SCAVENGING

by Harold Hyman
VJ Electronix
Littleton, MA

ABSTRACT

Scavenging, Site Dressing, Residual Solder Removal. What's in a name? "That which we call an onion, by any other name would smell as strong" (apologies to the immortal bard). And, regardless of the name you give it, the objective is the same, namely the clean up of remaining solder after a component (particularly a BGA) or R.F. Shield has been removed from a PCB. This paper will describe the various methods that are available and discuss their pros and cons.

INTRODUCTION

There are a number of ways of performing this operation, bearing in mind that all soldering becomes more critical when dealing with Lead **Free alloys and** elevated temperatures.

Using a soldering iron and solder braid or wick**.** This method is cheap, relatively fast and does a reasonably good job although it requires a skilled operator, is difficult to control and suffers greatly from inconsistency. It is quite labor intensive, as is:

Manual Vacuum Scavenging which is performed with hand tools or on a Rework system and uses a special concentric convective heating/suction tool that melts the solder and sucks it off the PCB. This approach is a **non-contact** method which alleviates the problems associated with conductive tools but it still relies on a skilled operator to carry out the lateral movements.

Automatic Scavenging uses the same procedure as the Manual approach except that the lateral motions are motorized and some form of height sensing automatically sets the gap between the tool and the surface of the board resulting in a damage free, high reliability solution to the clean-up requirement.

COMPARISONS

Hand Scavenging with Soldering Iron.

This relies on the capillary action that causes liquid solder to "wick" along a piece of copper braid. Heating is done with a soldering iron which, together with the braid, is positioned on the solder to be removed. If done correctly, with suitable application of flux, this operation can be an effective way of removing solder from pads or conductors on a PCB. Millions of successful hand scavenging operations are performed daily. However, a great deal of skill is required and the correct tools and materials are essential. A poorly executed job will not only fail to adequately remove the solder but can result in any of a number of defects.

The soldering iron must be of the correct wattage to be capable of transferring enough heat to melt the solder and cause the wicking. Too little heat will obviously not do an adequate job of melting the solder, with disastrous results.

There is always the temptation to increase the wattage/tip temperature with a view to completing the task very quickly but, unless the operator is experienced and well skilled, there is a high probability of board damage. Too much heat can be very harmful and damaging to the PCB substrate: delamination, blistering, break down

of copper/substrate adhesion, solder resist degradation, excess Cu/Sn intermetallic compound formation resulting in an unsolderable surface, are a few of the potential problems.

Good practice requires the tip to be placed on the braid and left there until the solder has melted and been absorbed by the wick, after which both the braid and tip are removed together. If only the tip is moved the braid can remain soldered to the pad or conductor - a sure recipe for pulled pads or conductors.

Another common problem is associated with the tendency to agitate or move the soldering iron and press the tip into the braid to bring about a faster melting of the solder. Since the braid is composed of a mass of fine copper wires it exhibits a somewhat abrasive nature and acts rather like a scouring pad which is very effective in scratching solder mask or otherwise damaging board surfaces. The more the tip is moved the more this effect is exaggerated.

The shortcomings and inconsistencies of this hand operation open the door for a method that is based on precise control and repeatability of critical parameters.

Manual Vacuum Scavenging

The objective here is to bring under control those process parameters that are major contributors to board damage – temperature and contact. This is achieved by changing from conductive (soldering iron) to convective (hot gas) heat transfer.

Convective heating is performed by directing a flow of hot gas, typically air or Nitrogen, to the discrete point where the solder needs to be melted, after which, the resulting liquid solder is removed by applying vacuum sufficient to extract the molten globule. A special coaxial tool is used consisting of a small diameter vacuum probe surrounded by a concentric tube that delivers the hot gas. Melting and removal of the solder occur very quickly. Once this has happened the board is moved laterally with respect to the heating tool (or vice versa) so that the next point is treated in the same way. In practice, an operator provides the lateral motion on a continuous basis, rather than as a series of discrete steps, resulting in a rapid and efficient operation.

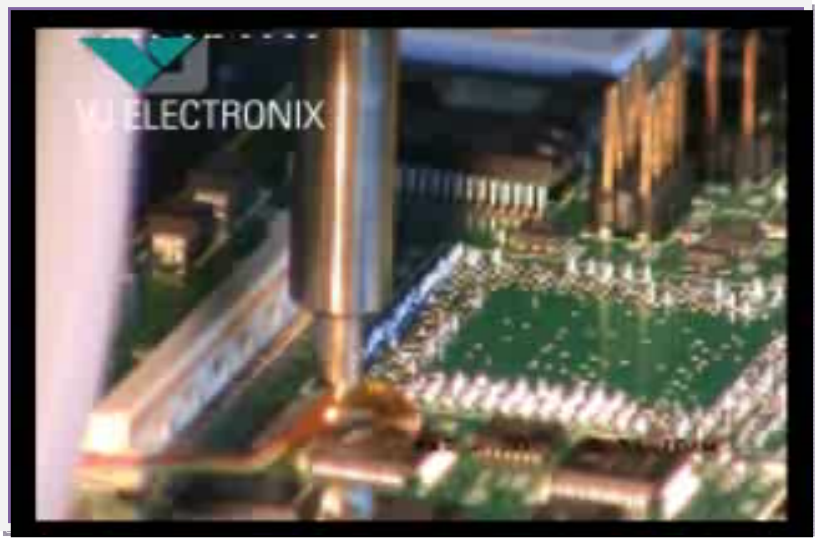
This procedure is performed on a semi-automated surface mount rework system that incorporates a movable, linear bearing X-Y table and work holder to accommodate the board, a platform for the heating/vacuum tool and a large area bottom heater together with a highly intelligent software program for process control.

The scavenging tool is height adjustable to suit boards of different thickness, resulting in a truly non-contact operation that avoids damage to the board.

This approach assures the user that the critical parameters are carefully controlled and potential damage is avoided with the possible exception of accidental contact.

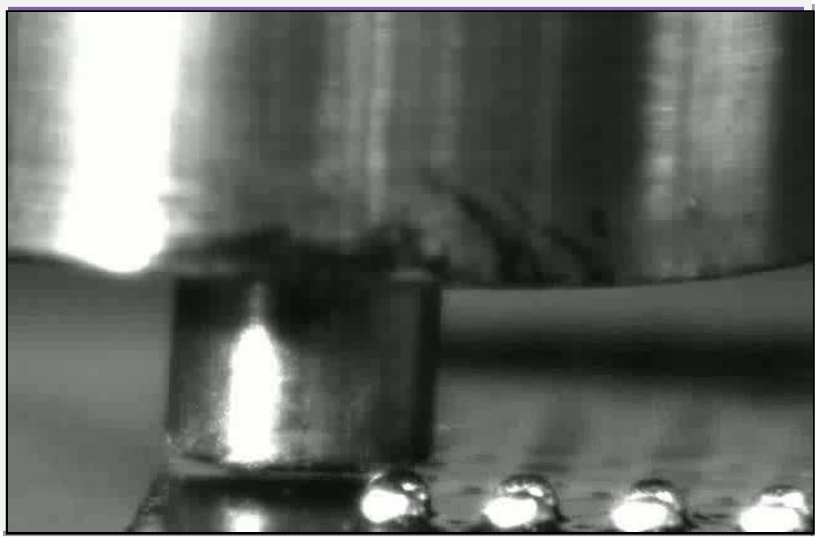
Automatic Scavenging follows much the same procedure as employed in Manual Vacuum Scavenging but automates it so that, apart from the loading and unloading of the assembly to be scavenged, all the elements of the operational sequence and associated processes are pre-programmed and further operator involvement is unnecessary.

An automated Surface Mount Rework system with motorized X-Y motion is taught to scan a component site so that, once the assembly is correctly located on the system, the complete sequence of operations is performed automatically. Identification of the board/site combination automatically selects the correct set of times, temperatures, motion directions, speeds and any other relevant parameters for the procedure. **(See Video No.1)**



Video No.1 (Click inside the video to activate)

Essential to the success of this operation is the incorporation of a feature such as VJ Electronix's *Dynamic Height Sensing* (DHS). This is invaluable since it automatically maintains a consistent gap between the scavenging tool and the surface of the board. **(See Video No.2)** This not only guarantees repeatable, optimum process conditions but also assures that there will be no contact between the tool and board thus avoiding any damage.



Video No.2 (Click inside the video to activate)

CONCLUSION

Hand Scavenging with Soldering Iron - QUESTIONABLE! Prone to high defect rate. Dependent on skill level of operator. Only advantage is low up-front cost.

Manual, non contact vacuum scavenging – BETTER! Much lower defect rate but still operator dependent.

Automatic Scavenging – BEST! Software driven. Minimum operator involvement. Consistent results. . Very low defect rate.