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*THE INSTITUTE FOR
INTERCONNECTING
AND PACKAGING
ELECTRONIC CIRCUITS*

IPC-QL-653A

Certification of Facilities that
Inspect/Test Printed Boards,
Components and Materials

A standard developed by the Institute for Interconnecting
and Packaging Electronic Circuits

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The Principles of Standardization

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

Standards Should:

- Show relationship to DFM & DFE
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feed back 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

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Developed by the Laboratory Qualification Task Group (7-10c) of the Testing Committee of the Institute for Interconnecting and Packaging Electronic Circuits

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

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the IPC

Laboratory Qualification Task Group (7-10c) of the IPC Testing Committee are 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 the IPC extend their gratitude.

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Certification of Facilities that Inspect/Test Printed Boards, Components, and Materials

1.0 SCOPE

1.1 Scope This specification establishes the certification requirements for facilities that inspect/test printed boards, components and materials. This specification is intended to provide a minimum standardized basis for evaluating or auditing a technically oriented inspection/testing facility.

Any location that performs inspection or testing for end-product acceptance to a specific specification shall be considered part of the facility.

1.2 Purpose The purpose of this document is to establish the requirements for certifying that inspection/test facilities are capable and are performing inspection/testing functions to IPC or other specifications. In addition, this specification defines the auditing procedures and auditing functions.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue currently in effect form a part of this specification to the extent specified herein. Copies of the specification and standards required by contractor in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.

2.1 Institute for Interconnecting and Packaging Electronic Circuits (IPC)¹

IPC-T-50 Terms and Definitions

IPC-TM-650 Test Methods Manual

1.4 Reporting, General

1.5 Reporting, Format

1.6 Reporting, Numerical

1.7 Reporting, Invalid Results Discarding

2.2 National Conference of Standards Laboratories²

2.2.1 ANSI/NCCL 540-1-1994³

2.3 Order Of Precedence In the event of a conflict, the following shall be the order of precedence:

- a) the applicable specification
- b) this document
- c) any references in this document

Nothing in this specification, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 Terms and Definitions The definition of terms shall be in accordance with IPC-T-50.

3.1.1 Inspection/Test Personnel Inspection or test personnel are those individuals who perform inspection or testing of products for the purpose of certifying to the conformance requirements of applicable specifications.

3.1.2 Inspection/Test Facility A combination of resources consisting of equipment, personnel and procedures that perform inspection, testing, measurements and evaluations on electronic components or materials in accordance with the applicable specifications.

3.1.3 Certifying Agency The certifying agency or organization (internal or external) used to perform the documentation review and audits of the inspection/test facility. In the case of military specification approvals, this organization may be comprised of the appropriate government organization(s) (i.e., DSCC, DCMO, etc.) or their delegate(s) as applicable. In the case of commercial specification approvals, this organization may be comprised of internal, customer, or third party designated auditors as applicable.

3.2 Certification The inspection and/or test facility shall be certified by the Certifying Agency for each test method to be performed at that facility, to the applicable specification(s).

3.3 Inspection/Test Program A system shall be established and maintained, to integrate training, inspection, evaluation, testing, and calibration functions related to the inspection/test facility.

The inspection/test facility shall document quality procedures in a manner adequate to demonstrate compliance with this specification and the applicable test methods. The system shall include the inspection and/or test facility's interpretation of how each requirement of this specification shall be implemented. The system, after acceptance by the Certifying Agency, shall constitute the requirements to be met by the inspection and/or test facility as they relate to

1. Institute for Interconnecting and Packaging Electronic Circuits, 2215 Sanders Road, Northbrook, IL 60062-6135.

2. National Conference of Standards Laboratories, 1800 30th Street, Suite 305B, Boulder, CO 80301.

3. American National Standard for Calibration, Calibration Laboratories and Measuring and Test Equipment - General Requirements.



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the appropriate specification(s) for which certification has been granted.

3.4 Documentation The basic inspection/test system (Para. 3.3) and the inspection/test report formats (3.5) specified herein, shall be available to the Certifying Agency as a prerequisite for certification.

3.4.1 Documentation Submission The following documentation shall be submitted at the time of application for certification:

- Complete legal name and address of the facility being audited.
- The audited facility principal ownership, managerial structure, including the relationship with its organizational components, affiliations, and other supporting information. (NOTE: If the affiliate is another inspection/test facility, it must also be approved.)
- Functional description of the inspection/test facility's organizational structure, operational departments, support departments and services. This may be demonstrated in the form of charts or other forms of documentation.
- Listing of the relevant technical services offered as related to the test methods, and/or appropriate specification(s) for which certification is requested.
- A complete generic listing of inspection and/or test equipment used to perform the inspection/testing. See Figure 1.

TEST REQUIRED	EQUIPMENT USED
Visual Methods	3 Diopters/1.75x Magnification Aid 10-30 Magnification aid with measuring reticle
Solderability	Solder pot with temperature monitoring device
Dimensional	Surface Plate Dial Gage Metallograph with Filar eyepiece Micrometers
Rework Simulation	Soldering Iron
Bond Strength	Soldering Iron Tensile Tester
Thermal Shock	Thermal Shock Automated System Resistance Measuring Device Soldering Iron
Moisture and Insulation Resistance	Temperature/Humidity Chamber DC Voltage Source Megohm Bridge Soldering Iron Oven

Figure 1 Generic Equipment List Example

3.4.2 Documentation at the Facility The following documentation, as applicable, shall be available at the facility:

- Test method equipment list (see Appendix A).
- Equipment calibration records as defined in Para. 3.5.2.
- All applicable government and non-governmental specifications, standards, and test methods.
- Training materials.
- Facilities for the storage of specimens and samples.
- Data processing equipment for technical operations (measurements, calculations, etc.), documentation and storage of inspection test data.

3.5 System Implementation Documentation specified herein shall be retained in the facility and shall be made available at the facility upon request by the Certifying Agency. Documentation shall be dated and shall substantiate that the system, as defined by the inspection/test facility, has been implemented and is being effectively maintained.

3.5.1 Inspection/Test Personnel Certification The following shall be established and maintained:

- A written outline or chart defining personnel positions, their responsibilities and authority.
- A written practice shall be established and maintained for the documentation and administration of personnel education, training, periodic evaluation, and experience. This written practice shall describe the level of capability required for performing inspection, tests and/or evaluation of test specimens in accordance with the applicable specifications, standards, and procedures. (See Appendix B for recommended guidelines.)
- Personnel shall receive sufficient training to become familiar with the principles and practices of the applicable inspection/test methods. The training program should include instruction in basic principles, products, equipment, operating procedures, inspection, and test techniques the individual will encounter in their specific assignment. Personnel shall not conduct inspections/tests until the required level of proficiency has been demonstrated.
- Personnel designated as inspectors whose duties require visual acuity, shall be required to take an eye examination on an annual basis as a minimum. The examination shall be adequate to assure that the individual has natural or corrected near-distance acuity in at least one eye such that the individual is capable of reading a minimum of 8 letters (0.58 mm x 0.58 mm) at a distance of not less than 30.5 cm (12 inches) on a standard Tom Nearpoint Card. The Tom Nearpoint Card is manufactured by MEDI-SOURCE, INC., Syosset, NY, or can be created using dimensioning random letters on a small chart as follows:

- Line (1) **20/200** – Three letters 5 mm x 5 mm
- Line (2) **20/100** – Four letters 3 mm x 3 mm
- Line (3) **20/80** – Five letters 2.3 mm x 2.3 mm
- Line (4) **20/60** – Five letters 1.6 mm x 1.6 mm
- Line (5) **20/50** – Five letters 1.4 mm x 1.4 mm
- Line (6) **20/40** – Five letters 1.0 mm x 1.0 mm
- Line (7) **20/30** – Six letters 0.87 mm x 0.87 mm
- Line (8) **20/25** – Seven letters 0.76 mm x 0.76 mm
- Line (9) **20/20** – Eight letters 0.58 mm x 0.58 mm

The ability to read all of the letters accurately on a given line demonstrates the visual acuity (i.e., **20/30** would reflect **20/30** vision).

- e. Records shall be maintained to indicate the type of training received, dates of training, names of instructors, work experience, and eye examination certification (if applicable) of each individual. The records shall be reviewed and updated at least once a year.

3.5.2 Calibration Each instrument used to condition, inspect, measure, or test the product for acceptability shall be calibrated in accordance with ANSI/NCSL-540-1-1994.

3.5.3 Description of Inspection/Test Procedures and Controls The facility shall prepare and maintain a detailed description of the procedures, and controls applied to the inspection/test methods performed. Requirements and tolerances shall be specified for all critical environments and utilities which affect the inspection/test results.

3.5.4 Traceability The inspection/test facility shall establish procedures to provide accurate test specimen (i.e., coupons, boards, laminate, etc.) identification, with identification retention through receiving, inspection, testing, transportation, and documentation phases.

3.5.5 Handling Procedures Handling procedures shall be established to provide appropriate protection of material during all sequences of inspection/testing. Protection shall be consistent with the requirements for transporting within the facility or transporting to other inspection/test facilities.

3.5.6 Controlled Storage Area The inspection/test facility shall describe the procedures and controls which will be used to maintain a storage area, not defined within inspection/test procedures. Controlled storage areas to be used for storage of test specimens include; on-hold, received test specimens, test specimens in-process, documentation, etc. NOTE: Storage conditions for deliverable product are controlled by the product specification(s).

3.5.7 Inspection/Test Facility's Internal Audit Activities The internal audit activity and procedures shall be included in the system. (See Appendix D). The system

shall identify key review areas, the frequency of audit, and the corrective action system to be employed when variations from approved procedures or specification requirements are identified.

3.5.8 Inspection/Test Reports The inspection/test facility shall establish reporting formats for inspection/tests performed in accordance with each applicable specification. The reports shall comply with IPC-TM-650, Method 1.4, 1.5, 1.6, 1.7 or any other format specified by the purchase document. Report formats can include results obtained directly by automatic test equipment and stored in an electronic data base and/or results obtained via a computer or test equipment program after entry of individual measurements into an electronic data base. Entered data and its associated information shall be readily retrievable.

3.5.9 Record Retention Unless otherwise specified records of inspection/testing shall be retained by each facility for a minimum of three (3) years. Records retained shall be data sheets per the established formats, data in electronic data bases in their unique format for the automated system, or combinations thereof. Periodic back-up shall be provided for all computer data bases. All back-up media shall be properly stored in accordance with Para. 3.5.6.

3.5.10 Safety Operating Procedures The inspection/test facility shall establish safe operating procedures that should follow safety recommendations (e.g., OSHA) for those techniques and procedures that directly apply to the facility.

3.6 Certifying Agency Accessibility The Certifying Agency shall have access to those areas necessary for the purpose of verifying compliance to the applicable specification.

3.6.1 Confidentiality The Certifying Agency shall maintain strict confidentiality with all materials and documentation submitted, reviewed, or witnessed to support the inspection/test facility's application for approval to this specification. When applicable, the Certifying Agency shall sign a non-disclosure agreement to protect the facility from release of proprietary information received or related to the facility audit. The non-disclosure format shown in Appendix E, or any similar equivalent may be used.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Inspection/Test Conditions All inspection/testing shall be performed in accordance with the conditions specified in the applicable test method(s) or specification(s). Where Inspection/Test conditions are not specified a standard Laboratory condition of 15°C to 35°C at ambient air pressure and relative humidity shall apply.