

## How do I validate the stability and accuracy of my station?

Appendix A of IPC J-STD-001 Revision E was changed in Revision F on 2014 (Now Revision G). All Hakko products that meet or exceed J-STD-001E guidelines also meet the new Revision G guidelines.

One important issue in Revision E was the stability guideline where the stability as measured at rest and not under load was  $\pm 5^{\circ}\text{C}$ , however once a measurement is taken, the tip is put under a load, although a small one. This means that the measurement is not at rest, but in fact under a load.

All good quality soldering equipment in the market today has the ability to maintain a stable soldering iron temperature and recover. The main difference is the ability to transfer and control the power that they now have in the high watt density heaters that are being used.

For this reason, Appendix A, Section A-2(b) through A-2(d) were revised to ensure that the soldering station you use is in control of the tip temperature to within  $\pm 10^{\circ}\text{C}$ . This is tighter than the accuracy of the previous version of  $\pm 15^{\circ}\text{C}$ , but good soldering equipment can do this.

Stability at rest is no longer an issue because it has no effect on the assembly... after all the iron is at rest. What does matter is that the temperature you measure on a soldering iron tip shows that it starts at a point  $\pm 10^{\circ}\text{C}$  within your selected or required temperature, and that it can recover quickly to that same temperature after a point-to-point soldering operation or applying a large single mass to heat-sink the tip.

If the tip can recover to within  $\pm 10^{\circ}\text{C}$  of the original starting point, then you can ensure more consistency in the hand soldering operation since all the solder joints are getting a more uniform thermal excursion from a similar starting point.

There are some systems that meet Revision E specifications, but due to an inability to recover under control, the tip temperature would overshoot, and at the proper point-to-point frequency, the overshoot would build to the point that by the time you've moved to the 3rd or 4th multi-leaded component on the assembly, the tip temperature at the start of the process is no longer  $400^{\circ}\text{C}$  as required by the operator, but now  $470^{\circ}\text{C}$ ! This now leads to latent defects due to thermal shock/stress on the component(s) and the passives today are even more heat sensitive... so Revision F (now Revision G) focuses more on demonstrated return to an accurate setting with overshooting limited to no more than  $10^{\circ}\text{C}$ .

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With regards to the accuracy validation, that was clarified under A-2(b) in the appendix. If a load is applied to the soldering iron tip, it should be able to demonstrate control of the tip temperature within  $\pm 10^{\circ}\text{C}$  of the selected or required temperature. So, if you apply solder to the tip and then use physical contact with a thermocouple, you are creating a solder joint, and as you measure the tip temperature, you can observe the control the station has on the tip temperature. It should stabilize within the tolerance called for. If you wanted to do the test 'old school', you could heat sink the tip in peanut oil to draw out as much heat as possible to simulate a high thermal mass, and after removing the soldering iron from the simulation you can measure tip temperature. You should see the recovery happen in this case because of the high load that was on the tip. The final temperature should be within the tolerance called for.

The method also will depend on the process indicators you have experienced. It's best to replicate a measurement based on how the assembly sees the heat from the soldering iron tip, so I would use physical contact with a thermocouple sensor. I will have to understand that I can introduce error into this by not making proper surface area contact so my angle to make the measurement is critical. Also, oxidation can introduce error as it is a barrier to heat transfer, so I want to be sure I clean a tip prior to the validation process. I also want to ensure I measure the tip at the same physical location since I will get abnormally high readings if I am too close to the heat source (heater). This can also introduce a ripple but a well-controlled soldering station will have a ripple that is within the tolerance called for by the standard.

An embedded thermocouple or one that is CD welded to the surface of the tip will work well also, but that will only qualify the station. What I'd really want to measure is the tip that is actually in use.

IR probes have error from the emissivity of the surface and the spot size is not small enough so this is the worst of them all.

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