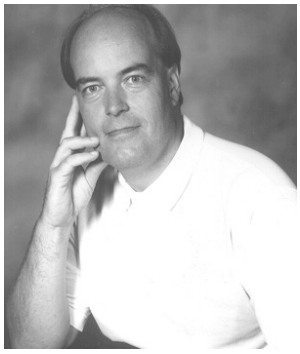
Setting Up Wave Soldering Parameters



Bob Willis

The following procedure may be used when setting up a wave soldering system for a new board design or the test board. To fully prove the soldering process only fully populated boards should be used. The component lead length should be checked along with the correct position of all surface mount components. The samples should be soldered with all the necessary jigs or support clips to prevent any sagging of the boards during the soldering operation.

Engineering should specify the flux to be used for the new design and it should be used in the machine's fluxing system during final trials. The speed of the conveyor should initially be set at approximately 3.0/3.5ft/min for double sided and multilayer boards and 4.0ft/min for single sided boards. The solder temperature should be 235-240oC when using 63% tin /37% lead alloys.

Fluxing Operation

The spray fluxer should be set-up and checked for correct operation. A sample unsoldered board should be passed through the machine. The board should be removed just after passing through the fluxer and the air knife. There should be evidence of a thin coating of flux over the complete board with evidence that the flux has just entered the holes, (plated through hole boards only).

In the case of foam fluxers the flux head should be stable and have the smallest bubbles possible when adjustments have been made to the air pressure. Using an unsoldered board or a Lev Check, confirm that good contact is being made with the foam head. When using the Lev Check, the foam head is depressed, again check that the foam bubbles making contact are relatively small.

In the case of both fluxers the air knife should be set to remove excess flux from the base of the board. In the case of spray fluxing with plated through hole boards the air knife should be adjusted vertically to aid flux rising into the plated through holes.

To monitor flux penetration into through hole with a spray unit a piece of thermal fax paper is placed on the top side of the un-populated printed board and passed through the spray fluxing system. There should be evidence of the flux wetting the paper due to the flux penetration. Using the air knife at 90o to the board will aid flux rise and allow the amount of flux applied with spray fluxing to be reduced.

It is common to have poor solder rise on any board regardless of the surface finish on copper or nickel/gold. It's easy to overcoat the board with flux and get good results, the trick is to get good results with a minimum deposit.

Pre Heat Operation

A fully populated assembly should be passed through the machine to establish the temperature profile. This will be done with the fluxer and solder wave switched off. The assembly may have been previously soldered to locate the components in position. The temperature on the topside of the board should reach a minimum of 100oC prior to passing over the solder bath.

Either temperature labels or the ECD Mole or Datpaq profiler can be used for this operation. Ideally the profiler should be used as this provides a full record of the profile for future reference. If the profiler is used thermocouples should be positioned on the bottom of the board and on the topside. The probes should be soldered in position using high temperature solder and only the leads held in place with tape. The additional probes should be located in areas of the board where there is the greatest heat sinking effect.

In the case of surface mount boards the termination points of selected parts on the underside of the boards should be checked. There should be no more than an 80oC temperature difference between termination temperature and solder wave temperature prior to hitting the first wave.

If topside surface mount components are included in the design, the peak temperature over the wave is also important. If fine pitch terminations reflow again during wave contact it can cause them to be lifted leading to open joints. This can occur due to the increased movement of the board during wave contact, although not desirable all boards do flex during wave contact.

A record of the profile file name saved on the computer should be recorded for future reference along with a copy of the profile attached to the prototype result report. The file reference should be the board name or board reference number for ease of location.

A test board should be passed through the machine with the fluxer and pre heater section operating. The board should be removed prior to passing over the solder wave. There should be no evidence of solvent left on the underside of the board which may cause gassing and spitting during wave contact.

Solder Wave Operation

As the board goes through the solder wave the board should not sag. If it does the support is inadequate and should be reviewed. If surface mount parts are positioned on the bottom of the board then the double wave should be used. The solder contact should be checked by using the Lev check before processing the prototype boards. It can be valuable to check for flux gassing which can affect satisfactory soldering of chip components.

The contact width on the solder wave should be approximately 15mm for the chip wave and 30mm for the second wave. This should provide a minimum of 2 seconds in the chip wave and 4 seconds in the second wave. During wave contact the back section of the second wave should be moving at the same speed as the board assembly. It is also important that the solder flow for the full length of the board not just for the initial contact which often causes shorts at the end of the board; it can also lead to dross shorts. After soldering the first board check that on any through plated holes full solder penetration has been achieved. If this is not visible check flux application again in the through holes and the pre-heat settings to confirm topside temperature is correct in the area of poor solder penetration.

To maintain the same conveyor speed for the intended through put the contact time on the wave can be adjusted by using the support and back plate on lambda system waves. Adjust the support plate to increase of decrease the contact time with the PCB, you have to use the adjustment screw which is always under the movable conveyor unless you are running wide boards. When this is set then adjust the back plate to allow the solder to flow over the back of the wave when a board or pallet makes contact. This is covered in the training video on machine set-up see our web site for details www.bobwillis.co.uk

The solder wave height setting should achieve a board depth of 50% of the board thickness with or without jigs or fixtures. In the case of tooling holes or breakout routs the solder meniscus should be clearly visible. In the case of finger transport, the fingers should fully depress the wave with the solder lapping into the finger "V" groove.

After soldering the minimum of flux residues should be left on the board surface. Provided the soldering performance is satisfactory with no shorts or missing joints the quantity of flux applied by spray may be reduced. The

inspection department should be asked to inspect the board samples after soldering with reference to the current soldering standard. A photocopy of the bottom board layout should be made and any defects marked with colour pens. Shorts should be marked with red, unsoldered joints should be marked in blue.

A full report on the soldering trials should be produced highlighting any soldering problems encountered. This should be attached to any new design assessment form which should accompany all new prototype production designs. If specific soldering faults are encountered or the correct jigs or support clips are not provided the soldering section of any design review should not be approved.

Bob Willis is a process engineer providing engineering support in conventional and surface mount assembly processes. He runs production lines at exhibitions and also provides wave soldering seminar and workshops world wide. He has one of the largest collection of training videos, interactive CD-ROMs and training material in the industry. Bob will be presenting four Master Classes at APEX in California, he will also be presenting classes at SMT Nuremberg in Germany for those engineers visiting the show. For further information on how Bob may be able to support your staff contact him via his web site **www.bobwillis.co.uk**

Don't forget to e-mail this paper on to a friend!