

## Looking forward to more rework?

Patrick McCall

Director of Engineering & Product Services  
PACE Incorporated, Annapolis Junction Maryland, USA

Over the years, the number of hand soldering and rework stations on the production line has dramatically declined. It was once common to see 100, 200, up to 500 stations in place on the production floor. Now, it is more common to see 10, 20, maybe 30. This is primarily due to the high yields that are easily obtainable using today's automated equipment. While hand soldering operations have become less important of late, we are now on the verge of, quite possibly, a significant increase in rework operations due to the lead free solder initiatives. It is well documented that lead free solders are not as forgiving as their leaded counter parts, and it is common for parts that have gone through the "production line" to require additional inspection as well as touchup or re-soldering due to poor wetting, tin whiskers, etc. It is important that any company assembling PCBs that will be changing to Lead Free solders carefully examine their hand soldering & rework, procedures and skill sets before the lead free implementation is upon us. What are the important points to review with respect to hand soldering & rework operations?

1. Process Control & temperature selection
2. Equipment selection
3. Resource Training

An effective process control program will increase productivity, reduce scrap, and ensure product reliability. The process should always be defined by a qualified individual. Leaving this to the operators can cause problems due to a lack of consistency in the how the work is completed. While it is not always necessary that a process/manufacturing engineer be involved, they should at least review the process to verify that it is safe and that it won't cause additional damage. As a minimum the following items should be identified:

1. The preferred handpiece (iron, solder extractor, tweezer, air pencil, etc), tips and other tools required to do the job correctly.
2. The materials (solder & flux) should be identified,
3. The specific working temperature or temperature range should be specified.
4. Operator skill proficiency level required to complete the repair
5. A procedure for reporting issues or damage to assembly during rework – this will allow for procedural improvements to be implemented as required.

Of the four items listed above, the only one where the operator may require flexibility is on the temperature selection. In some cases where multiple rework operations are being performed (e.g. iron and tweezing application), the operator may require some flexibility in the set temperature.

When selecting equipment for hand soldering and rework operations, there is a wide variety of choices for process control tools. Some of the more common ones are:

1. Systems that have a password to prevent the operator from making changes. One of the advantages of these systems is that they are usually digital and an operating "temperature range" can be defined as opposed to a single temperature to give them some degree of flexibility. For example, a range of 700 to 750 can be defined and the operator can freely adjust the temp within the range but can not go below 700 or above 750. The challenge of these systems is that someone has to program each system and "remember" the password. If the work changes frequently, reprogramming can become a full time job. Another spin on a password lockout is the use of a mechanical device that has to be inserted in to the system to change the temperature. These "cards" can be lost and can be easily defeated by inserting something with a similar shape as the card key.

2. Systems where the tip determines the operating temperature. These work well and prevent the operator from making changes **IF and only IF** all other tips are removed from the operators work bench. The difficulty in using this method is that if certain tip is specified, someone has to police the operators to make sure they have the correct one in the handpiece. Additionally, it is impossible to identify what tip is in the handpiece unless it is removed from the handpiece. Also, significant operating costs are realized because 3 or 4 "temperatures" of each tip geometry must be inventoried.
3. The most user friendly method of controlling temperature are systems that use a "control module" to select operating temperature. This method is highly effective because the same tip can be operated at multiple temperatures and if it is removed, the system shuts down. Additionally, the control module is visible from a distance, so verification can be done quickly and easily with a simple visual review of the work area.

Providing adequate training for operators that are functioning in a rework capacity is very important because they will be performing a wide variety of tasks. Often, as they get into the repair, other issues become apparent that must also be dealt with. If rework is not completed correctly by qualified technicians damage may be caused to the assembly or components. Operators must be trained in the proper techniques that they will have to perform to complete their work. In-house training programs that offer a certification to third party standards can be expensive to run and maintain, also they aren't justifiable unless you have hundreds of operators. The best solution is often to contract out the training. A number of companies offer training programs either on-site or off-site. A variety of certifications are available to meet the needs of your company.