



# IPC-TM-650 TEST METHODS MANUAL

**1 Scope** The scope of this test method is to provide a means by which hand soldering tools can be evaluated under a standard, controlled set of conditions. This method may be used to either evaluate a single tool's performance or for a comparison of several tools. This test method is to be used for the evaluation of hand soldering tools intended for use on PWBs. A separate test method is available for evaluation of tools for discrete terminals.

## 2 Applicable Documents

**IPC-S-804** Solderability Test Methods for Printed Wiring Boards

**IPC-S-805** Solderability Tests for Component Leads and Terminations

**MIL-P-55110** Military Specification for Printed Wiring Boards

**3 Test Specimen** The test specimen shall be a PWB. The laminate should typically be 1.57 mm thick FR-4 material, double-sided with plated through holes (PTHs). The land areas on the board should typically be 1 oz. copper (final copper thickness to be 0.005 mm to 0.01 mm on lands and 0.0025 mm min. in holes), and the land size will be 1.40 mm diameter. Land areas shall be nickel plated. The hole size shall be 0.97 mm finished. The board shall have tracks on both sides no greater than 1 mm wide and at least 12.7 mm long. The tracks shall connect from hole to hole and be daisy chained top to bottom, similar to the MIL-P-55110 test coupon. The board shall be solderable per IPC-S-804. The device to be soldered to the board is to be a 16 pin dual-in-line integrated circuit (IC). The IC can have either a ceramic or plastic body, but whatever the type used, it must be noted as a ceramic body that has a larger heat sinking effect. The IC shall be held secure to the board and be solderable to IPC-S-805.

**3.1** Final configuration of the workpiece must be held constant throughout the test program.

## 4 Equipment/Apparatus

**4.1 Solder** The solder type, diameter, and flux type used for this test should be selected to represent the in-house production task. The solder diameter, alloy type, flux volume, and type should be consistent throughout the test.

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**4.2 Thermocouple Wire** The thermocouple wire shall be insulated Type J. The wire size shall be 30 gauge or smaller. The working junction shall be formed by welding.

**4.3 Data Recorder** The data recorder shall be capable of resolving a graph that can be read to  $\pm 2.8^{\circ}\text{C}$  and  $\pm 1$  second of time. The normal response time shall be 10 cycles per second or better.

**4.4 Component leads** The finish on the leads shall be hot solder dipped. The leads shall be solderable per IPC-S-805.

## 5 Procedure

**5.1 Preparation for Test** The test specimen shall be prepared by welding the thermocouple wire to the PWB lands. The weld shall be nominally half way between the outer edge of the land and the edge of the hole (see Figure 1). A nickel plated surface is required for a proper weld of the thermocouple.

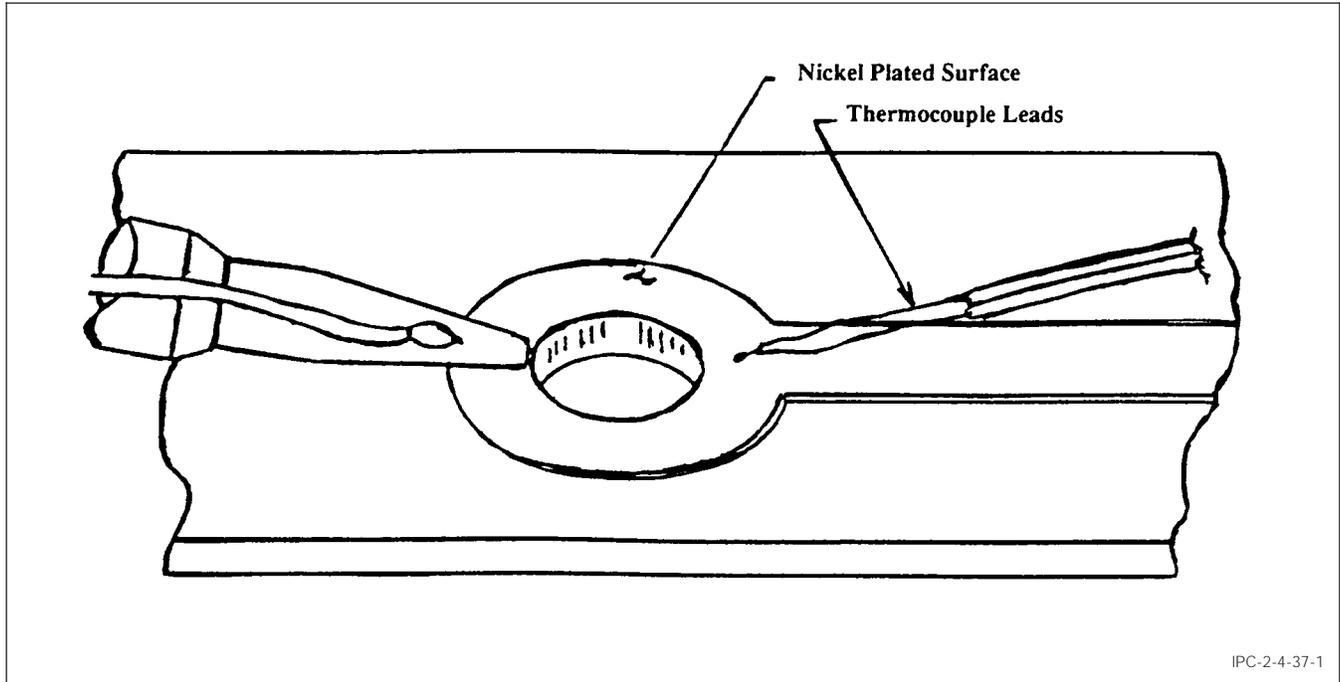
Depending on the application and the information needed, the thermocouple wire can be attached to either the solder side or the component side (on double-sided boards with PTHs).

**5.2 Preparation of the Soldering Tip** A thermocouple shall be attached to the tip to be used in the test. This attachment shall be to the tip face opposite the working face. The attachment to the tip can either be done by drilling a small hole in the tip, nominally 3 mm back from the tip end, inserting the thermocouple wire and securing it with a small copper wedge, or by welding the thermocouple directly to the tip, also nominally 3 mm from the end, but not on the tinned tip surface (see Figure 2). Once the thermocouple is attached to the tip, the wires leading from the junction shall be taped to the handle to prevent damage.

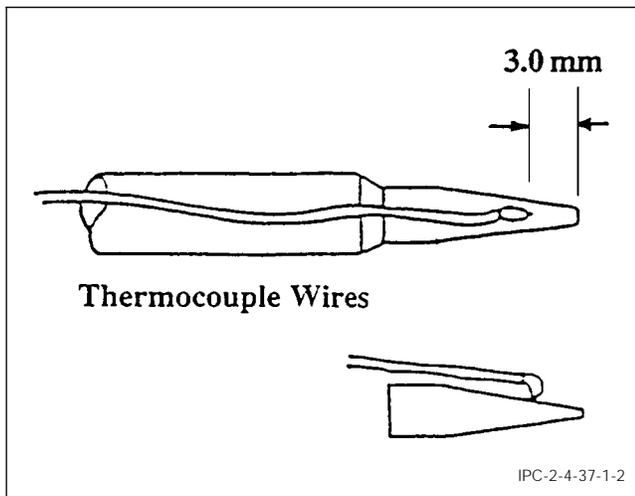
## 5.3 Test Procedure

**5.3.1 Preparation** The test specimen shall be secured in such a way that it will not move during soldering. Both the test specimen and soldering tool temperatures shall be measured simultaneously. The recorder should be properly zeroed or adjusted for correct reading.

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**Figure 1 Placement of Thermocouple Leads**



**Figure 2 Thermocouple Placement**

The amount of solder used shall be consistent with the development of a fully wetted solder joint. The time of contact of the iron with the workpiece shall not exceed two seconds. The recorder shall be shut off after solder solidification.

**5.3.1 Test B - Multiple Termination Evaluation** All 16 terminations are to be soldered, and the terminations shall be temperature monitored. At a minimum, the 1st, 8th, and 16th terminations shall be monitored. The recording is completed when the solder is solidified. The delay time between joints shall be minimized, consistent, and shall not exceed two seconds.

**5.3.2 Test A - Single Termination Evaluation** The tool tip should be wiped and prepared in the best commercial practice. The tool tip and solder shall be brought in contact with the instrumented land, avoiding direct contact with the thermocouple. Good soldering includes, but is not limited to, a solder heat bridge between a properly wetted tip and the connection.