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EIA STANDARD

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RESISTANCE TO SOLDERING HEAT TEST PROCEDURE FOR ELECTRICAL CONNECTORS AND SOCKETS

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Electronic Components, Assemblies & Materials Association

THE ELECTRONIC COMPONENTS SECTOR OF THE ELECTRONIC INDUSTRIES ALLIANCE



EIA/ECA-364-56C

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(From Standards Proposal No. 5124 formulated under the cognizance of the CE-2.0 National Connector Standards Committee.

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TEST PROCEDURE No. 56C

RESISTANCE TO SOLDERING HEAT TEST PROCEDURE
FOR
ELECTRICAL CONNECTORS AND SOCKETS

(From EIA Standards Proposal No. 5124, formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA-364-56B.)

1 Introduction**1.1 Scope**

This standard establishes a test method for determining whether connectors can withstand the effects of the heating and/or environment that they will be subjected to during the soldering of their terminations by solder dip, soldering iron, solder wave, or reflow soldering techniques.

1.2 Object

The heat and/or environment of soldering may affect the electrical characteristics of the connector and may cause damage to the materials making up the connector. It may also result in loosening of terminations, softening or distortion of insulation materials, opening of solder seals, weakening of mechanical joints, etc.

1.3 Reference documents

The following documents form a part of this standard to the extent indicated herein. In the event of conflict between this standard and the referenced document this standard shall take precedence.

- ANSI/EIA/IPC J-STD-004: Requirements for Soldering Fluxes
- ANSI/EIA/IPC J-STD-006: Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

2 Test resources

2.1 Equipment

2.1.1 Solder pot

A solder pot, of sufficient size to accommodate the mounting board and to immerse the terminations to the depth specified for the solder dip without touching the bottom of the pot, shall be used. This apparatus shall be capable of maintaining the solder at the temperature specified. The solder bath temperature shall be measured in the center of the pot at a depth of at least 12.70 mm (0.500 inch), but no deeper than 25.4 mm (1.00 inch) below the surface of the solder.

2.1.2 Heat sinks or shielding

The use of heat sinks or shielding is prohibited except when it is part of the connector. When applicable, heat sinks or shielding shall be specified in the referencing document, including all of the details such as materials, dimensions, method of attachment, and location of the necessary protection.

2.1.3 Mounting board

2.1.3.1 A mounting board suitable for the specified test temperatures shall be used. When applicable, the terminal hole size shall be such that diametrical clearance between the hole and component terminals shall not exceed 0.71 mm (0.028 inch) nor less than 0.15 mm (0.0006 inch) unless otherwise specified in the referencing document. For procedure 3, the board shall have no circuitry or copper surfaces. For procedures 5 and 6, terminal holes may be plated through.

2.1.3.2 The mounting board shall be of appropriate size and shall protrude 19.05 mm (0.750 inch) minimum around the periphery of the connector.

2.1.4 Reflow chambers

The reflow chambers or equivalent shall be of sufficient size to accommodate the connector to be evaluated. They shall be capable of generating the environment as specified.

2.2 Material

2.2.1 Solder

The solder alloy shall be 63Sn/37Pb or 60Sn/40Pb and be similar to the composition found in EIA/IPC J-STD-006; unless otherwise specified in the referencing document.

2.2.2 Flux

When specified, the flux shall conform to type ROL0, type ROL1, or type ROM1 as found in EIA/IPC J-STD-004 flux soldering, liquid (rosin base). Unless otherwise specified in the referencing document, type ROM0 (previous designation RMA) flux shall be used.

3 Test specimen

3.1 Description

The test specimens shall be selected from an actual lot of production material per the appropriate referencing document.

3.2 Preparation

3.2.1 All test specimens or terminations shall be tested in the condition that they would normally be in at the time of assembly soldering.

3.2.2 The test specimens to be tested shall not be touched by fingers or otherwise contaminated, nor shall the leads or terminations being tested be wiped, cleaned, scraped or abraded. Special preparation of leads or terminations, such as bending or reorientation before test, shall be specified in the referencing document.

4 Test procedure

The test shall be performed on solder terminations attached to the connector, unless specifically stated in the referencing document. There are five types of solder techniques covered by this procedure.

- Procedure 1: Solder cup
- Procedure 2: Solder eyelet tab and post terminations
- Procedure 3: Dip and wave solder terminations
- Procedure 4: Vapor phase reflow (OBSOLETE)
- Procedure 5: Infrared reflow
- Procedure 6: Convection reflow

4.1 General for procedure 1 and 2 only

4.1.1 Unless otherwise specified in the referencing document, the applicable copper wire size 25.4 mm (1.00 inch) minimum in length, properly prepared shall be inserted into the termination.

4.1.2 The test specimens shall be fluxed, see 2.2.2, accordingly with flux liquid or other techniques as may be specified in the referencing document.

4.1.3 Unless otherwise specified, a pencil type iron rated for 25 watts shall be used. When required, due to the terminations size being evaluated, the appropriate solder iron wattage shall be specified in the referencing document.

4.2 Procedure 1, solder cup termination

4.2.1 The solder iron shall be heated and applied for a duration that is normally used to perform the soldering operation and shall be specified in the referencing document. In the absence of such a designation, the solder iron tip shall be heated to a temperature of $360^{\circ}\text{C} \pm 10^{\circ}\text{C}$ ($680^{\circ}\text{F} \pm 18^{\circ}\text{F}$) and shall be applied for a time duration allowing the solder to become liquid and remain in a liquid state for 4 seconds to 5 seconds.

4.2.2 Remove the solder iron and perform a visual inspection at 10X

4.3 Procedure 2, solder eyelet tab or post terminations.

4.3.1 The solder iron shall be heated to a level and applied for a duration that is normally used to perform the soldering operation and shall be specified in the referencing document. In the absence of such a designation, the solder iron tip shall be heated to a temperature of $360^{\circ}\text{C} \pm 10^{\circ}\text{C}$ ($680^{\circ}\text{F} \pm 18^{\circ}\text{F}$) and shall be applied for a time duration allowing the solder to become liquid and remain in the liquid state for 4 to 5 seconds.

4.3.2 The solder iron and solder shall be applied to that portion of the solder eye closest to the plastic housing. For solder post or tab type terminations, the solder iron and solder shall be applied at a distance of 1.91 mm (0.075 inch) to 2.54 mm (0.100 inch) from the plastic housing unless otherwise specified in the referencing document.

4.3.3 Remove the solder iron and perform a visual inspection at 10X.

4.4 Procedure 3, dip and wave solder terminations

4.4.1 The test specimens shall be mounted on a printed circuit board with terminals inserted in the termination holes as specified in the referencing document. The printed wiring board shall be as described in 2.1.3.

4.4.2 The test specimens shall be fluxed, see 2.2.2, accordingly with flux liquid or other techniques as specified in the referencing document.

4.4.3 Special preparation of specimens: Any special preparation of specimens prior to testing, shall be as specified in the referencing document. This could include specific instructions such as bending or any other relocation of terminations, cleaning, application of flux, pretinning, and the attachment of heat sinks or protective shielding (see 2.1.2), prior to the solder dip. The test specimens mounted on a board shall not be in contact with each other; however, they shall be in contact with the board. Hole placement shall be such that the shortest possible lead length from the connector body to the board shall be accommodated.

4.4.4 Solder dip: the terminations of the test specimens as prepared shall be immersed to the depth specified in the referencing document. Terminations shall be immersed simultaneously if the geometry of the component part permits and remain in that position for the duration specified in the referencing document.

4.4.5 Where the terminations are mounted on board material they shall be immersed so that the bottom of the board rests on the molten solder for the immersion duration specified in the referencing document.

4.4.6 The temperature of the solder, duration of immersion, and the immersion and emersion rate shall be selected from one of the test conditions in table 1. When not specified in the referencing document, test condition D shall be used. Dross shall be removed prior to testing. The surface of solder shall be kept bright and clean.

Table 1 – Test conditions

Test condition	Temperature	Immersion duration, seconds	Immersion and emersion rate, per second
A	350° C \pm 10° C (662° F \pm 18° F)	3 \pm 0.5	25.4 mm \pm 6.35 mm (1.00 inch \pm 0.25 inch)
B	260° C \pm 5° C (500° F \pm 9° F)	10 \pm 1	25.4 mm \pm 6.35 mm (1.00 inch \pm 0.25 inch)
C	260° C \pm 5° C (500° F \pm 9° F)	10 \pm 2	—
D	260° C \pm 5° C (500° F \pm 9° F)	20 \pm 2	—
E	280° C \pm 5° C (536° F \pm 9° F)	30 \pm 2	—
F (see note)	—	—	—
NOTE — Test condition F superseded by test condition D.			

4.4.7 The test condition letter shall be as specified in the referencing document. Upon removal from the solder, the specimens shall be allowed to cool and stabilize at room ambient condition before final examinations and measurements are made.

4.4.8 After cooling, the test specimens shall be visually examined under 10X magnification.

4.5 Procedure 5, infrared reflow; or Procedure 6, convection reflow

4.5.1 A test chamber with infrared (procedure 5) or convection (procedure 6) heating capability shall be available and of such a size to accommodate all the test specimens to be evaluated. . The chamber may be single or multiple temperature zones, also with or without conveyor transport system, as long as it meets the temperature profile requirements of 4.5.4 and 4.5.5.

4.5.2 The test specimens shall be placed on a substrate surface in a position normal for the actual use of the connector. Mounting considerations shall be specified in the referencing document. In the absence of said document the test specimens shall be exposed in an unfastened manner.

4.5.3 Unless otherwise specified in the referencing document, flux shall not be applied.

4.5.4 Unless otherwise specified in the referencing document, the heat shall be applied to the test specimens increasing at an average rate of 1°C to 4°C ($1.8^{\circ}\text{F} \pm 7.2^{\circ}\text{F}$) per second until the specified temperature is obtained.

4.5.5 Unless otherwise specified in the referencing document, the temperature of the board surface in the termination area shall be maintained at one of the following levels indicated in table 2 and shall be applied for a duration of 30 seconds to 35 seconds.

4.5.6 The test board temperature shall be verified by a thermocouple attached to the board surface. If possible, the thermocouple should be placed within $1\text{ inch} \pm 0.5\text{ inch}$ of (one of) the connectors mounted on the pc board. If multiple boards are placed into a chamber, then a minimum of one board shall have a thermocouple applied.

Table 2 – Test levels

Test level	Board surface temperature
1	$215^{\circ}\text{C} + 10^{\circ}\text{C} / - 0^{\circ}\text{C}$ ($419^{\circ}\text{F} + 18^{\circ}\text{F} / - 0^{\circ}\text{F}$)
2	$235^{\circ}\text{C} + 10^{\circ}\text{C} / - 0^{\circ}\text{C}$ ($455^{\circ}\text{F} + 18^{\circ}\text{F} / - 0^{\circ}\text{F}$)
3	$250^{\circ}\text{C} + 10^{\circ}\text{C} / - 0^{\circ}\text{C}$ ($482^{\circ}\text{F} + 18^{\circ}\text{F} / - 0^{\circ}\text{F}$)
4	$260^{\circ}\text{C} + 10^{\circ}\text{C} / - 0^{\circ}\text{C}$ ($500^{\circ}\text{F} + 18^{\circ}\text{F} / - 0^{\circ}\text{F}$)

4.5.7 After removal from the chamber and cooled to room ambient, the test specimens shall be visually examined under 10x magnification.

5 Details to be specified

The following details shall be specified in the referencing document:

5.1 Type of flux, if required.

5.2 Solder, if required.

5.3 Test procedure and conditions other than default levels.

5.4 Heat sink devices, if applicable.

5.5 Temperature level.

5.6 Number of specimens to be tested and defect level allowed.

5.7 Type of termination.

5.8 PC board size (when applicable), hole size, plated through hole or unplated through holes, etc.

5.9 Failure criteria.

6 Test documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

6.1 Title of test

6.2 Specimen description

6.3 Test equipment used, and date of last and next calibration

6.4 Test procedure, conditions and levels, if applicable

6.5 Values and observations

6.6 Name of operator and date of test

Annex

A Normative

A.1 Other than visual observations, it is recommended that applicable electrical and mechanical tests be performed to assure compliance to referencing document. These electrical and mechanical tests may include such attributes as:

- Component torque,
- Contact resistance
- Contact retention,
- Dielectric withstanding voltage,
- Insert retention,
- Insulation resistance,
- Mating and unmating capability.

A.2 The above type tests are recommended to assure that internal damage has not occurred that would affect these attributes.

EIA Document Improvement Proposal

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