Vitronics Soltec

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The length of the main solderwave

Introduction

The length dimension of a main wave is related to the contact and drainage length during soldering.
The contact length is depending on the soldering depth and the conveyor angle.
The soldering depth is in most cases restricted to half the board thickness or 1mm, to prevent solder overflow to the component side of the PCB.

A factor that affects the contact length in an uncontrolled way is the bending / sagging of the PCB during soldering. This should be prevented since this will also give an uncontrolled solder process that can result in too long dwell times and more solderbridging.
The drainage length depends on the PCB-layout on the solderside and the conveyor angle, but is also affected by bending of the PCB.

Process

Bending or sagging of the PCB during soldering affects the process in a negative way.
Using pallets, temporary support strips on the front edge of the PCB, or a supporting wire in the machine, will prevent or at least reduce this effect.
This will result in a more robust and better controllable solderprocess.

Wave soldering machines were originally designed to work under conveyor angles between 4° and 8°. The wavelength must be designed to give a good solderdrainage within the wave area at the lowest conveyor angle. This resulted in a length for the mainwave of 120 mm.

The practical situation however is that the 7° conveyor angle is by far mostly used. The reason is that the best relation between conveyor speed and acceptable dwell time, that will give the best process quality, is found at this 7°-soldering angle.

At this angle the practical contact length giving a soldering depth of 1 mm is about 25 - 30 mm on a glassplate. To this length the drainage area of about 10 - 25 mm, depending on the PCB layout, must be added for standard leadlengths up to 2 mm. The total contact length is in that case about 55 mm. To be certain that under normal conditions the drainage process will finish well within the nozzle, 15 mm should be added to this theoretical nozzle length.
So when soldering under a 7° transport angle a 70-mm main nozzle length would be sufficient.
However if serious PCB bending takes place during soldering, without compensation, the drainage may need even a longer contact length.

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Nozzle design

In comparative tests with main wave nozzle lengths of 120 and 70 mm, with a conveyor system under 7°, the solder quality was comparable.
Assuming a controlled solderprocess where excessive PCB-bending is compensated and the leadlength on the soldering side is limited to 2 mm for closely spaced components, the use of a 70-mm nozzle is preferred. It gives more space for options like the use of a nitrogen supply, or the use of a SelectX® debridging system.
When the conveyor angle is 'fixed' the use of a 70-mm nozzle with a 'forced' drainage profile to assist debridging by a correct setting of the nozzle backplate is possible.
Due to these benefits a 70-mm mainwave nozzle is now standard for wave soldering.

Note: This nozzle is designed for a 7°-conveyor angle only.

SelectX®

The SelectX® can only work successfully if the solder is still liquid at the board area to be SelectX®-ed. Therefore the SelectX®-nozzle must be positioned close to the point where the PCB exits from the solderwave. As soon as one works at a PCB area where the solder is already solidifying, the correct setting of the SelectX® becomes more difficult or even impossible.

Since solderjoints on non-plated through holes are unstable during their formation, the use of the SelectX® might be limited on such board.