



# IPC-TM-650 TEST METHODS MANUAL

**1 Scope** This test method measures DC and AC current leakage from the tip of the Unit Under Test (UUT) to ground. The AC frequency range measured is in the 20 Hz to 20 MHz range, which covers the currently known equipment base. If soldering systems with oscillator or microprocessor frequencies higher than 20 Mhz are to be qualified, then wider band width measuring equipment should be considered. Failure to do so is likely to qualify equipment that might otherwise be disqualified.

There are three times when current leakage measurements should be done:

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

Current leakage is measured and indicated by measuring the voltage developed across a resistor, which closes the circuit between the tip of the UUT and ground. DC and true rms AC measurements will be made separately.

This test may be falsely influenced by radio frequency interference and electromagnetic interference from lighting and equipment found in the workplace and testing area. At a minimum, shielded test leads should be utilized. To avoid these influences it may be necessary to perform the leakage and transient tests in a screen room. In lieu of a screen room, a separate test procedure (see Method 2.5.33.4) has been provided to make a low cost shielded enclosure, which should provide adequate shielding for the performance of these test procedures.

**Warning:** These are laboratory test procedures 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:** These tests are performed with soldering systems at their normal operating temperature. Test personnel must take adequate precautionary steps to protect themselves and others from potential burns.

Number <b>2.5.33.3</b>	
Subject <b>Measurement of Electrical Overstress from Soldering Hand Tools - Current Leakage Measurements</b>	
Date <b>11/98</b>	Revision
Originating Task Group <b>Manual Soldering Task Group (5-22c)</b>	

## 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

2.5.33.4 Measurement of Electrical Overstress from Soldering Hand Tools - Shielded Enclosure

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

**4 Equipment/Apparatus** The apparatus, materials, and preparation of apparatus and materials used to perform this test shall be as stated in 4.1 through 4.7.

**4.1** Test Electrode (see Section 3)

**4.2** AC millivoltmeter capable of measuring true mvAC/rms having a resolution of 0.1 mv AC. The frequency response of the millivoltmeter shall be 20 Hz-to-20 Mhz. (MilliVac MV814A, Hewlett-Packard HP3400B, or equivalent).

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

**4.4** Test box (see Section 6)

### 4.5 Optional

**4.5.1** Storage oscilloscope, (with rms math function), 100 Mhz bandwidth or faster, 1 M $\Omega$  input vertical amplifier

**4.5.2** Oscilloscope probe - X10 attenuation

**4.5.3** Screen room/shielded enclosure - capable of accommodating the entire UUT, cord, and handpiece. A filtered AC power receptacle shall be available from within (see Method 2.5.33.4).

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**4.5.4** Resistor, 1.00 K $\Omega$ , 1% (any commercially available brand carbon or metal film)

**4.5.5** Diodes (two) shall be of the lowest practicable known forward bias devices. 1N34 diodes have been found satisfactory for this purpose.

**4.5.6** AC Receptacles (two)

**4.5.7** Line cord

**4.5.8** Strain relief

**4.5.9** BNC connector

**4.5.10** Edge Card Connector w/mounting hardware

**4.5.11** Metal (bud) box

**4.6 Preparation of Apparatus** Connect the apparatus as illustrated in Figure 1. The diodes shall be wired head-to-tail to be effective regardless of the applied signal's polarity ( $\pm$  DC or AC). The negative electrode of the apparatus must make good electrical contact with the ground reference point. These connections will be automatic when using the test box detailed in Figure 2. Configure the UUT for typical operation. In those UUT's that utilize additional functions (such as pressure or vacuum), provide switching actuation for these functions.

**Note:** The plugs are in power receptacles during measurements. They are shown unplugged here for clarity. Non-US power receptacles may be different from those illustrated.

**4.7 Calibration & Standardization** The millivoltmeter shall bear a current calibration sticker. If an oscilloscope is used, the probe shall be adjusted to display the square wave calibration signal generated by the oscilloscope without undershoot or overshoot.

## 5 Procedure

**5.1 DC Measurement** Configure the millivoltmeter for measuring DC. Turn on the UUT and allow it to warm up to a normal operating temperature. Touch the hot tip of the UUT to the tinned area of the test electrode. Apply solder to form good electrical contact. Let the tip dwell on the electrode while the UUT cycles power to maintain temperature. Operate various other functions of the UUT if present, such as the vacuum pump or air solenoid by actuating the UUT's finger switch or foot switch. Wait for the reading to stabilize, then record the reading.

**5.2 AC Measurement** The procedure for measuring AC is the same as for DC except the millivoltmeter is configured for AC.

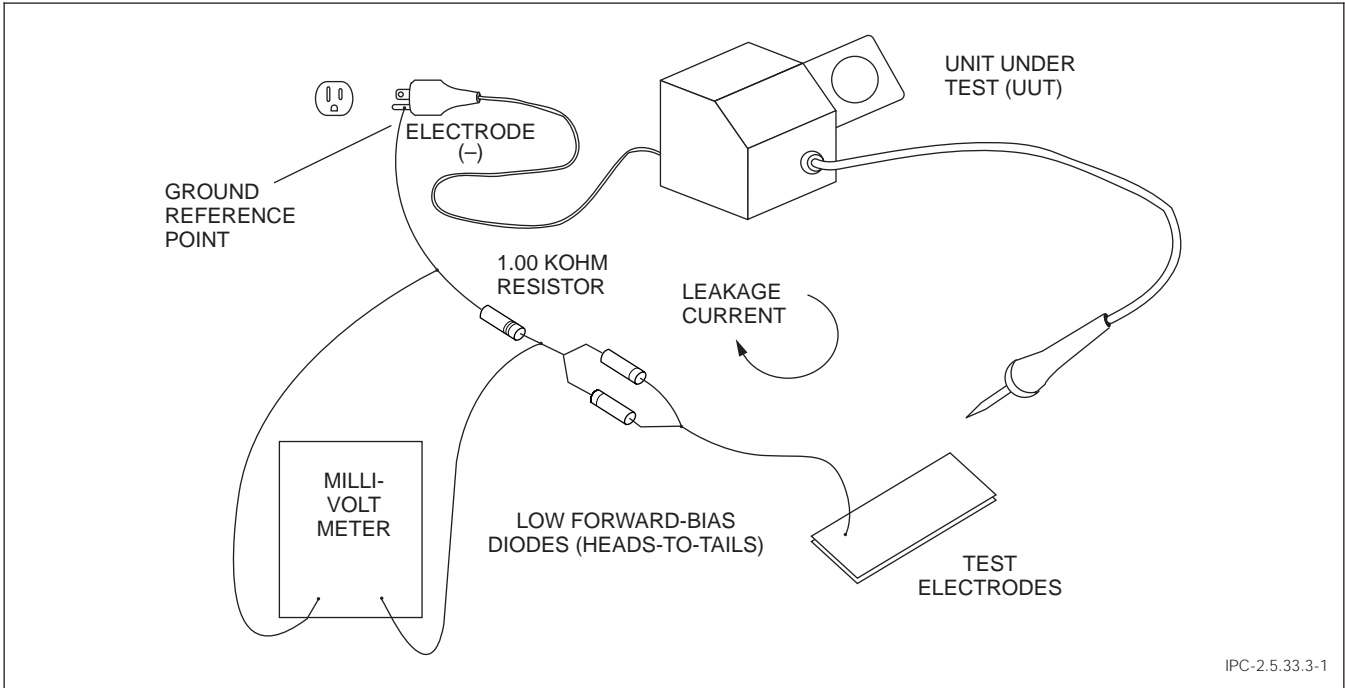
**5.3 Calculation and Interpretation of Results** Even though the meter reads out in millivolts, using 1.00 K $\Omega$  for the resistor value results in the displayed numbers representing the current in microamps without calculation (i.e., a readout of 0.8 mv indicates 0.8  $\mu$ A).

The DC reading shall not exceed 1.0  $\mu$ A. The AC reading shall not exceed 1.0  $\mu$ A.

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

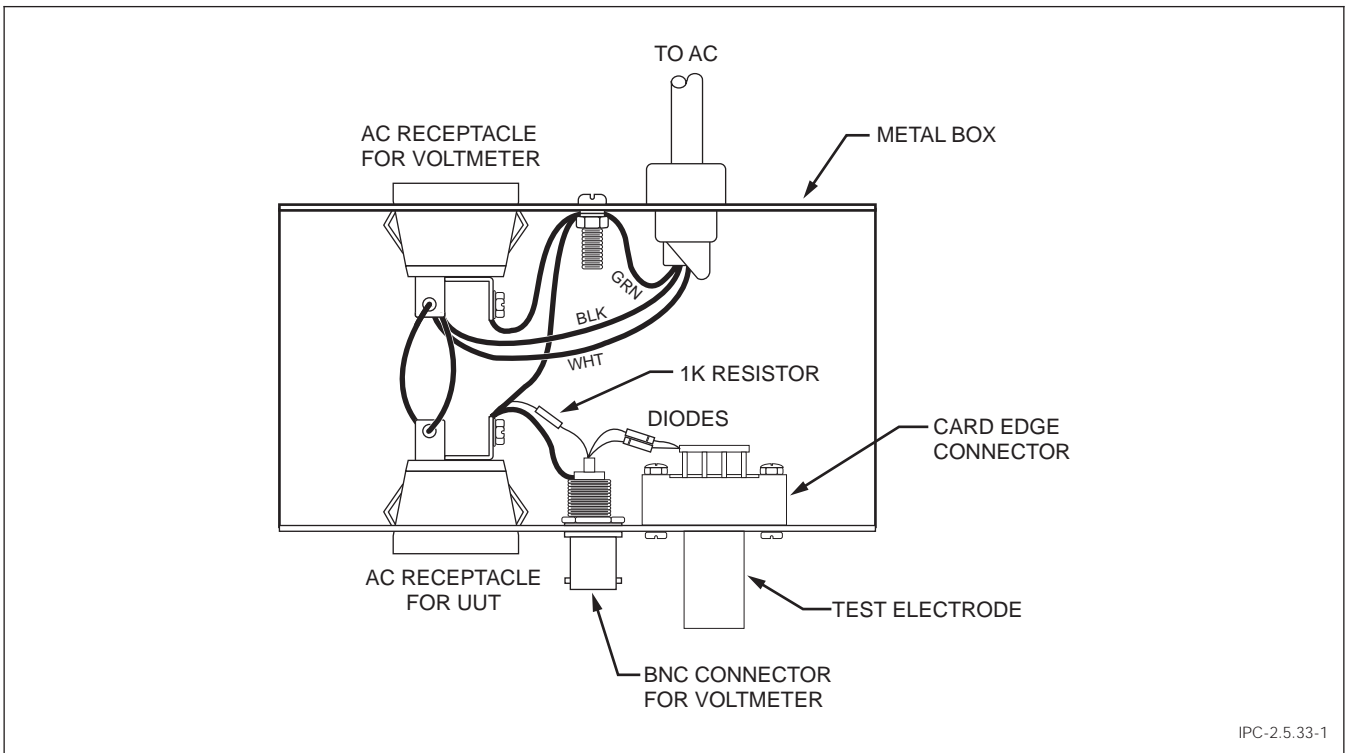
Testing has shown that for UUTs that utilize high frequency circuits, layout and cord positioning can influence the AC current leakage reading. A compact configuration such as the one shown in Figure 2 minimizes those influences.

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Figure 1 Apparatus for Current Leakage Measurement



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Figure 2 Current Leakage Test Circuit Configuration (Cover Removed)