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WHAT IS VAPOR PHASE REFLOW SOLDERING?

By Andi,
Vapor Phase Reflow Soldering is an advanced soldering technology. This is fast replacing other forms of soldering processes manufacturers presently use for assembling printed circuit boards in lead technologies for all sorts of electronic products. Soldering electronic components to printed circuit boards is a complex physical and chemical process requiring high temperatures. With the introduction of lead-free soldering, the process is more stringent, required still higher temperatures and shorter times. All the while, components are becoming smaller, making the process more complicated.
Manufacturers face soldering problems because of many reasons. Main among them is the introduction of lead-free components and the lead-free process of soldering. The other reason is boards often can contain different masses of components. The heat stored by these components during the soldering process varies according to their mass, resulting in uneven heat distribution leading to warping of the printed boards. As well metal core PCBs and environments where solder joint integrity is critical.
With Vapor Phase reflow soldering, the board and components face the lowest possible maximum temperatures necessary for proper soldering. Therefore, there is no overheating of components. The process offers the best wetting of components with solder and the soldering process happens in an inert atmosphere devoid of oxygen – resulting in the highest quality of soldering. The entire process is environment friendly and cost effective.
In the Vapor Phase Reflow Soldering process, the soldering chamber initially contains Galden, an inert liquid, with a boiling point of 230°C. This is same as the process temperature for lead-free Sn-Ag solders. During start up, Galden is heated up to its boiling point, causing a layer of vapor above the liquid surface, displacing the ambient air upwards. As the vapor has a higher molecular weight, it stays just above the liquid surface, ensuring an inert vapor zone.
A printed circuit board and components introduced in this inert vapor zone faces the phase change of the Galden vapor trying to cool back its liquid form. The change of phase from vapor to liquid involves the release of a large amount of thermal energy. As the vapor encompasses the entire PCB and components, there is no difference in temperature even for high-mass parts. Everything inside the vapor is thoroughly heated up to the vapor temperature. This is the biggest advantage of the vapor phase soldering process.
The heat transfer coefficients during condensation of the vapor ranges from 100-400Wm-3K-1. This is nearly 10 times higher than heat transfer coefficients involved in convection or radiation and about 10 times lower than that with contact during liquid soldering processes. The excellent heat transfer rate prevents any excessive or uneven heat transfer and the soldering temperature of the vapor phase reflow process stays at a constant 235°C.
There are several advantages from the Vapor Phase Reflow Soldering process. Soldering inside the vapor zone ensures there can be no overheating. As the vapor completely encompasses the components, there are no cold solders due to uneven heat transfer and shadowing. The inert vapor phase process precludes the use of nitrogen. Controlled heating up of the vapor consumes only one-fifth the usual direct energy consumption and saves in air-conditioning costs.
As the entire process is a closed one, there is no creation of hazardous gasses such as from burnt flux. Additionally, Galden is a neutral process fluid and environment friendly.