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IPC-TM-650
TEST METHODS MANUAL

Number	
2.5.33.1	
Subject	
Measurement of Electrical Overstress from Soldering Hand Tools - Ground Measurements	
Date	Revision
11/98	
Originating Task Group	
Manual Soldering Task Group (5-22c)	

1 Scope This test method describes the measurement of the DC tip-to-ground resistance of an electric hand soldering/desoldering tool designed with a grounded tip. Measurement of tip-to-ground AC reactance is outside the scope of this test method. Also, measurement of soft grounded or equipment with insulated tips is outside the scope of this test method.

There are three times when ground testing should be done:

- Equipment qualification for purchase
- Incoming inspection of new or repaired equipment
- Process monitoring (periodic checks)

Determination of tip-to-ground resistance is accomplished by using a basic ohmmeter circuit, passing a current through the tip and its grounding circuit and measuring the resultant voltage drop. The values used in this test eliminate error caused by the Seebeck (thermocouple) effect.

Warning This is a laboratory test procedure that may, of necessity, expose terminals that carry line voltages. All standard laboratory safety procedures regarding the setup and performance of tests with line voltage equipment must be observed at all times.

Caution This test is performed with soldering systems at their normal operating temperature. Test personnel must take adequate precautionary steps to protect themselves and others from potential burns.

2 Applicable Documents.

ANSI/J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies.

IPC-TM-650 Test Methods Manual

2.5.33 Measurement of Electrical Overstress from Soldering Hand Tools

3 Test Specimens Test specimens for this procedure are detailed in Method 2.5.33.

4 Equipment/Apparatus

4.1 Test electrode per Method 2.5.33

4.2 Constant current source capable of providing 10 milliamps DC

4.3 DC millivoltmeter capable of measuring at least 60 mv DC and having a resolution of 1 mv DC

4.4 Resistor, 4.99Ω 1% precision ¼ w or greater (any commercially available brand carbon or metal film)

4.5 Preparation of Apparatus Connect the apparatus as illustrated in Figure 1. The negative electrode of the test apparatus shall make a good electrical connection to the ground reference point of the Unit Under Test (UUT). The UUT shall be turned on and adjusted (if applicable) to achieve normal operating temperature.

Note: The plug is in the receptacle during measurements. It's shown unplugged in Figure 1 for clarity. Non-US power receptacles may be different from that illustrated.

4.6 Calibration and Standardization The apparatus is checked by separately placing two resistive elements across the test apparatus's electrodes: a shorting wire (0.0Ω) and 4.99Ω 1% precision ¼w or greater resistor. The combination of the current source and the measuring/indicating device will be accurate to within ± 0.2Ω (± 4% of upper limit).

5 Procedure Once the electrodes are in position and the test apparatus is operating, touch the HOT tip of the UUT to the tinned area of the test electrode. Apply solder to form a good electrical contact. Wait for the reading to stabilize, then record the reading.

5.1 Calculation and Interpretation of Results Even though the meter reads out millivolts, using 10 ma DC for excitation current results in the displayed numbers representing the resistance in ohms without calculation, except for decimal place shifting (i.e., a readout of 30 mv dc indicates 3.0Ω).

The reading shall be equal to or less than 5.0Ω.

6 *Notes* If tracking test results, record the measured values on a copy of the form found in Method 2.5.33.

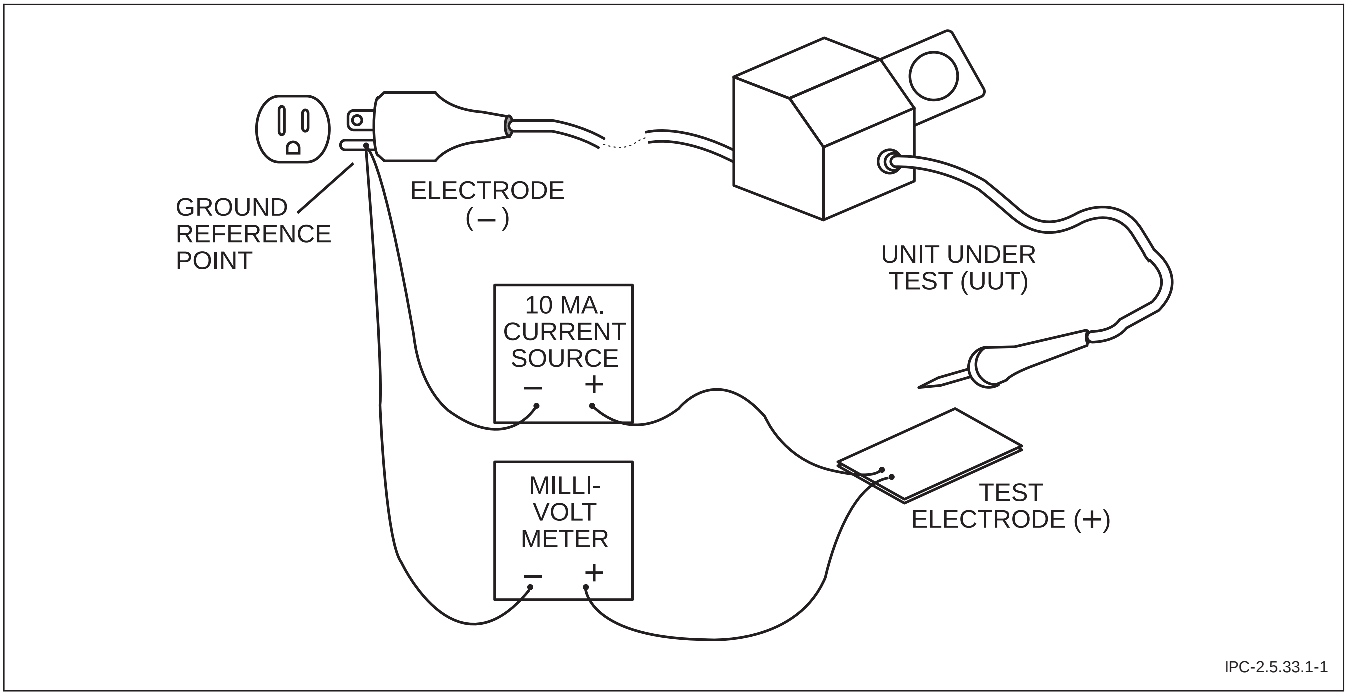

Figure 1 Test Apparatus

6.1 Ground Measurement Determination of tip-to-ground resistance is accomplished by using a basic ohmmeter circuit as represented in Figure 2. It works by passing a current through the tip and its grounding circuit and measuring the resultant voltage drop. This test method recognizes the thermocouple effect present due to the assembly comprising different metallic materials whose junctions operate at different temperatures (including the test apparatus electrodes). Testing using ohmmeters having too low excitation current has resulted in the thermocouple voltage introducing a significant error or even causing a negative resistance reading. Error from the thermocouple effect is made insignificant by increasing the excitation current, thus increasing the voltage drop. Testing has demonstrated an excitation current of 10 milliamps suffices.

The voltage measuring device must indicate the voltage drop in such a manner that the reading the operator sees directly reflects the resistance in ohms and tenths of ohms. No calculations other than decimal place shifting should be used.

6.2 Constant Current Source The constant current source can be an off-the-shelf unit, a custom-built active circuit, or a simple passive circuit. Figure 3 shows a very simple

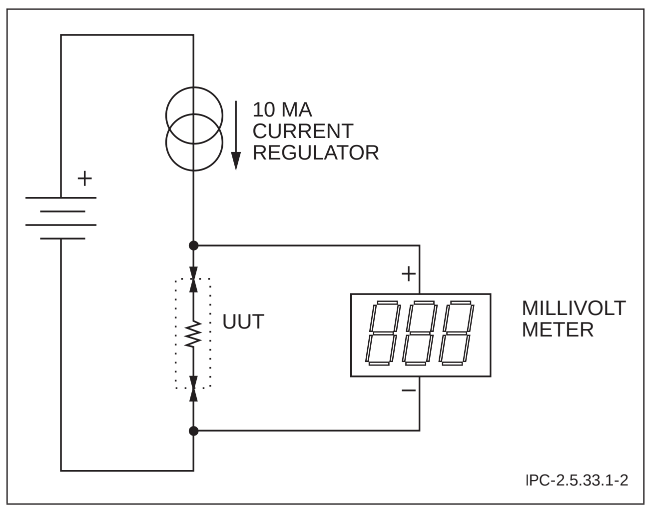

Figure 2 Block Diagram of Test Apparatus

way to achieve a 10 ma source accurate enough for measuring soldering systes.

This circuit works because the battery voltage is high compared to the drop across the UUT. Assume a battery voltage of 48 volts and a dropping resistor of 4800 ohms. When the resistance of the UUT equals zero, the current will be 10 ma.

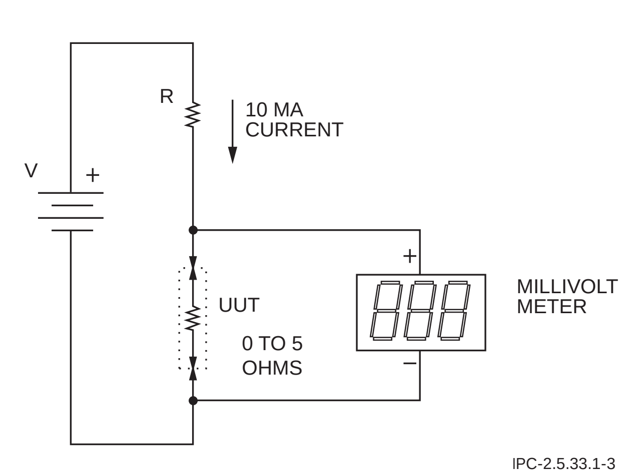

Figure 3 Simple Constant Current Source

If the resistance of the UUT rises to the upper limit of 5Ω, the current will be 9.989 ma, just outside 0.1% on the low side. This inaccuracy is well within the limits of the stanard.

Table 1 Examples for Battery, Dropping Resistor, and Accuracy

V	R	Accuracy
6	600	-0.8%
9	900	-0.6%
12	1200	-0.4%
24	2400	-0.2%
48	4800	-0.1%