

SOLDERING STATION SPECIFICATIONS - WHAT DO THEY MEAN ?

BACKGROUND.

In response to several requests from customers facing ISO certification, curiosity-seekers, and the cat:

There are oodles of standards describing what a soldering station should and should not do. Some of them are: DOD-STD-2000; MIL-STD-2000 (with half the alphabet chasing along after it); J-STD-001 and its offspring; occasionally one encounters a special project or company standard that obviously derives - perhaps at a great distance - from one of the more familiar standards. These standards exist because:

- a) The government, of which the military is a part, loves to control things. Imposing standards is one way to do that.
- b) Sometimes things actually need controlling. Soldering iron characteristics, for example, because volts or degrees or ohms in the wrong place, or in the wrong proportions, can damage sensitive parts.

DEFINITIONS.

Temperature accuracy: You might say to yourself, 'Self, this is so obvious that even a geezer could understand it, given time.' In a way you would be right. Temperature accuracy is indeed how closely tip temperature comes to the temperature you thought you set at the station. If you are of a curious turn of mind, or face a specification with preposterous requirements, here is a brief explanation of the things that affect temperature accuracy, and how to get around them.

1. Things that affect temperature accuracy.
 - a. The design of the control circuit. The designer would have loved to make the thing perfect, but there wasn't budget for that. He made some compromises. Perhaps the accuracy could have been $\pm 0.001^\circ$ but it is more likely to be $\pm 5^\circ$. Soldering temperatures do not have to be held to the nearest femtodegree and the sooner we all remember that the better off we'll be.
 - b. Tolerances that exist in components.
 - c. The tolerance that exists in the heater. Heaters aren't made with 10^{-10} precision in their mix - if they were they'd cost more than your house - and each one is just the least little bit off-centre from perfect.
 - d. The size and shape of the tip. The laws of thermodynamics and heat transfer work. Tips lose heat by radiation, convection, and conduction. The part that does the work is conduction; the other two are parasites. If your tip is a big fat one, it will have a large mass-to-surface-area ratio and retain heat better than a long skinny one. If someone fans the tip with their hat, it will lose heat to the air moving by.
2. How to get around them.
 - a) Calibrate the station whenever tips or heaters are changed. Sometimes you can do this. Sometimes you can't.
 - b) Measure the temperature every now and again.

Temperature stability: This is a measure of how well the control circuit works, allowing for this and that and the circumstances that prevail. Stability is only valid when the iron is idling in its rest - it does not have squat to do with thermal response when actually soldering.

Thermal recovery. This is a measure of how well the control circuit works, too. When heat is lost from the tip through conduction, allowing a solder joint to be made, the tip's temperature will drop. I understand that. You understand that. The cat understands that. 'Thermal recovery' means - how long does it take THIS station, with THIS tip at THIS temperature, to get back to temperature? The better the thermal recovery, the faster the operator can work. Getting him/her/it to work faster is a personnel problem and not within the purview of this department.

Tip-to-ground potential: Sometimes called 'millivolt leakage'. The voltage existing between the soldering iron tip and the workstation common point ground. It should not exceed 2mV per DOD-STD-2000; not specified in J-STD-001B.

Tip-to-ground resistance: The resistance existing between the tip of the soldering iron and the workstation common point ground. It should not exceed 5 Ω per J-STD-001B, appendix A, and 2 Ω per DOD-STD-2000.

Insulation resistance: The resistance between the soldering iron tip and its heating element (applies to Hakko soldering irons, series 900, 903, 907, 908). Properly termed 'isolation resistance', it is a measurement of the isolation of the tip from the transformer secondary winding.

The temperature accuracy is $\pm 15^{\circ}\text{F}$. for any single measurement. This figure is obtained as follows:

1. The accuracy of any soldering station is $\pm 10^{\circ}\text{F}$. from the displayed value (assuming that the station has a digital display).
2. The temperature stability of a precision soldering station at idle (e. g. the Hakko 939) is $\pm 1.8^{\circ}\text{F}$. about the set temperature.
3. The specified accuracy of the Hakko 191 or 192 thermometer circuit, with a fresh, clean K-thermocouple sensor, is $\pm 10^{\circ}\text{F}$. This is typical for any intrusive measurement.

These values give an acceptable RSS temperature error of $\pm 15^{\circ}\text{F}$. FOR THE STATION ITSELF. The effect of the tip will be algebraically additive to this value.

The following table sums up the progress, or lack of it, through the thicket of specifications.

| PARAMETER | MIL-STD-2000 | DOD-HDBK-283 | WS-6536E | MIL-S-45743E | DOD-STD-2000-1B | J-STD-001B |
|--------------------------------|--------------------------------|--------------|--------------------------------|--------------------------------|--------------------------------|---|
| TIP TEMPERATURE, DEGS | SET $\pm 10^{\circ}\text{F}$. | N/S | SET $\pm 10^{\circ}\text{F}$. | SET $\pm 10^{\circ}\text{F}$. | SET $\pm 11^{\circ}\text{F}$. | SET $\pm 5^{\circ}\text{C}$. |
| LEAK VOLTAGE, MV | 2 RMS MAX | < 15 V | 2 RMS MAX | 2 MAX | 2 RMS MAX | 'SHALL NOT CREATE DELETERIOUS EFFECTS' ¹ |
| TIP-TO-GROUND RESISTANCE, OHMS | ≤ 2 | ≤ 20 | ≤ 20 | N/S | ≤ 20 | ≤ 5 |
| SOLDER POT TEMPERATURE, DEGS | 500 $\pm 10^{\circ}\text{F}$. | N/S | N/S | N/S | SET $\pm 11^{\circ}\text{F}$. | SET $\pm 5^{\circ}\text{C}$. |
| AMBIENT TEMPERATURE, DEGS | 75 $\pm 9^{\circ}\text{F}$. | N/S | N/S | 75 $\pm 9^{\circ}\text{F}$. | 75 $\pm 9^{\circ}\text{F}$. | N/S |

If you want to know how to measure these things, go to the next chapter. I will show you EXACTLY what to do, and what to use.