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Design

There aremany various difficulties in each of manual assembly and surface mounttechnology within soldering. For manual assembly a variety of these problemsinclude disturbed joints which is when the solder moves as it's solidifying. Another problem that commonly occurs is a ' cold joint' where the solder hasbeen removed from the board too early and has not been allowed to meltproperly. Another frequent problem is an overheated joint, which is where thesolder has not yet flowed and the residue of the burnt flux makes this jointhard to fix.

Insufficient wetting is when the solder has wet the leads but thenhas not went on to form a good bond with the pad. There are also many problems withsurface mount technology these include, solder balls which are mainly caused bypoor process conditions which could include someone moving the board while thesolder is settling. Another is solder beads which can occur when the reflowramp up is either too fast or too slow. A further problem is bridging which canoccur both due to hot slumping and cold slumping.

As well as this another commonproblem is tombstoning which is most commonly caused by unequal componentsplacement on the board before reflow results in unbalanced solder forces. Circuit boards are made up of extremely sensitivecomponents, and moving them about in a careless manner will almost certainlycause the circuit board to break and no longer usable, especially puttingtension on the small components, static electricity damages boards completely sothe best way to prevent damage is to keep any sort of static electricity nearthe board to a minimum and discharge any static charge that has been built upin the circuit over time and hold the circuit board with care. Whiletransporting boards you should wear rubber

soled shoes in order to groundyourself before handling a board. When you are in control of circuit boards youshould make sure the humidity within your workspace is higher than normal asstatic electricity builds up much more and much faster in low humidity and indry air. Also you are recommended to put on gloves to handle a circuit board. Solderpaste is a material used in the creation of printed circuit boards to join surfacemount components to pads on the board, it is also possible to solder throughhole pin in paste components by printing solder paste over the holes. There arethree kinds of solder paste deposition these are Step stencil which have thepossibility of soldering all chip component types into cavities, also has a lowcycle time and more space for different depths, the other kind is dispensing whichhas the possibility of soldering all chip component types into cavities, thecycle time of this depends on the needle which is used to create dispensed dotsizes and the third and final type is jetting, a jetting machine is capable forprocesses and for different volumes, a jetting machine is designed to feed a and place machine and can sometimesmount 40, 000 components an hour. The most appropriate and cost effective methodto use will depend on the final product confirmation since each method eachhave its own limitations in terms of capability to support design features orcycle time.

Transferring solder paste in high density cavities is a processthat can be done with high quality and capable of achieving IPC-610 class. A pick andplace machine helps with the assembly of circuit boards by automating of whereofsmall surfaces mount components on to boards, which then removes the process ofmanually planning and soldering small components while using pick and place preparationis key throughout soldering, solder

paste must be applied to the solder pads ofthe board before operating the machine. Companies tend to use a laser cut vinylstrider as a mask with holds cut over the solder pads. Then with the mask onthe board, solder paste can be forced onto the solder pads. The pick and placemachine does exactly what the name states, it picks up the components andplaces them in a specified location. Solder paste is applied to the boardbefore they are placed into the machine. Once the machine has placed thecomponents the solder paste holds the components in place while the band istransferred to an oven.

When the solder paste is melted, reflowed and thencooled, permanent solder joints are created at each component, completing theprocess. Also the pick and place machine does not require an air compressor asit has a vacuum and pump within the machine. Reflowsoldering is a process in which a solder paste is used to temporarily attachone or more electrical components to their bond pads after which the entireassembly is dependant on controlled heat, which then melts the solder, whichleads to the joint connecting. Heating may be achieved by putting the assemblythrough a reflow oven or by soldering individual joints with a hot air pencil. Reflow soldering is the most well-known method of connecting surface mountcomponents with a circuit board.

The aim of the reflow process is to melt thesolder and heat the touching surfaces without overheating and damaging theelectrical components. There are 4 sections of reflow soldering these are ; preheat zone, thermal scale zone, reflow zone and cooling zone. Preheat zone isthe first stage of the reflow process, during this reflow phase, the entireboard assembly climbs towards a target soak or dwell temperature.

The main goalof the preheat part of the process is to get the entire assembly safely andconsistently to a soak or pre-reflow temperature. The second stage is thermalsoak zone which usually takes around 1-2 minutes to remove the solder paste andthe flux components start the oxide reduction process on the component leadsand pads. The third stage is the reflow stage where the temperature reaches itshighest point. The final zone is a cooling zone which slowly cools the boardand finally solidifies the joints on the solder.