

## Processing Tips - Conformal Coating Connectors

**Abstract:** This paper identifies different masking preparation steps and application methods for Samtec connectors to ensure that conformal coatings do not contaminate critical contact areas.

Samtec typically manufactures our connectors by inserting the contacts or terminals from the bottom of the insulator housing. As a result, many connectors are open and susceptible to conformal coating contamination. In most cases the insulator housing sits just above the solder leads to assist in normal electronic manufacturing methods and to improve the effectiveness of the cleaning process. Keeping the conformal coating out of the critical contact areas can be challenging due to the low viscosity of most conformal coatings. Because there is such a wide variety of materials and application methods available, viscosity is often difficult to control. Masking these sensitive areas is a common protective practice.

It is also important to note that the prevalence of no-clean fluxes in the industry has led to compatibility issues between conformal coatings/gels and the solder joints of the connectors. Adhesion is greatly affected and without adhesion, there is no protection of the solder joints and leads. Humidity and temperature cycling will accelerate this phenomenon. For this reason water soluble flux should be used if possible. However if no-clean flux is chosen, the boards should still be cleaned with a chemistry designed to remove flux.

Materials and Application Methods are broken down into the following classifications:

### Masking Methods:

- Rubber Masking Boots
- Peelable Mask
- UV Curing Peelable Mask
- Masking Tape

### Materials:

- Type AR – Acrylic resin
- Type ER – Epoxy resin
- Type SR – Silicone resin
- Type UR – Polyurethane resin
- Type XY – Paraxylylene

### Application Methods:

- Dip
- Brush
- Dispense
- Spray
- Selective Spray
- Vacuum Deposited

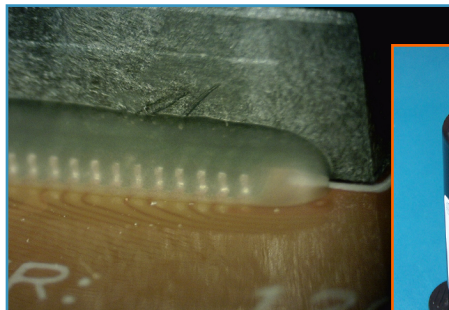
### Curing Methods:

- Room Temperature
- Oven / Heat Cure
- Ultra Violet (UV)
- Moisture Cure



## MASKING METHODS



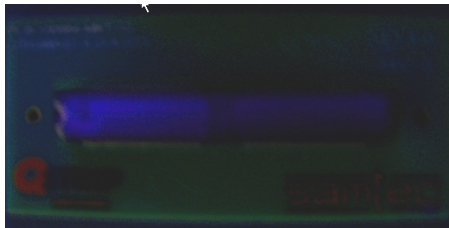

It is important to understand what types of materials, applications and curing methods are going to be used for your electronic assembly. Knowing this information is vital to ensure that the proper masking preparation is performed. Samtec also suggests contacting your conformal coating supplier if contamination is a concern.



Some manufacturers offer a high viscosity gel with medium to high thixotropic characteristics that can be applied around the connector base prior to conformal coating. The thixotropic nature of these materials reduces migration and prevents wicking and contamination in the critical contact areas. These materials can be used in conjunction with the masking methods mentioned below. An example of one of these high viscosity gels is Loctite® 3705™. This material can be applied as a bead around the base of the connector prior to coating. This material is UV curable but there are other heat curable materials available. If this is used in conjunction with a UV curable mask, the two materials can be cured simultaneously.


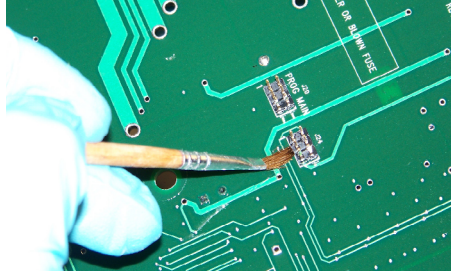
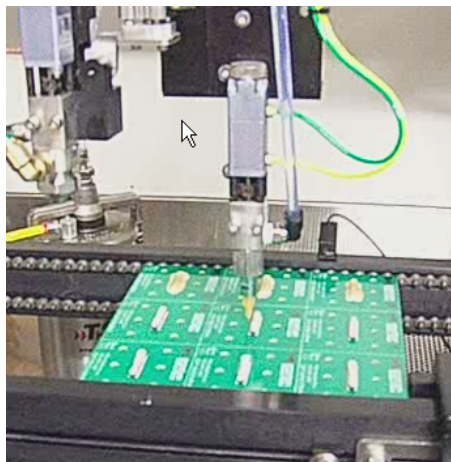
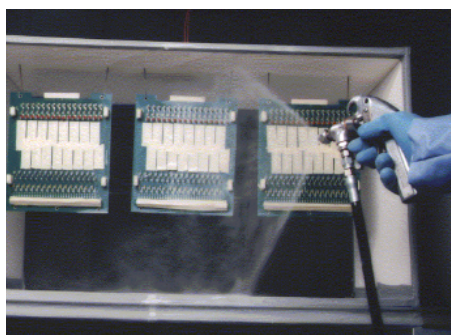
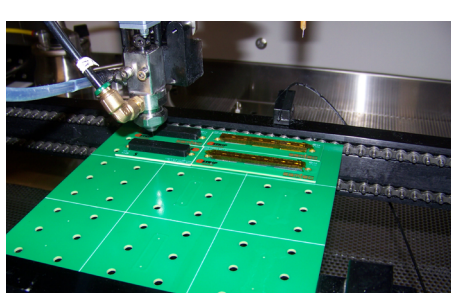
Table 1 describes several masking methods used to prevent conformal coating contamination. These are only recommendations and results may vary based on the application method.

**Table 1. Masking methods**

<b>Rubber Masking Boots</b>	Boot masking is typically used for spray applications and can provide cost savings by eliminating the labor and material required for masking tapes and latex (peelable mask) in addition to being reusable. It is not recommended for dip applications since it does not form an adequate seal. Because the boot sits on top of the leads it allows conformal coating to flow under the boot and into the contact area. However, depending on the viscosity of the material and how liberally it is applied it may be used to successfully keep coating out of the contact areas.	
<b>Peelable Mask</b>	Peelable mask is a temporary mask that can be applied to the contacts and more importantly around the base of the insulator housing. The pitch and design of the connector should be considered when deciding to use peelable mask. It fills every opening and can leave residual material after removal on fine pitch connectors. It is also critical to allow the peelable mask to completely cure before removing. Curing is typically accomplished at room temperature after 30-60 minutes or oven curing at 150° F may be used to expedite the process.	
<b>UV Curing Peelable Mask</b>	UV curing peelable mask is similar to that of the peelable mask but it can be cured within seconds when exposed to worker-friendly visible and long wave UV light or with lamps combining short and long wave UV. UV curing peelable mask can easily be dispensed from automated dispensing equipment and can be an excellent choice to place around the base of connectors to keep coatings from bleeding into contact areas.	
<b>Masking Tape</b>	Masking tape is one of the best known methods for protecting components but its application can be labor intensive. Pre-cut tapes may be used to minimize labor costs. Tape masking materials (typically polyimide) are heat sensitive tapes that can withstand elevated temperatures during UV or heat curing should they be used in conjunction with other masking methods. Since silicone is incompatible with organic compounds, acrylic adhesive tapes should be used.	

## APPLICATION METHODS

**Table 2. Application Methods**

<b>Dip</b>	The dip method requires the assembly to be completely sealed. The assembly is immersed in a tank of liquid coating material and withdrawn. This method ensures uniform coverage and film thickness.	
<b>Brush</b>	The brush method is a manual process in which an operator dips a brush into the coating container and then applies it to the leads of the connector. The brushing method should start at the toe end of the lead and work away from the component allowing the viscosity of material to draw it up the leads but not into the contact area. Brushing will need to be performed carefully to prevent the formation of bubbles and to reduce the risk of wicking.	
<b>Dispense</b>	The dispense method can be done by hand or on an automated system by forcing the material through a needle to create a bead. This application method can be done in conjunction with the selective coating systems mentioned below. New robotic equipment can include multiple heads which may include a dispensing needle. This method is especially useful if UV or heat curing is available and the systems are in-line. It is accomplished by selectively spraying the circuit board assembly, leaving ample room between the point of application and the connector to avoid overspray. The dispenser head then applies a bead of coating just at the toe end of the lead, allowing the viscosity to draw it onto the leads. Then the assembly is immediately cured. This method will ensure that the leads are covered with conformal coating but the coating does not seep into the contact area.	
<b>Spray</b>	The spraying method is the most popular and fastest method but can be hazardous for connectors if they are not properly masked. The spray gun passes back and forth covering the entire assembly, and is then rotated 90 degrees. The process is repeated until the target thickness is obtained. Assemblies are hung or placed on fixturing and allowed to cure at room temperature. The curing can also be accelerated by heat or UV cure. Based on the material selection, which is typically solvent borne, the spray material can easily seep into the contact areas if not properly masked.	
<b>Selective Spray</b>	Selective spraying is the new trend for applying conformal coatings with solvent or solid based materials. It is typically installed in-line with a curing system (UV or Oven). Selective spray eliminates the labor-intensive masking operations. If properly programmed these systems can be controlled to spray around connectors while covering the critical leads without over-spray contamination. Immediately curing does not allow the viscosity of the material to seep into the contact areas.	

## Parylene (Paraxylylene)

The methods listed in Tables 1 and 2 cover conventional conformal coatings. Another material that should be mentioned is Parylene.



This coating is a vacuum deposited insulating material that is applied at the molecular level by inserting the electronic assemblies into an evacuated deposition chamber. The gas material goes through several different stages and is finally deposited in a uniform method with excellent material thickness control. This results in a high degree of conformity and the polymerization occurs on all exposed surfaces. Because of its unique properties, Parylene conforms to virtually any shape.

Parylene has excellent crevice penetration and Samtec connectors must be carefully masked to prevent contamination. Samtec recommends that you work closely with your Parylene provider to ensure proper masking methods are employed.

In conclusion, keeping conformal coatings out of the critical contact areas can be a challenge, but with proper masking, application methods and curing you can find the right solution to protect your components.

**For further information or questions, please contact the Interconnect Processing Group at:**

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