



IPC-9111

Troubleshooting for Printed Board Assembly Processes

Developed by Assembly Process Effects Handbook Subcommittee (7-23)
of the Process Control Management Committee (7-20) of IPC

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

Contact:

IPC

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Troubleshooting for Printed Board Assembly Processes

Section 1 – General Introduction

1 GENERAL INTRODUCTION

The Process Effects Committee of the IPC has developed this Process Control Handbooks for Printed Board Manufacture and Assembly, which is a documentation of problems, process causes, and the possible corrective action that may be taken. The inputs were voluntarily established by technical representatives of IPC member companies and have been reviewed in open discussion at the Process Effects Handbook meetings prior to publication.

New inputs are encouraged to help assure that the future Process Control Handbooks are complete and match the latest state-of-the-art in a particular subject.

1.1 Purpose and Format

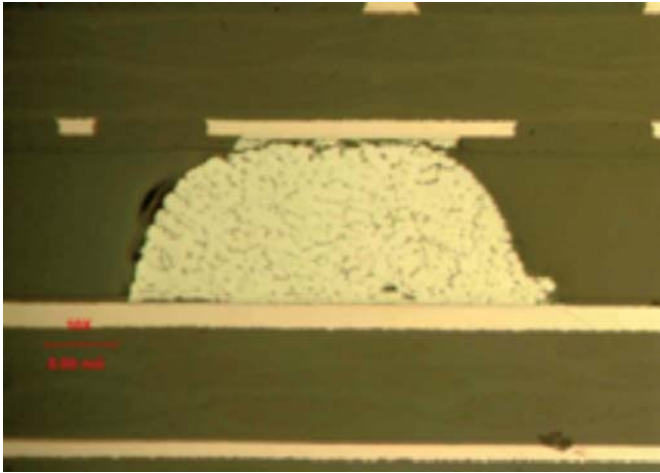
The purpose of this Handbook is to provide guidance in the form of troubleshooting examples, process cause and effect information and statistical methods for correcting problems in all areas relating to the design, manufacture, assembly, and test of printed wiring products. A comprehensive Table of Contents deals with all of the various aspects of the design through delivery cycle.

The Guideline has been segmented into 16 major sections:

Section	Topic Descriptions	Comments
1	General information	Terminology
2	Documentation	Assembly drawing, Bill of Materials (BOM), Specification Control details, work instructions, routers, Specifications
3	Tooling and Fixturing	Stencils, Holding devices, Calipers, Torque devices
4	Handling and Storage	Materials, PWBs, and components
5	Assembly Material	Solder, flux, paste, adhesive, encapsulation
6	Mechanical Operation	Stenciling, paste deposition, conveyerization
7	Component Preparation	Lead forming and trimming, verification, and kitting
8	Component Mounting Site Preparation	Land pattern redressing, solder dotting, adhesive application, solder jetting
9	Component Placement	Insertion, SMT, bare die
10	Component Attachment	Reflow, wave solder, fountain soldering, hand soldering, welding, surface contact, press fit
11	Cleaning	Manual and automated; in-process and final
12	Coating and Marking	Conformal coating, assembly serialization, and labels
13	Inspection	Visual, magnification, measurement, go/no-go, x-ray
14	Testing	In-circuit, physical, end-use, material testing
15	Reliability Stress Conditioning	Thermal Cycling, Vibration, Humidity Testing

The Handbook follows this format:

Issue: Solder Mask-Defined and Non-Defined Lands



CAUSE	ACTION
Interposer is solder mask defined; board is metal-defined. If the two areas are very different the stresses are not uniform and cracks may occur at the solder mask defined side. Board land pattern too large.	Area of the two attachment conditions should be similar or identical. In addition, solder mask defined lands create additional stress and should be avoided on both the interposer and the printed board land.
Potential test methods (discover)	Potential test method (verification)
X-Ray	Cross section – Visual inspection

Where available, an illustration is included to aid in clearly identifying the problem.

General instruction may at times be provided. Text will be printed across the page, dealing with the subject in general, and not highlighting a problem, cause, or corrective action.

1.2 Guidelines for Effective Troubleshooting and Process Control

One of the keys to effective problem solving is a structured routine that addresses key points each time a major problem is encountered. This section suggests steps to be taken in order to effectively find the cause of a problem and to solve it permanently. Refer to IPC-9191 for greater detail to suggested methodology for Statistical Process Control.

1. Problem Identification before beginning a detailed troubleshooting project, use common sense in defining the problem. Verify that there is a problem. Observe the defective product and compare to the standard. Identify the standard process and product, and then determine any present deviation from the standard, or any change in the product.
2. Establish whether operating procedures were followed and whether an assignable cause can be quickly identified as the reason behind the problem. Only continue into more detailed analysis if the initial questions do not lead to an obvious answer. Even if the answer appears to be obvious, confirm the answer by operation of the process before closing the project.
3. Develop a clear, concise problem statement that quantifies the problem whenever possible and reduces the scope of the investigation to a manageable size.
4. Gather all pertinent data and facts. Use SPC, historical data, records, logs, etc. This includes temperature charts, analysis records, maintenance logs and the like.
5. Use root cause analysis.
6. Producing out-of-specification parts require immediate action, i.e., shut down the process.
7. Out-of-control processes require determination as to whether the process can continue to operate.
8. Severe process variation requires evaluation of the severity and effect of the problem on the final product.