IEC 61189-5-503

Edition 1.0 2017-05

INTERNATIONAL STANDARD

colour inside

Test methods for electrical materials, printed board and other interconnection structures and assemblies –
Part 5-503: General test method for materials and assemblies – Conductive anodic filaments (CAF) testing of circuit boards

IEC 61189-5-503:2017-05(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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International Standard IEC 61189-5-503 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
91/1433/FDIS	91/1443/RVD

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 parts in the IEC 61189 series, published under the general title *Test methods for electrical materials, printed boards and other interconnection structures and assemblies*, 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- withdrawn,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.

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TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARD AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

Part 5-503: General test method for materials and assemblies – Conductive anodic filaments (CAF) testing of circuit boards

1 Scope

This part of IEC 61189 specifies the conductive anodic filament (hereafter referred to as CAF) and specifies not only the steady-state temperature and humidity test, but also a temperature-humidity cyclic test and an unsaturated pressurized vapour test (HAST).

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 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-38, *Environmental testing – Part 2-38: Tests – Test Z/AD: Composite temperature/humidity cyclic test*

IEC 60068-2-66, *Environmental testing – Part 2: Test methods – Test Cx: Damp heat, steady state (unsaturated pressurized vapour)*

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

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

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

IPC-TM-650 No.2.6.14.1, *Electrochemical Migration Resistance Test [viewed 2017-01-31]. Available at: https://www.ipc.org/TM/2-6_2-6-14-1.pdf*

IPC-TM-650 No.2.6.25, *Conductive Anodic Filament (CAF) Resistance Test: X-Y Axis [viewed 2017-01-31]. Available at: https://www.ipc.org/4.0_Knowledge/4.1_Standards/test/2-6-25.pdf*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194 and IEC 60068-1 as well as the following 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
electrochemical migration
degradation of insulation characteristics between conductors due to eletrochemical elution of ions in a humid environment when voltage is applied to conductors of a printed wiring board

Note 1 to entry: In addition, ionic impurities present in the insulations contribute to their degradation.

Note 2 to entry: Electrochemical migration may take the forms of dendrite (3.2) and CAF(3.3).

3.2
dendrite
metal migration

Note 1 to entry: Dendrite is visible in that it creates a branching and tree like structure on the surface, on the interface between layers, etc. of a printed wiring board.

3.3
CAF
conductive anodic filament
migration which occurs along the monofilament of reinforcing material such as glass cloth in an inner layer part of a printed wiring board

3.4
HAST
highly accelerated temperature and humidity stress test
stress test under unsaturated pressurized vapour test

Note 1 to entry: See IEC 60068-2-66.

3.5
automatic insulation resistance measurement
measurement to take continuous or predetermined periodic test data using an automatic measurement system without an operator

3.6
manual insulation resistance measurement
measurement to take predetermined periodic test data using measurement equipment by an operator

Note 1 to entry: Measurement can be done with or without taking out a specimen from the test chamber.

3.7
test voltage
voltage to apply on the specimen as a stress in the testing environment

3.8
measuring voltage
voltage to apply on the specimen in order to measure the insulation resistance

4 Testing condition

4.1 Standard condition

Measurement is performed under the standard atmospheric condition which is specified in Clause 4 of IEC 60068-1:2013.

It depends on a reference condition stated in 4.2 when an ambiguity is found for the judgment in the standard atmospheric condition or when it is required in particular.

It may be performed under other conditions than the standard atmospheric condition, when no doubt about the judgment subsits and when measuring in standard condition proves difficult, or when specified in particular specifications.

4.2 Judgment state

Reference condition is the standard atmospheric condition for measurement as stated in 4.2 of IEC 60068-1:2013.

5 Specimen

5.1 Outline of CAF test vehicle design

5.1.1 Evaluation design for the glass cloth direction

The in-line test combs are comprised of a series of alternate rows of via holes with a voltage applied across the comb. They represent the most common failure sites where CAF can occur: between via hole walls. The via holes are in line with one another and in alignment with the woven glass fibre reinforcement. The closest point between each via pair is the most likely point for CAF growth (example highlighted in Figure 1). The black spots represent the drilled hole, and the copper pads associated with the via holes are in orange.

The construction of staggered combs is similar to that of the in-line combs, however, the via pairs are arranged at 45°. This means that the most likely route for potential CAF growth is longer since the orientation of the glass fibres may only permit growth in the horizontal and vertical directions (as represented by the white ellipses in Figure 2).

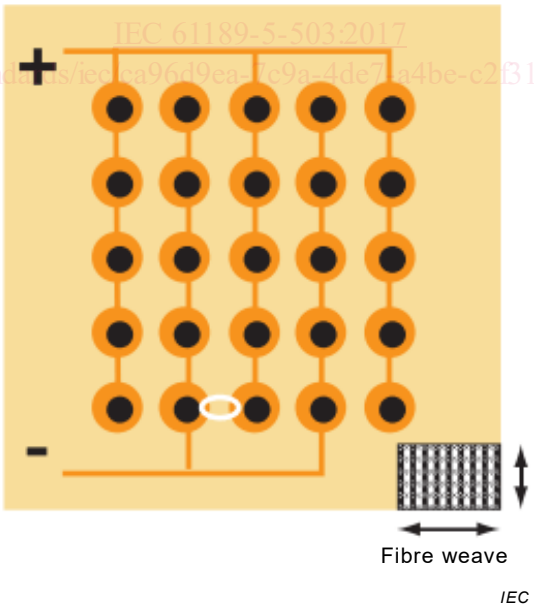

Figure 1 – Schematic of in-line test comb, with possible failure site