

TECHNICAL REPORT



**Test methods for electrical materials, printed boards and other interconnection structures and assemblies –
Part 5-506: General test methods for materials and assemblies – An
intercomparison evaluation to implement the use of fine-pitch test structures for
surface insulation resistance (SIR) testing of solder fluxes in accordance with
IEC 61189-5-501**



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intercomparison evaluation to implement the use of fine-pitch test
structures for surface insulation resistance (SIR) testing of solder fluxes
in accordance with IEC 61189-5-501**

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IEC/TR 61189-5-506, which is a technical report, has been prepared by IEC technical committee 91: Electronics assembly technology.

The text of this Technical Report is based on the following documents:

| Draft TR | Report on voting |
|-------------|------------------|
| 91/1500/DTR | 91/1530A/RVDTR |

Full information on the voting for the approval of this Technical Report 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- withdrawn,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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INTRODUCTION

This document addresses the development of IEC 61189-5-501 and the introduction of a fine-pitch test pattern. The introduction of this pattern is needed to meet the need for IEC 61189-5-501 to reflect current assembly technology. This document describes an intercomparison that tests a new test pattern and benchmarks it to existing test patterns. The work validates the introduction of the new fine-pitch test pattern.

It is well known that structures at fine pitches with flux residues are more susceptible to corrosion issues and electrochemical migration (ECM) problems. Characterization of flux residues in terms of ECM are commonly characterized using SIR testing. A key parameter of the SIR test is the comb pattern used and gap between the electrodes. The current B24 and B25 with their 500- μm and 318- μm gap patterns are not representative of fine pitches. It has been proposed to use a 200- μm gap pattern, and this document describes an intercomparison that validates the introduction of the 200- μm gap pattern.

This document describes an exercise that used a new test board that included the B24 and B25 patterns with an additional 200- μm pattern, with each pattern duplicated, giving six patterns in all on each test board. This work was motivated by an update to IEC 61189-5-501. A protocol for the testing was developed that took a standardised test rosin flux and defined the flux loading and thermal conditioning. Seven laboratories took part from five countries. The test boards were prepared centrally and then tested in the seven laboratories, and the results analysed to validate the usage of the 200- μm pattern. The document describes the intercomparison and the data analysis.

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

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1 Scope

This Technical Report is an intercomparison supporting the development of IEC 61189-5-501 in relation to the SIR method. This document sets out to validate the introduction of a new 200- μm gap SIR pattern, and was benchmarked against existing SIR gap patterns of 318 μm and 500 μm .

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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>

4 Test board concept for intercomparison

4.1 The need for a fine-pitch SIR pattern

The pursuit of higher quality and reliability leads to the requirement of proving that electronic assemblies are not susceptible to electrochemical failure. Such robustness will lead to proven lifetime performance in the field. Electrochemical failure can occur at the surface or sub-surface, and in this paper we focus on surface failure phenomena and its characterisation. Electrochemical failure needs three factors to be present simultaneously for a failure to occur: a continuous water film, an applied electric field, and soluble ionic material. Under condensing conditions, a macroscopic water film will form and in most instances an uncoated assembly will fail instantly. But for high humidity conditions, an invisible sub-micron water film will form that will support low levels of conduction, and certainly no fast dramatic loss of isolation. Applied electric fields can cause electrochemical failure, from 25V/mm and upwards, by driving ions down an electric field. Ionic material is needed as pure water has very high resistivity, hence dissolved ions increase conductivity and polarization at electrodes resulting in corrosion at anodes. Sources of contamination can appear on the surface of the assembly from the manufacturing process or the environment. If the contamination is water soluble and dissociates to form ionic species, these ions migrate under an electric field.

It is of course of interest as to what ionic materials are present, but more importantly, the question is what will be the impact of these residues or contamination. The industry many years ago developed the basis of the “Surface Insulation Resistance” test, which applies an