Technical Bulletin

Designing Circuit Boards for Selective Robotic Coating Application

Why should you use Design Rules when considering Robotic Conformal Coating Processing?

The Rules for Selective Conformal Coating are straightforward. Follow them and you can save money and time in your application process. However, if the Rules are not followed, the resultant circuit board design can challenge even the most sophisticated conformal coating system and its operator to achieve the finish desired.

Selective Conformal Coating for Designers

Most companies have successfully adopted Design for Manufacture (DFM) principles, and have increased the level of communication between design teams and those required to manufacture the product, to eliminate or reduce the number and variety of production challenges.

Unfortunately, for too many designers, conformal coating is simply a part number, to be applied in straight lines and rectangles. For companies embracing lean philosophies and using selective coating machines, this failure to appreciate the subtleties of the application process can result in an un-coatable (at least as specified) assembly process.

Every company has its own horror stories and folk lore about the challenges faced when conformal coating an assembly to successfully meet the designer's specification. It is almost certain that the majority of these 'nightmare' scenarios could have been headed off during the design and or prototyping stages of development.

Selective Conformal Coating for Designers

A selective coating machine is a robot that is software programmed to dispense a series of dots or nominal stripes in designated areas. The combination of these dots and stripes make a coating pattern.

Whilst most machines have a tolerance and variation measured in microns for their dispense pattern positioning, most fluids have a very wide tolerance in properties by comparison, and are subject to flow and levelling forces that mean, as a rule of thumb, although the machine positioning capability is often better than 25 microns, one should allow as much as 2.5mm in variation due to the material properties.

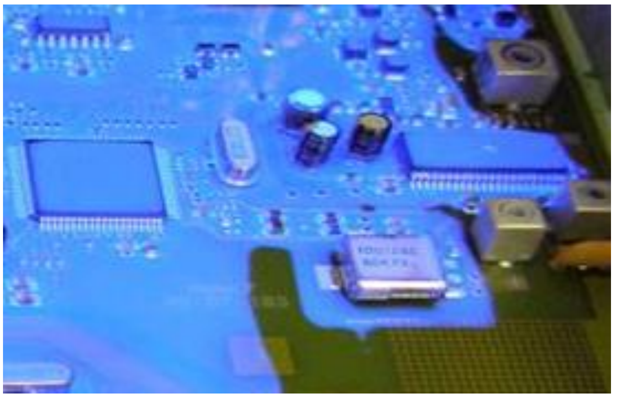

Figure 1: A Printed Circuit Board that has been selective coated by a robot

The Design Rules for Selective Conformal Coating for Designers

Designate three areas on a conformal coating diagram:

- Areas that MUST be coated
- Areas that MUST NOT be coated
- Areas where it doesn't matter (coating is optional).

Maintain a minimum 2.5mm distance between MUST coat areas and MUST NOT coat areas. If you do, be prepared for production people to attack you with a pitch fork as it may not be possible to prevent the liquid flowing into restricted areas.

Try and group all components of similar heights within the same general area of the assembly. This minimises the changes in dispensing height, enabling the machine to run efficiently at optimum speeds and give you the best coating coverage.

4. Understand that through-hole components have a very wide range of placement orientations, and if used on a PCB, the drawing must cover all possible orientations of the devices, plus 2.5mm optional coating area. This is to ensure you coat the component leads, wherever they may be positioned.
5. Do not specify the use of conformal coating as an under fill EVER. If a device needs to be under filled, specify a formulated under fill. Or, be prepared to find the component lifting off the PCB in the long term.
6. Specify and use tented via's to prevent the capillary flow of material from one side of the assembly to another which can result in coating restricted areas on the other side of the board.
7. Add tooling holes for the PCB if the board is not a standard shape to be supported on the fixture or conveyor.
8. When coating multiple PCBs in a biscuit configuration, ensure you seek input from production engineers regarding orientation to optimise robot path and valve operation. Having to stop and start often and/or change dispense height reduces your throughput massively and the coating can be deposited poorly.
9. The board should be flat and sufficiently rigid to prevent sagging during dispensing or curing, otherwise coatings may flow and pool in unexpected fashions. In particular, heavy boards may need to be palletized to provide sufficient rigidity.
10. Use conformal coating gel around connectors. Conformal coating materials will flow freely into unsealed connectors and wick up connector leads.
11. Make coating the edge of a PCB optional - it is tricky and messy, especially if there is no frame or breakout around the board, and is of questionable efficacy in improving coating or reliability performance.
12. Make coating component packages optional. Coating the sides of a 3D device is difficult, especially since the coating is subject to gravity, as well as de-wetting due to mould release agents used in the component fabrication. The plastic or metal package mouldings are almost certainly more resistant to humidity or other forms of water than any conformal coating.
13. If you call out silicone staking materials for ruggedisation purposes, use a silicone conformal coating. If you don't want to use a silicone conformal coating, then use a urethane or epoxy staking compound.

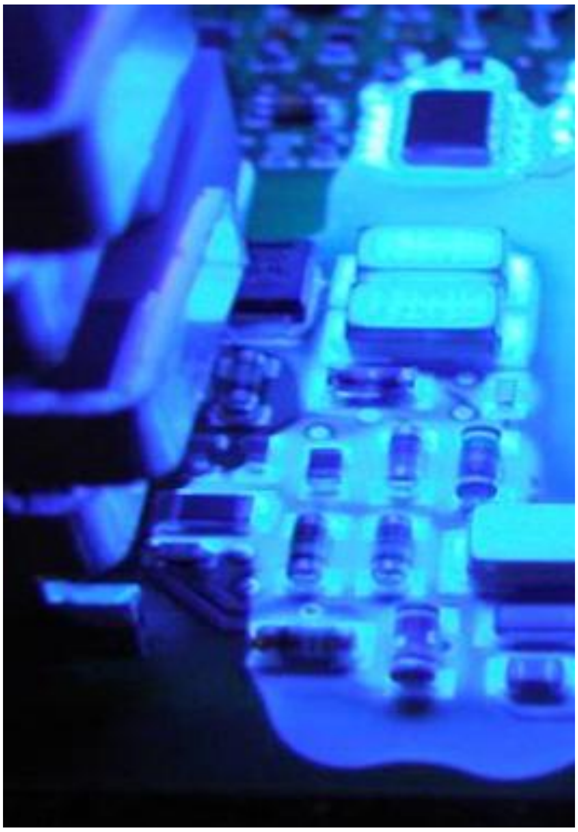

Figure 2: Selective conformal coating against 3D components can be difficult with a robot

This is a short list that a DfM team should be able to use quickly and easily to ensure they get optimum yields and cycle times from their conformal coating process and avoid problems on the production floor.

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