







# 91/1968/CDV

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TITLE:  
**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 ELECTROTECHNICAL COMMISSION

## 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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IEC 60068-2-83 has been prepared by IEC technical committee 91: Assembly Technology. It is an International Standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

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

- a) Revise Clause 5 to align with that in IEC 60068-2-20:2021.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

53  
54 Full information on the voting for its approval can be found in the report on voting indicated in the above  
55 table.

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

57 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance  
58 with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at  
59 [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in  
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  - 65 • withdrawn, or
  - 66 • revised.
- 67

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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 paste.

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

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

IEC 60068-2-20:2021, *Environmental testing – Part 2-20: Tests – Test Ta and Tb: 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 60194-2, *Printed boards design, manufacture and assembly - Vocabulary - Part 2: Common usage in electronic technologies as well as printed board and electronic assembly technologies*

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 60068-2-20:2021, IEC 60068-2-58, IEC 60194-2, and IEC 61190-1-3 and the following apply.

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

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

##### 3.1

##### wettability

intrinsic property of the termination material to form an alloy with the solder

Note 1 to entry: Wettability depends on the base metal used to produce the termination or, in the case of a plated termination, the condition and material used to plate the base metal.

[SOURCE: IEC 60068-3-13: 2016, 3.1.3]

**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****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.

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.

**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) can 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 agreed between the trading partners.

**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 cleaning is required by the relevant specification. No other method shall be used to clean the specimen. The specimen thus cleaned may be dried in air.

If required by the relevant specification, one of the preconditioning methods prescribed in 4.1.4 of IEC 60068-2-20:2021 may be used.

**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.

Expiration date of the solder paste shall be checked before solder paste preparation procedure listed below.

- 157 a) The solder paste shall be allowed to achieve ambient conditions that shall be nominally  $25\text{ °C} \pm 5\text{ °C}$   
 158 and relative humidity of  $(50 \pm 10)\%$  for 8 h or in accordance with the manufacturer's data sheet.
- 159 b) Open the supply container(s); remove any internal cover, scrape off paste adhering to the lid(s),  
 160 internal covers, and the container walls; and add this material to the paste in the supply container(s).  
 161 Check that the solder paste is not obviously deteriorated nor separated.
- 162 c) Using a spatula, stir the paste gently for 1 min to 2 min to homogenize it; taking care to avoid the  
 163 introduction of air.
- 164 d) If necessary, gently transfer the paste to a test container of sufficient volume, taking care to avoid  
 165 the introduction of air. The remaining solder paste taking out from the container, shall be discarded.  
 166 The remaining solder paste in the supply container shall be stored in the original dark and cool  
 167 environment.

## 168 6.2 Test jig plate

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

## 172 6.3 Specimen holder

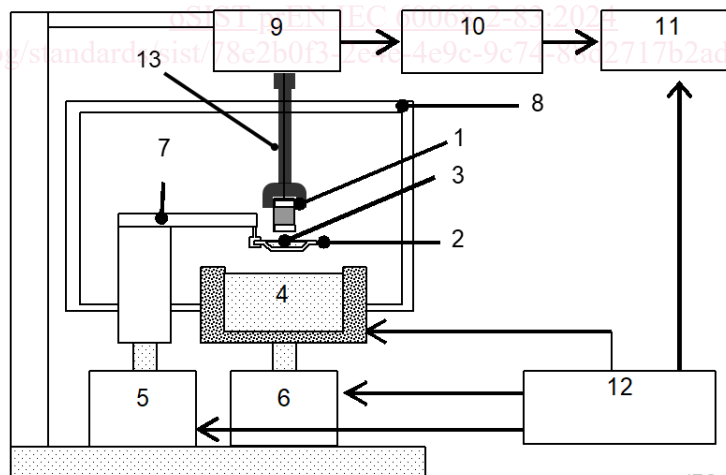
173 The specimen holder is usually contaminated by creeping of flux used in a test. A specimen holder shall  
 174 be cleaned using a neutral organic solvent. It is desirable to use ultrasonic agitation in cleaning.

## 175 7 Quick heating method

### 176 7.1 Equipment

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

- 179 a) The measuring system consists of the force sensor that can measure the force vertically acted on a  
 180 specimen, signal transducer and a recorder.
- 181 b) The heating system shall be capable of controlling the determined set temperature within  $\pm 3\text{ °C}$ .
- 182 c) The lift system shall be capable of carrying out immersion and withdrawal of the specimen, as  
 183 specified in 7.4.3.



IEC 1936/11

184

### 185 Key

1	Specimen	8	housing
2	test jig plate	9	sensor
3	solder paste	10	transducer
4	heating bath	11	recorder
5	lift for test jig plate	12	controller