TIP SHAPES

Recommendations for Selection of Tip

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HAKKO Recommendations for Selection of Tip Size

When selecting the most suitable tip size (diameter) for the workpiece, what do you base your selection on? When soldering, if the tip shape has already been determined, then you may be at a loss to select the size (diameter). How do you select what size (diameter) to use?

If the proper size (diameter) for the work piece is selected, the following merits will be obtained and the "soldering environment will be improved.

Heat will be efficiently transferred to the workpiece, which offers easy wetting by solder.
If wetting by solder is easy, the setting temperature can be set to the lowest possible temperature.
If the set temperature is lower, tip oxidation is prevented.
If tip oxidation is prevented, the service life of the tip will be prolonged.
If the service life of the tip is prolonged, the cost will be reduced!

There are two steps for studying how to select a tip with the appropriate size by using the T12 series Shape D as an example.

Step 1: Select a tip with the appropriate size for the work piece

The size of the tip changes the contact area with the workpiece. The contact area determines how efficiently heat is transferred to the workpiece. What size will transfer heat the most efficiently? Let's study it by using T12-D12, D16 and D24 as examples.

Look at the following Graph 1 and 2 for tips smaller than the workpiece, appropriate for the workpiece and larger than the workpiece.

Graph 1: Change in working time due to different tip size selection

Measurement Conditions

Measurement Method	**Solder at 5 points and measure the time until the temperature of the workpiece reaches 250ºC**
Board	Glass epoxy board
Component	Connector
Tip Shape	T12-D12, T12-D16 and T12-D24
Temperature Setting	360ºC
Solder	Lead-free solder (Sn-3Ag-0.5Cu) Φ0.5

Comments

It is assumed that if the drop in temperature and working time are focused on, "selection of a tip with a larger size" is favorable. The shorter working time makes the tip less oxidized, so "tip with the appropriate size" is also acceptable.

Which one is better size, 'tip with the appropriate size' or 'tip with the larger size'?

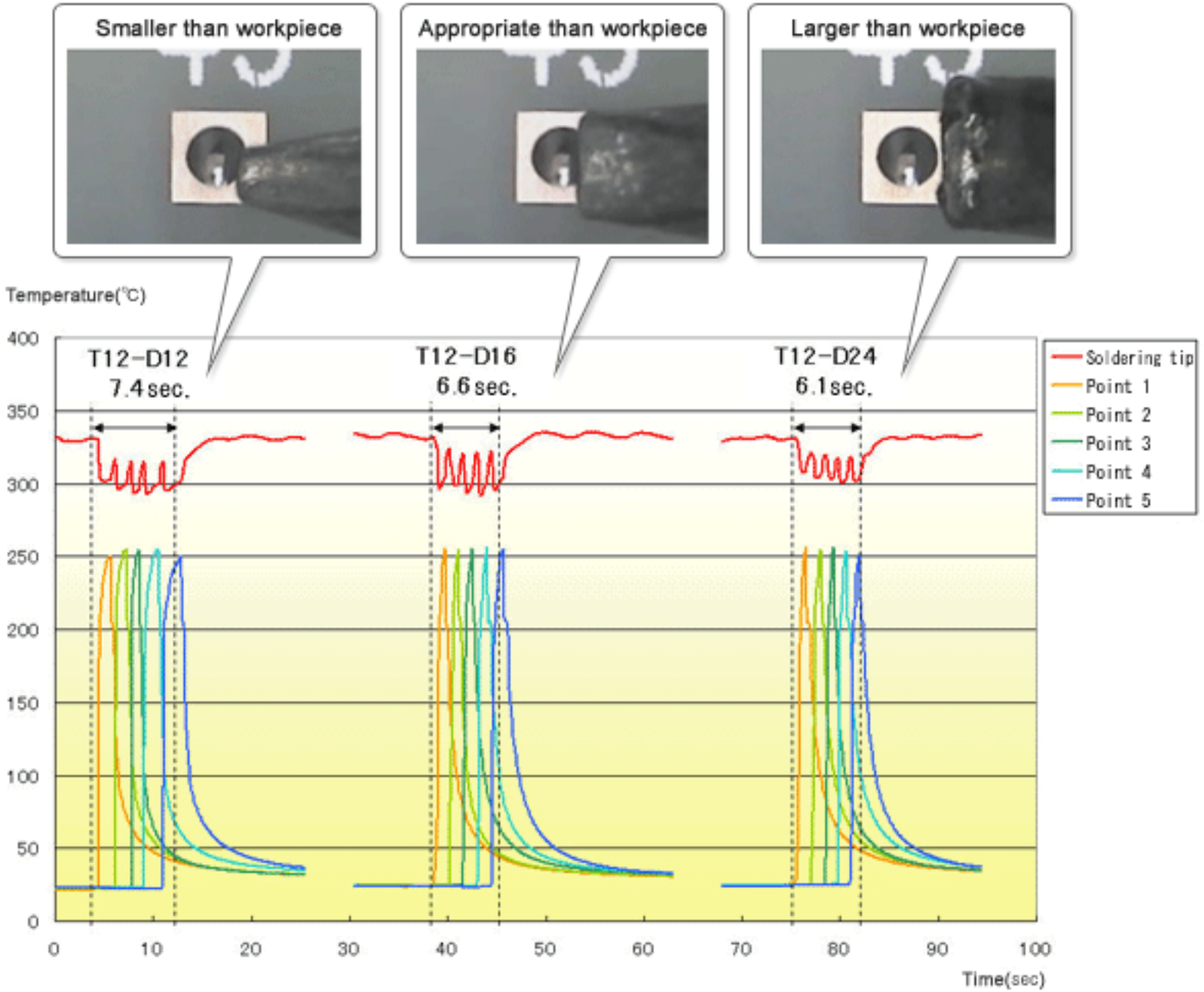


Figure 1. Select a tip with the appropriate size for the work piece

Graph 2: Change in temperature of workpiece due to different tip

Measurement Conditions

Measurement Method	**Measure the temperature of the workpiece when 5-point soldering is performed once every 3 seconds**
Board	Glass epoxy board
Component	Connector
Tip Shape	T12-D12, T12-D16 and T12-D24
Temperature Setting	360ºC
Solder	Lead-free solder (Sn-3Ag-0.5Cu) Φ0.5

Comments

It is assumed that “selection of tip with the appropriate size for the workpiece” is better considering the temperature drop and the workpiece temperature. In the graph, the temperature drop of “tip with the appropriate size” is the largest, which indicates the sufficient heat is transferred to the workpiece.
So in the end, is “tip with the appropriate size for the workpiece” better?

The two types of graphs show that there is a complicated relationship between drop in temperature, working time and temperature of the workpiece. In order to obtain the best “soldering environment”, the tip size should be determined after taking the above conditions into consideration.

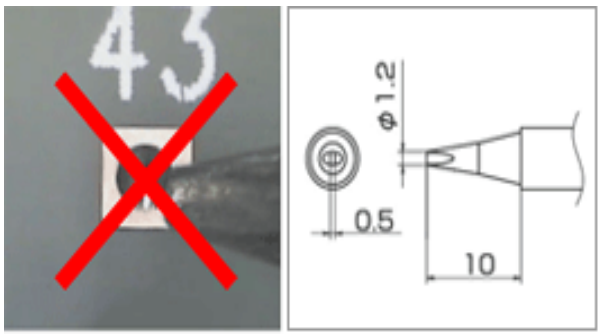
Finally, which is the best selection: “smaller than the workpiece”, “appropriate for the workpiece” or “larger than the workpiece”? We recommend a tip with “the appropriate size for the workpiece”. If the tip is smaller than the workpiece, heat is not efficiently transferred and working time will be prolonged. On the other hand, if the tip is larger than the workpiece, it causes P.W.B. to be damaged.

If it is impossible to use a tip with the appropriate size for the workpiece in a narrow space, reduce the tip size gradually to minimize the amount of size reduction and solder the workpiece in combination with the following methods.

1. Solder the workpiece using a combination of “a tip smaller than the workpiece” and a preheater, which can preheat the P.W.B. by applying hot air to the underside of the P.W.B.

2. Replace “a tip smaller than the workpiece” with an N2 system (nitrogen gas) and solder a workpiece.
   The preheating effect of the nitrogen gas will increase the wettability and ductility.

Smaller than the workpiece

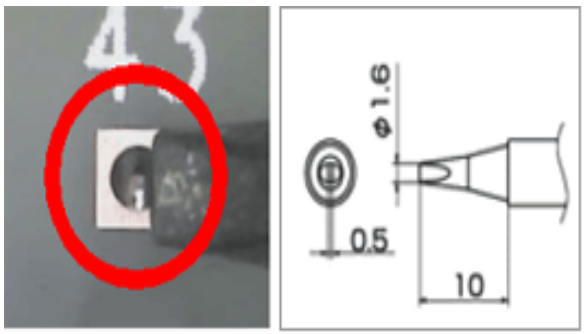


A tip smaller than the workpiece cannot transfer sufficient heat to the workpiece

If the tip is smaller than the land, heat from the tip is not transferred to a workpiece efficiently and it takes much time to transfer a sufficient amount of heat that solder can be wet.

* The reason for the temperature drop being the smallest is because heat cannot be transferred to the workpiece efficiently.

Appropriate than the workpiece

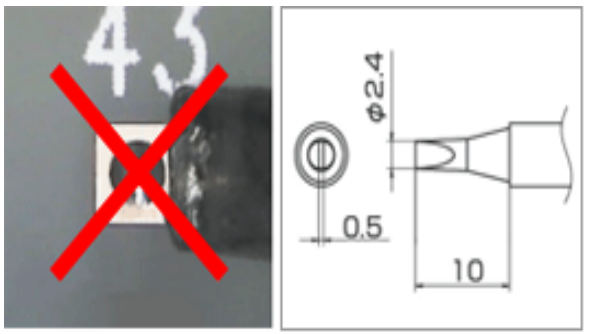


A tip with the appropriate size for the workpiece can tranfer heat to the workpiece efficiently

If the tip size is appropriate for the land, an amount of heat sufficient to let solder be wetted is transferred, and the drop in temperature will be larger.

However, if a soldering iron with excellent thermal recovery rate is used, the time until recovery to the set temperature is shortened, enabling the working time to be reduced as a result.

Larger than the workpiece



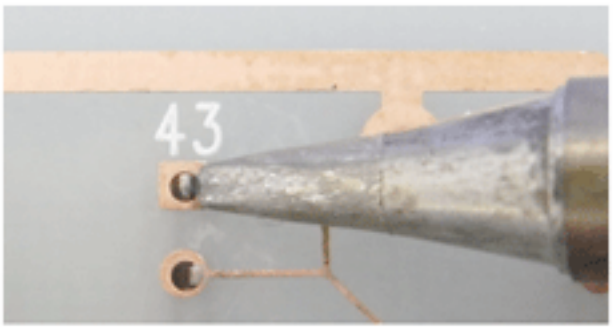
Do not use a tip larger than the workpiece.

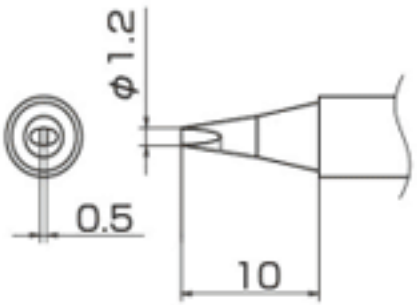
Doing so may cause the P.W.B. to be damaged.

Step 2: Select a tip with as high a heat storage capacity as possible

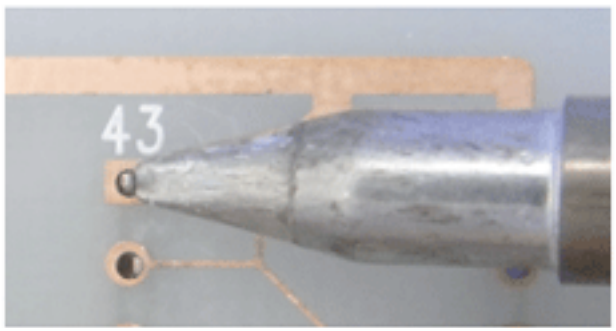
For example, which of the following tips do you choose? The end of both tips is 1.2mm, which is just appropriate for the workpiece.

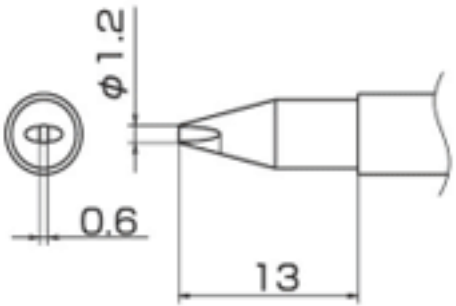
T12-D12





T12-DL12





* Although the tip size is the same for both, the heat storage capacity is different

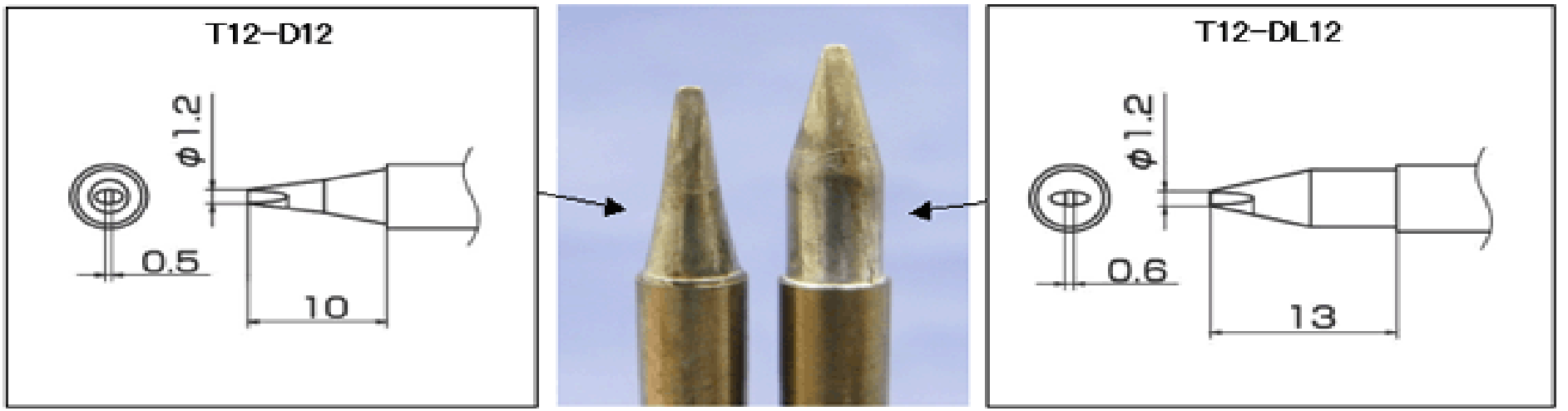
The tip size of T12-D12 and T12-DL12 is 1.2mm; however, DL12 looks larger overall. This produces differences in the heat storage capacity, which contributes to improving the soldering environment.

Therefore, select a tip with the highest heat storage capacity possible if the size is the same. Further, reduce the size gradually considering various conditions such as narrow pitch, etc.

The difference in storage heat amount can be confirmed by the difference in temperature drop. If the temperature drop is small, the set temperature can be kept lower. It is unnecessary to set the temperature excessively high. The working time required for one soldering operation can be reduced, resulting in a reduction of working time for the day.

(T12 series has Heavy Duty Type. This type enables soldering at narrow pitches in which the tip end of L type touches the near by ICs.)

The difference which you cannot feel from the drawing is cleary apparent in the photo!
The difference will affect the soldering environment.



Temperature Comparison graph between T12-D12 and T12-DL12

Measurement Conditions

Measurement Method	**Measure the time until temperature of workpiece is increased up to 250ºC when 5-point soldering is performed**
Board	Bakelite board
Component	Terminal (External diameter Φ8.5 / Internal diameter Φ4)
Tip Shape	T12-D12 and T12-DL12
Temperature Setting	360ºC
Solder	Lead-free solder (Sn-3Ag-0.5Cu) Φ0.5

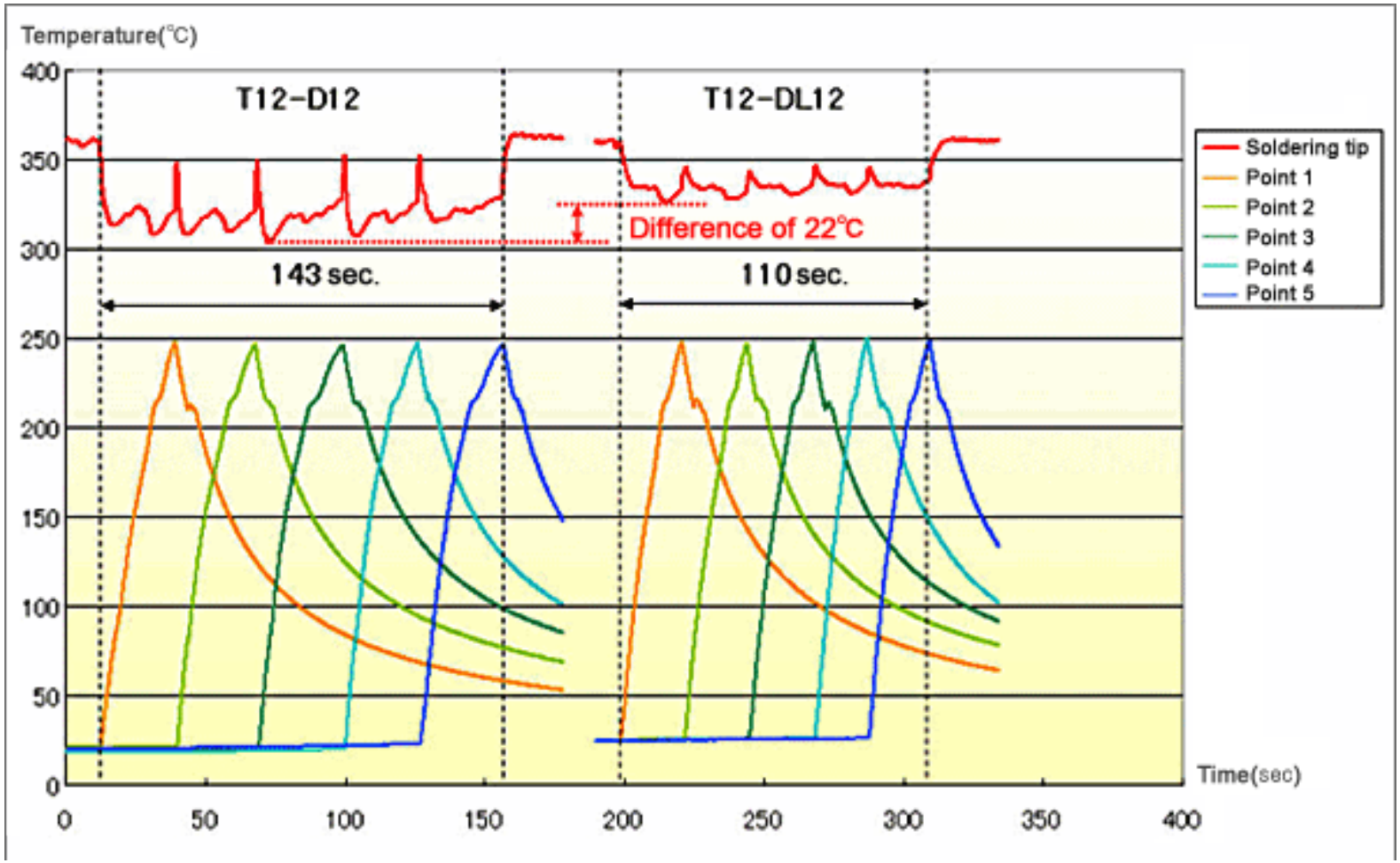


Figure 2. Select a tip with as high a heat storage capacity as possible

* Only T12 series offers Heavy Duty Type which has larger heat capacity than Standard type (T12-D12)

Comments

The difference in heat storage capacity produced a difference in temperature drop of 22ºC. If the drop in temperature is small even for the same set temperature, working time can be reduced (143 sec – 110 sec = 33 sec).

Thus, reduction in the soldering time prevents the tip from being oxidized. In addition to selection of products compatible with lead-free soldering, we strongly recommend selecting the appropriate tip size. It will improve your soldering environment