JBC
The Soldering Co.

TIME OPTIMIZATION

How JBC stations can optimize production efficiency in hand soldering

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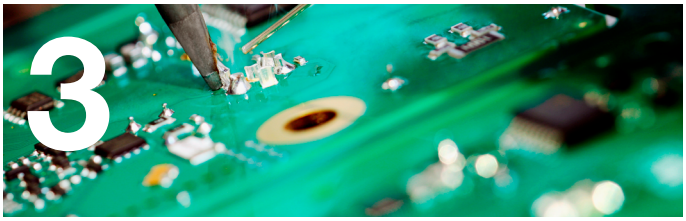
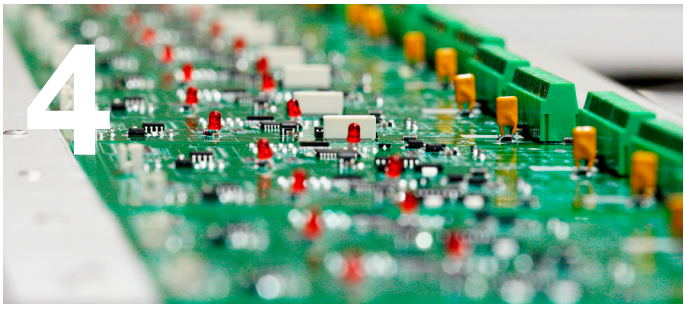
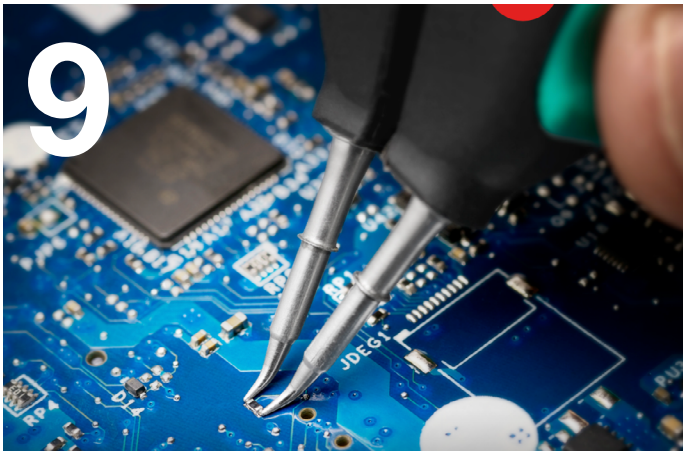






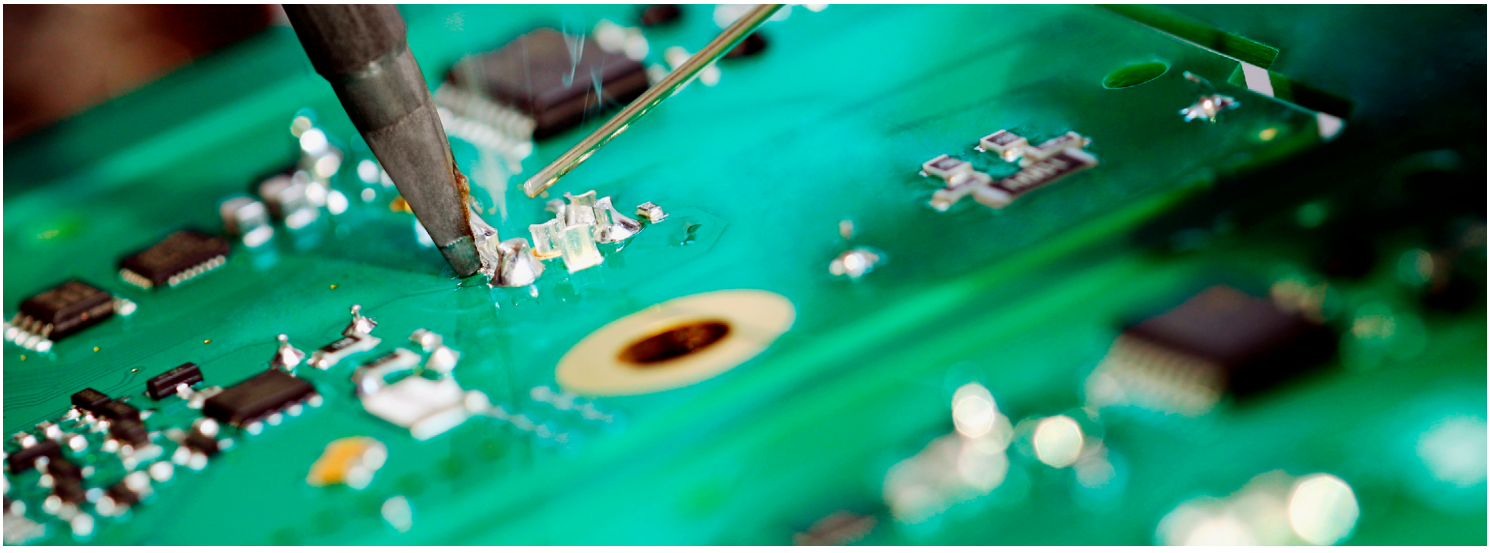
The need for time optimization

The demand for faster and cheaper production is increasing the pressure on manufacturers to improve production efficiency and reduce overhead costs.

Hand soldering and rework are key operations in the manufacture of electronic equipment. Hand soldering involves soldering electronic components to Printed Circuit Boards (PCBs) by melting and placing a low-temperature alloy solder to form an electronically conductive joint. Rework of a PCB assembly usually involves desoldering and re-soldering surface mounted electronic components. Generally, this procedure takes place towards the end of the production process when the PCB has a high value, so its impact can be significant in terms of both cost and productivity.

The good news is that with the right equipment the hand soldering process can be optimized to deliver the best joint quality in the optimum time and cost.

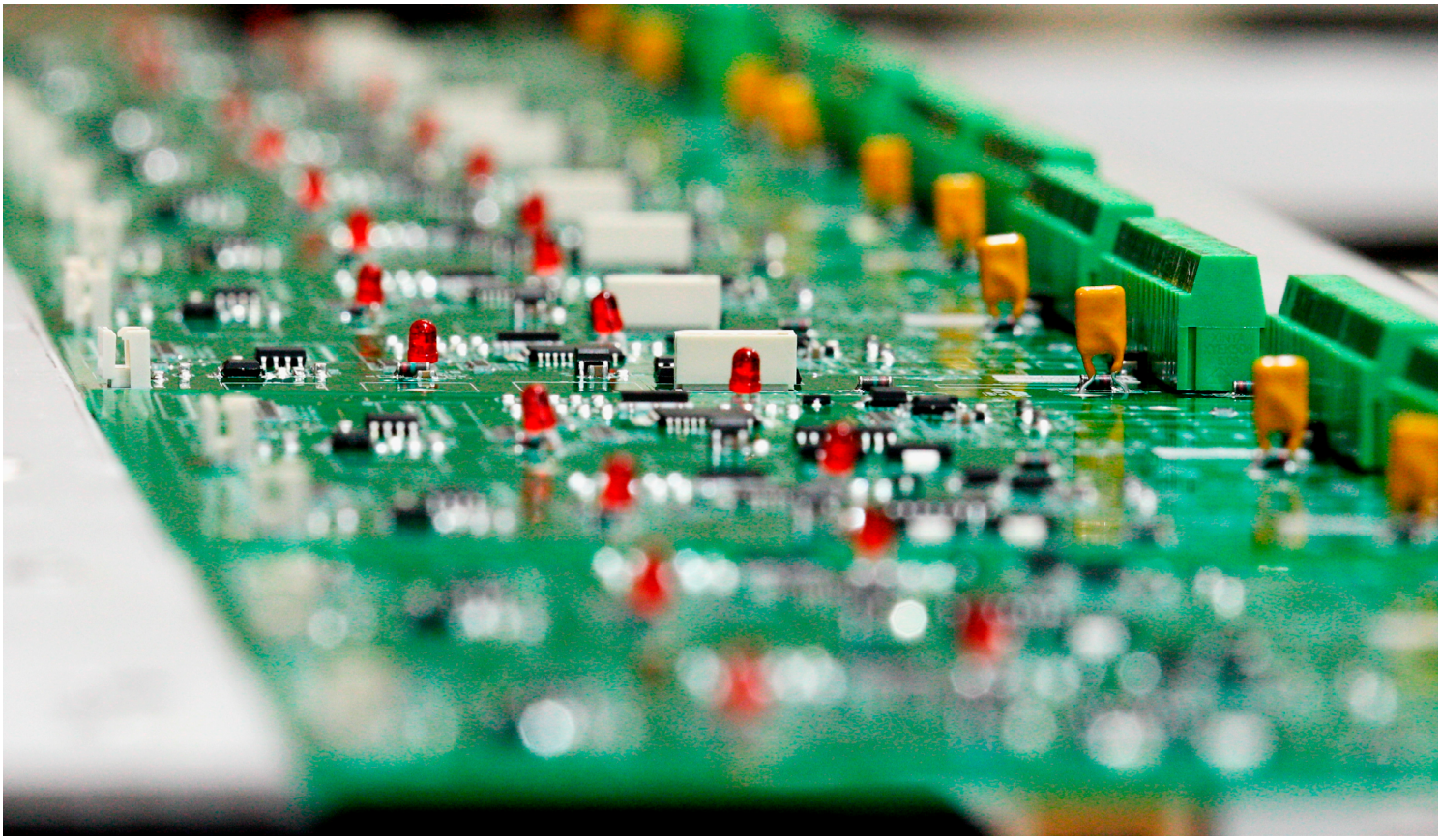
This highlights some of the challenges of delivering high quality solder joints. It then outlines how the features of JBC's range of innovative solder work stations help optimize the solder process by overcoming many of these challenges in order to deliver consistently high quality solder connections in the optimum time.



The challenges of time optimization

Each element in the hand solder process comes with its own set of challenges and process parameters that have to be addressed in order to deliver a high quality joint in the optimum time.

The key to achieving a good quality soldered connection is achieving the optimum rate of heat transfer from the solder iron to the component. The efficiency of heat transfer is dependent on a number of factors including: the solder, flux and content in the solder wire, tip condition and shape, the thermal performance of the soldering iron and tip temperature dropping in addition to the specific characteristics of the PCB and component for each application.



Flux and solder alloy considerations

As solder wire is applied to the surfaces being soldered, its diameter should match the joint being made.

From 2006, the use of lead in solder wire has been prohibited for most applications. The lead-free alloys that have replaced it have a higher melting point. For most lead alloys, fusion occurs at a temperature of around 180°C (350ºF), whereas for lead-free alloys this happens at a temperature of approximately 220°C (430ºF).

To enable the joint to reach this higher temperature, the soldering time can be extended, which increases the potential for damage to both the component and the PCB. Alternatively, to achieve a solder joint in the same length of time, the temperature of the solder tool can be increased, which will reduce the life of the solder tip through increased oxidation and also, the SMDs and PCB could be damaged.

The type of flux used will also have an impact on solder joint quality, its performance and its long term reliability.

Flux is added to help remove oxides and impurities from the surfaces to be soldered, protect the metal surfaces from re-oxidation during the solder process, and to aid the application of the molten solder by altering its surface tension.

While having a positive affect by removing oxidation, it has an adverse effect on tip life. Thus using a more aggressive flux than necessary will reduce tip life unnecessarily.

Flux is usually present in the core of the solder wire, although the quantity present might not be sufficient to form a quality joint when a small diameter wire is being used, in which case additional flux can be applied using a Flux Dispenser.

Tip condition and shape

The solder tip is where the heat is transferred from the heating element to the joint. Tips can suffer from oxidation, wear and damage.

Oxidation

Copper is used to form the core of the solder tip because of its high thermal conductivity. Copper is soft and can dissolve into the solder, so iron plating is added to extend the operational life of the tip. The problem with iron is that it can oxidise and impact the tip's heat transfer efficiency.

When iron is exposed to air or moisture, oxidation converts iron into iron oxide. Oxidation is a natural process; at room temperature, if left unprotected, the iron on the solder tip will slowly oxidise over time. However, the oxidation process is rapidly accelerated by the heat used in soldering; the higher the soldering temperature, the greater the rate of oxidation.

Unfortunately, iron oxide does not transfer heat well. The oxidized layer will reduce the rate of heat transfer from the tip to the component and affect the quality of the joint. In addition, iron oxide build-up on the tip can create a de-wetting barrier that can prevent the solder from flowing smoothly and evenly across the working surface, which will also impact quality.

JBC's blog provides advice on how to remove oxidation from solder tips.

To minimise the rate at which oxidation occurs in the first place JBC recommend the following:

- Tin the tip with a covering of fresh solder after cleaning and before storing to shield the iron from the air;
- Avoiding excessive heat when soldering to minimize tip oxidation; and
- Turn off the heat when the iron is not in use by taking advantage of Sleep and Hibernations Modes to power down the tool when not in use.

Plate wear and cleaning

The iron plating on the tip must be able to resist abrasion. Over time, plate wear as a result of the tip repeatedly coming into contact with components and solder is inevitable. Tip life can be extended by increasing the plate thickness. However, this will limit the tip's thermal responsiveness and impact the efficiency of state-of-the-art solder stations, such as those manufactured by JBC, which rely on fast temperature recovery for efficient operation.

Keeping solder tips clean will help prolong their life and improve efficiency. With the implementation of lead-free soldering it has become necessary to use means such as metal wool or brushes to clean tips rather than a wet sponge.

Incorrect techniques

The iron plating is added to extend the operational life of the solder tip, but applying too much pressure to the tip will cause the iron plating to crack. An operator might apply more pressure to the tip when soldering in the mistaken belief that it will improve heat transfer.

Once a crack has formed in the plating, it will propagate through to the core. Solder can then start to dissolve away the exposed core creating a hollow in the copper. Over time, the size of the hollow will increase until it reaches a point where there is insufficient copper to support the iron plating, which will break.

Instead of pressing hard on the tip, the best way for an operator to ensure good heat transfer is to use the correct tip. Tips should have similar dimensions to the object being soldered. A larger tip will maximize the area in contact with the joint and allow the joint to be formed at the lowest possible temperature.

When changing tips JBC advise using the cartridge changer provided by the manufacturer and not pliers or other tools that might cause damage to the tip.

Working temperature

Maintaining the correct tip temperature is critically important for the formation of good quality solder joints. With the right solder station it will be possible to make a series of solder joints, each taking the same amount of time, without the tip temperature dropping significantly.

However, not all soldering irons are capable of responding instantaneously, which results in the tip temperature dropping when forming a series of joints. This is a particular problem in solder irons where the temperature sensor is located away from the tip because there will be a time-lag between a joint being made and the station responding. This will result in each consecutive joint being made using a solder iron that is progressively colder and will produce joints or cold joints of an inconsistent quality.

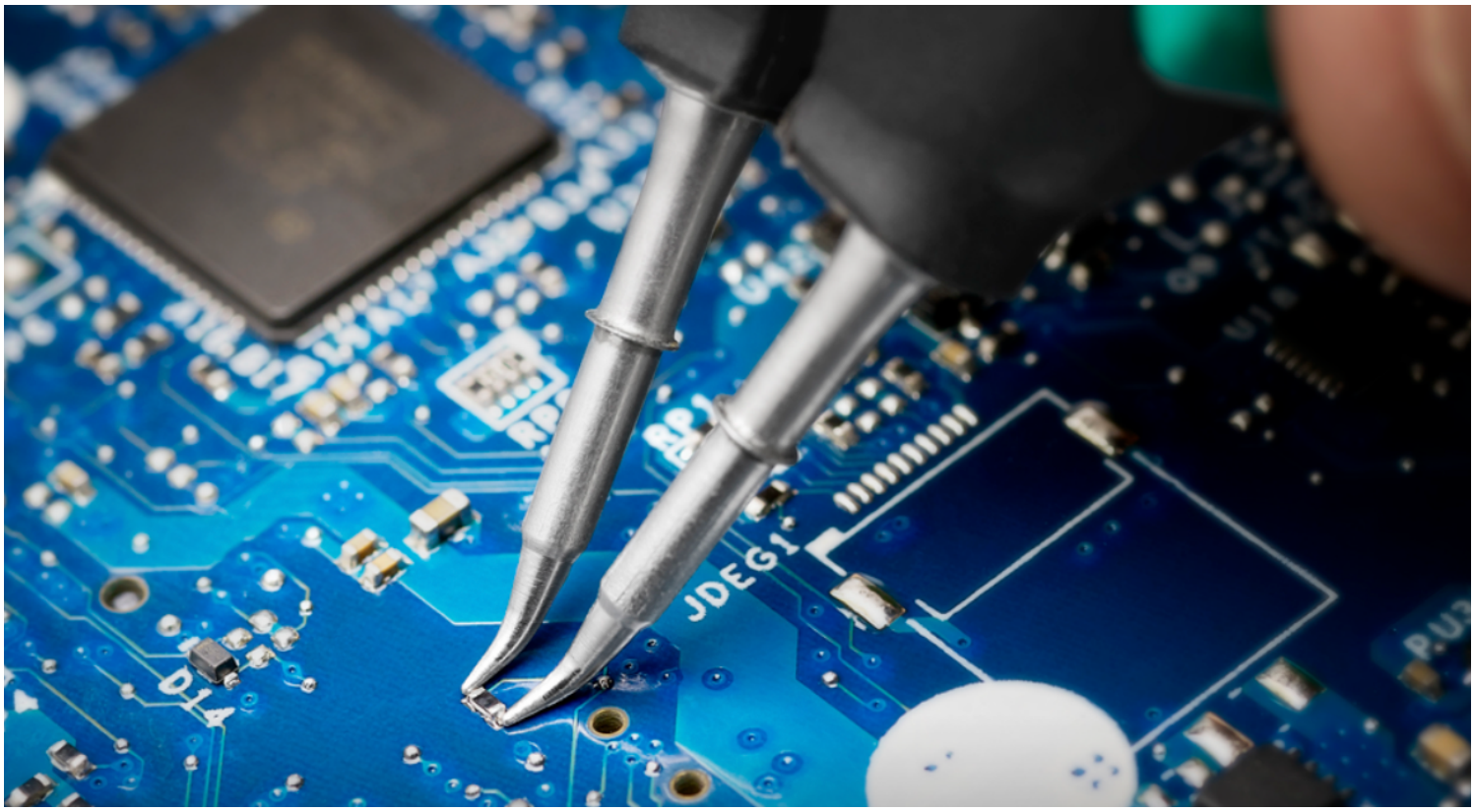
To overcome the temperature lag and to maintain throughput, many operators set the iron temperature higher than is needed to form a single joint. This problem is exacerbated when using lead-free solder because the process temperature is already higher.

In addition, while an increased tip temperature may improve the wetting characteristics of lead-free solder and make the overall process time quicker, it will increase the risk of damage to the component and PCB.

Time optimization with JBC

JBC is based in Barcelona with over 90 years of experience serving clients worldwide. It offers a wide range of innovative, efficient and reliable soldering solutions developed to satisfy the most demanding customers requirements.

JBC's innovative range of stations are designed to improve quality and increase production efficiency by enabling the rapid placement, precision hand soldering and easy reworking SMT components onto the surface of a PCB.



JBC Technology

JBC has developed the most advanced technology based on excellent heat transfer, instantaneous heating-up and great durability.

Reduction in working temperature

JBC's lightweight soldering irons incorporate a compact heating element close to the solder tip. The heater incorporates a fully-integrated thermal sensor to provide accurate and virtually instantaneous temperature readings to ensure power is immediately delivered to the heater to instantly recover tip temperature.

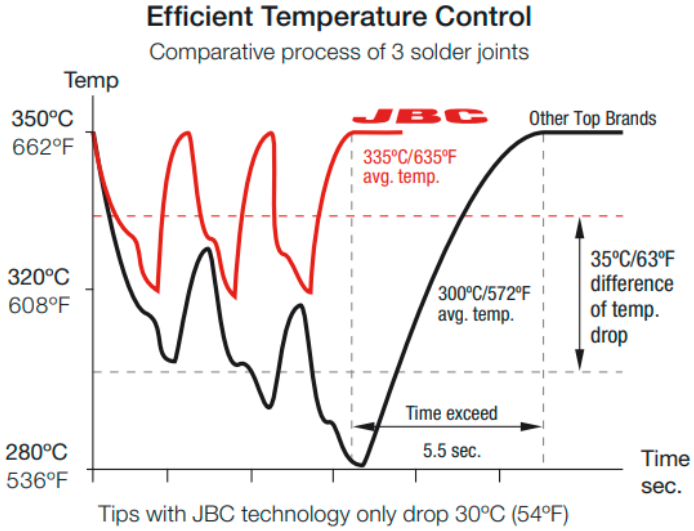
The tool's excellent heat-transfer ability coupled with its short reaction time enables the soldering iron tip to work at a temperature of up to 50ºC (120ºF) lower than those of many manufacturers. This means that while some solder stations have to work with a tip temperature of up to 400ºC (750ºF), JBC's stations enable tips to work at just 350ºC (650ºF). This prevents damage to components and to the PCB, vastly improving quality and lengthening the life of the tip.

Heat control

In addition to working at a lower tip temperature, JBC Exclusive Heating System ensures the temperature fluctuations at the tool's tip are minimised. This ensures operators can deliver a series of high-quality solder joints with minimal risk of damage to the component through thermo shock or through the application of excessive soldering temperature.

When undertaking a series of soldered connections, the tip temperature of a conventional device can drop by as much as 70ºC (126ºF).

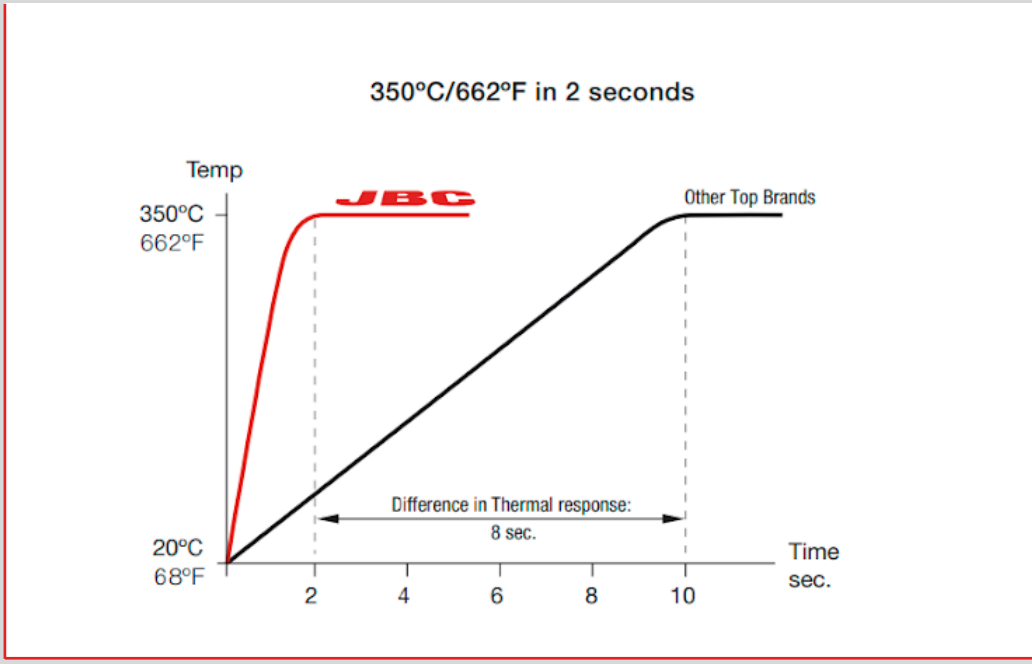
To compensate for this, an operator will run a conventional soldering iron at a much higher temperature, which can shorten the tip's life and may even damage the PCB or the component being soldered. By contrast, the rapid response of the Exclusive Heating System reduces the temperature drop by up to 60% compared to other brands.



Instant heat

The efficiency of JBC Heating System enables the tip temperature to rise rapidly from room temperature to an operating temperature of 350ºC (660ºF) in just 2 seconds, depending on the model of the cartridge – far quicker than the majority of systems on the market which can take between 10 and 90 seconds to reach temperature.

In addition, to maintain productivity the heating system also ensures that as soon as the operator touches the joint with the soldering iron's heated tip, the embedded sensor will instantly register a temperature drop and instruct the station to deliver power to the heater to quickly recover temperature.

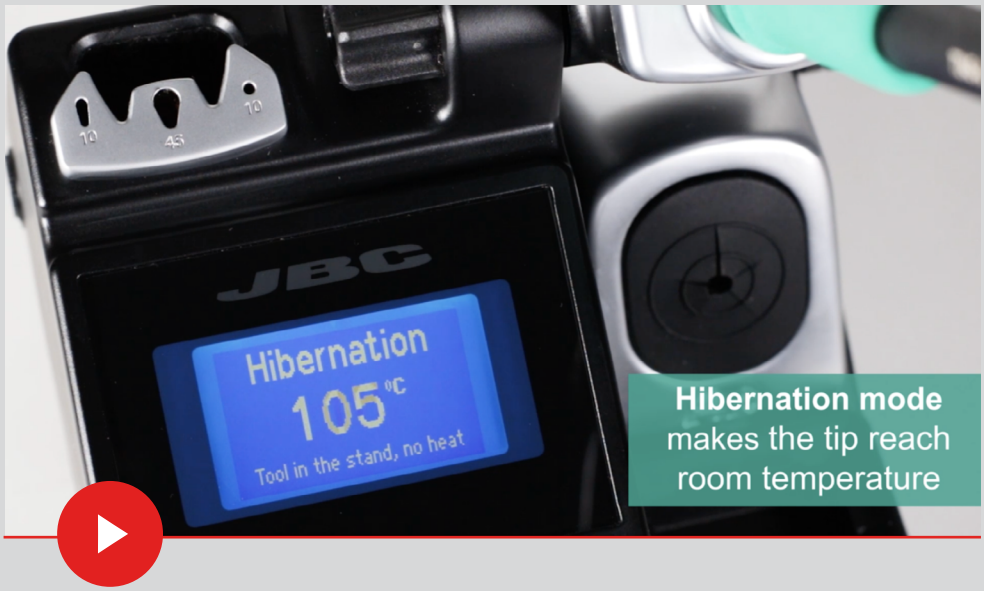


Intelligent Heat Management

Sleep and Hibernation Modes

Alongside the Exclusive Heating System, JBC Intelligent Heat Management system helps prolong the soldering tip's life by allowing it to cool when not in use.

JBC's solder stations automatically put the tool into Sleep Mode as soon as the handpiece is placed in the tool stand. This lowers the tip temperature below that of the melting point of solder, preventing dissolution of the tip's iron coating.

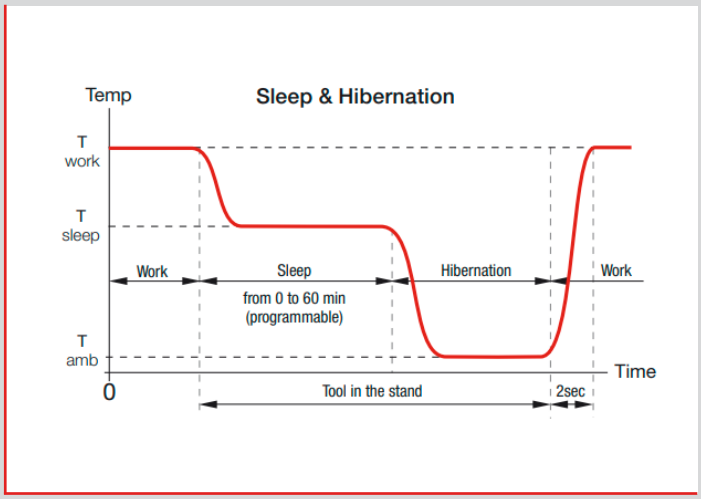


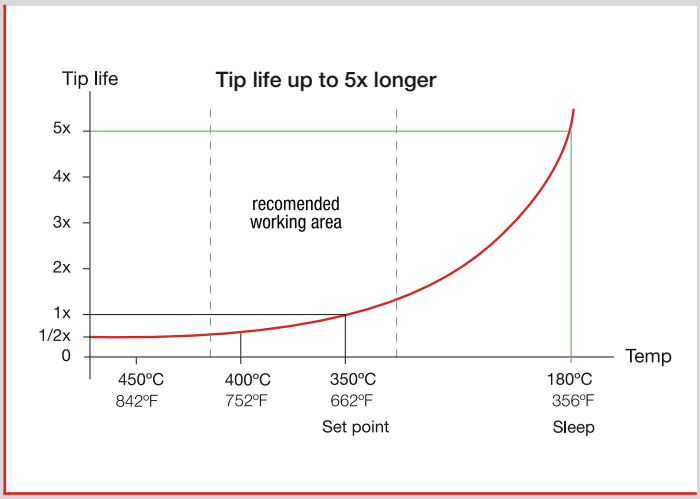
If the tool remains unused for a further, configurable, period of time, the stations will automatically cut the power of the tool completely to put it into Hibernation Mode. This returns the tip to room temperature, helping to prevent oxidation and saving energy.

We recover the tip temperature so quickly that Sleep and Hibernation Modes do not affect production. We are ready to solder while the operator takes the soldering iron from the stand to the PCB.

Extended tip life

JBC Exclusive Heating System and Sleep and Hibernation Modes lower the tip temperature to prevent oxidation and extend tip life by up to 5 times.





Increased Productivity

JBC's Quick Cartridge Changer and cleaning systems help maximise productivity.

Quick Cartridge Extractor

To maximise productivity, many JBC Soldering Stations are fitted with a Quick Cartridge Extractor.

To change a tip, an operator places the tip in the extractor, removes the tip by giving it a gentle pull, the operator and is then able to insert a new tip from the holder. It is a feature that enables JBC Cartridges to be swapped quickly and safely without tools and without the need to switch the station off. As such, operators can safely switch between jobs in just a few seconds, reducing idle time. And, of course, the Intelligent Heating System will ensure the new tip is back up to working temperature in seconds.

Cleaning System

For optimal heat transfer and to maintain joint quality, it is important to keep the tip clean, tinned and free of oxides. JBC Tip Cleaning System allows manufacturers to choose from three safe methods according to their needs: metallic wool, sponge or metal brush. The integrated wiper also allows excess solder to be removed from the tip single-handedly. JBC recommends the use of automatic cleaners to reduce cleaning time and increase productivity.

The best tip for the optimum soldering solution

JBC has developed the most advanced technology to extent tip life and optimize time based on:

- Excellent heat transfer
- Instantaneous heating-up
- Great durability

Tip selection

JBC has over 500 models of cartridges of different sizes and shapes for every application, from precision work to high-power applications. Tip types include:

- **Chisel:** The size is usually specified as the length of the flat area and thickness of the tip, for example JBC C245907 Cartridge Chisel has a tip 2.2 x 1mm..
- **Bevel:** A beveled tip has a flat oval end set at an angle. The size is specified by the diameter of the shaft. JBC C245951 Cartridge Bevel has a diameter of 3.8mm.
- **Conical:** The end of the soldering tip comes to a point. The size is specified by the diameter of the end, so it can be as small as 0.1mm, for example C115126, or several millimetres diameter, such as C245107, which has a diameter of 3mm. These tips are generally used when pin-point accuracy is needed. The ends of the tips may also be bent for difficult-to-access areas.
- **Drag:** Usually used for drag soldering when the solder is drawn across multiple contact pins when soldering THT components. The size is measured by the gap between blades, for example C245754, which has a 0.75mm gap between blades.

If you have a particular application JBC can work with you to design a tip specifically for the application. JBC is not limited to these 4 cartridge shapes. We have a wide range of custom made shapes and sizes.

Feel free to contact us at customtips@jbctools.com and let us customize the best tip for your process.

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