



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**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.180

ISBN 978-2-8322-7083-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Test board concept for intercomparison	7
4.1 The need for a fine-pitch SIR pattern	7
4.2 Test board design	8
4.3 Test board fluxing	9
5 Test procedure for intercomparison	10
5.1 Sample preparation.....	10
5.2 Preparation of samples for humidity chamber.....	11
5.3 Placement of samples inside the humidity chamber	11
5.4 Resistance measurements	12
5.5 Evaluation of results	12
5.6 Additional information	12
6 Results	12
Bibliography.....	23
Figure 1 – TB144	9
Figure 2 – Connector arrangement.....	11
Figure 3 – Sample orientation in test chamber	12
Figure 4 – Participants (a to f) resistance measurements for the six test patterns on the checker board.....	13
Figure 5 – Participant A control boards	13
Figure 6 – Participant A flux loaded boards.....	14
Figure 7 – Participant B control boards	14
Figure 8 – Participant B flux loaded boards.....	14
Figure 9 – Participant C control boards	15
Figure 10 – Participant C flux loaded boards.....	15
Figure 11 – Participant D control boards	15
Figure 12 – Participant D flux loaded boards.....	16
Figure 13 – Participant E control boards	16
Figure 14 – Participant E flux loaded boards.....	16
Figure 15 – Participant F control boards	17
Figure 16 – Participant F flux loaded boards	17
Figure 17 – Participant G control boards.....	17
Figure 18 – Participant G flux loaded boards	18
Figure 19 – Participant D, and evidence of a fibre and the effect on the SIR	18
Figure 20 – Participant E and evidence of corrosion shorting across the gap	18
Figure 21 – Participant G and evidence of a water droplet and the resulting drop in SIR and dendrite like failure.....	19
Figure 22 – Participant G and a corrosion defect probably from a flux residue	19

Figure 23 – Participant C dendrites and corrosions formed on all SIR patterns of all fluxed samples tested at 85°C/85% 19

Figure 24 – The average final SIR value for the control boards 20

Figure 25 – The average final SIR value for the flux loaded boards 20

Figure 26 – The average final SIR for flux-loaded patterns by participant 21

Figure 27 – Final SIR plotted as ohm.squares 21

Figure 28 – Ratio of the log Ω .square value to the 500- μ m pattern 22

Table 1 – SIR pattern information 9

Table 2 – Flux to be used for SIR evaluation test 10

Table 3 – Samples for SIR evaluation testing 10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 –

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

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.