



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

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Pre and Post Solder Mask Application Cleaning Guidelines

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A standard developed by IPC

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Pre and Post Solder Mask Application Cleaning Guidelines

Developed by the Pre-Solder Mask Cleaning Task Group of the IPC
Dry Fabrication Processes Committee of IPC

APPROVED MAY 11, 1990 BY



AMERICAN NATIONAL STANDARDS INSTITUTE

Users of this standard are encouraged to participate in the
development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Pre-Solder Mask Cleaning Task Group of the IPC Dry Fabrication Processes Committee are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Pre and Post Solder Mask Application Cleaning Guidelines

1.0 SCOPE

This document is intended to cover all aspects, both method and degree, of cleaning associated with the preparation of bare printed circuit boards prior to solder mask application. It continues with the prudent control of the cleanliness level during the solder mask application and cure processes. It includes maintenance of the cleanliness level of solder masked boards during pre-assembly processes and/or storage time prior to assembly. Finally, based on the procedures used in the previous steps, it deals with maintaining the soldered assembly at a degree of cleanliness consistent with the end use.

1.1 Introduction The cleaning process prior to any printed board fabrication step is the single most important function over which there must be complete control. Also, it is paramount to remember that with any “build up” type of manufacturing, each step taken, no matter how trivial it is perceived, may involve multiples in cost added. This is especially true with printed circuit boards where the myriad of steps require complete cleaning procedures. Cleaning before solder mask application is critical because there will not be further opportunity to remove extraneous matter after the application step. In general, the use of a class 10,000 or better clean room is desirable to reduce particulate contamination.

Because of the differences in preparing and cleaning boards with copper and tin/lead, this document treats each type of circuitry individually in Sections 3 and 4, respectively.

2.0 APPLICABLE DOCUMENTS

The following document, of the issue currently in effect, forms a part of this specification to the extent specified herein.

2.1 Institute for Interconnecting and Packaging Electronic Circuits (IPC)¹

IPC-TM-650 Test Methods Manual²

- 2.3.25 Detection and Measurement of Ionizable Surface Contaminants
- 2.3.26 Ionizable Detection of Surface Contaminants (Dynamic Method)
- 2.3.26.1 Ionizable Detection of Surface Contaminants (Static Method)
- 2.3.38 Surface Organic Contaminant Detection Test (In-House Method)

- 2.3.39 Surface Organic Contaminant Identification Test (Infrared Analytical Method)

- 2.6.3.1 Moisture and Insulation Resistance—Polymeric Solder Masks and Conformal Coatings

IPC-S-804 Solderability Test Methods for Printed Wiring Boards

IPC-SM-840 Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards

3.0 SOLDER MASK OVER BARE COPPER

In this process, an etch resist, which is usually plated tin/lead, is removed so that the plated copper traces are left bare. Solder mask is applied over bare copper to permit solder leveling, reduce solder pot contamination, protect electrical integrity, and eliminate mechanical damage. The removal of etch resists, pre-cleaning and post-cleaning, are explained in Section 3. See Figure 1 for the process flow chart.

3.1 Metallic Resist Stripping Two techniques are used for stripping tin-lead or tin, the key metallic resists, from circuit boards. They are distinguished by the use of either a peroxide or a non-peroxide (acid based) solution, and are described in the following paragraphs.

3.1.1 Peroxide Peroxide is an aggressive oxidizer, and all equipment exposed to it should be of plastic construction. In addition, many products also contain ammonium bifluoride, which will also etch glass. Since the peroxide reactions are exothermic, cooling coils are recommended. Laminate attack can result from the heat and the ammonium bifluoride. Compatibility of laminates with the solutions should be checked before setting process guidelines.

3.1.2 Non-Peroxide Non-peroxide strippers are nitric- or fluoboric-acid-based solutions. They are used in either single- or two-step processes. Single-step processes usually involve spray techniques, while two-step processes can involve either soak or spray techniques. Non-peroxide strippers are generally not exothermic, and will not attack laminate. However, a specific laminate should be checked for compatibility with the particular stripper being used. In general, non-peroxide strippers are slower than peroxide. With fluoboric acid-based solutions, spray equipment used

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2. For convenience, reprints of IPC-TM-650 test methods are provided at the end of this specification.

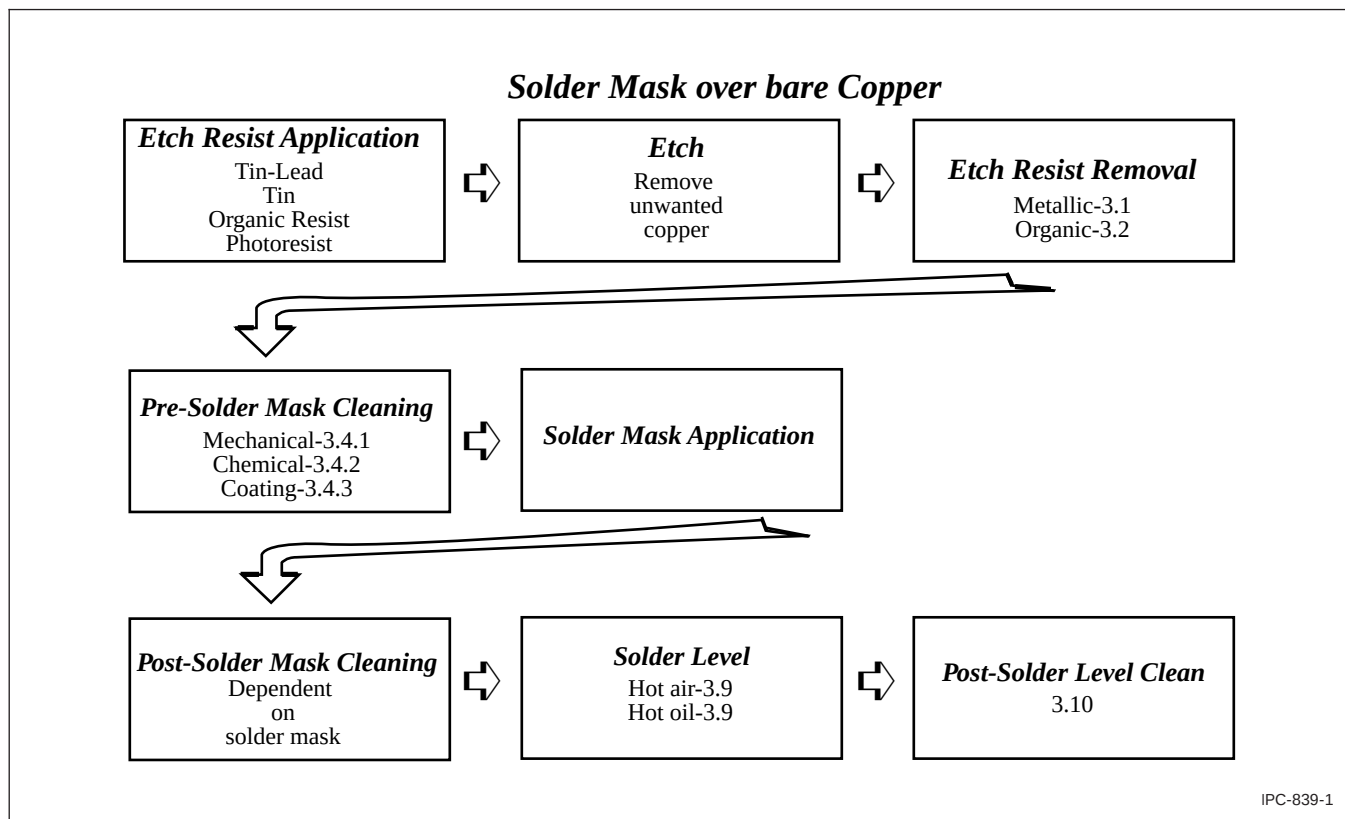


Figure 1

must not contain titanium, as it is readily attacked by fluoboric acid.

3.1.3 Detection of Residuals Incomplete tin/lead stripping is evidenced by a dull gray-colored copper or white powdery residue. This indicates incomplete removal of the intermetallic layer or lead fluoride.

Note: At times it may be possible to have a board that visually appears to be free of residuals, but actually still has an intermetallic layer that can lead to non-wetting. This condition can be identified using surface analytical techniques, such as X-ray fluorescence or Auger electron spectroscopy.

3.1.4 Removal of Residuals Removal of residuals varies with the type of stripping technique used. In peroxide stripping, lead fluoride residues are removed by an extended dwell time in the stripper, or by immersing the parts in an acid cleaner. Residues may also indicate that a need exists for replenishment/replacement of the stripper solution.

In non-peroxide stripping, the incomplete removal of a copper-tin intermetallic layer may require extended dwell time in the second step stripper solution or the replenishment/replacement of the stripper solution.

3.2 Stripping Organic Resists Panels made with the tent and etch process, or any other process where a photoresist or other organic resist is used as the final etch resist, must

be stripped to bare copper to insure proper solder mask adhesion and no blisters during subsequent high temperature processes.

3.2.1 Solvent Processed Resists Solvent processible resists are generally stripped in methylene chloride containing an azeotropic amount of methanol. Properly exposed, these films strip very quickly, and leave almost no residue. The biggest potential problem is an insufficient supply of fresh solvent, which leads to resist residues building up in the final solvent chambers. Evaporation of the dirty solvent then leaves a film of resist on the surface, which must be removed through a chemical cleaning process as described below.

3.2.2 Aqueous Processed Resists Aqueous and semi-aqueous resists are stripped in a caustic solution which sometimes contains an organic solvent. The caustic can be either organic (monoethanolamine) or inorganic (sodium hydroxide). In general, these films do not strip as cleanly as the solvent products and frequently leave a thin film of organic residue on the surface of the copper which must be removed with a chemical cleaning process.

3.2.3 Removing Resist Residues The chemical cleaning of copper stripped of resist can be done in either conveyORIZED spray equipment or process tanks. The choice of equipment will probably depend on the method of stripping. There should be little or no hold time between the