The Institute for Interconnecting and Packaging Electronic Circuits
2215 Sanders Road • Northbrook, IL 60062

IPC-TM-650
TEST METHODS MANUAL

Number **2.5.33.2**	
Subject **Measurement of Electrical Overstress from Soldering Hand Tools - Transient Measurements**	
Date **11/98**	Revision
Originating Task Group **Manual Soldering Task Group (5-22c)**	

1 Scope This test method deals only with transients generated within the Unit Under Test (UUT) and not with transients originating elsewhere (i.e., power line transients), which propagate through the UUT.

This procedure measures transient voltage events appearing at the hot tip of an electric hand soldering/desoldering tool, which could be seen by the workpiece. The test electrode and measuring equipment represent a workpiece having a high impedance.

There are two times when transients testing should be done:

• Equipment qualification for purchase

• Incoming inspection of new or repaired equipment

A storage oscilloscope is used to observe and measure transient events. The test electrode is coupled to the vertical input of the oscilloscope via a 10 MΩ probe. The UUT may be isolated from ambient electronic noise by placing it in a screen room or shielded enclosure and supplying filtered AC power. Inside the shield, the hot tip of the UUT is touched to the test electrode.

This test may be falsely influenced by radio frequency interference and electromagnetic interference from lighting and equipment found in the workplace and testing area. This will normally be demonstrated by ambient transients of 1.5 V peak being present. 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, which makes a low cost shielded enclosure, which should provide adequate shielding for the performance of these test procedures.

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

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 Apparatuses utilized by the procedures that make up this test method are given in 4.1 through 4.5.2.

4.1 Test electrode (see Section 3)

4.2 Storage oscilloscope, 100 Mhz bandwidth or faster, 1 MΩ input vertical amplifier

4.3 Power line filter, 20 ampere @ 115 VAC, 50 dB insertion loss @ 5 Mhz/50Ω

4.4 Oscilloscope probe - X10 Attenuation

4.5 Optional

4.5.1 Screen camera, diskette, or hard copy waveform printer

4.5.2 Screen room or 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).

4.6 Preparation of Apparatus Turn on the oscilloscope and allow it to warm up.

Connect the UUT to a shielded AC line filter assembly as shown in Figure 1 and configure for typical operation.

Note: The plugs are in power receptacles during measurements. They are shown unplugged in Figure 1 for clarity.

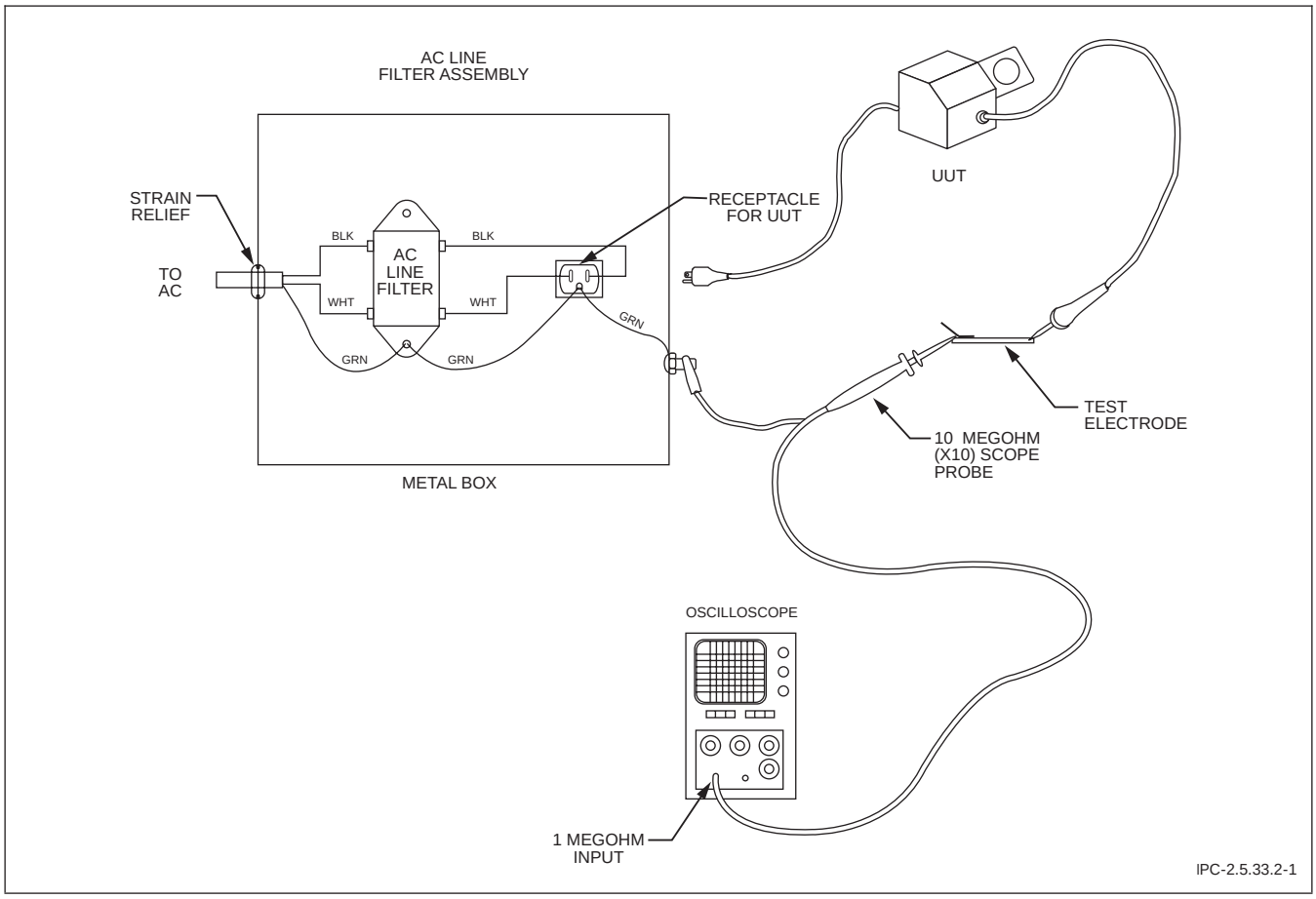

Figure 1 Apparatus for Transient Measurement

Non-US power receptacles may be different from those illustrated.

4.7 Calibration and Standardization The oscilloscope (vertical and horizontal amplifiers) shall bear a current calibration sticker. The scope probe shall be adjusted/compensated to display the square wave calibration signal generated by the oscilloscope without undershoot or overshoot.

5 Procedure

5.1 Baseline Measurement Turn on the UUT and allow it to warm up to a normal operating temperature. Touch the hot tip to the tinned area of the test electrode. Apply solder to form good electrical contact. Turn off the UUT. Adjust the oscilloscope controls as required and record any ambient signals that are displayed by the oscilloscope. Attempt this for a minimum of two minutes. Repeat this baseline test for a minimum of three trials. If any ambient transients are greater than 1.5 V peak, measures must be taken to reduce the effects of the ambient interference to below 1.5 V peak.

Place the UUT in a screen room or the shielded enclosure (see Figure 2) if the test is to be conducted in a shielded enclosure. If the shielded enclosure is utilized, arrange for support and/or remote movement of the handpiece. Configure the UUT for typical operation. In cases where function switches must be operated, arrange for remote switch actuation, such as by using a non-metallic rod through a small hole in the enclosure. Position the tip of the handpiece for remote placement onto the test electrode.

5.2 Test Measurement Turn on the UUT. Let the tip dwell on the electrode while the UUT cycles power to maintain temperature for a minimum of two minutes. Operate various other functions of the UUT if present, such as the vacuum pump or

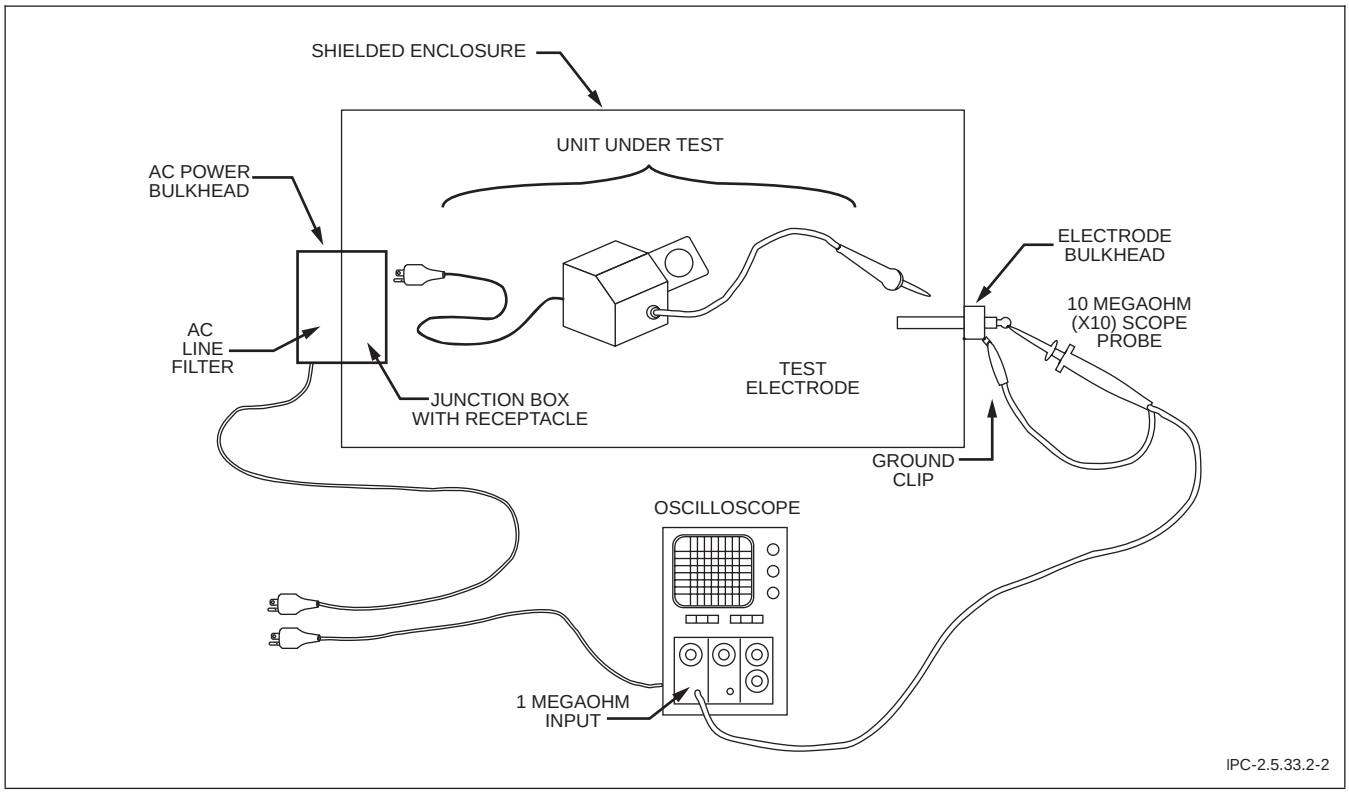

Figure 2 Alternate Apparatus for Transient Measurement

air solenoid by actuating the UUT's finger switch or foot switch. Repeat these operations, fine-adjusting the oscilloscope for best display of any transient peaks for a minimum of three measurable trials.

5.3 Calculation and Interpretation of Results Record the peak amplitude (see Figure 3). All three measurement trials must have peak voltages ≤ 2.0 volts.

The peak voltage shall be ≤ ± 2.0 volts.

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

6.1 Oscilloscope Adjustments A good initial setup for the oscilloscope was found to be as shown in Table 1.

It's important to start from a position of low trigger sensitivity and work toward high sensitivity. If one were to start with high sensitivity, weak transients would trigger the oscilloscope before the strong, more potentially damaging ones.

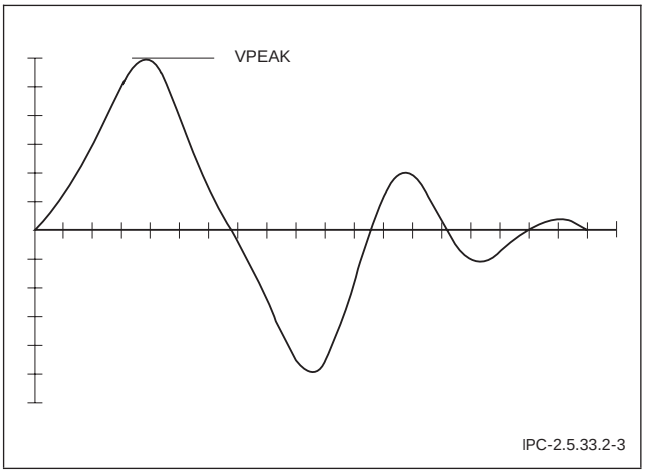

Figure 3 Transient Waveform Measurement

6.2 Discussion of Transients. Transients are generated by voltage or current switching in the UUT. Switching typically occurs in circuits that modulate heaters, drive LED displays,

Table 1 Oscilloscope Setup

Vertical	500 mv/div. DC coupling
Horizontal	100 ns/div.
Trigger Source Level Mode	Internal Full cw or ccw rotation (large peaks cause trigger) single sweep
Polarity	+ or -
Storage (for analog scopes)	fast variable persistence auto erase

and control motor-pumps and solenoids. To facilitate observing or capturing a transient event, the UUT should be operated in such a manner where switching takes place. The UUT should be brought to a state where heater power is cycling off-and-on. Heaters that are running at 100% duty cycle (constantly on) may not generate any measurable transients. For UUTs that incorporate relays, solenoids, or motors the UUT's functions should also be operated in such a manner where these devices energize and de-energize.

As the UUT is cycled, the oscilloscope's trigger should be adjusted to a more sensitive setting until a transient causes a trigger. The event may have to be repeated as the oscilloscope's storage controls are re-adjusted for best picture. Sometimes the event has a peak amplitude better observed on a different vertical scale.