BS EN 62739-2:2016

BSI Standards Publication

Test method for erosion of wave soldering equipment using molten lead-free solder alloy

Part 2: Erosion test method for metal materials with surface processing

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National foreword

This British Standard is the UK implementation of EN 62739-2:2016. It is identical to IEC 62739-2:2016.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic Assembly Technology.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 62739-2

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English Version

Test method for erosion of wave soldering equipment using molten lead-free solder alloy - Part 2: Erosion test method for metal materials with surface processing (IEC 62739-2:2016)

Méthode d'essai de l'érosion de l'équipement de brasage à la vague utilisant un alliage à braser sans plomb fondu - Partie 2: Méthode d'essai d'érosion de matériaux métalliques avec traitement de surface (IEC 62739-2:2016)

Verfahren zur Erosionsprüfung für Wellenlötausrüstungen bei Verwendung von geschmolzener, bleifreier Lotlegierung - Teil 2: Erosionsprüfverfahren für metallische Werkstoffe mit Oberflächenbehandlung (IEC 62739-2:2016)

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European foreword

The text of document 91/1365/FDIS, future edition 1 of IEC 62739-2, prepared by IEC/TC 91 "Electronics assembly technology" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62739-2:2016.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-05-17
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-08-17

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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60194:2015	NOTE	Harmonized as EN 60194:2016.
IEC 62739-1:2013	NOTE	Harmonized as EN 62739-1:2013.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
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	EN 61190-1-3	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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TEST METHOD FOR EROSION OF WAVE SOLDERING EQUIPMENT USING MOLTEN LEAD-FREE SOLDER ALLOY –

Part 2: Erosion test method for metal materials with surface processing

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International Standard IEC 62739-2 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
91/1365/FDIS	91/1379/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.

A list of all parts in the IEC 62739 series, published under the general title *Test method for erosion of wave soldering equipment using molten lead-free solder alloy*, can be found on the IEC website.

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

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

TEST METHOD FOR EROSION OF WAVE SOLDERING EQUIPMENT USING MOLTEN LEAD-FREE SOLDER ALLOY –

Part 2: Erosion test method for metal materials with surface processing

1 Scope

This part of IEC 62739 provides an evaluating test method for the erosion of the metallic materials with surface processing intended to be used for lead-free wave soldering equipment as a solder bath and other components which are in contact with the molten solder. It aims at prevention of an accident or a fire by predicting a setup and life of a suitable maintenance cycle.

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.

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 following terms and definitions apply.

3.1
erosion
phenomenon where a base material is dissolved and made thinner by coming into contact with molten solder

[SOURCE: IEC 62739-1:2013, 3.1]

3.2
lead-free solder
alloy that does not contain more than 0,1 % lead (Pb) by weight and used for joining components to substrates or for coating surfaces

[SOURCE: IEC 60194:2015, 75.1904]

3.3
dross
oxide and other contaminants that form on the surface of molten solder

[SOURCE: IEC 60194:2015, 75.0410]

4 Test

4.1 General

The specimen is mounted to the rotation block of the test equipment which is driven by the motor (may include gear unit) then immersed into molten lead-free solder and rotated to simulate solder flow in the wave soldering equipment. The erosion depth is measured after the block is rotated for a designated period of time.

4.2 Test equipment

4.2.1 Test equipment description

Test equipment shall include equipment that realises the test conditions specified in 4.4.

Component materials of the test equipment which come in contact with molten solder shall be erosion resistant or processed to be erosion resistant.

Details of the specifications of the equipment are given in Annex A.

4.2.2 Configuration example of test equipment

An example of the configuration of the test equipment is shown in Figure 1.

The test equipment consists of a pot unit, rotation unit, and control unit:

a) the pot unit consists of a heater to melt the lead-free solder alloy and a pot in which a specimen can rotate.
b) the rotation unit consists of a motor which rotates the specimen and a rotation block to which the specimen is attached.
c) the control unit has functions to control the heater, using a temperature sensor, control mechanism and motor rotation.

Since dross spreads during the test, it is preferable for the test equipment to have a ventilatory function with an exhaust air duct.

Other test equipment can be used if its configuration and functions meet the above requirements.

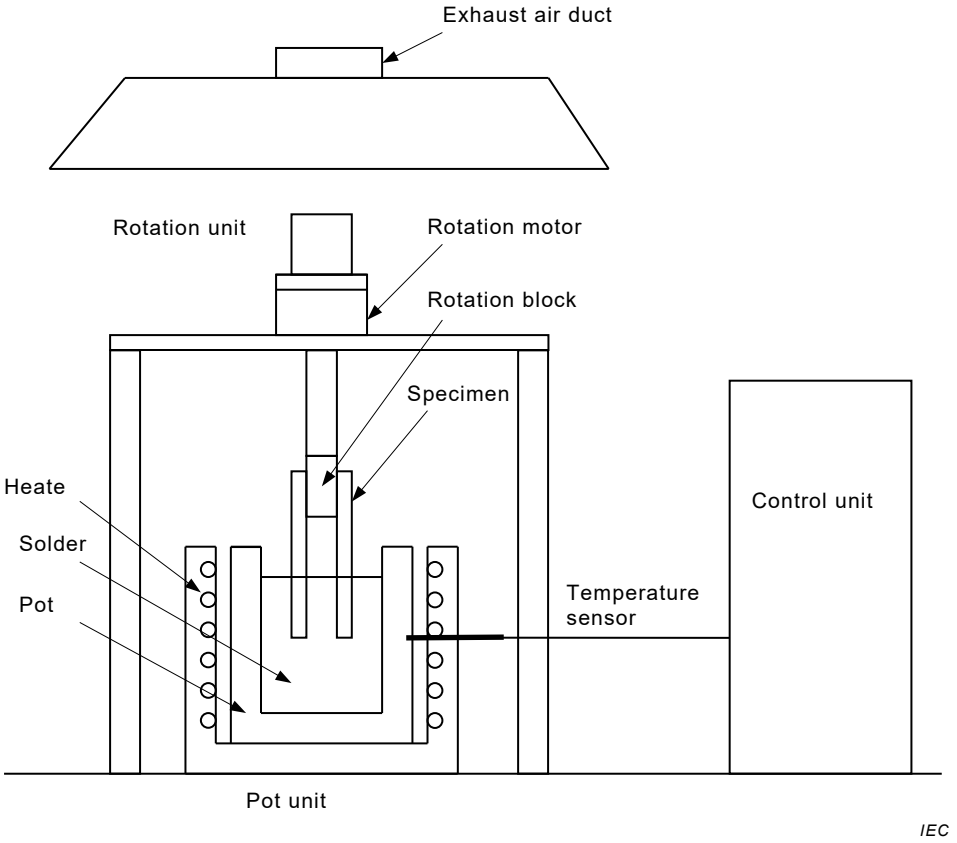


Figure 1 – Configuration example of test equipment

4.3 Specimen

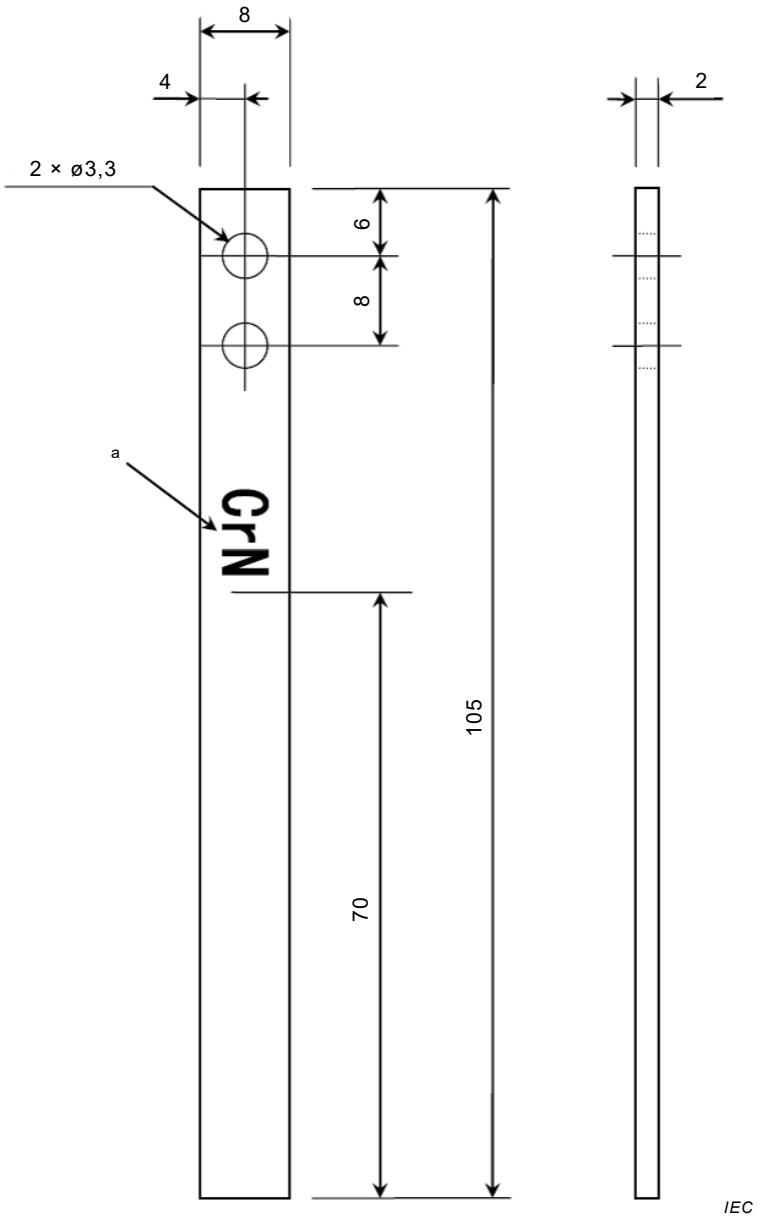
A specimen of the following material and shape is used.

a) The surface processing of the specimen shall be the same as that of the solder bath and its components which come into contact with the molten solder.

b) The shape of specimen and the indication of the surface processing designation shall be as shown in Figure 2. The indication shall be engraved.

c) The surfaces of the specimen to be evaluated shall be the surface with surface processing indication (face A) and its backside (face B), and from the lower edge to 50 mm above it.

Dimensions in millimetres



Key

[a] Engraved mark

Figure 2 – Shape of the specimen

4.4 Test conditions

Test materials and test conditions are shown in Table 1.

Table 1 – Test conditions

Composition of test solder alloy	Sn96,5Ag3Cu,5 specified in IEC 61190-1-3 shall be used if not otherwise specified in individual standards.
Solder temperature (at measurement position)	450 °C ±3 °C (the temperature is measured at a depth of 35 mm to 40 mm from the solder surface and at a distance of 20 mm to 30 mm from the specimen).
Rotation speed of specimen	100 r/min ±3 r/min.
Rotation radius of specimen	6 mm to 8 mm (from the centre of the rotation block to the outer edge of the specimen).
Dipping depth of specimen	65 mm to 70 mm (from molten solder surface to the lower edge of the specimen).
Test duration	Suitable test time needs to be set up in advance.
Frequency of removal of dross	A minimum of once every 16 h.
The time until erosion shows varies in accordance with the surface processing of the specimen. The appropriate test duration that shows the difference of the erosion depth depending on the surface processing, should be defined before performing the test. Care shall be taken to keep the uneroded area clean since this area is used as the base of the erosion measurement.	

4.5 Test methods

4.5.1 Method A – Without bending

If no further acceleration is demanded, the test without bending is conducted following the steps outlined below.

a) Clean the surface of the specimen with gauze or a paper towel.

b) The specimen shall be attached to the rotation block with face B touching the block, without contacting the molten solder.

c) Remove the dross floating on the molten solder in the pot following the dross removal procedure specified in 4.5.3. Dip the specimen attached to the rotation block into the molten solder maintained at the specified temperature. The specimen should be dipped in the molten solder to the depth specified in 4.4 and rotated by the rotation motor at the rotation speed specified in 4.4. After the rotation is complete, start measuring the elapsed time of the test. An example of a specimen attachment state without bending is shown in Figure 3.

d) Remove the specimen from the molten solder within 2 h after the test duration reaches to a specified value, and wipe off the solder completely from the specimen with a waste cloth.

e) The dross floating on the molten solder in the pot is removed at the frequency specified in 4.4.

f) After the test duration specified in 4.4, measure the depth of the erosion by the method specified in Clause 5.

g) Do not remove the specimen from the molten solder until the elapsed time of a test has reached the rated value, which includes the time for removing the dross and the equipment down time during the night.

Dimensions in millimetres

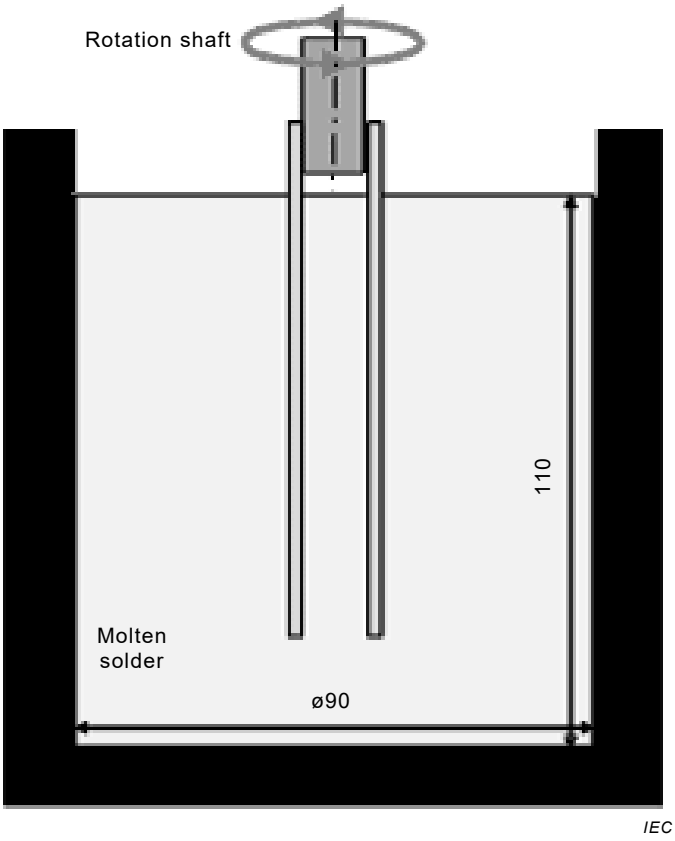


Figure 3 – Example of a specimen attachment state without bending

4.5.2 Method B – Accelerated in bended state

If further acceleration is demanded, the test with bending is conducted following the steps outlined below.

a) Clean the surface of the specimen with gauze or a paper towel.

b) The specimen shall be attached to the rotation block with face B touching the block, without contacting the molten solder.

c) Remove the dross floating on the molten solder in the pot following the dross removal procedure specified in 4.5.3. Dip the specimen attached to the rotation block into the molten solder maintained at the specified temperature. The specimen should be dipped in the molten solder to the depth specified in 4.4 and rotated by the rotation motor at the rotation speed specified in 4.4. After the rotation is complete, start measuring the elapsed time of the test. An example of a specimen attachment state with bending is shown in Figure 4.

d) Remove the specimen from the molten solder within 2 h after the test duration has reached a specified value, and wipe off the solder completely from the specimen with a waste cloth.

e) The dross floating on the molten solder in the pot is removed at the frequency specified in 4.4.

f) After the test duration specified in 4.4, measure the depth of the erosion by the method specified in Clause 5.

g) Do not remove the specimen from the molten solder until the elapsed time of a test has reached the rated value, which includes the time for removing the dross and the equipment down time during the night.

Dimensions in millimetres

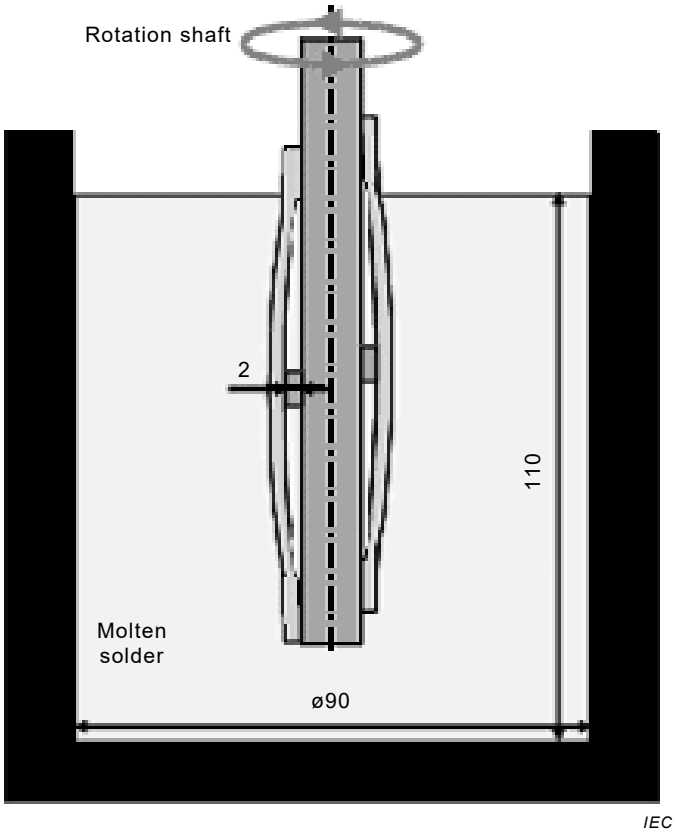


Figure 4 – Example of a specimen attachment state with 2 mm bending

4.5.3 Dross removal procedure

The dross floating on the molten solder in the pot is removed following the steps outlined below.

a) Stop the rotation motor and use an appropriate jig (like a stainless steel ladle with many holes) to remove the dross floating on the molten solder in the pot. Put the dross in a sealed container.

b) Check the volume of the molten solder in the pot (to ensure the dipping depth as specified in 4.4 is maintained). If the volume does not meet the specified requirements, supply additional solder accordingly.

c) Dip the specimen into the molten solder, which is now free from dross, to the depth specified in 4.4. Continue the test specified in 4.5.1 or 4.5.2.

5 Erosion depth measurement

5.1 General

After the test, the erosion depth of the specimen is measured by the focal depth method using an optical microscope as described below.

5.2 Preparation of the specimen

The specimen is prepared following the steps outlined below.

a) After the test has been conducted for the test duration specified in 4.4, continue dipping the specimen in the molten solder until the rotation stops. Remove the specimen from the solder when the rotation stops.

b) Remove the specimen by picking it up from the molten solder and detaching it from the rotation block.

c) Dip the specimen again into the molten solder, heat it, and remove it from the solder. Wipe the surface of the specimen to be evaluated immediately with a cotton cloth to remove the solder.

If the solder has not been removed completely, repeat step c) until all solder has been removed.

5.3 Measurement equipment

The measurement equipment shall consist of an optical microscope, digital micrometre, CCD camera, and TV monitor and be able to measure focal depth. An example of the measurement equipment is shown in Figure 5.

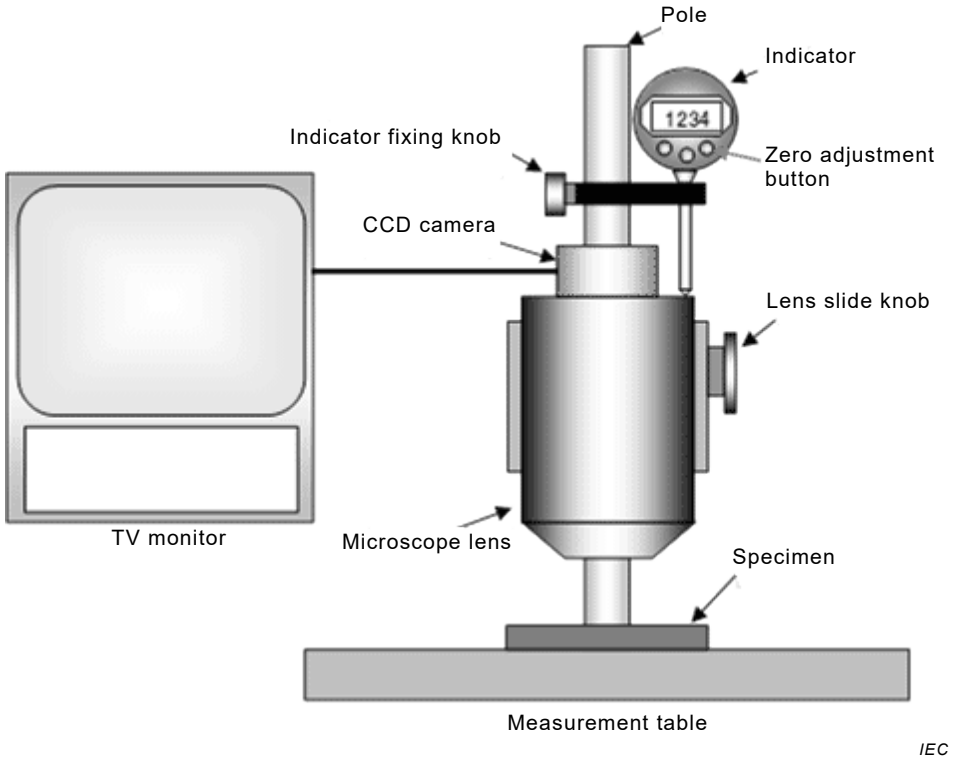


Figure 5 – Example of measurement equipment configuration for the focal depth method using an optical microscope

5.4 Measurement procedure

The specimen is measured following the steps outlined below.

a) Prepare the measurement equipment specified in 5.3 (if the equipment includes no CCD camera, specimens shall be observed using normal or corrected vision).

b) Visually observe faces A and B specified in 4.3 to find the seemingly deepest erosion area in advance (more than 3 areas on each face).

c) Place the specimen on the measurement equipment and find the deepest erosion area by multiplying the magnification of the microscope to its maximum setting (the magnification ratio is preferably 200 or higher).

d) After identifying the deepest erosion area, focus the microscope's lens on an uneroded area within the view angle by rotating the lens slide knob.

e) Press the zero setting button of the digital indicator to reset the indicated value to zero.

f) Then, rotate the lens slide knob of the microscope to focus on the deepest erosion area.

g) Read and record the value indicated on the digital indicator.

h) It is preferable to take a photograph of the erosion area if possible.

i) The position where the erosion seems to be the deepest is measured at three places or more on each face, and the maximum value is adopted as erosion depth. To exclude the influence of the erosion generated by dross, the evaluation area is limited to 50 mm from the lower edge of the specimen. It is premised that the specified dipping depth is 65 mm to 70 mm. In the case of a test with 2 mm bending, the specimen area touching with bending pin and holder shall be excepted from the evaluation area.

6 Items to be recorded in test report

In the test report, each of the following items shall be included:

a) date and time of the measurement;

b) test and measuring equipment manufacturer and equipment number;

c) specimen:
   1) material, surface processing, and number;
   2) thermal refining;
   3) processing conducted (e.g. cutting, grinding);
   4) surface condition;

d) solder material;

e) test conditions:
   1) temperature of molten solder;
   2) rotation speed;

f) presence/absence of erosion, depth of erosion;

g) condition of erosion (details of the erosion's condition; photographs that indicate the location of the erosion).

Annex A
(normative)

Specifications of test equipment and measurement equipment

A.1 Overview

This annex provides specifications of the test equipment mentioned in 4.2 and measurement equipment mentioned in 5.3.

A.2 Characteristics of the test equipment

A.2.1 General

The test equipment of this standard shall consist of a pot unit, rotation unit, and control unit, each of which has the following characteristics.

A.2.2 Pot unit

The pot unit shall have the following characteristics.

a) The pot should be large enough to contain more than 5 kg of solder so that the specimen can rotate inside it and not block the rotation of the specimen specified in 4.4.

b) The pot should be deep enough to dip the specimen to the specified depth.

c) If a steel pot is used, the pot surface should be processed to prevent erosion. No particular specification is given to the surface processing.

d) The heater should be capable of melting the solder and heating the molten solder up to 500 °C.

e) If the heater needs to be dipped in the molten solder, the heater surface should be processed to prevent erosion.

A.2.3 Rotation unit

The rotation unit shall have the following characteristics.

a) The rotation unit has a motor that rotates the specimen.

b) The shaft of the rotation motor is provided with a rotation block to hold the specimen.

c) The specimen attached to the rotation block rotates in the solder at the depth specified in 4.4.

A.2.4 Control unit

The control unit shall have the following characteristics.

a) The control unit has a temperature sensor and uses a temperature adjuster to control the heater. The unit is capable of maintaining the temperature of the molten solder at 450 °C ± 3 °C.

b) If the temperature sensor needs to be dipped in the molten solder to the depth specified in 4.4, it is preferable that the sensor is surface processed.

c) The motor shall be controlled at a rotation speed of 100 r/min ± 3 r/min as specified in 4.4.

d) It is preferable that the elapsed time of the test specified in 4.4 can be automatically recorded.

e) For safety reasons, it is preferable that the equipment has an interlock or other functions to prevent overheating of the solder.

A.2.5 Ventilation

Since the specimen is rotated during the test, the dross and hot air would diffuse in the surrounding air. It is therefore preferable that the test equipment has an exhaust air duct for ventilation. The ventilation rate does not need to be specified if it does not affect the solder temperature. Moreover, dross formation can be reduced by supplying nitrogen to test equipment as an option.

A.3 Accuracy of the measurement equipment

A.3.1 General

The measurement equipment of this standard shall consist of an optical microscope, digital indicator, CCD camera, TV monitor, and possess the following measurement accuracy.

A.3.2 Measurement accuracy

Measurement accuracy = depth of field + accuracy of digital indicator

a) Example of 100 times: 382 + 30 = 412 μm or less.

b) Example of 300 times: 38 + 30 = 68 μm or less.

c) Example of 600 times: 17 + 30 = 47 μm or less.

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ISO 16143-1:2014, *Stainless steels for general purposes – Part 1: Corrosion-resistant flat products*

ISO 16143-2:2014, *Stainless steels for general purposes – Part 2: Corrosion-resistant semi-finished products, bars, rods and sections*

ISO 16143-3:2014, *Stainless steels for general purposes – Part 3: Wire*

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