In May 1995 the IPC’s Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC’s standardization efforts.

**Standards Should:**
- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

**Standards Should Not:**
- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

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Adopted October 6, 1998

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC’s volunteers in the standards and publications development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC’s staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

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Thank you for your continued support.
IPC-TM-650-MDP

IPC Test Method Development Packet

Developed by the IPC Test Methods Subcommittee (7-11) of the Testing Committee (7-10) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

Contact:

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105
## Acknowledgment

Members of the IPC Test Methods Subcommittee (7-11) of the Testing Committee (7-10) of IPC have worked together to develop this document. We would like to thank them for their dedication to this effort. Any document involving a complex technology draws material from a vast number of sources. While the principal members of the IPC Test Methods Subcommittee is shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude.

### Testing Committee

<table>
<thead>
<tr>
<th>Chair</th>
<th>Vice-Chair</th>
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<tbody>
<tr>
<td>Renee Michalkiewicz, Trace Laboratories – Baltimore</td>
<td>Chris Mahanna, Robisan Laboratory Inc.</td>
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### Test Methods Subcommittee

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<tr>
<th>Chair</th>
<th>Vice-Chair</th>
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</thead>
<tbody>
<tr>
<td>Joseph Russeau, Precision Analytical Laboratories, Inc.</td>
<td>Graham Naisbitt, Gen3 Systems Ltd</td>
</tr>
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</table>

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- Shane Whiteside, TTM Technologies

### Test Methods Subcommittee

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IPC-TM-650-MDP
IPC Test Method Development Packet

1 Scope
This packet defines the elements that shall be included in an IPC-TM-650 Test Method and used to assist the IPC 7-11 Test Methods Subcommittee (TMSC) in their reviewing process. The goal is to evolve a coordinated and standardized approach for drafting and validating an IPC test Method.

1.1 Background The purpose of the following is to help in defining criteria that will yield better test methods for use by the electronics and all related industries. With the ever-increasing demand for improved accuracy, precision and documentation, it is the responsibility of the IPC TMSC to regularly request better evaluation of the methods that IPC publishes and maintains. This not only aids the user in achieving a higher quality standard, but also keeps IPC in leading the way in its continuous improvement endeavors. As such, the TMSC has compiled, from multiple sources, the criteria believed to assist in achieving a higher standard in IPC test methods without sacrificing from originating task groups (OTGs) their ability to utilize shared expertise.

1.2 Terms and Definitions
1.2.1 Quantitative Method A method by which an objective measurement is being made.
1.2.2 Qualitative Method A method by which a subjective measurement is being made.

2 Applicable Documents
2.1 IPC
• IPC-TM-650 Test Methods Manual, Section 1, Reporting and Measurement Analysis Methods
• IPC-QL-653 Certification of Facilities that Inspect/Test Printed Boards, Components and Materials
• IPC Metric Policy
• IPC Test Methods Approval Form
• IPC Test Methods Flow Chart
• IPC Patent Policy

2.2 ISO/IEC
• ISO / IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories (Sections 5.4.5.1 and 5.4.5.2)
• ISO 5725 – 1 Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions
• ISO 5725 – 2 Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method
• ISO 5725 – 3 Accuracy (trueness and precision) of measurement methods and results — Part 3: Intermediate measures of the precision of a standard measurement method
• ISO 5725 – 4 Accuracy (trueness and precision) of measurement methods and results — Part 4: Basic methods for the determination of the trueness of a standard measurement method
• ISO 5725-5 Accuracy (trueness and precision) of measurement methods and results — Part 5: Alternative methods for the determination of the precision of a standard measurement method
• ISO 5725-6 Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values
• ISO 17000, Conformity assessment – Vocabulary and general principles VIM, International vocabulary of basic and general terms in metrology
• ISO/IEC Guide 43-1, Proficiency testing by interlaboratory comparisons — Part 1: Development and operation of proficiency testing schemes
• ISO/IEC Guide 43-2, Proficiency testing by interlaboratory comparisons — Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies

2.3 The International Bureau of Weights and Measure (BIPM)
• GUM Guide to the Expression of Uncertainty in Measurement

1. www.ipc.org
2. Current and revised IPC Test Methods are available on the IPC Web site (www.ipc.org/html/testmethods.htm)
3. The IPC Metric Policy and Patent Policy are contained within the Standardization Process of the IPC, available at www.ipc.org/standards
4. www.iso.org/www.iec.ch
5. www.bipm.org
3 Developing and Re-affirming an IPC Test Method (Quantitative and Qualitative)

Each IPC test method, prior to its submission to the TMSC, shall include the items described in the following paragraphs:

3.1 Test Method Format The test method format shall conform to the IPC-TM-650 Test Method Template (see Appendix A).

3.2 Measurements and Values In accordance with the IPC Metric Policy, any measurements or values found within an IPC test method shall be defined metrically with imperial soft values contained in brackets as mandated by the IPC Technical Activities Executive Committee (TAEC). Explanations and examples of the metrics policies can be found within the IPC Metric Policy document and IPC-TM-650, Method 1.6.

3.3 Test Method Validation There are two key objectives to validating an IPC test method. The first objective, as described in 3.3.1, is to provide objective evidence that the elements defined within a method fulfill the intended use. The second objective, as described in 3.3.2, is a Gauge R&R study, to show that a method yields repeatable and reproducible results when executed by multiple facilities, which are preferably separate entities. The following describes the items that the TMSC requires when any method is submitted for review.

3.3.1 IPC Test Method Validation The OTG shall validate that any submitted IPC test method meets the requirements identified by that group and clearly defines the procedures used for validation and the collecting of relevant data. Additionally, the OTG shall define variables that may influence the outcome of the data, the method detection limits (MDL's) and the statistical impacts of all variables on the data (where practicable). IPC-TM-650, Methods 1.8 and 1.9 have procedures defined to help with the evaluation of measurement variables (see also ISO 5725 – Part 1 through Part 6 and/or GUM).

The validation procedure, all collected data, measurement variables, MDL's, statistical impacts and a statement from the OTG that the IPC test method does meet the intended requirements shall be submitted to the TMSC for review upon submission of any such method. No IPC test method will be approved by TMSC until all validation testing is completed by the OTG. Further, the OTG shall have a minimum of three independent task group members perform the validation protocol and report their results.

3.3.2 Multiple Facility Gauge R&R The OTG shall support the IPC test method with proven Gauge R&R that shall be appropriate for the proposed test method. The Gauge R&R shall be performed by a minimum of three independent facilities as a blind study. In addition, Cpk values with realistic tolerances, supported by data, shall be provided where applicable.

4 IPC Test Methods for a Single Manufacturer of Test Equipment

A minimum of three independent facilities, defined by the OTG, shall perform a study of the instrument to validate the equipments ability to objectively carry out the method and generate data considered as reasonable by the OTG. Where practicable the output of the equipment shall be traceable to SI (le Système international d’unités [International System of Units]) or SI derived units. Additionally, the OTG shall follow the same criteria defined in Section 3 when validating the equipment and method and reporting the results to the TMSC.

5 IPC Test Methods involving Patented Equipment, Materials or Processes

For IPC test methods utilizing patented equipment, materials or processes, IPC’s patent policy shall be adhered to. The OTG shall follow the same criteria defined in Section 3 when validating the patented items and reporting the results to the TMSC. Additionally, the OTG shall include an accompanying statement in the IPC test method noting that proper license has been obtained. The following language taken from IPC’s patent policy is an example:

“The user’s attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no positions taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be oriented from the standards developer.”

6 Existing IPC Test Methods

Existing methods are those that have already been adopted into the TM-650 Test Methods Manual. Existing methods should be reviewed every five years to ensure that a test method is still current. If an existing method is kept active, then the TMSC requires that the OTG make an effort to validate the method per Section 3, assuming no prior effort to validate the test method has taken place. If the data from a previous validation effort is already available, it should be reviewed and provided to the TMSC to ensure that it is still valid.

Note: There is no requirement to gather historical data from their independent sources each time an IPC test method is submitted for its five-year review if such data was previously submitted.
Appendix A
IPC-TM-650 Test Method Template

Test Method ##Title:
Stage:
Date: Month 200X
Originating Task Group: Group Name (Code)
Working Task Group: Group Name (Code)

1 Scope The Scope section defines the purpose of the test method, as well as giving an overall view of the test method. This section should be written in summary fashion and include any limitations that might cause erroneous test results. It should also include a general statement regarding any cautions, hazards, or warning about the test method, referencing section 6.0 Notes for detailed information. The scope should also indicate who typically would be performing the test as well as providing information on where (scenarios, such as a type of lot) the test is to be employed.

2 Applicable Documents The Applicable Documents Section should include a list of all applicable documents, and may show where to obtain these documents. Applicable documents are defined as documents that are specifically called out within the test method, and do not include other reference documents. Reference documents may be included in Section 6.0 Notes of the test method.

3 Test Specimens The Test Specimens section should include the type, size, and quantity of specimens required to conduct the test. Preparation of the specimens should be detailed in this section. If preparation is covered by another IPC-TM-650 test method (i.e., microsection preparation), then that method should be referenced here. Necessary considerations for storage preservation and handling of test specimens must also be made in this section.

4 Apparatus or Material This section should include all apparatus or materials utilized in the test method. It should include the technical data, accuracy requirements, and range capabilities of the equipment or materials necessary to adequately complete the test. This section should also include reference drawings for any specialized equipment or test fixtures required. If chemical reagents, purified water, or other specialized materials are to be used, purity, concentration, and/or special formulas required must be detailed. Specific brand names or trademarks should be avoided unless they are required for a well-defined reason. In this case utilize a footnote giving the required information along with either of the following phrases: “has been found satisfactory for this purpose”; “or equivalent”.

5 Procedure The procedure section is to be used to detail all of the specific steps necessary to perform the actual test. It shall include any specific conditioning requirements, or other specimen preparation not previously detailed. It shall then describe in detail the successive steps of the procedure, grouping related operations into logical divisions in a concise manner. It shall include times, temperatures, voltages, pressures, concentrations, linear measurements and quantitative criteria when necessary in applicable units (both Metric and English).

It shall then state any detailed information required in reporting the test results. When two or more procedures are described in the same test method, the report shall indicate which of the procedures was used. When a test method allows variations in operating or other conditions, the report shall state the particular conditions utilized for the test.

6 Notes The Notes section is to be used to discuss any special considerations, or detail other reference documents necessary or recommended for the test. This section should include any safety precautions, hazard information, or warning statements necessary for the safe completion of the test method. This section should also be used to show sources of obtaining specialized test apparatus or materials for the test.
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To help IPC serve your member site in the most efficient manner possible, please tell us what your facility does by choosing the most appropriate member category. (Check one box only.)

☐ Printed Circuit Board Manufacturers

This facility manufactures and sells printed circuit boards (PCBs) or other electronic interconnection products to other companies. What products do you make for sale?

☐ One and two-sided rigid, multilayer printed boards
☐ Flexible printed boards
☐ Other interconnections

☐ Electronic Manufacturing Services (EMS) Companies

This facility manufactures printed circuit assemblies, on a contract basis, and may offer other electronic interconnection products for sale.

☐ OEM — Original Equipment Manufacturers

This facility purchases, uses and/or manufactures printed circuit boards, or other interconnection products for use in a final product, which we manufacture and sell.

What is your company’s primary product line?

☐ Industry Suppliers

This facility supplies raw materials, equipment or services used in the manufacture or assembly of electronic products.

What industry segment do you supply?

☐ PCB
☐ EMS
☐ Both

What products do you supply?

☐ Government, Academic, NonProfit

We are representatives of a government agency, university, college, technical institute or nonprofit organization who are directly concerned with design, research and utilization of electronic interconnection devices.

☐ Consultant

What services do you provide?
Application for Site Membership

Site Information

Company Name

Street Address

City State Zip/Postal Code Country

Main Switchboard Phone No. Main Fax

Company E-mail address Web site URL

Name of Primary Contact

Title Mail Stop

Phone Fax E-mail

Payment Information

Membership Dues

(membership will begin the day we receive your application and dues payment, and will continue for one or two years based on your choice indicated below.) All fees quoted in U.S. dollars.

Please check one:

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Enclosed is our check for $________________

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Card No.   Expiration Date

Authorized Signature

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Chicago, IL 60678-1349

Fax/Mail application with credit card payment to:

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Bannockburn, IL 60015
Tel: +1 847-615-7100
Fax: +1 847-615-7105
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Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Standard Improvement Form IPC-TM-650-MDP
The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

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www.ipc.org/standards-comment

| 1. I recommend changes to the following: |
| __ Requirement, paragraph number ________ |
| __ Test Method number __________, paragraph number ________ |
| The referenced paragraph number has proven to be: |
| __ Unclear  __ Too Rigid  __ In Error |
| __ Other ________ |

| 2. Recommendations for correction: |
|__________________________________|
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| 3. Other suggestions for document improvement: |
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Submitted by:

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