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User's Guidelines for Automated Solder Joint Inspection Systems

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User's Guidelines for Automated Solder Processes Inspection Systems Selection and Implementation

Foreword This users guide is designed to assist a user in selecting and implementing automated solder joint inspection systems to best meet the users needs. The material contained herein constitutes a broad range of considerations which can be drawn upon to develop a specification which defines the system characteristics required for a users application.

1.0 Scope This guide prescribes general requirements for an automated solder joint inspection system. This guide also describes the steps which should be taken to implement an automated soldered connection inspection system in lieu of 100% visual inspection. Statistical sampling of soldered connections may be used in lieu of 100% inspection when done as part of a process control system which is fully documented. Several automated soldered connection inspection systems are currently available which may be used as part of a process control system. The technologies range from systems based on machine vision or X-Ray to laser systems, while capabilities range from strictly process control tools to systems capable of detecting a large variety of defects. These guidelines apply to all technologies of automatic soldered connection inspection systems. Each specific system may have unique requirements which must be considered in addition to those outlined in this document. The goal is to add future technologies as they are developed.

1.1 Purpose

1.1.1 To do an automated scan of a printed board assembly and to identify individual and machine soldered solder joints which do not meet applicable acceptance criteria for workmanship.

1.1.2 To store and maintain trend data for use in statistical process control.

1.1.3 To identify the location and type of each defective solder joint in a manner which allows a touch-up operator to quickly locate each such joint for solder touch-up.

1.1.4 To eliminate subjectivity in the inspection process through repeatability in the results of machine inspection.

1.2 Classifications Printed board assemblies may be classified as to type of printed boards, types of solder joints, and end use classifications.

The user, with the assistance of the vendor, must select equipments and operating modes of that equipment which best address his unique needs and the quality level that is to be maintained.

The vendor must fully identify to the user any restrictions relating to the proper use of the equipment such as:

- Dimensions of plated through holes
- Material & size of component leads
- Area of lands
- Internal connections to PTH

Consideration should include but not be limited to the following:

1.2.1 Types of printed boards

1.2.1.1 Rigid types

1.2.1.1.1 Single sided

1.2.1.1.2 Double sided

1.2.1.1.3 Multi-layered

1.2.1.2 Other types

1.2.1.2.1 Flex

1.2.1.2.2 Ceramic substrates

1.2.1.2.3 Implanted shields

1.2.1.2.4 Shielded

1.2.1.2.5 Single sided components

1.2.1.2.6 Double sided components

1.2.2 Types of solder joints

1.2.2.1 Plated through hole

1.2.2.1.1 Straight through lead

1.2.2.1.2 Semi-clinched lead

1.2.2.1.3 Clinched lead

1.2.2.1.4 Solder filled vias

1.2.2.2 Surface mounted components

1.2.2.2.1 J lead

1.2.2.2.2 Lap joints

1.2.2.2.3 Leadless chip carriers

1.2.2.2.4 Solder filled vias

1.2.2.2.5 Surface mounted discrete devices w/o leads

1.2.2.3 Exclusions Turrets and connection stand offs are outside the scope of this document.

1.2.3 Classification This standard recognizes that electrical and electronic assemblies are subject to classifications by intended end-term use. Three general end-product classes have been established to reflect differences in producibility, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

The user (see 3.2.5) of the assemblies is responsible for determining the class to which this product belongs. The contract must specify the class required and indicate any exceptions or additional requirements to the parameters, where appropriate.

CLASS 1 General Electronic Products Includes consumer products, some computer and computer peripherals, and hardware suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicate Service Electronic Products Includes communications equipment, sophisticated business machines, and instruments where high performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically the end-use environment would not cause failures.

CLASS 3 High Performance Electronic Products Includes equipment for commercial and military products where continued performance or performance-on-demand is critical. Equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support systems and critical weapons systems.

Note: The reference of a single class does not preclude invoking specific requirements defined in other classes.

2.0 Applicable documents The following documents, of the issue currently in effect, form a part of this specification to the extent herein.

2.1 IPC

IPC-T-50 Terms and Definitions

IPC-TC-510 Rigid Printed Board Clinched Leadwire Interfacial Connections

IPC-D-300 Printed Board Dimensions and Tolerances

IPC-D-320 Printed Boards, Rigid, Single and Double Sided, and Product Standard

IPC-TC-550 Rigid Printed Board Fused-in-place Connections

IPC-A-600 Acceptability of Printed Wiring Boards

IPC-A-610 Acceptability of Assemblies

IPC-OI-645 Standard for Visual Optical Inspection Aids

IPC-R-700 Repair and Modification of Printed Wiring Boards

IPC-CM-770 Printed Board Component Mounting, Guidelines for

IPC-SM-780 Surface Mounting and Interconnecting Chip Carrier Guidelines

J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies (Supersedes IPC-S-815)

J-STD-002 Solderability Tests for Printed Boards (Supersedes IPC-S-804A)

J-STD-003 Solderability Test for Printed Boards (Supersedes IPC-S-840A)

2.2 Government Government and industry standards can be applied through corresponding IPC specifications given above.

3.0 System requirements This guide clearly recognizes that a wide range of acceptance criteria are applied to solder joints. These reflect the end uses of the printed wiring boards, and range from low cost consumer products up through military or life supporting hardware.

In addition there is a wide range of automated inspection system needs in the users facilities. The automated inspection system will be used to assist in optimizing the solder process through reporting trend data as a given parameter will vary. The use could be extended to monitor the process thus established and to annunciate an alarm when the defect trends upwards. The use could be further extended to identifying location of each defective solder joint in a manner which allows the defect to be located for verification/rework. The use could be even further extended to store and display a wide range of trend data for statistical process control purposes. These include sampling of a production lot of printed wiring boards to determine lot acceptance.