitative data for pass – fail purposes.

NOTE Different solderability test methods for SMD are described in IEC 60068-2-58 and IEC 60068-2-69. IEC 60068-2-58 prescribes visual evaluation using solder bath and reflow method, IEC 60068-2-69 prescribes wetting balance evaluation using solder bath and solder globule method.

2 Normative references

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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.

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

IEC 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-58, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60194, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 61190-1-3, *Attachment materials for electronic assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1, IEC 60068-2-20:2008, IEC 60068-2-58, IEC 60194, and IEC 61190-1-3 and the following apply.

3.1
wettability
ease with which a metal or metal alloy can be wetted by molten solder

3.2
wetting balance method
method to measure wetting performance and solderability by measuring vertical force (difference with surface tension and buoyancy) to the specimen and recording as a function of time, when the specimen is immersed into molten solder

3.3
starting point of heating
time of the start of temperature rise by heating the solder paste applied to a testing jig

3.4
zero line
line extended to the time axis of the force experienced by the specimen as indicated by the test equipment (force sensor) when the specimen is taken out from the molten solder after the end of the measurement

4 Test

4.1 General description

The specimen is held on a holder suitable to the specimen and is suspended from sensitive balance. The specimen is immersed into solder paste applied onto the test jig plate, then solder paste is heated to melt. The resultant of the vertical forces of buoyancy and surface tension (hereafter, referred to as "acting force") acting upon the immersed specimen by force sensor and converted into a signal which is continuously recorded or monitored as a function of time on recorder.

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NOTE The wetting force can be evaluated only for components of the same shape and size. The absolute evaluation is not achieved by this method.

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4.2 Test methods

There are three methods as described below. The choice of the method shall be specified in the relevant specification.

a) Quick heating method: The wettability of electrodes of a component is evaluated while the solder paste is melted in a rapid temperature rise. The specimen is immersed in the solder paste before the temperature rise starts.

b) Synchronous method: The wettability of electrodes of a component is evaluated while the solder paste is melted due to a rapid temperature rise. The specimen is immersed in the solder paste when the temperature rise starts.

c) Temperature profile method: Solder paste is melted using a similar temperature profile used in production and the wettability of the electrodes of a component is evaluated.

NOTE 1 This test (Tf) may be applicable to leaded SMD packages. In order to achieve comparable and repeatable results, test Tf should be done on straight leads.

NOTE 2 Solder paste to be used is not specified in this standard.

5 Preconditioning

Unless otherwise specified in the detailed specification of the component, the test shall be made on the specimens as received and care shall be taken not to contaminate the specimens by fingers and other items. The specimen may be immersed in organic solvent at room temperature to remove possible contamination such as grease attached to the surface if the preconditioning is specified in the specification. No other method shall be used to clean the specimen. The specimen thus cleaned may be dried in air.

When accelerated ageing is prescribed by the relevant specification, one of the methods of 4.1.4 (Ageing 1) of IEC 60068-2-20:2008 shall be used. The aging condition shall be specified in the relevant specification.

6 Preparation

6.1 Solder paste

Use solder paste that has been stored in a sealed container and stored in a dark environment and below 10 °C, avoiding exposure to direct sunlight. Before conducting this test, it is important to prepare the solder paste properly.

a) The solder paste shall be allowed to achieve ambient conditions that shall be nominally 25 °C ± 5 °C and 50 % RH ± 10 % for 8 h or in accordance with the manufacturer's data sheet.

b) Open the supply container(s); remove any internal cover, scrape off paste adhering to the lid(s), internal covers, and the container walls; and add this material to the paste in the supply container(s).

c) Using a spatula, stir the paste gently for 1 min to 2 min to homogenize it; taking care to avoid the introduction of air.

   If necessary, gently transfer the paste to a test container of sufficient volume, taking care to avoid the introduction of air.

6.2 Test jig plate

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Test jig plates shall be stored in a sealed container. Immediately prior to their use, they shall be cleaned using acid such as dilute hydrochloric acid. A new test jig plate shall be used for each test. Unused test jig plates shall be discarded and not be returned to the sealed container.

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6.3 Specimen holder

The specimen holder is usually contaminated by creeping of flux used in a test. A specimen holder shall be cleaned using a neutral organic solvent. It is desirable to use ultrasonic agitation in cleaning.

7 Quick heating method

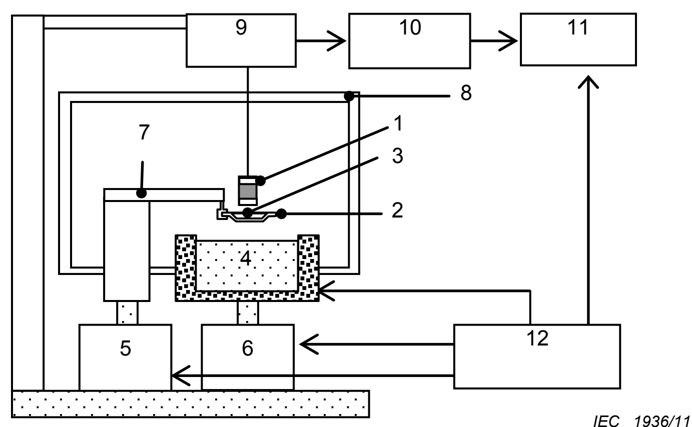
7.1 Equipment

The equipment used for the quick heating method consists of a measurement, heating and lift system, as shown in Figure 1. The detailed requirements to the equipment are specified in Annex A.

a) The measuring system consists of the force sensor that can measure the force vertically acted on a specimen, signal transducer and a recorder.

b) The heating system shall be capable of controlling the determined set temperature within ± 3 °C.

c) The lift system shall be capable of carrying out immersion and withdrawal of the specimen, as specified in 7.4.3.



Key

1	Specimen	7	Holding jig of a test jig plate
2	Test jig plate	8	Housing
3	Solder paste	9	Sensor
4	Heating bath	10	Transducer
5	Lift for test jig plate	11	Recorder
6	Lift for heating bath	12	Controller

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Figure 1 – Examples of the quick heating method test equipment

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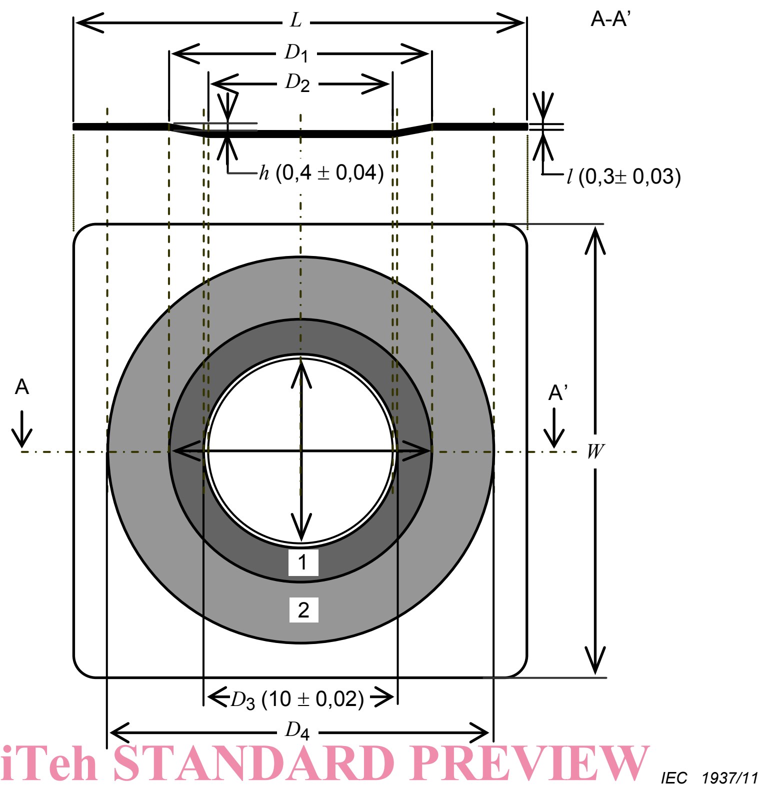
7.2 Test jig plate

The test jig plate shall be as specified in Table 1.

Table 1 – Specification of the test jig plate for quick heating and synchronous method

Item	Specification of the test jig
Material	Oxygen-free phosphate copper
Shape	Circular indented pan
Dimensions (L, W)	Less than 30 mm one the side, or less than a total area of 900 mm^2
Thickness (l)	0,3 mm ± 0,03 mm
Drawn diameter (D_1, D_2)	9 mm to 10 mm at the bottom, 13 mm to 14 mm at the top
Drawn depth (h)	0,4 mm ± 0,04 mm
Solder resist (D_3, D_4)	Inner diameter of 10 mm ± 0,02 mm, and over 20 mm for the outer diameter
Resist coat thickness	0,035 mm ± 0,01 mm
Warp	± 0,05 mm (for the longer side for a rectangular shape)

An example of the test jig plate used in the quick heating and synchronous method is shown in Figure 2.



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Key

1	Drawing for solder resist	h	Drawing depth
2	Solder resist	l	Thickness
L, W	Outer dimension		
D_1	Outer diameter of drawing	D_3	Inner diameter of solder resist
D_2	Inner diameter of drawing	D_4	Outer diameter of solder resist

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Figure 2 – Example of test jig plate for quick heating and synchronous method

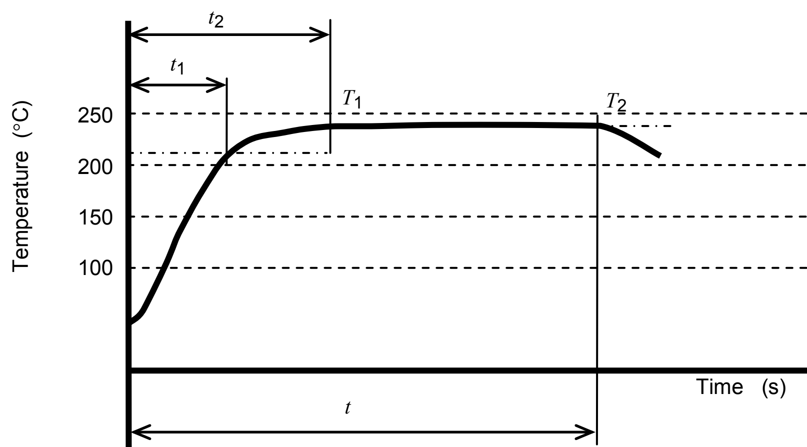
7.3 Preparation

See Clause 6 for details.

7.4 Test condition

7.4.1 Test temperature

The test jig plate shall be processed using the temperature profile as specified. Figure 3 shows a typical example.



Symbol	SAC type	Sn-Pb type
T_1	217 °C	183 °C
T_2	245 °C ± 3 °C	235 °C ± 3°C

Key

T_1 Solder melting temperature

T_2 Test temperature

t Test duration (5 s to15 s)

t_1 Time from start to T_1

t_2 Time from start to T_2

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The test starts at a temperature of 50 °C or less.

Time from start to T_1 (t_1) shall be 1,5 s or less.

Time from start to T_2 (t_2) shall be 3 s or less.

The ramp down rate is not specified.

Figure 3 – Example of the temperature profile

7.4.2 Feed of solder paste and immersion condition

The recommended condition of immersing a specimen into the solder paste is given in Table 2. For components not specified in Table 2, test conditions shall be specified in the relevant specification or agreed upon between the trading partners.