IEC 62739-3

Edition 1.0 2017-01

INTERNATIONAL STANDARD

Test method for erosion of wave soldering equipment using molten lead-free solder alloy – Part 3: Selection guidance of erosion test methods

IEC 62739-3:2017-01(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 31.190; 31.240

ISBN 978-2-8322-3769-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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International Standard IEC 62739-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

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

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CDV	Report on voting
91/1368/CDV	91/1400/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

A list of all the parts in the IEC 62739 series, 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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

Part 3: Selection guidance of erosion test methods

1 Scope

This part of IEC 62739 describes the selection methodology of an appropriate evaluating test method for the erosion of the metal materials without or 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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

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

IEC 62739-1:2013, *Test method for erosion of wave soldering equipment using molten lead-free solder alloy – Part 1: Erosion test method for metal materials without surface processing*

IEC 62739-2, *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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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 % mass fraction of lead (Pb) as its constituent and used for joining components to substrates or for coating surfaces

[SOURCE: IEC 60194:2015, 75.1904 modified – "mass fraction" is used instead of "weight" and "as its constituent" has been added]

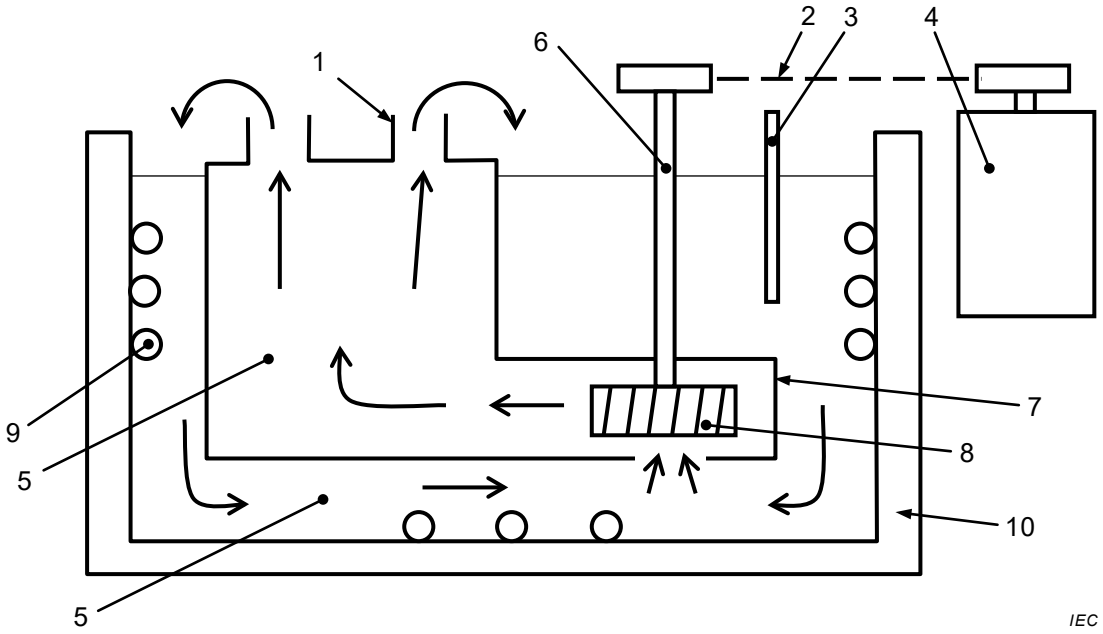
3.3
dross
oxide and other contaminants that form on the surface of molten solder

[SOURCE: IEC 60194:2015, 75.0410]

4 General remarks

Figure 1 shows a schematic example of wave soldering equipment showing a solder bath and auxiliaries which are subjected to evaluation. Table 1 shows the location of the erosion in the field, and an example of the problems. The tests specified in IEC 62739-1 and IEC 62739-2 are intended to provide an appropriate maintenance inspection cycle and replacement period of a solder bath and other metal components, by assessing the anti-erosion capability of material and other metal components, including surface processing, subjected to solder baths.

Except for the duration, test conditions such as molten solder temperature and rotation speed, specified in IEC 62739-1 and IEC 6273-2, are predetermined. Thus, the erosion occurrence durations vary depending upon the type of metal and the surface processing employed. For this reason, an adequate test duration needs to be pre-set so as to clearly identify the non-erosion which is used as the baseline of the erosion depth by the focal depth method and which is also used to discriminate the type of metal and surface processing employed by erosion depth on the specimen.



Key

1	Jet stream nozzle	6	Impeller shaft
2	Drive belt	7	Molten solder pump
3	Temperature sensor	8	Impeller
4	Motor	9	Heater
5	Molten solder	10	Solder bath

Molten solder flow directions are indicated by an arrow.

Figure 1 – Schematic example of wave soldering equipment

Table 1 – Location of erosion in the field and examples of problems

Location of erosion in the field	Example of problems
Solder bath inner wall	Hole, molten solder leaking
Impeller shaft	Thinning, impeller shaft breaking
Molten solder pump components such as impeller	Soldering defects due to molten solder jet stream disturbance
Jet stream nozzle	Soldering defects due to molten solder jet stream disturbance
Temperature sensor tube	Hole, unintentional molten solder temperature, insulation failure
Throw-in heater	Hole insulation failure, electricity leak

5 Selection of the appropriate erosion test method

5.1 Correlation between test methods and stresses induced in the field

Table 2 shows the correlation between test methods and stresses induced in the field, indicating the applicable material.

Table 2 – Correlation between test methods and stresses induced in the field

Test method (Applicable standard)	Accelerated stress conditions	Applicable material	Stress induced in the field
Rotation test at 350 °C [a] (IEC 62739-1)	High temperature (350 °C) Molten lead-free solder flow Flux application	Metal material without surface processing	Assuming encroach due to solid metal fusion by high temperature molten lead-free solder. Assuming encroach due to chemical erosion by flux.
Rotation test at 450 °C [b] (IEC 62739-2)	High temperature (450 °C) Molten lead-free solder flow	Metal material with surface processing	Assuming encroach due to solid metal fusion by high temperature molten lead-free solder.
Rotation test at 450 °C with 2 mm bending [c] (IEC 62739-2)	High temperature (450 °C) Molten lead-free solder flow Bent stress (2 mm)	Metal material with surface processing	Assuming encroach due to solid metal fusion by high temperature molten lead-free solder. Assuming encroach acceleration by bending stress on the metal surface with surface processing.

[a] This test method is conducted at a suitable temperature for metal material without surface processing to produce appropriate erosion depth measurements. However, a sufficient test duration for each metal material shall be predefined. For metal material with surface processing, erosion occurrence duration becomes too long. Thus, this test method is not applicable for metal material with surface processing.

[b] This test method is conducted at a suitable temperature for metal material with surface processing to enable an appropriate erosion depth measurement. However, a sufficient test duration for each surface processing shall be predefined. For metal material without surface processing, erosion progresses so fast that a non-erosion area which is used for the baseline of the erosion depth cannot be obtained. Thus, this test method is not applicable for metal material without surface processing.

[c] This test method is suitable for metal material with surface processing when the rotation test at 450 °C takes too long and additional acceleration is required. However, a sufficient test duration for each surface processing shall be predefined. For metal material without surface processing, erosion progresses so fast that a non-erosion area which is used for the baseline of the erosion depth cannot be obtained. Thus, this test method is not applicable for metal material without surface processing.

5.2 Recommended test method by materials

Table 3 shows an appropriate test method depending on the material used with respect to solder baths and auxiliaries.

Table 3 – Applicable test method depending on the materials

Metal materials and surface processing		Applicable acceleration test method		
Metal material	Surface processing	Rotation test at 350 °C	Rotation test at 450 °C	Rotation test at 450 °C with 2 mm bending
SUS304	None	A	B	B
SUS316	None	A	B	B
Titan	None	A	B	B
Cast iron	None	A	B	B
SUS304, SUS316	Surface diffusion type	B	A	A
SUS304, SUS316	Coating type	B	A	A

"A" denotes recommended. "B " denotes not applicable.