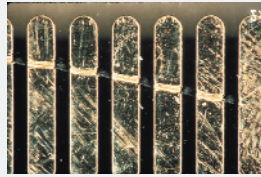
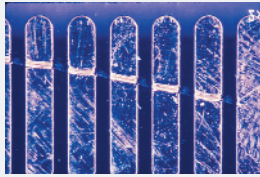
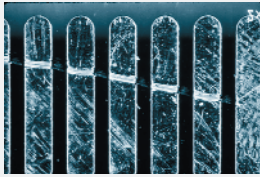
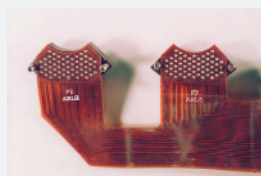
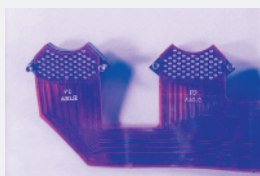
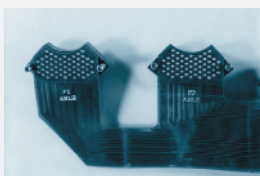
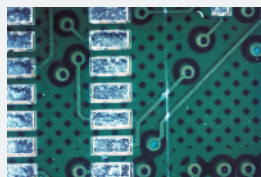
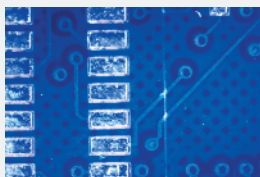
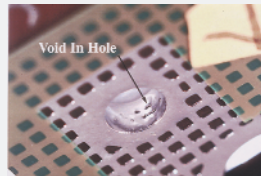
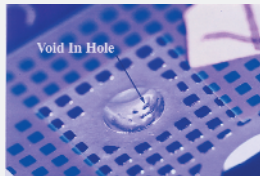
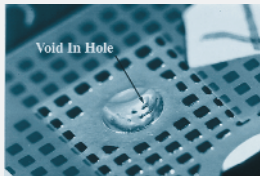
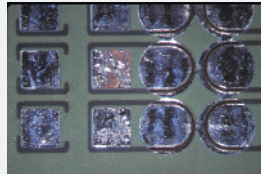
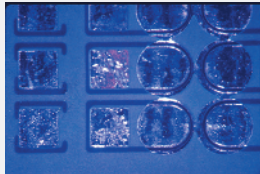
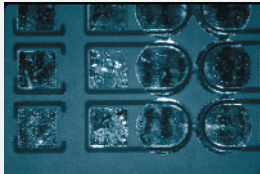


IPC-QE-605A

Revision A
February 1999



Printed Board Quality Evaluation Handbook



Developed by



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES



Documents

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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 feedback 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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IPC-QE-605A

Printed Board Quality Evaluation Handbook

Developed by the Bare Board Visual Support Task Group (7-31c)
of the Product Assurance Committee of IPC

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

Contact:

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Bare Board Visual Support Task Group (7-31c) of the Product Assurance Committee (7-30) are shown below, it is not possible to include all of those who assisted in the evolution of this document. To each of them, the members of the IPC extend their gratitude.

Product Assurance Committee	Bare Board Visual Support Task Group	Technical Liaison of the IPC Board of Directors
Chairman Mike Hill Viasystems	Chairman Ron Thompson NSWC-Crane	Stan Plzak Pensar Corp.
Bare Board Visual Support Task Group		
Nanci J. Baggett, Dell Computer Corporation	Stephen Korchynsky, Lockheed Martin Corporation	Scott S. Opperhauser, Trace Laboratories - East
Larry R. Breeden, Nelco Arizona	Richard Lundy, Lockheed Martin Astronautics	Mark Pritchard, IPC Video
Floyd L. Gentry, Sandia National Labs Albuquerque	James F. Maguire, Boeing Defense & Space Group	Jim D. Raby, Soldering Technology Int'l.
Steven A. Herrberg, Raytheon Systems Company	Susan S. Mansilla, Robisan Laboratory Inc.	Lowell Sherman, Defense Supply Center Columbus
Ralph J. Hersey, Ralph Hersey & Associates	Daniel J. Nelson, Coates/ASI	Joseph T. Slanina, AlliedSignal Aerospace
Ted J. Jones, NSWC - Crane	Bob Neves, Microtek Laboratories	

Printed Board Quality Evaluation Handbook

INTRODUCTION

“QUALITY” is a term used in such a variety of contexts and applications, that it is not a simple matter to define.

- For some it means THE VERY BEST PRODUCT POSSIBLE.
- For others it means A PRODUCT QUALIFIES FOR A JOB—AND IS WORTH THE PRICE.
- For still others, it simply means: MY PRODUCT IS BETTER THAN YOURS

One thing seems clear. If your company is to compete effectively in today’s world market, you need to know what “QUALITY” means to your company. Economic reality dictates that there is a difference in a PWB on a spacecraft vs. an inexpensive toy.

Finding words to describe your company’s philosophy on quality is not an easy task. It is even more difficult to communicate this meaning to your people. To do the job right, you need to do more than communicate a general concept of “QUALITY,” you need to inform your people as to how it impacts each element of your production process and your final product.

A key ingredient in the success of your company to produce the quality you want requires that your inspectors and your processing people fully understand and have a realistic awareness of what quality actually “looks like.”

To help you in this most important educational need, the IPC has provided a CD-ROM depicting a wide variety of photographic illustrations of various anomalies and characteristics of printed wiring boards.

In addition, IPC has provided this booklet, which is designed to help you utilize the CD-ROM.

While we have provided photographic illustrations of characteristics of PWB’S, we have not indicated any specific evaluation of acceptance or rejection. This is your job! Once you are able to obtain a consensus as to what each slide means to your company, you can begin a training program to educate your people to the appropriate awareness of quality.

HOW TO USE THIS HANDBOOK

As we indicated in the foreword, the material contained in the CD-ROM consists of photographic illustrations of various anomalies and characteristics of printed wiring boards.

The intent of this CD and handbook is not to pass judgment on whether a printed wiring board product is able to meet the performance requirements of the end item equipment, but rather to identify those anomalies that are some-

times seen during the inspection and evaluation processes. It is up to the user of this handbook/CD set to determine specific accept/nonconforming criteria for the anomalies contained in this evaluation set.

This handbook has been designed in a manner where only titles of the individual photographs and illustrations have been provided. No comment, as to the acceptability of the product based on the illustration, has been put forth since what is acceptable for one product could be a rejectable item for another.

Users are encouraged to take the standard IPC CD-ROM, “IPC-CD-605,” and review these photos with key individuals responsible for evaluation of the product.

Communication should take place between individuals participating in a training exercise, and if necessary cross referencing between various photographic illustrations can be accomplished using the numbering system. Each number is unique, and pertains only to one photograph.

Discussion leaders may wish to break the training programs into various segments. For this purpose, the CD-ROM, and this companion handbook, have been segmented into different sections. These sections are identified as:

SECTION	TOPIC
A	Handling/Damage
B	Laminate
C	Conductor characteristics
D	Surface plating
E	Solder coating
F	Registration
G	Plated-through holes
H	Machining
J	Flatness
K	Solder resist (mask)
L	Marking
M	Rigid multilayers
N	Flexible/Rigid-flex
P	Miscellaneous

It is also appropriate to assemble a set of photos that relate to a specific problem and may cut across the various groups. Discussion leaders are encouraged to make an agenda for such a meeting, identifying those photos which will be discussed and relate to a specific problem being experienced at the time. It is suggested that when such an agenda is prepared, in addition to providing the order in which the photos will be presented during the discussion, the discussion leader should also provide the corresponding page numbers of this manual. If necessary, in order to simplify the discussion, photocopies may be made of the

be used to isolate and focus on the subject being discussed without drifting into other discussions related to other problems identified within this handbook.

CAUTION TO THE READER

In addition to the condition described in the caption, some of the photos may have other undesirable/nonconforming conditions that are not discussed.

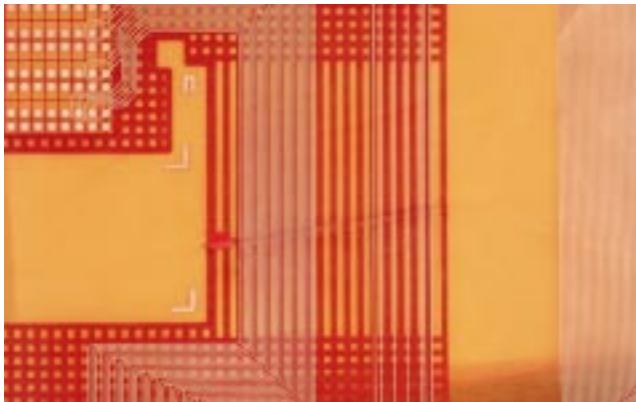
Further, some conditions can not be definitively categorized by examining one photograph. Examples of conditions that may need additional views or evaluation include:

- Resin smear vs. innerlayer separation
- Missing vs. variations in appearance of bond enhancement treatment
- Visual interpretation of subsurface defects (i.e., measles vs. delamination vs. laminate voids)

A — HANDLING/DAMAGE



A-1 Finger prints on copper foil (left side)
Smudge (right side)



A-2 Wrinkled flex

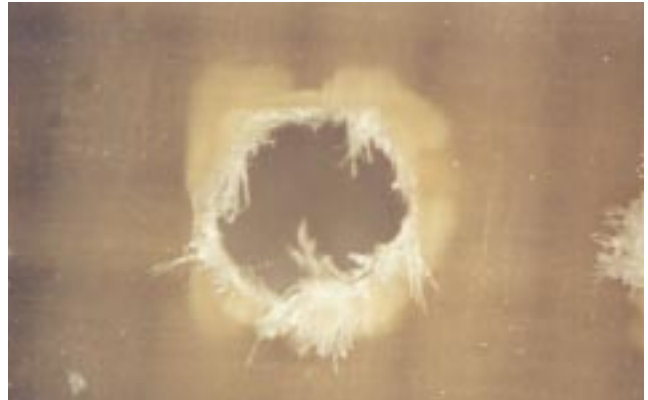


A-3 Corner damage

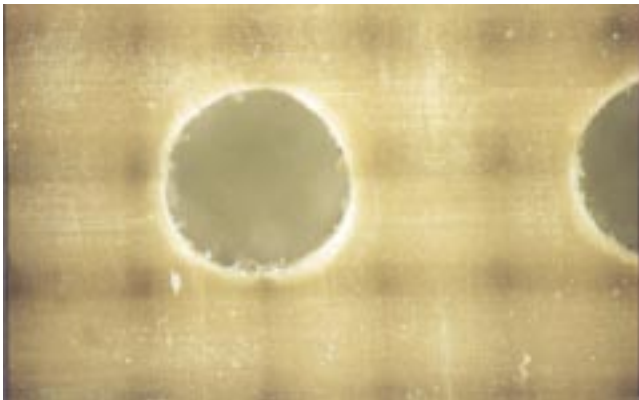
B — LAMINATE



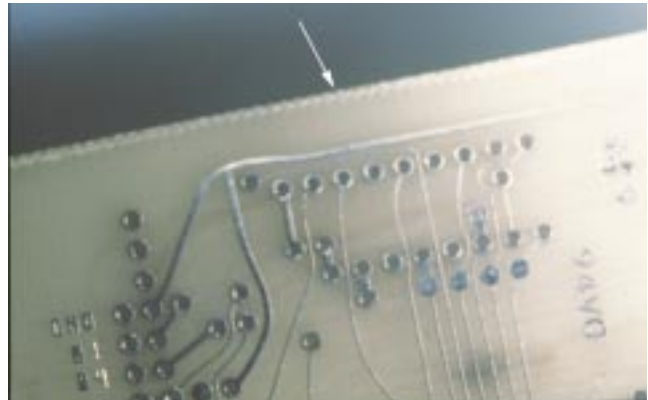
B-1 Unsupported hole
Haloing



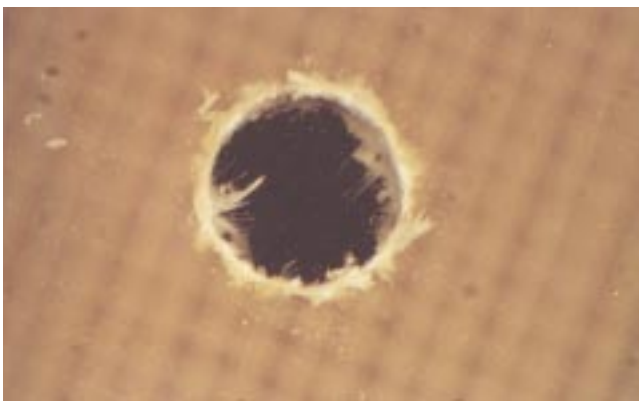
B-4 Unsupported hole
Haloing/severe mechanical damage



B-2 Unsupported hole
Haloing/slight mechanical damage



B-5 Haloing along edge

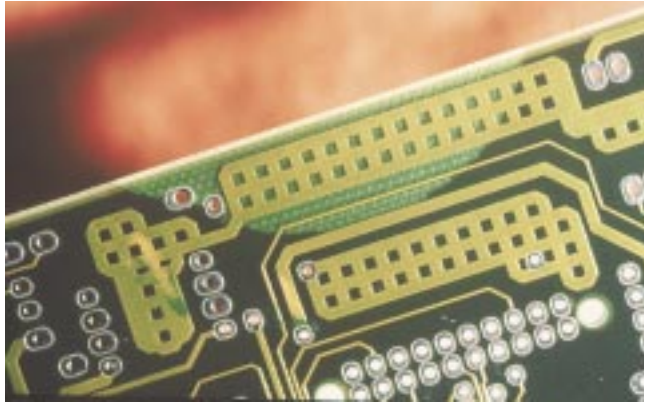


B-3 Unsupported hole
Haloing/severe mechanical damage

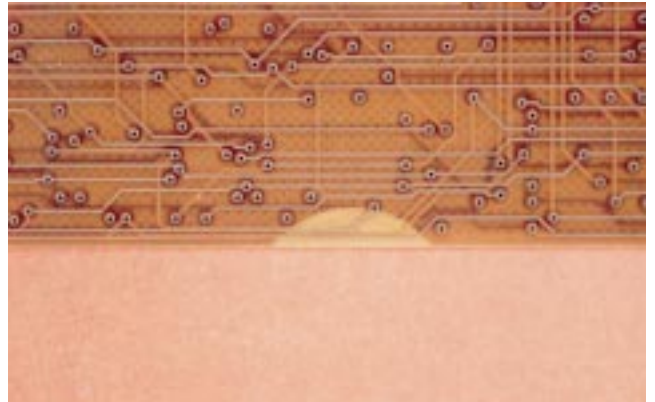


B-6 Haloing and nonmetallic burrs along edge

B — LAMINATE (continued)



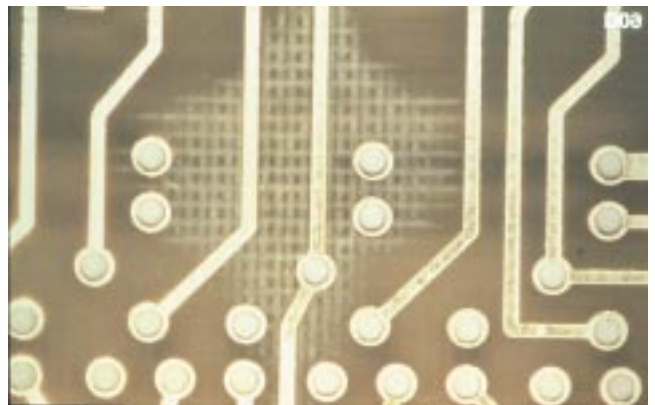
B-7 Delamination



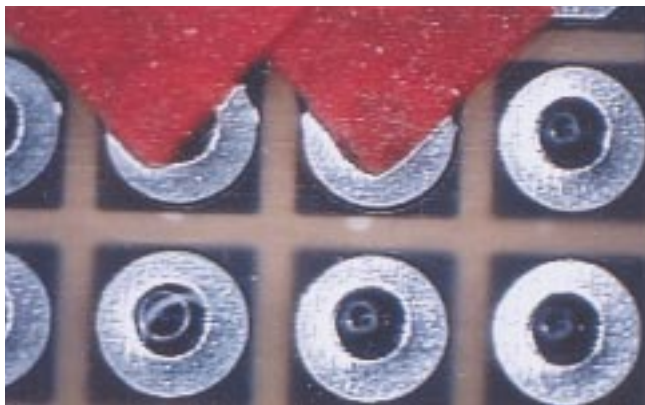
B-10 Delamination



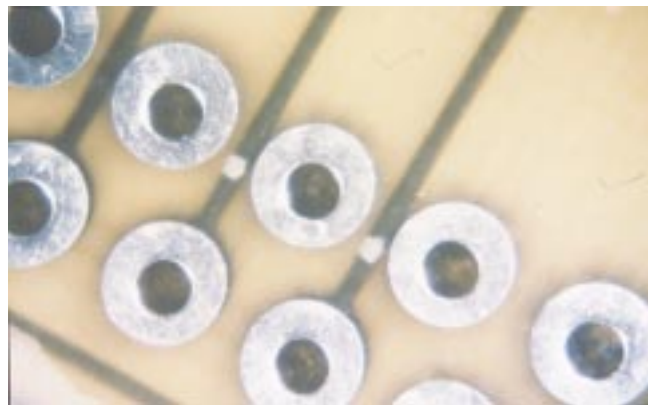
B-8 Laminate voids



B-11 Crazing

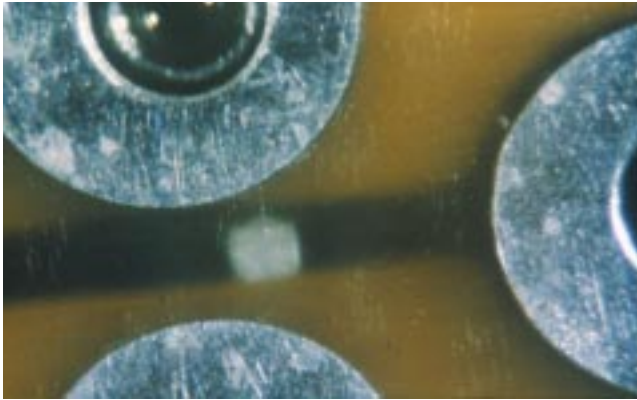


B-9 Laminate voids
(Possible measles)

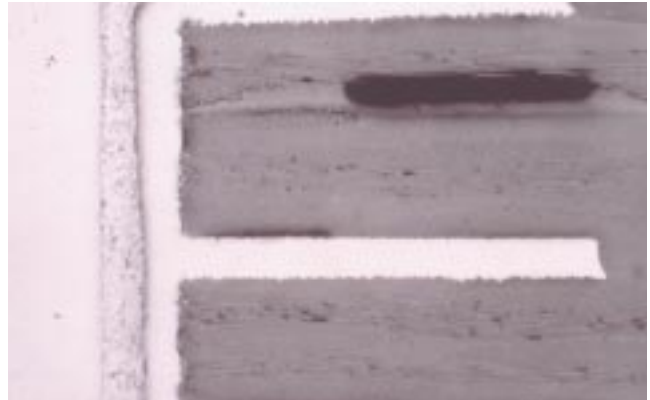


B-12 Measle over inner layer conductor

B — LAMINATE (continued)



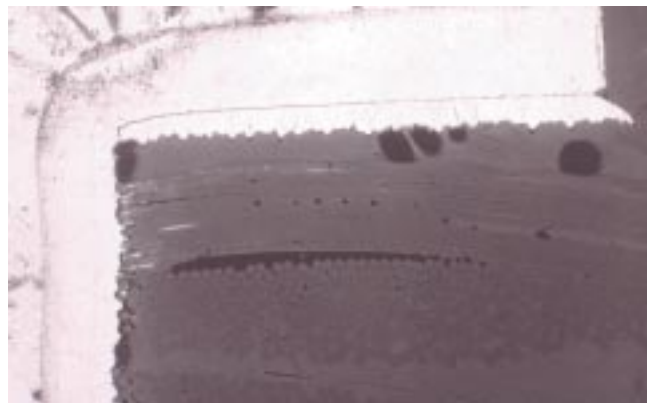
**B-13 Measled board
(Board edge view)**



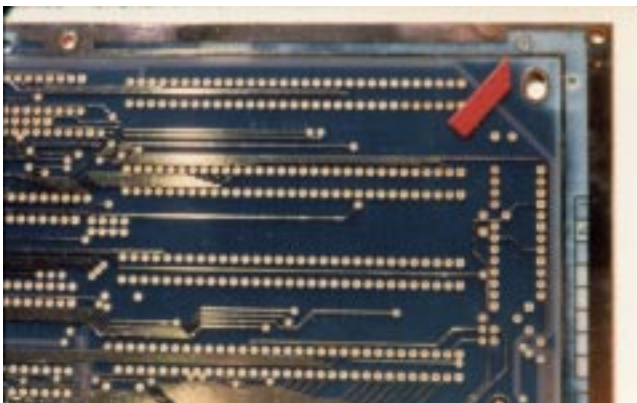
B-16 Laminate void in thermal zone



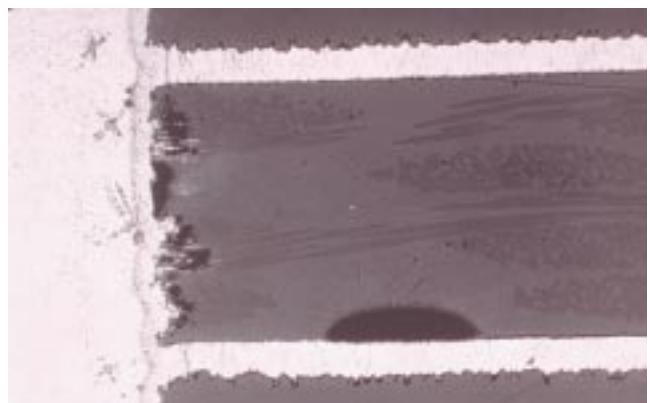
**B-14 Measle
(Cross-section)**



**B-17 Laminate voids in thermal zone
Measle**

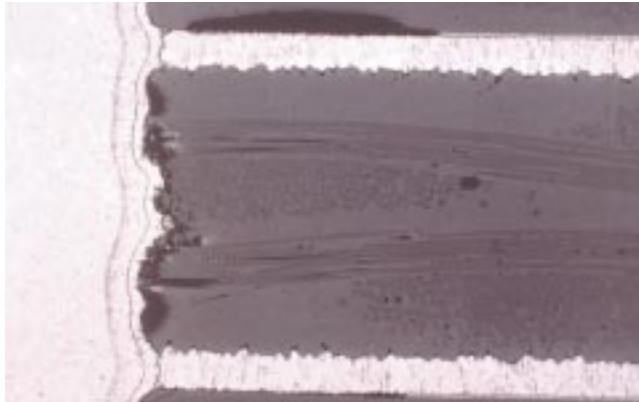


B-15 Resin starvation

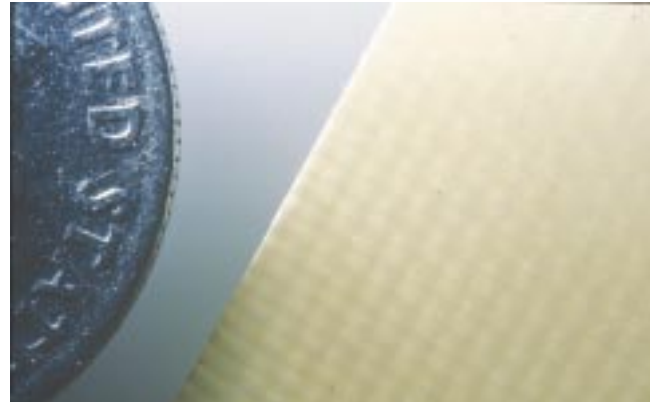


B-18 Laminate void and resin recession

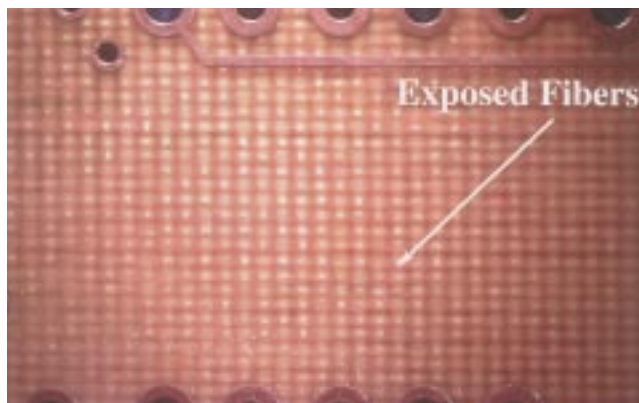
B — LAMINATE (continued)



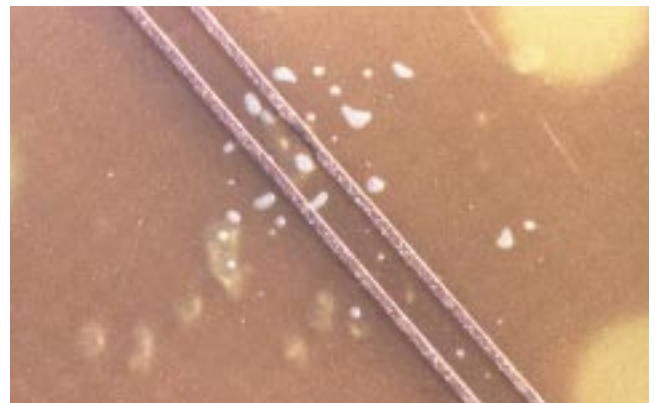
B-19 Laminate void and resin recession



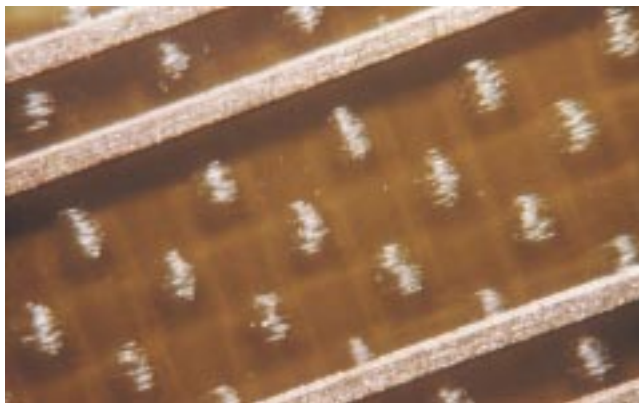
B-22 Weave texture



B-20 Weave texture/exposure



B-23 Surface blistering/delamination

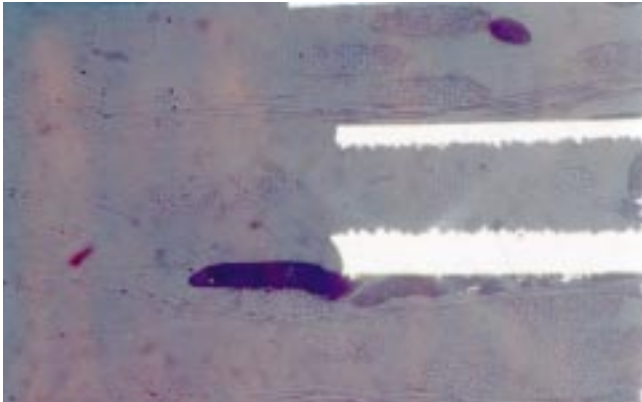


B-21 Weave texture/exposure



B-24 Blistering adjacent to land
Delamination

B — LAMINATE (continued)

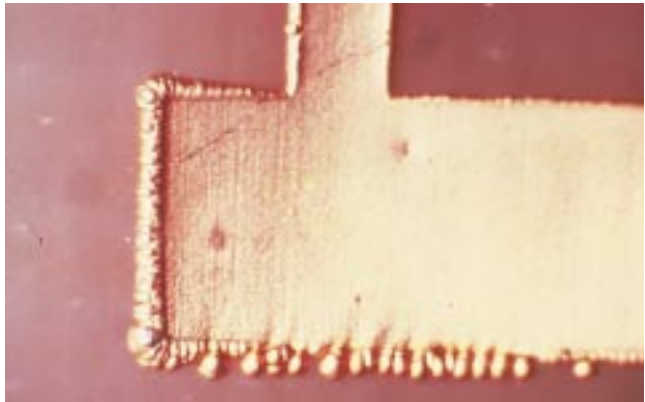


B-25 Voids

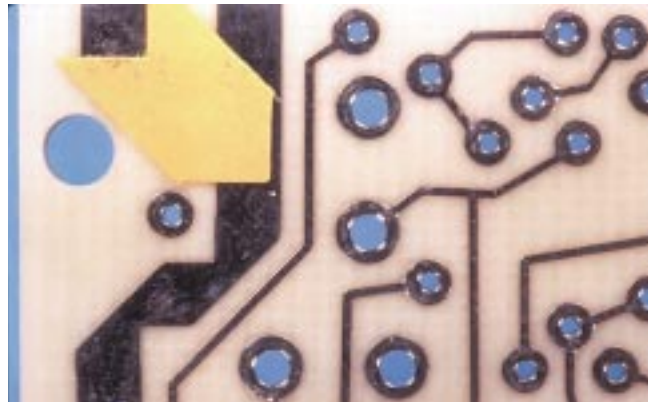


B-26 Copper foil - scratch and dent

C — CONDUCTOR CHARACTERISTICS



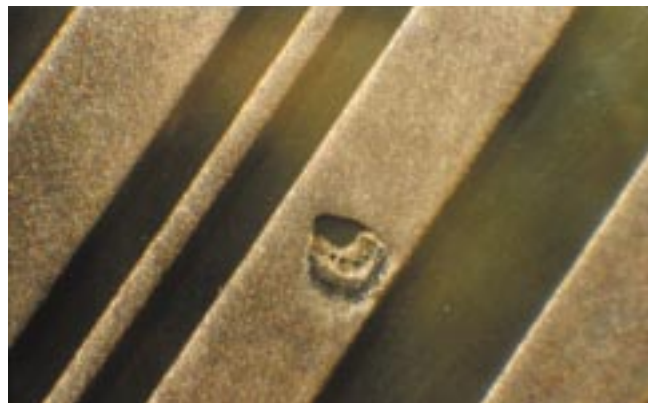
C-1 Conductor with plating nodules



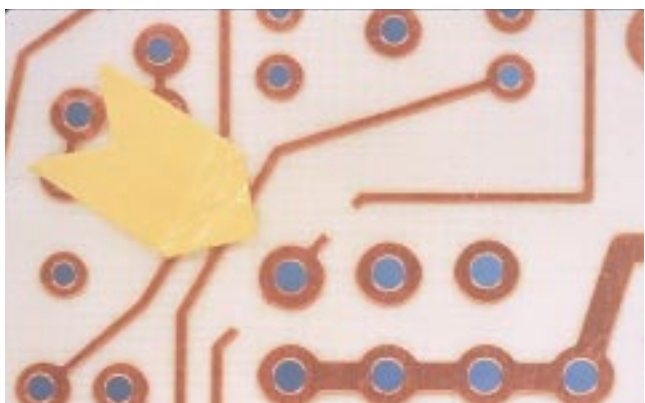
C-4 Conductor - pin hole



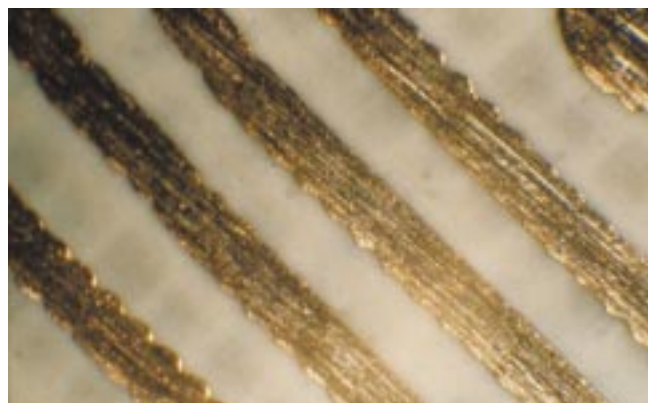
C-2 Conductor width reduction
Rough edge definition



C-5 Pin hole in conductor

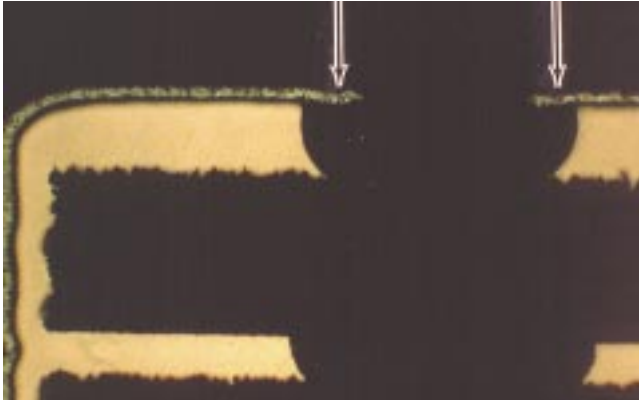


C-3 Etched conductor

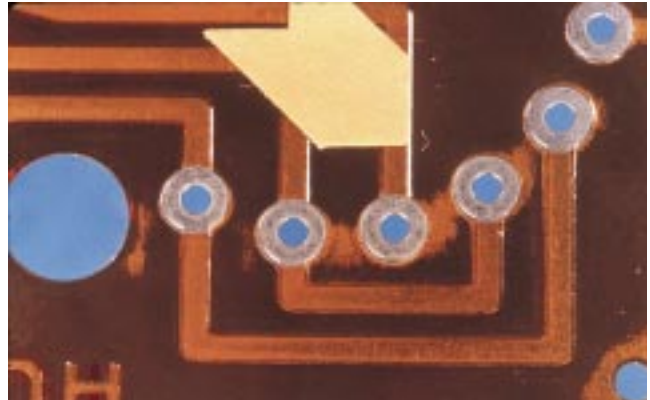


C-6 Conductor - rough edge definition

C — CONDUCTOR CHARACTERISTICS (continued)



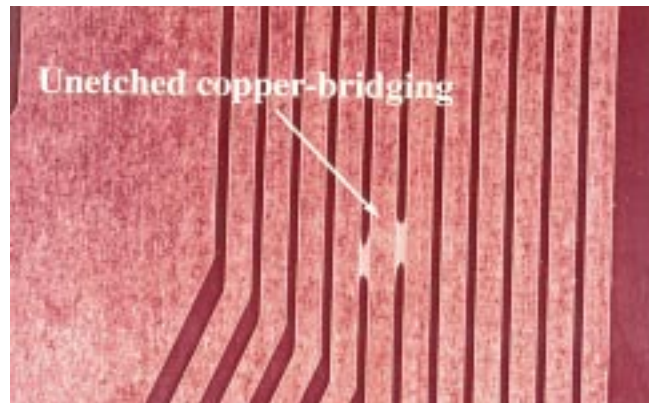
C-7 Tin/lead plating overhang



C-10 Incomplete etching



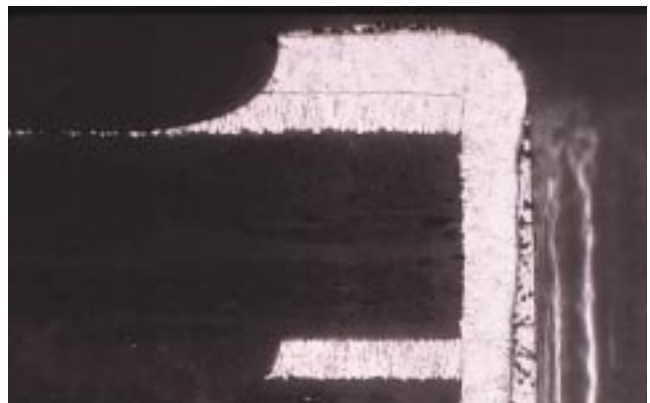
C-8 Conductor overhang



C-11 Incomplete etching



C-9 Conductor undercutting collapse

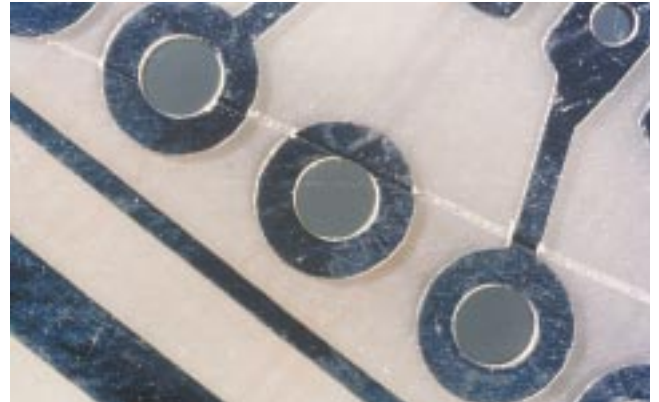


C-12 Incomplete etching

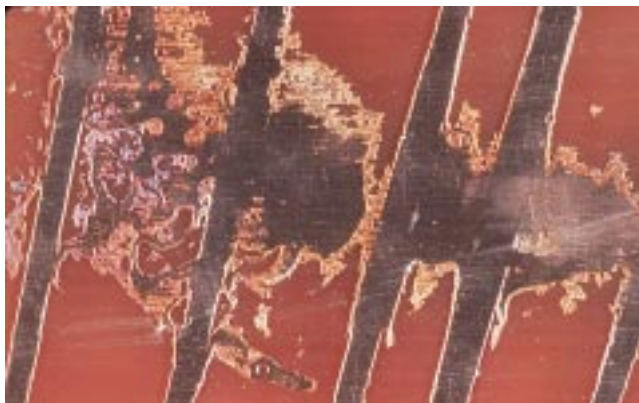
C — CONDUCTOR CHARACTERISTICS (continued)



C-13 Etched conductor (land)
Plating void in hole



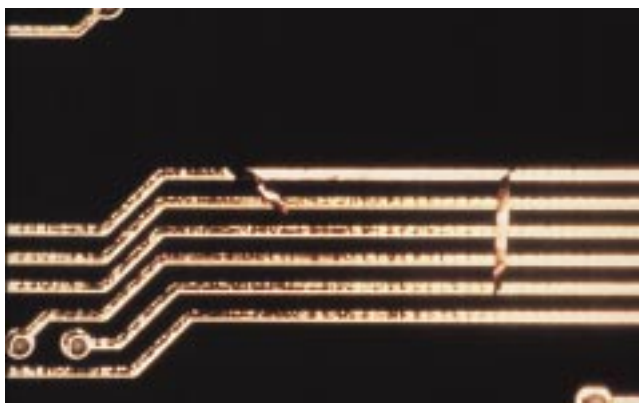
C-16 Scratched conductors and substrate



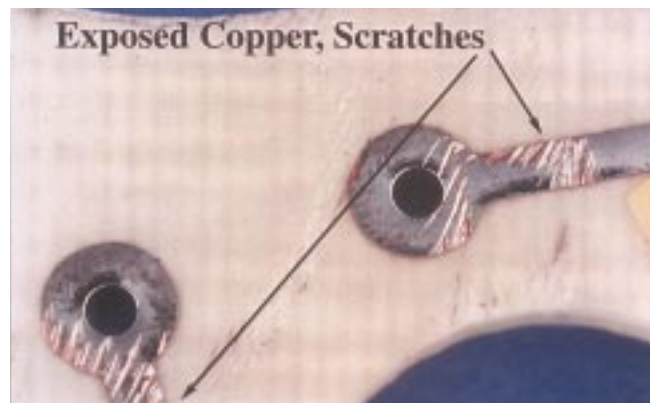
C-14 Shorts, extraneous copper



C-17 Scratched innerlayer conductors and substrate

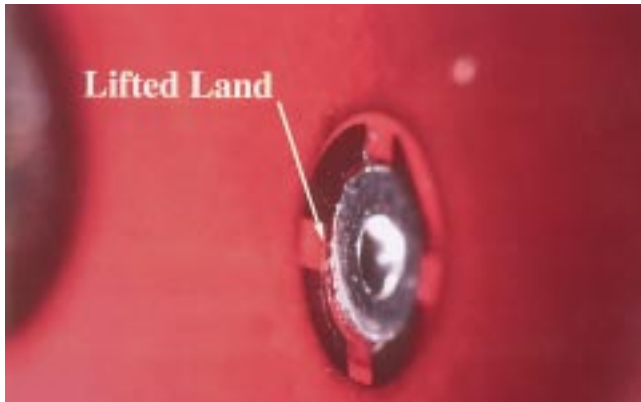


C-15 Peeled conductors

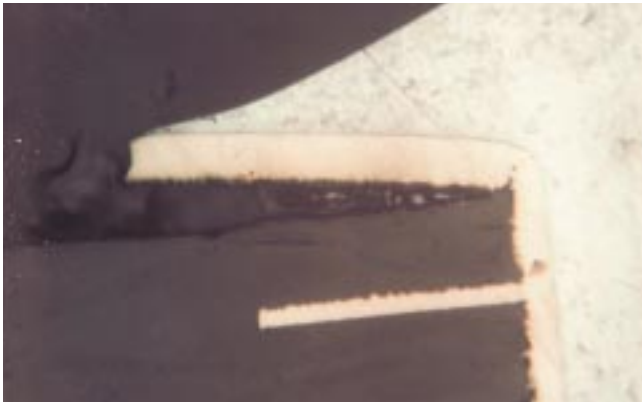


C-18 Scratched conductors exposing copper

C — CONDUCTOR CHARACTERISTICS (continued)



C-19 Lifted land

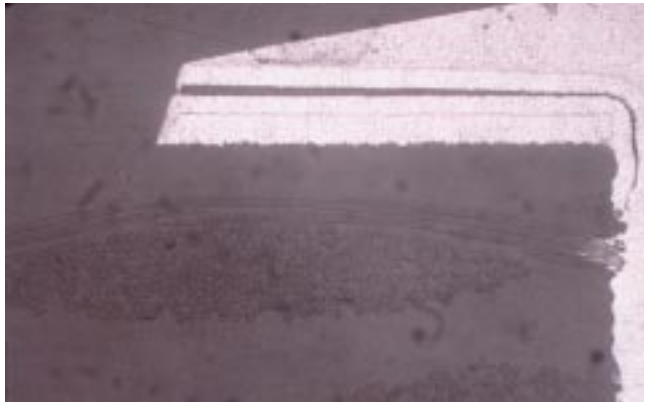


C-20 Lifted land and corner crack



C-21 Severe lifted land, corner crack, innerlayer separation

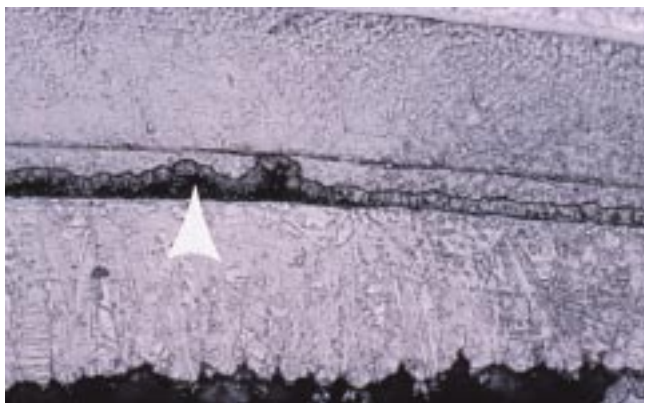
D — SURFACE PLATING



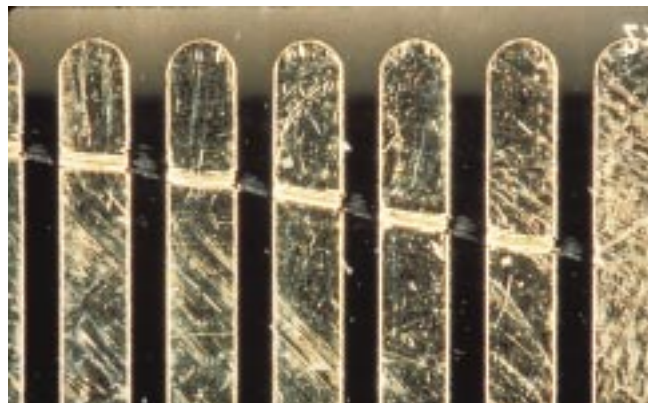
D-1 Separation between platings



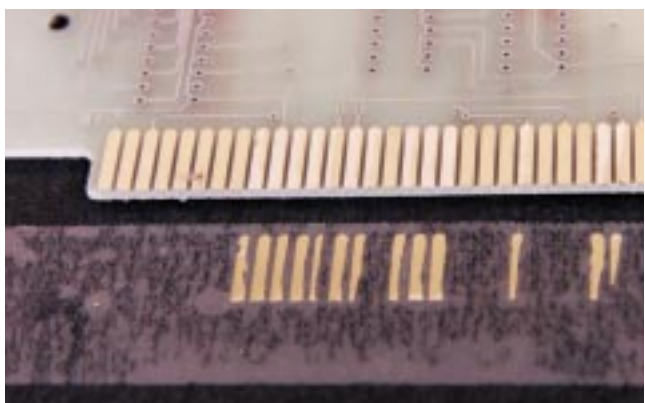
D-4 Gold contacts
Pit, pin holes and surface nodules



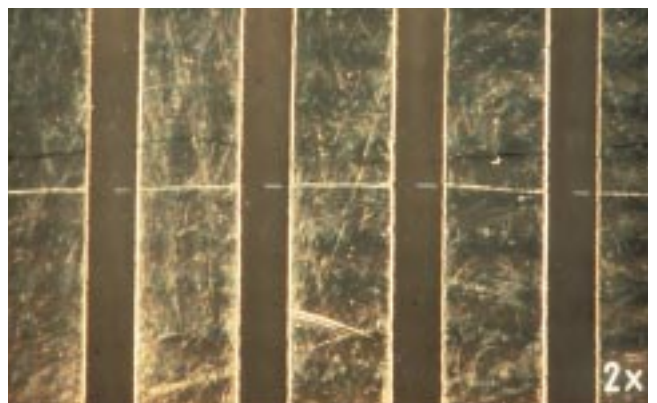
D-2 Surface contamination/electroless separation
from foil



D-5 Plating on printed contacts gouged



D-3 Gold contacts
Poor plating adhesion



D-6 Plating on printed contacts scratched