



*The Institute for
Interconnecting
and Packaging
Electronic Circuits*

IPC-A-311

Process Controls for Phototool Generation and Use

IPC-A-311

March 1996

A standard developed by the Institute for Interconnecting
and Packaging Electronic Circuits

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The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee adopted Principles of Standardization as a guiding principle of IPC's standardization efforts

Standards Should:

- Show relationship to DFM & DFE
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feed back system on use and problems for future improvement

Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

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The material in this standard was developed by the Phototool Generation Subcommittee (1-11) of the Printed Board Design Committee (10) of the Institute for Interconnecting and Packaging Electronic Circuits.



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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 IPC

Phototool Generation Subcommittee of the Printed Board Design 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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Process Controls for Phototool Generation and Use

1.0 Introduction

1.1 Scope and Purpose This publication sets forth the information and data which can be collected during the generation and use of phototools with the following objectives and potential benefits:

- improve artwork quality and thereby improve yields downstream;
- help establish and maintain ISO 9000 certification;
- help to establish an SPC program;
- facilitate trouble-shooting;
- standardize the process for the benefit of both experienced and inexperienced operators;
- identify process improvements for ultimate elimination of inspection and touchup of artwork.

1.2 General Considerations Quality artwork requires careful attention to the working environment. This encompasses:

- temperature control;
- humidity control;
- elimination of airborne dirt particles;
- elimination of particulates from processing solutions and wash water.

Artwork should be handled as little as possible. Every time a piece of film is picked up, dirt, scratches, kinks, and other defects can be introduced. Automatic conveyor systems eliminate many problems. Where silver phototools are required, the use of first generation phototooling can ensure higher quality.

The controls outlined in this document will not by themselves eliminate inspection and touchup. That can be achieved only by systematic identification and elimination of the causes of artifacts. The relative importance of each such source will vary from one facility to another and are best determined by Pareto analysis. This requires a team effort with the full support of all levels of management.

2.0 Applicable Documents

2.1 The Institute for Interconnecting and Packaging Electronic Circuits¹

IPC-A-310 Guidelines for Phototool Generation and Measurement Techniques

2.2 Department of Defense

2.2.1 Federal²

Federal Standard 209 Clean Room and Work Station Requirements, Controlled Environment

2.3 American National Standards Institute³

ANSI IT2.18 Photography (Sensitometry)—Density Measurements—Spectral Conditions

ANSI IT2.19 Photography—Density Measurements—Geometric Conditions for Transmission Density

3.0 Environmental Controls

3.1 General Requirements Requirements for temperature and relative humidity control are dictated by the physical properties of phototooling films, including how they respond to changes in their environment, and the need to limit changes in film size. For example, a typical size requirement for phototools used in the manufacture of multilayer boards is ± 1 part in 20,000 (± 0.025 mm per 50 cm) [± 0.001 inch per 20 inches]. To achieve these tolerances with most silver-gelatin and diazo phototooling films requires control of temperature to $\pm 0.6^\circ\text{C}$ [$\pm 1^\circ\text{F}$] and relative humidity to $\pm 3\%$ in all areas where the phototools are created and used, including the resist imaging area. The aim points for temperature and relative humidity are inconsequential to film size and can be set to provide an environment comfortable for the employees, provided they are the same in all areas where the films are handled and used. When artwork is shipped to another location, care must be taken to ensure the environments of the two locations are the same if changes in film size are to be avoided. Temperature and humidity measuring devices appropriate to these requirements must be chosen and properly calibrated.

Additional information on these topics can be found in IPC-D-310.

Room cleanliness requirements vary. Artwork with 0.08mm [0.003 in] lines and spaces obviously calls for tighter standards than artwork with 0.40 mm [0.015 in] lines and spaces. There are also differences in the amount of time and money a facility is willing to spend for touchup. Federal Standard 209 provides guidelines for the design and operation of clean facilities, and measuring the

1. Institute for Interconnecting and Packaging Electronic Circuits, 2215 Sanders Road, Northbrook, IL 60062-6135.

2. Naval Publications and Form Control, 5801 Tabor Road, Philadelphia, PA 19120.

3. American National Standards Institute, 11 West 42nd Street, New York, NY 10036.