

IPC-QE-605A

Revision A
February 1999

Printed Board Quality Evaluation Handbook

Developed by



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

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 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

Notice

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Thank you for your continued support.



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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:

IPC
2215 Sanders Road
Northbrook, Illinois
60062-6135
Tel 847 509.9700
Fax 847 509.9798

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 which can

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.

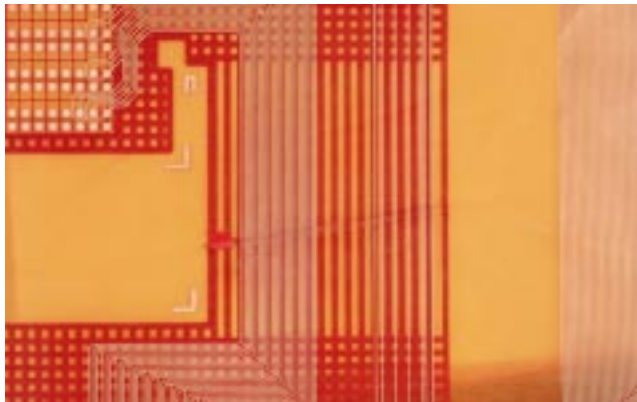
Further, some conditions can not be definitively categorized by examining one photograph. Examples of conditions that may need additional views or evaluation include:

- 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 Fingerprint on copper foil (left side)
Smudge (right side)



A-2 Wrinkled flex

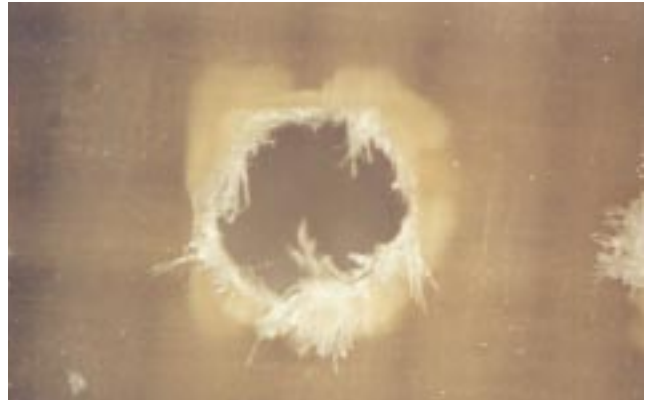


A-3 Corner damage

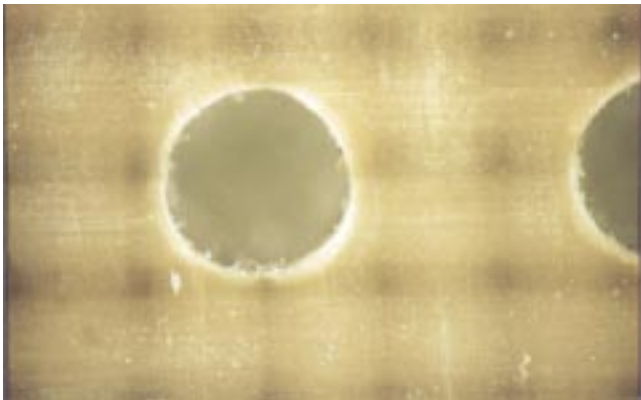
B — LAMINATE



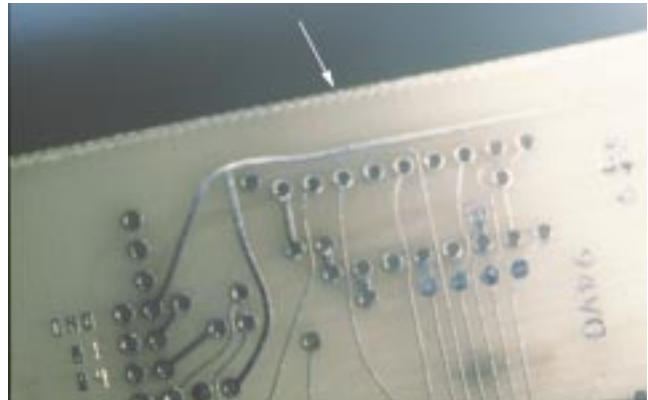
B-1 Unsupported hole
Haloing



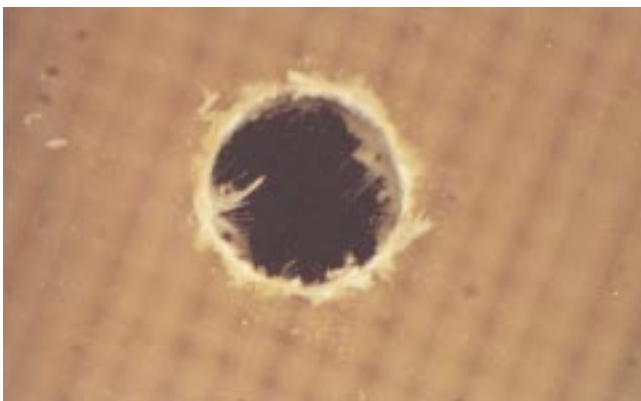
B-4 Unsupported hole
Haloing/severe mechanical damage



B-2 Unsupported hole
Haloing/slight mechanical damage



B-5 Haloing along edge

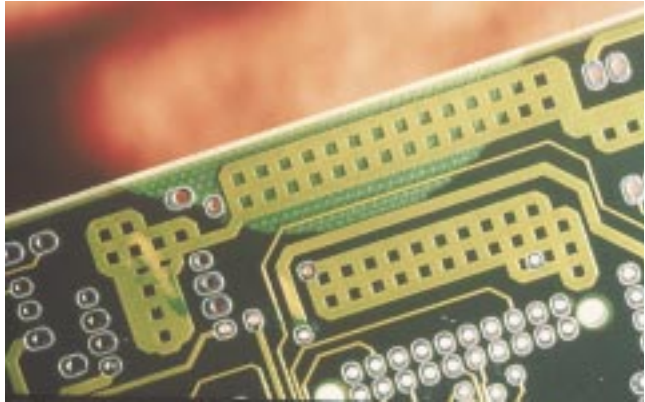


B-3 Unsupported hole
Haloing/severe mechanical damage

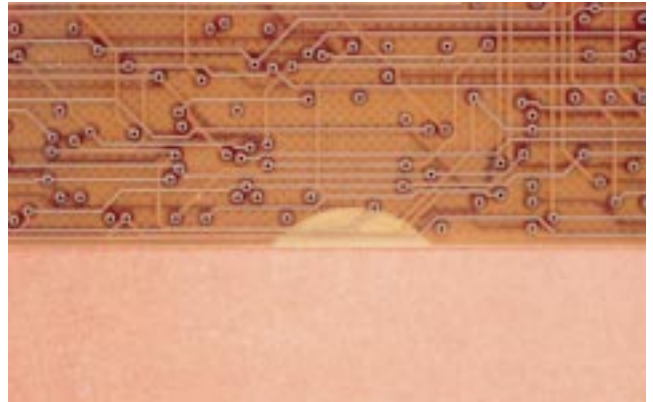


B-6 Haloing and nonmetallic burrs along edge

B — LAMINATE (continued)



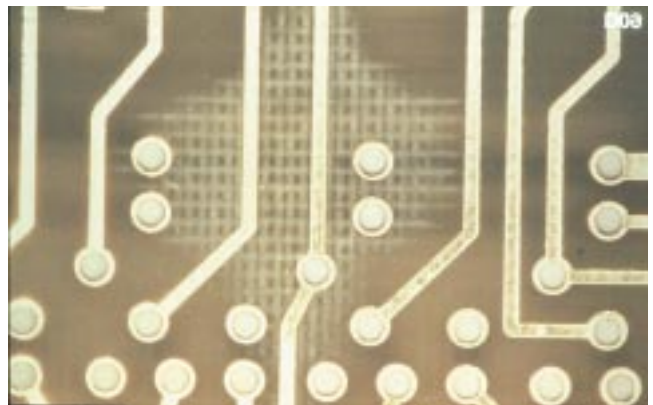
B-7 Delamination



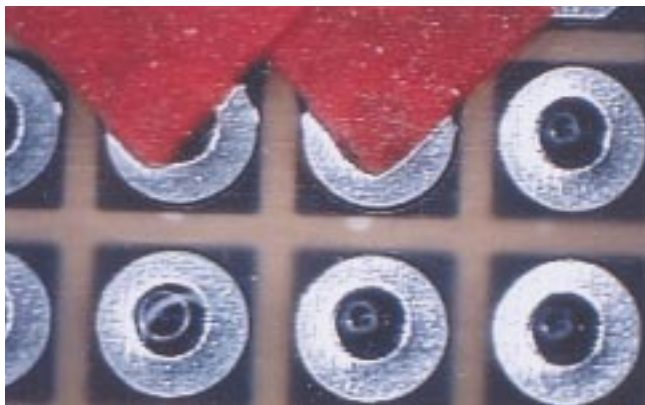
B-10 Delamination



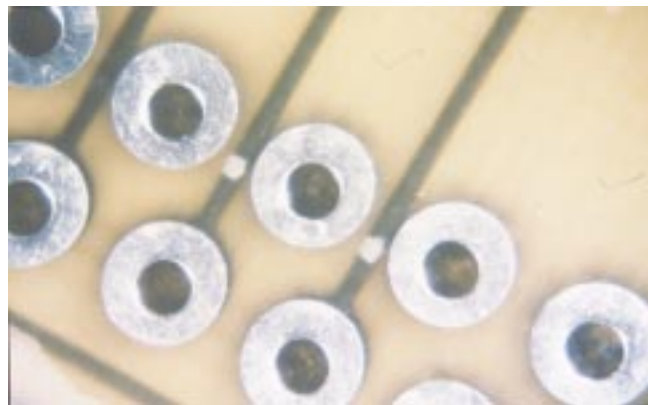
B-8 Laminate voids



B-11 Crazing

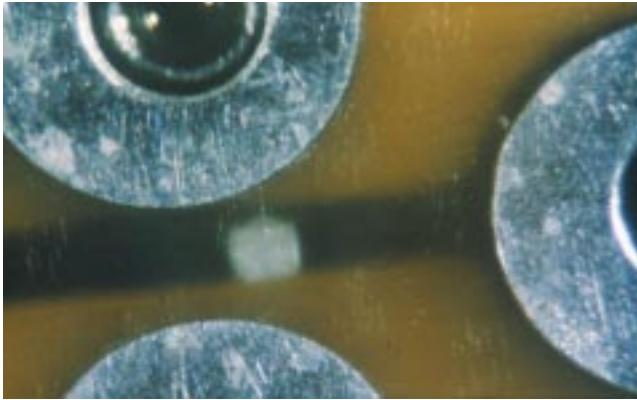


**B-9 Laminate voids
(Possible measle)**

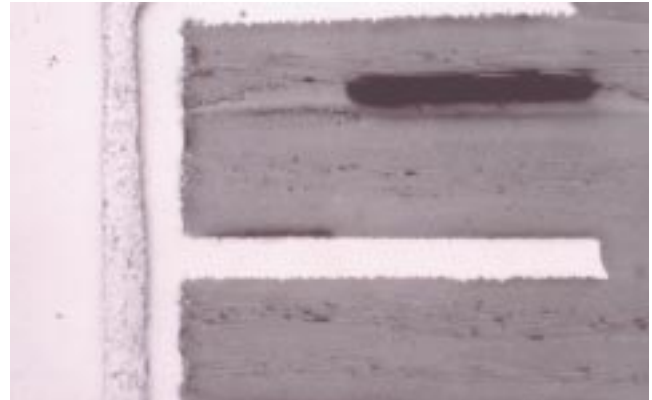


B-12 Measle over inner layer conductor

B — LAMINATE (continued)



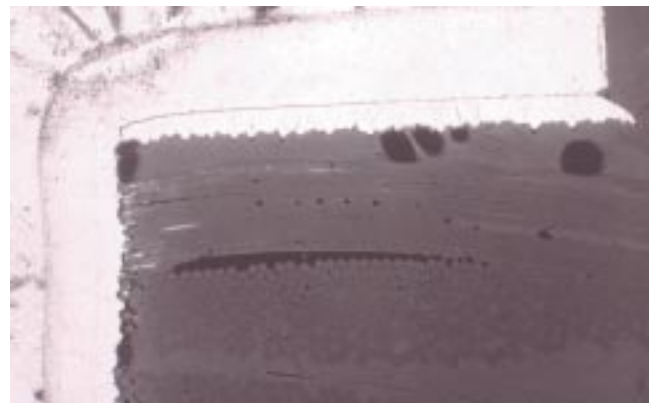
**B-13 Measled board
(Board edge view)**



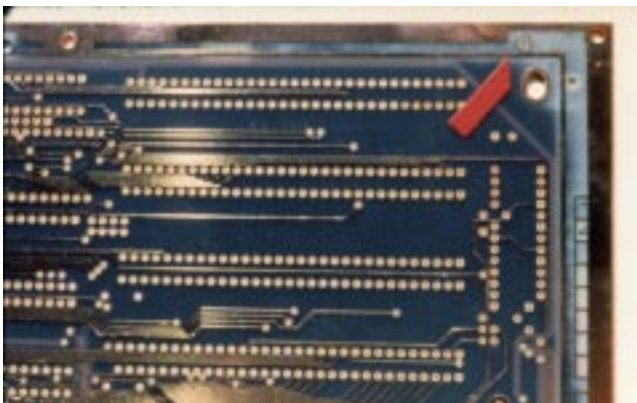
B-16 Laminate void in thermal zone



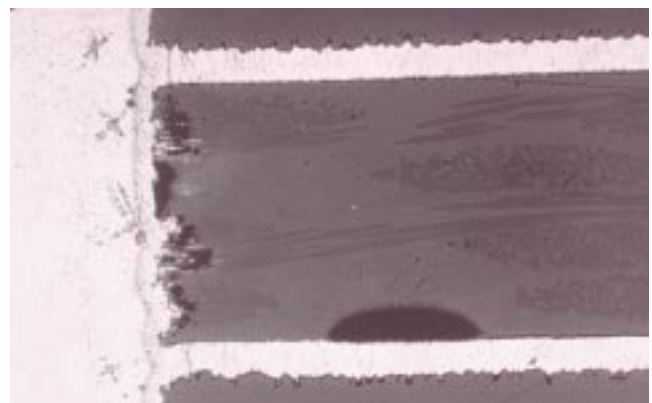
**B-14 Measle
(Cross-section)**



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

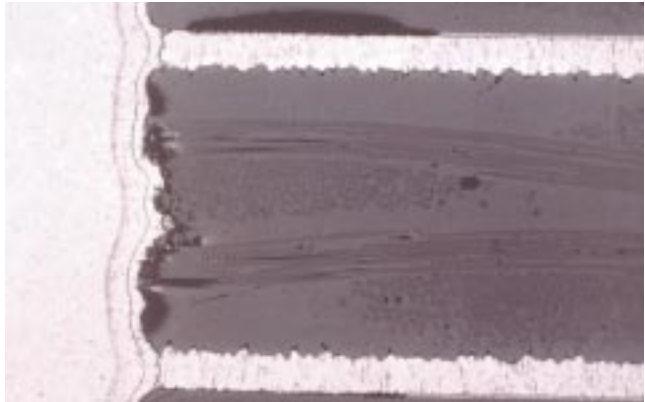


B-15 Resin starvation

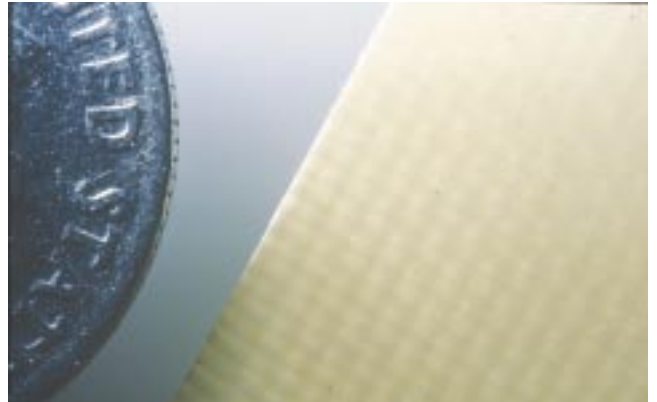


B-18 Laminate void and resin recession

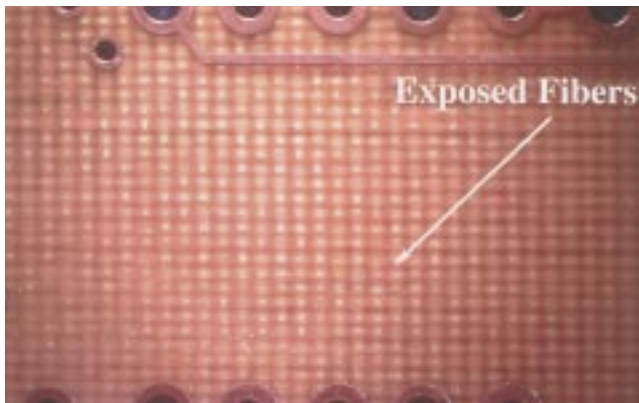
B — LAMINATE (continued)



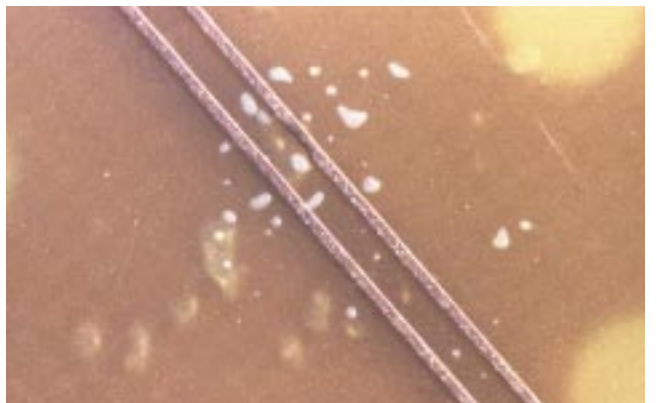
B-19 Laminate void and resin recession



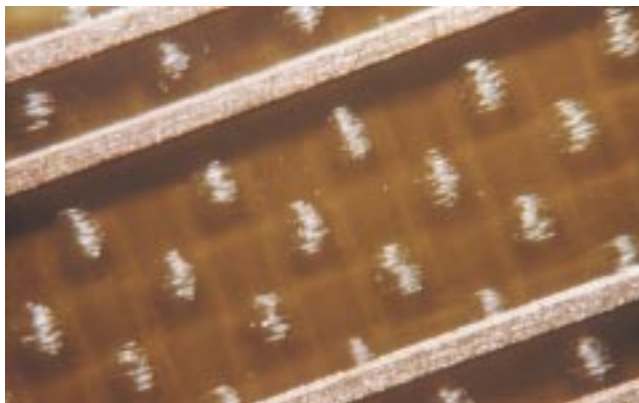
B-22 Weave texture



B-20 Weave texture/exposure



B-23 Surface blistering/delamination

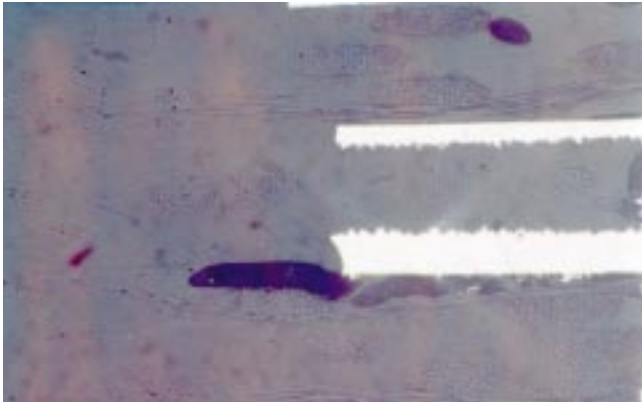


B-21 Weave texture/exposure



B-24 Blistering adjacent to land
Delamination

B — LAMINATE (continued)

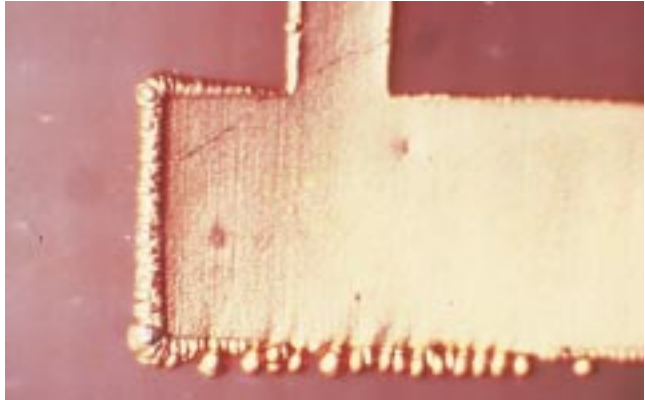


B-25 Voids

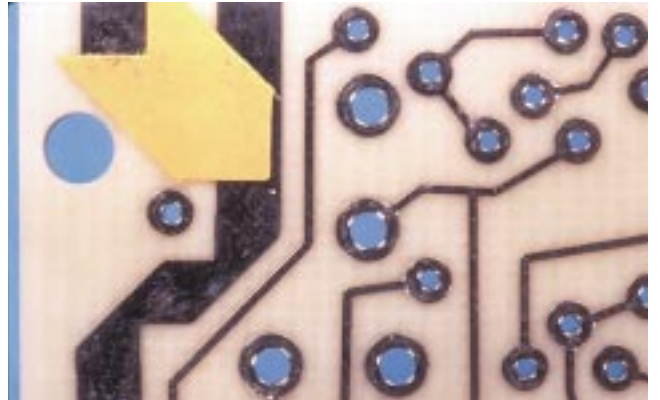


B-26 Copper foil - scratch and dent

C — CONDUCTOR CHARACTERISTICS



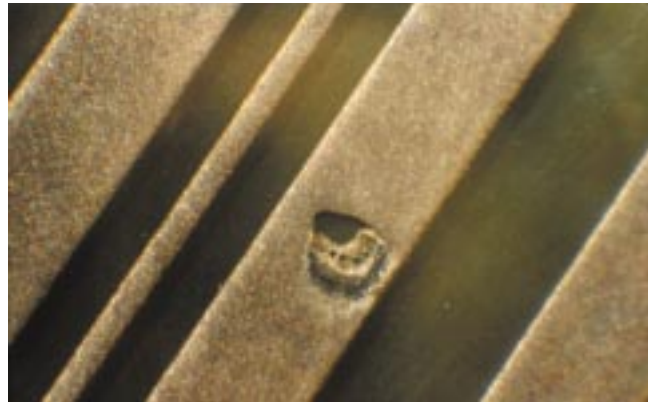
C-1 Conductor with plating nodules



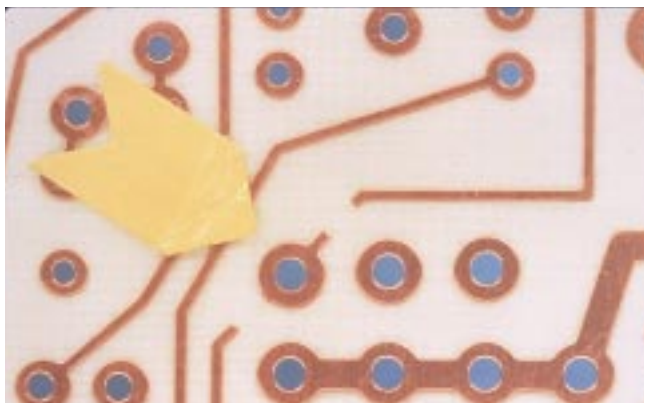
C-4 Conductor - pin hole



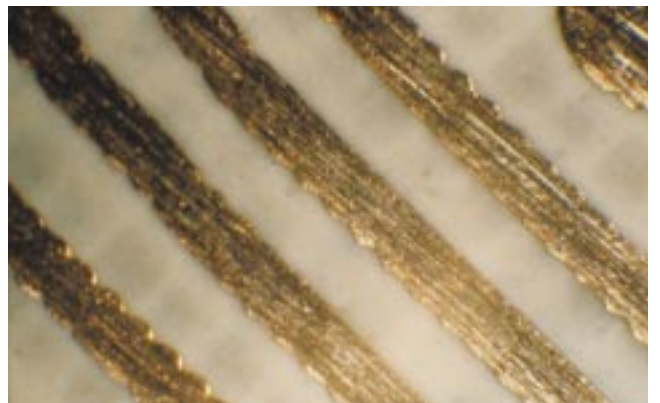
C-2 Conductor width reduction
Rough edge definition



C-5 Pin hole in conductor

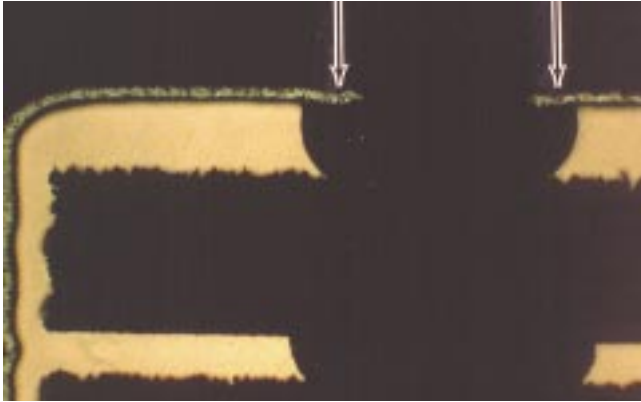


C-3 Etched conductor

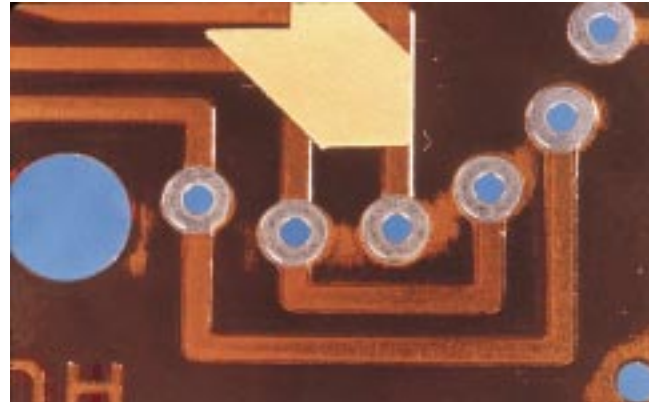


C-6 Conductor - rough edge definition

C — CONDUCTOR CHARACTERISTICS (continued)



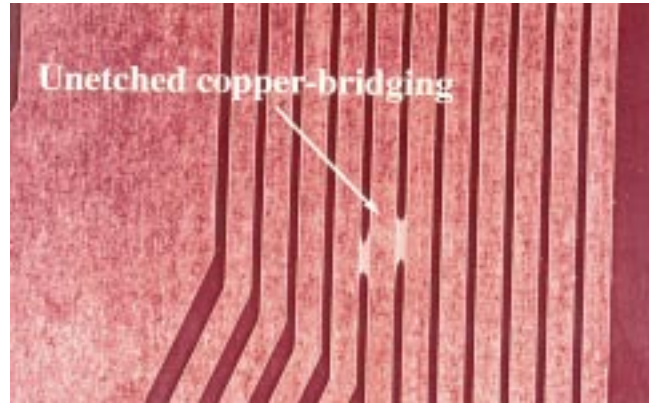
C-7 Tin/lead plating overhang



C-10 Incomplete etching



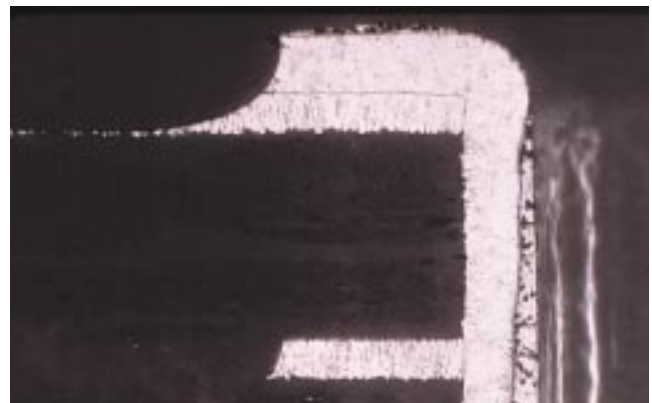
C-8 Conductor overhang



C-11 Incomplete etching

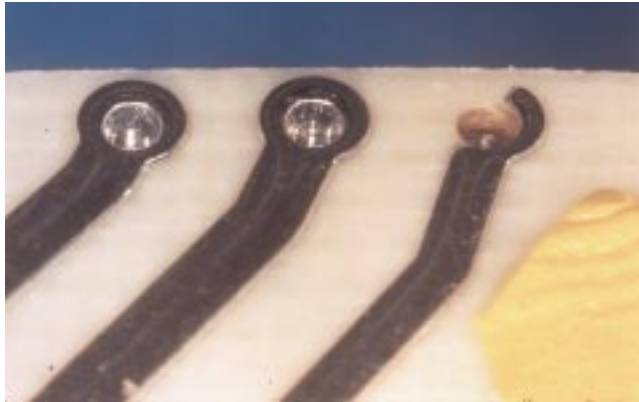


C-9 Conductor undercutting collapse

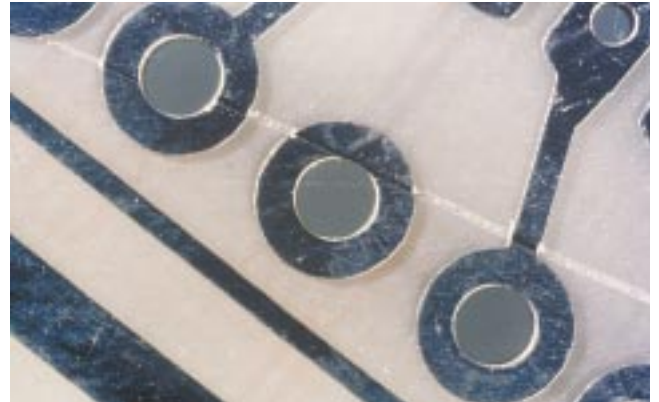


C-12 Incomplete etching

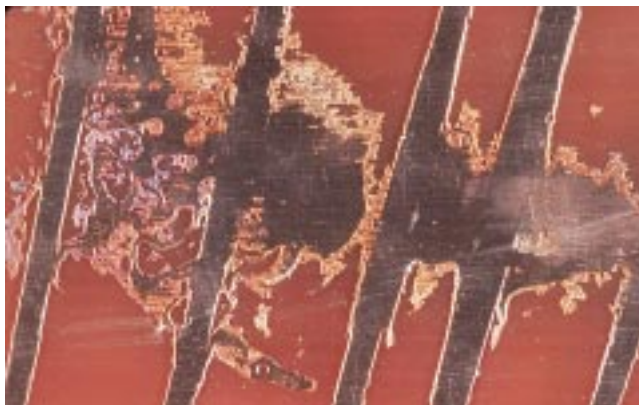
C — CONDUCTOR CHARACTERISTICS (continued)



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



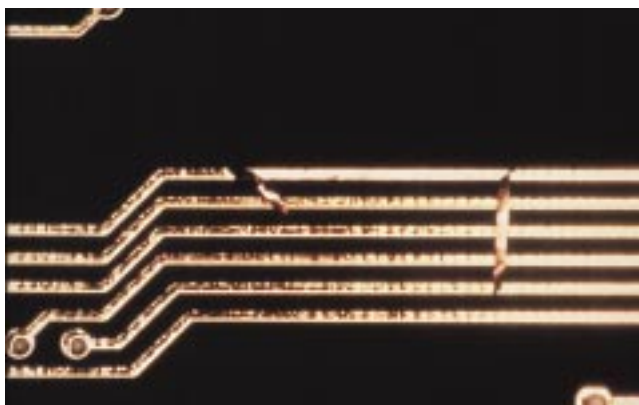
C-16 Scratched conductors and substrate



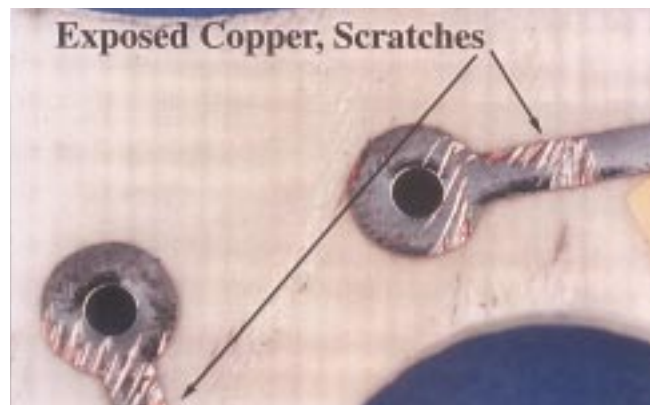
C-14 Shorts, extraneous copper



C-17 Scratched innerlayer conductors and substrate

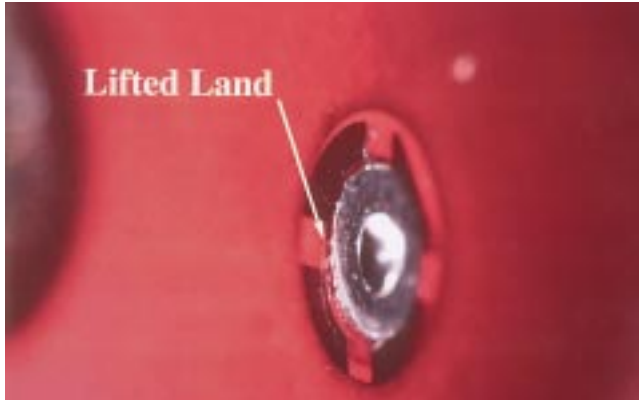


C-15 Peeled conductors

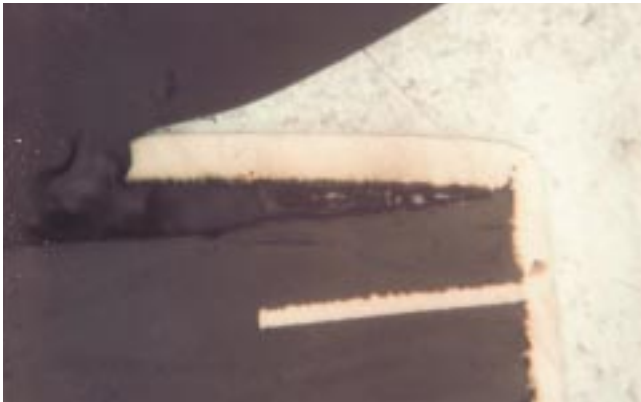


C-18 Scratched conductors exposing copper

C — CONDUCTOR CHARACTERISTICS (continued)



C-19 Lifted land

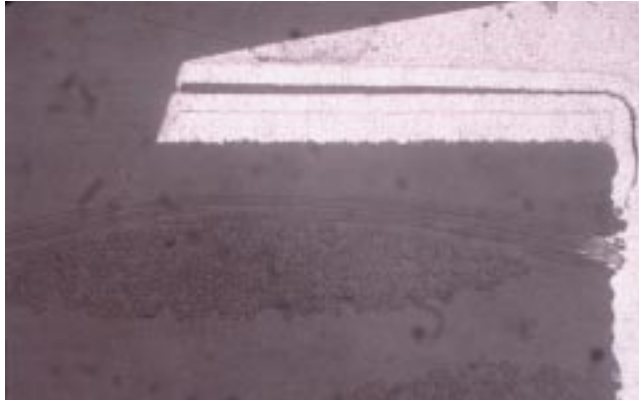


C-20 Lifted land and corner crack

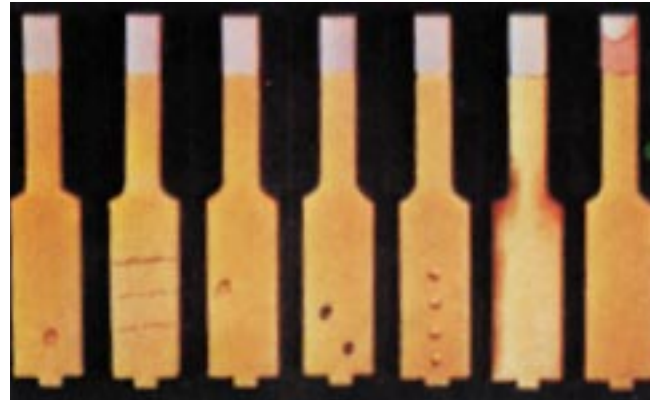


C-21 Severe lifted land, corner crack, innerlayer separation

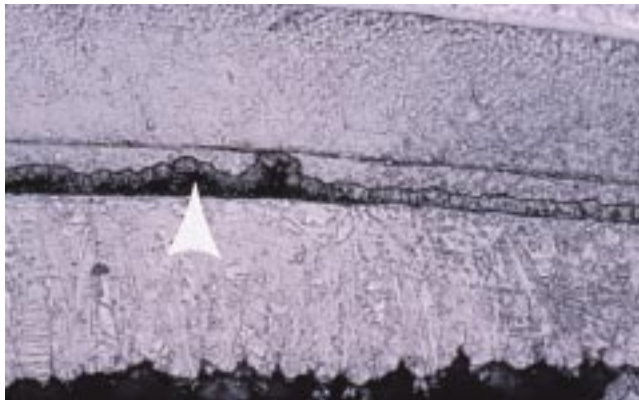
D — SURFACE PLATING



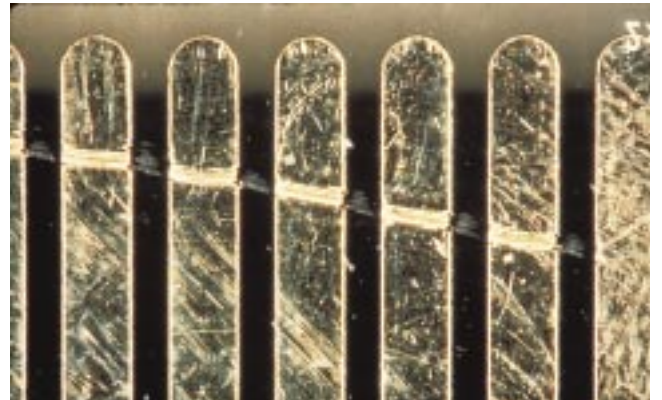
D-1 Separation between platings



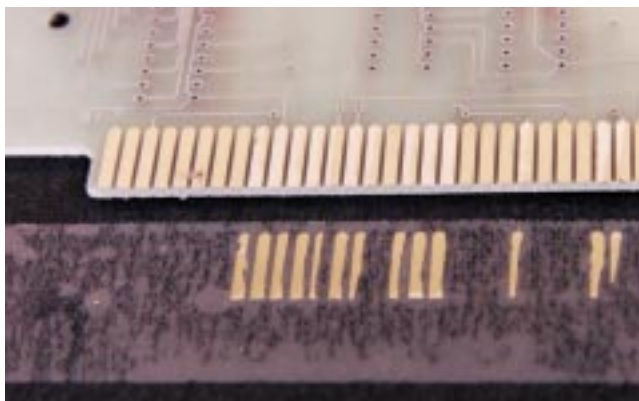
D-4 Gold contacts
Pit, pin holes and surface nodules



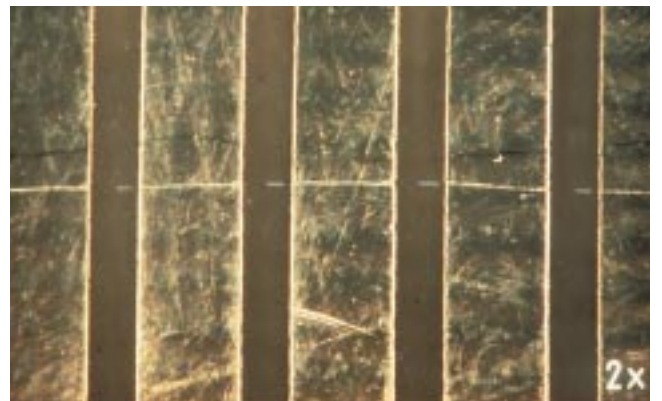
D-2 Surface contamination/electroless separation from foil



D-5 Plating on printed contacts gouged



D-3 Gold contacts
Poor plating adhesion



D-6 Plating on printed contacts scratched

D — SURFACE PLATING (continued)



D-7 Gold contacts
Plating anomalies

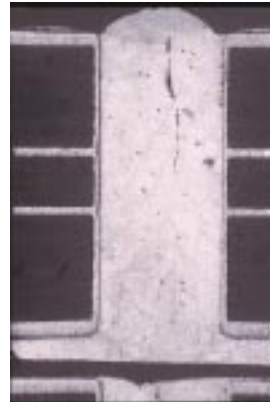


D-8 Gold plating adhesion failure

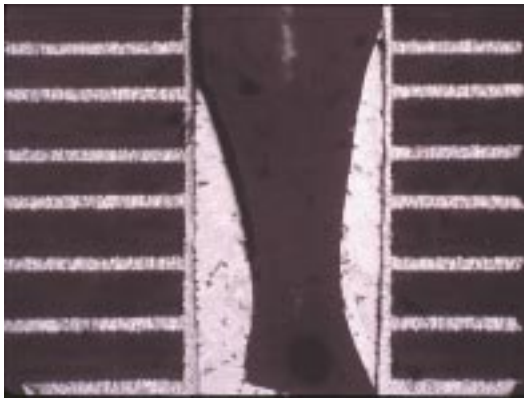
E — SOLDER COATING



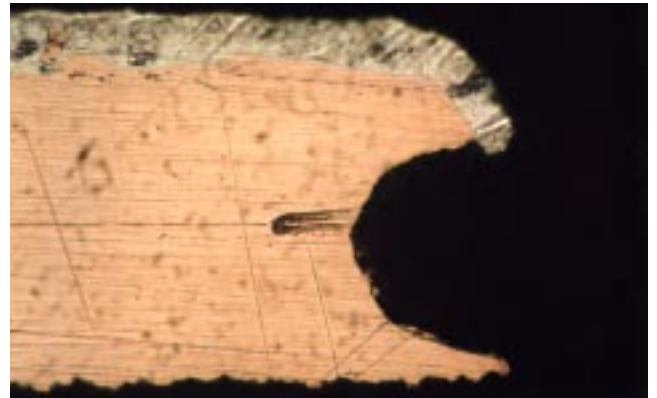
E-1 Plated-through hole - solder filled



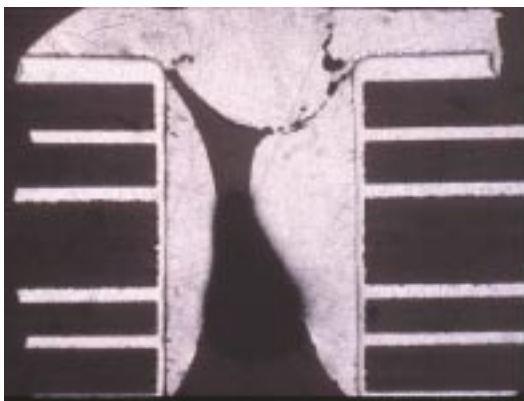
E-4 Complete hole fill - nonwetting top surface



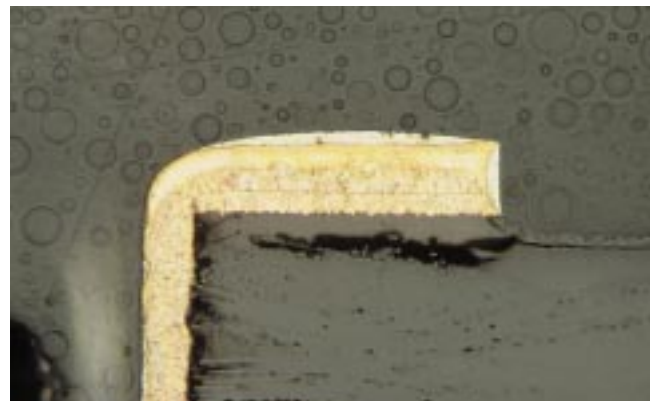
E-2 Nonwetting of hole



E-5 Tin/lead plating after fusing



E-3 Poor solder fill - voids and dewetting

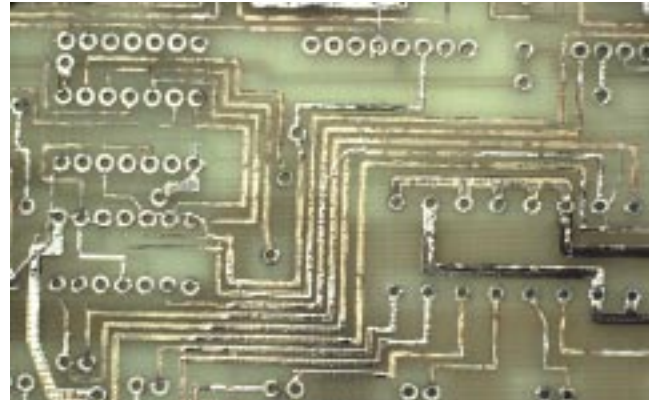


E-6 Hot Air Solder Leveled (HASL)

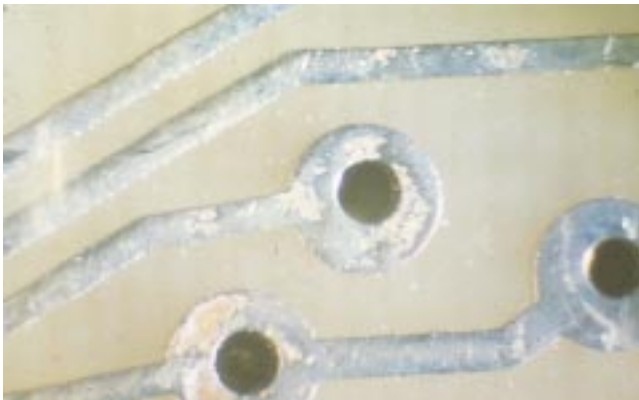
E — SOLDER COATING (continued)



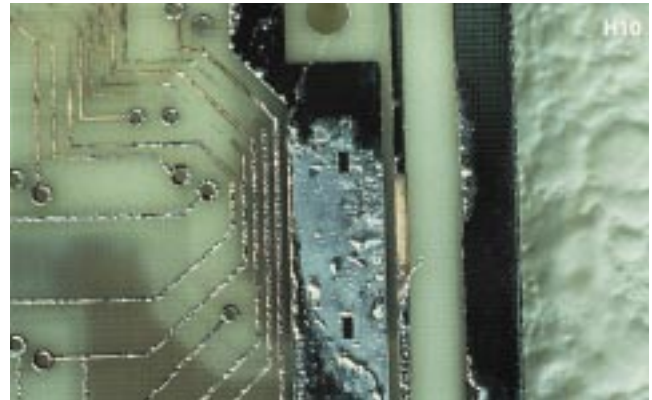
E-7 Solder dewetting



E-10 Conductor with dewetting, nonwetting and solder bridging



E-8 Conductor surface nonwetting with exposed copper



E-11 Conductor with solder dewetting and nonwetting plus etched conductors

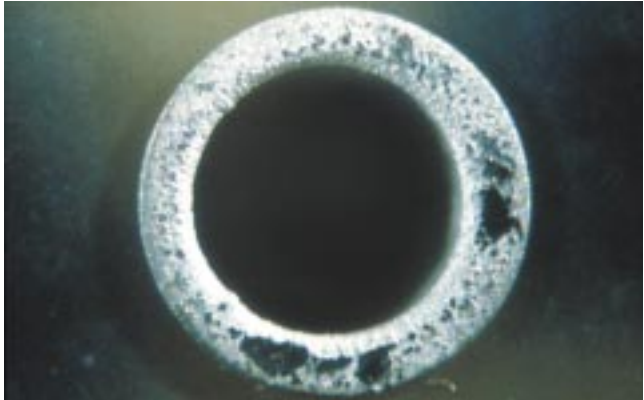


E-9 Dewetting of large plane



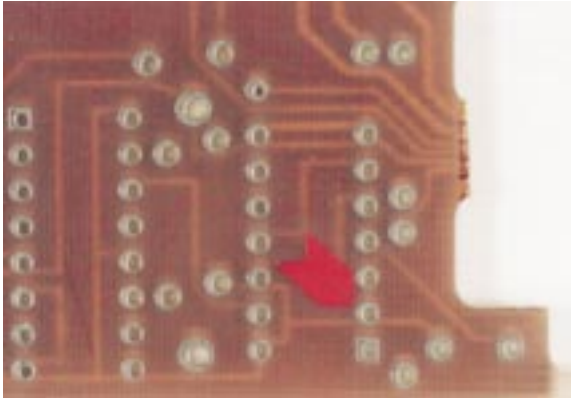
E-12 Solder dewetting and nonwetting surface lands

E — SOLDER COATING (continued)

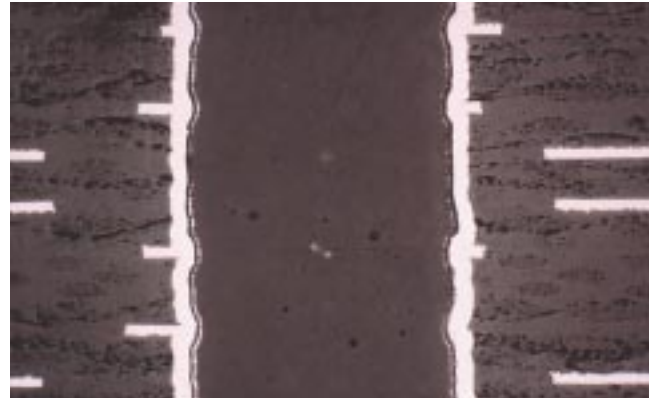


E-13 Tin lead contamination

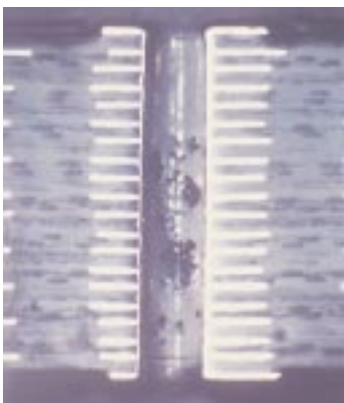
F — REGISTRATION



F-1 Misregistration



F-4 Misregistration - no annular ring



F-2 Good registration



F-5 Misregistration



F-3 Misregistration - no annular ring

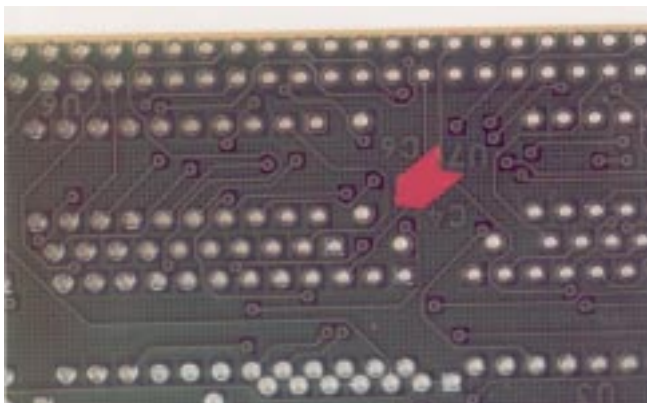


F-6 Innerlayer misregistration

F — REGISTRATION (continued)



F-7 Surface misregistration in blind via

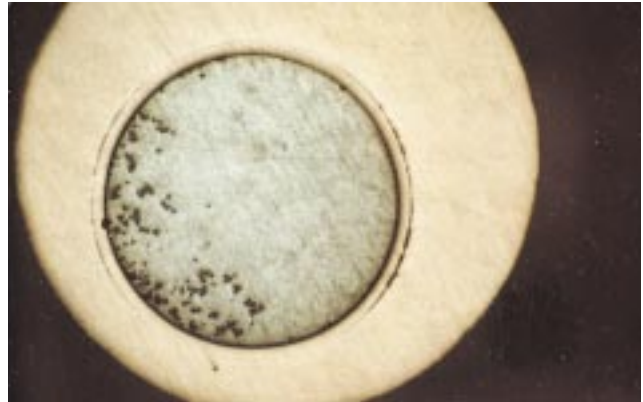


F-8 Misregistration - hole breakout

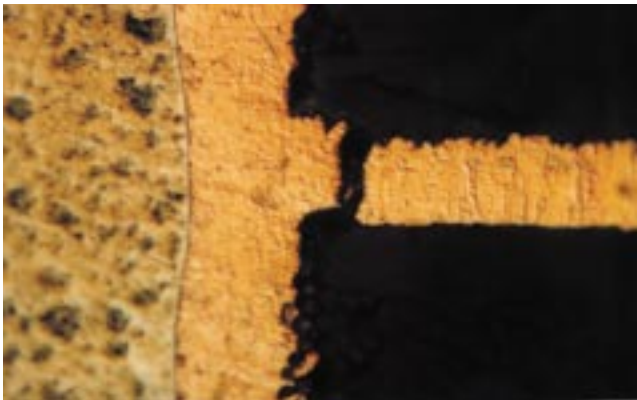
G — PLATED-THROUGH HOLES



G-1 Internal foil crack
Plating cracks (barrel)



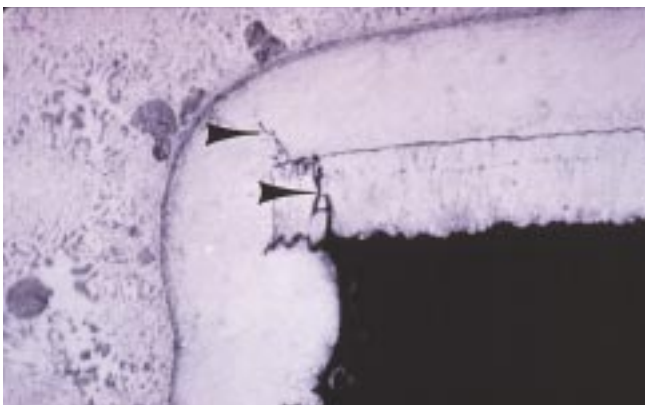
G-4 Resin smear
(Horizontal view)



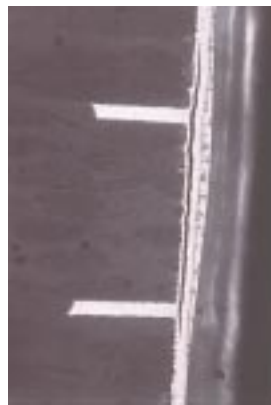
G-2 Internal foil crack



G-5 Innerlayer separation



G-3 External foil crack and corner crack



G-6 Copper plating - separation in plated-through hole

G — PLATED-THROUGH HOLES (continued)



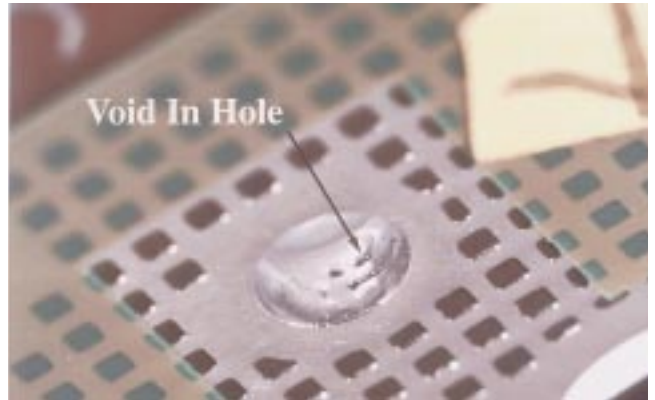
G-7 Innerlayer separation and resin recession



G-10 Plating void



G-8 Poor plating adhesion to hole wall



G-11 Voids in hole



G-9 Lifted land
Innerlayer separation
Poor plating adhesion to hole wall
Separation along vertical edge of external land



G-12 Nail heading

G — PLATED-THROUGH HOLES (continued)



G-13 Nail heading



G-16 Plating fold, metal core board



G-14 Nail heading



G-17 Protruding glass fibers, wicking and plating fold



G-15 Thin area in copper plating

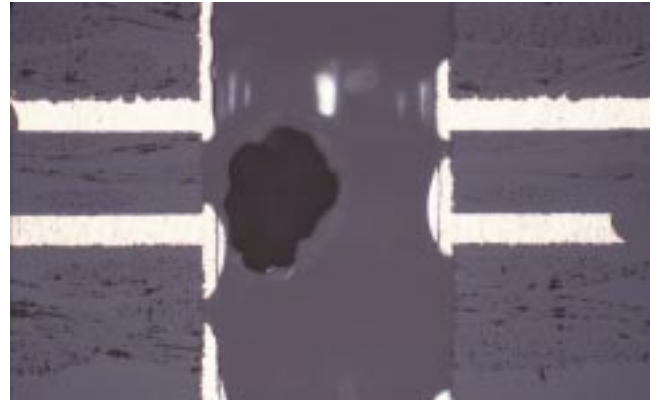


G-18 Plating nodule

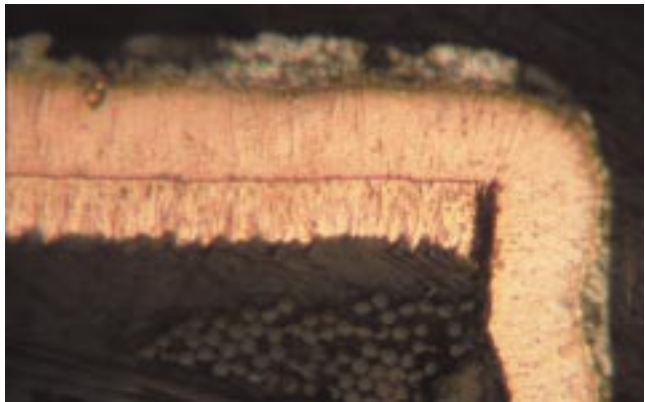
G — PLATED-THROUGH HOLES (continued)



G-19 Plating nodules



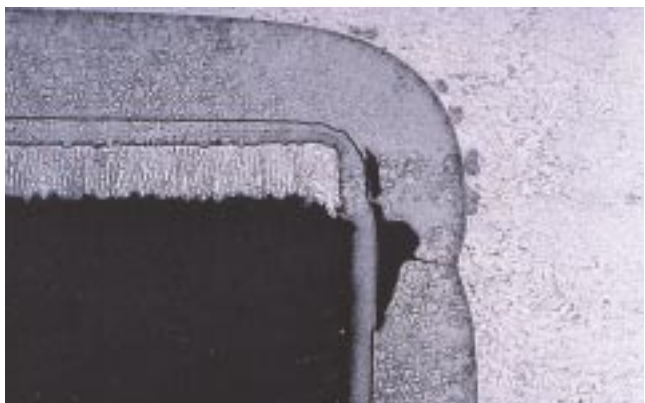
G-22 Gross plating voids



G-20 Separation along vertical edge of external foil



G-23 Electroless copper

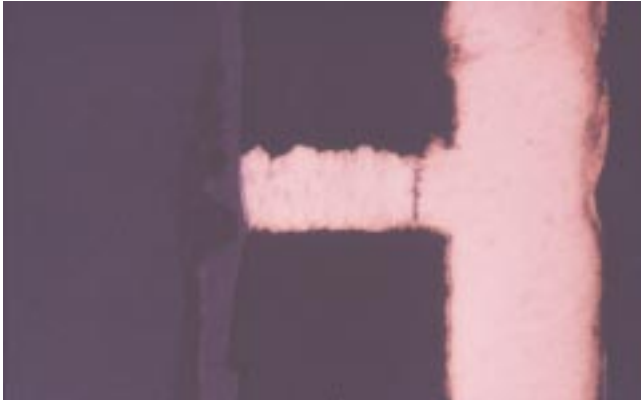


G-21 Plating void
Barrel crack

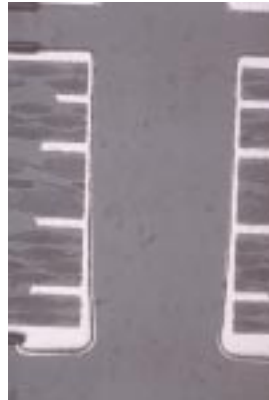


G-24 Etchback (positive)

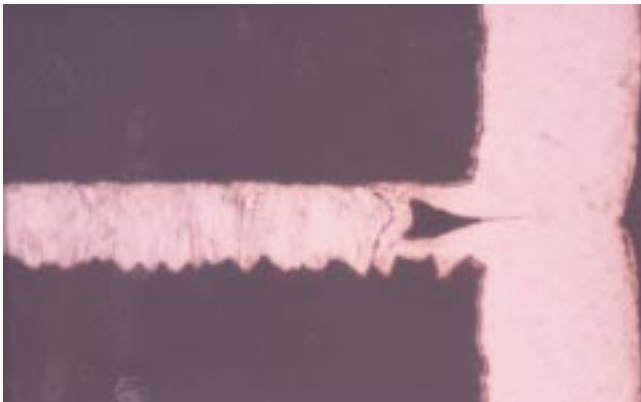
G — PLATED-THROUGH HOLES (continued)



G-25 Negative etchback



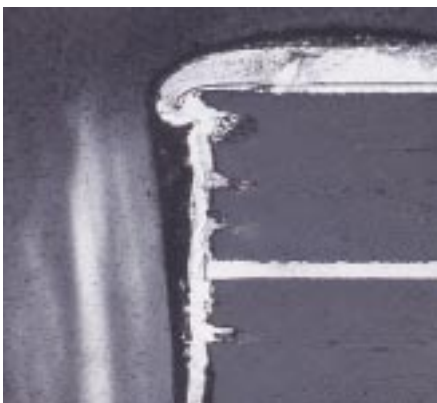
G-28 Taper plating



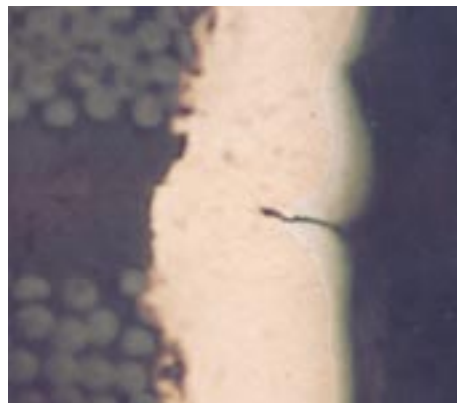
G-26 Negative etchback with plating fold and occlusion



G-29 Blow hole resulting from plating void

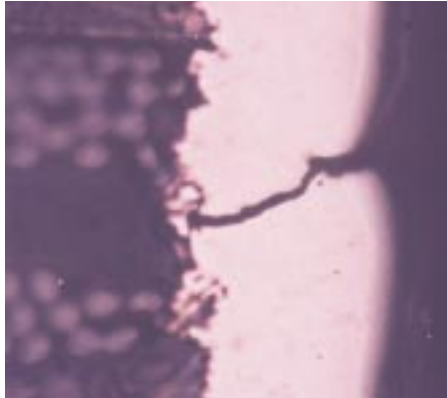


G-27 Plating fold
Plating nodule

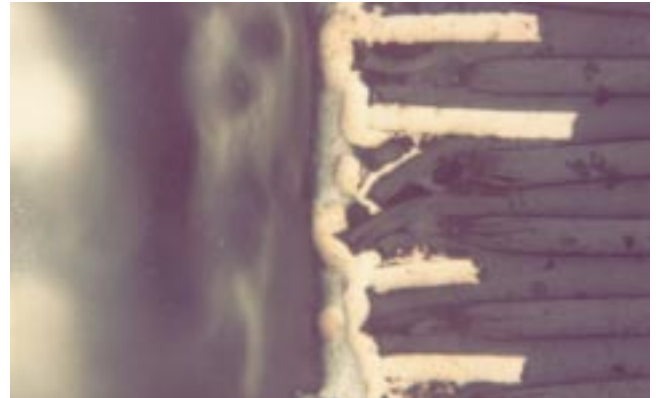


G-30 Barrel crack

G — PLATED-THROUGH HOLES (continued)



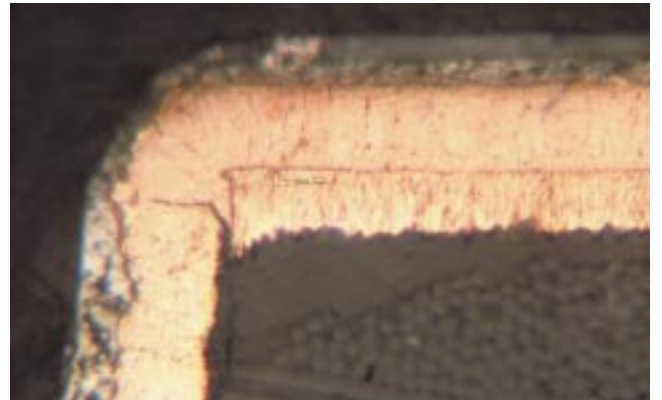
G-31 Barrel crack



G-34 Flex plating voids, severe damage of flex substrate
Gross dielectric damage



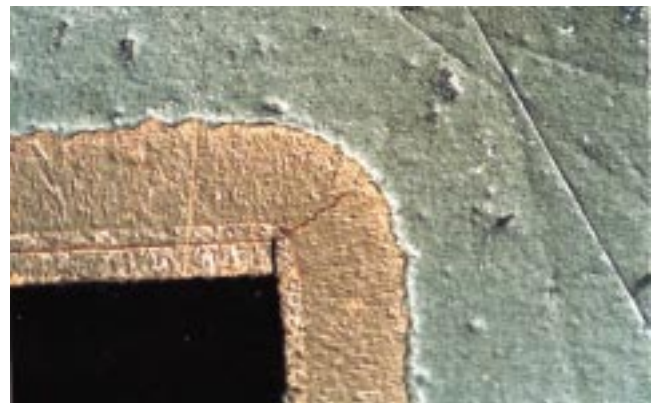
G-32 Flex barrel crack



G-35 Plating crack

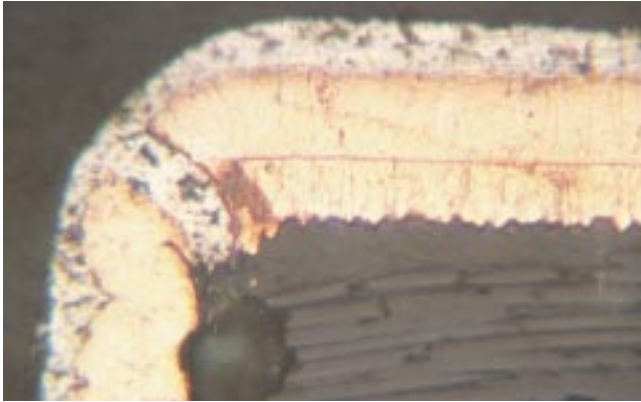


G-33 Flex plating voids

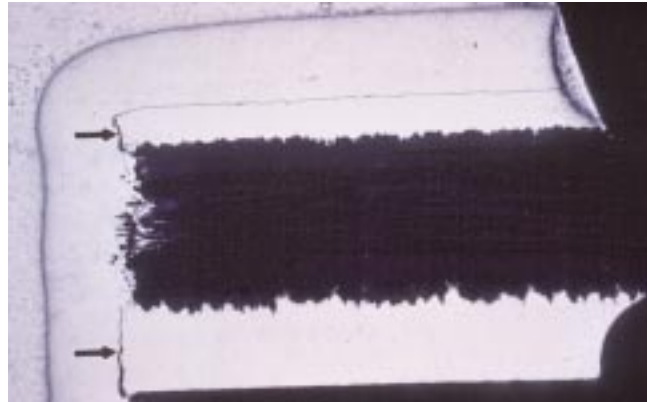


G-36 Corner crack

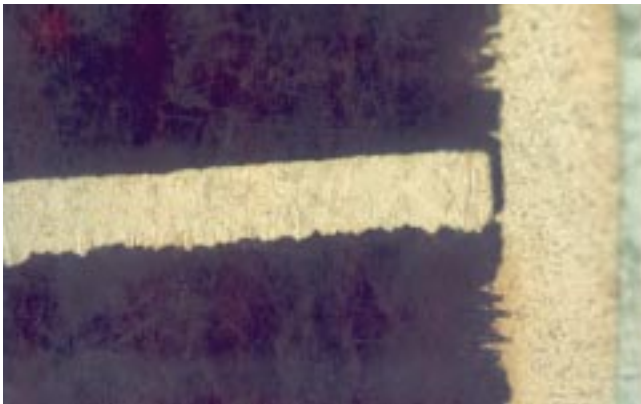
G — PLATED-THROUGH HOLES (continued)



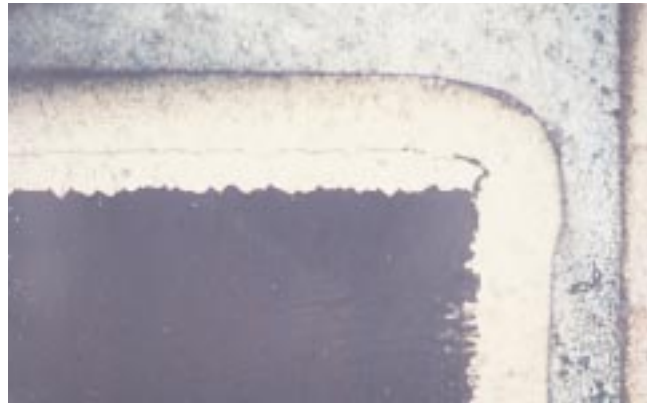
G-37 Severe corner crack



G-40 Separation along edge of external foil (top arrow)
Interplane separation (lower arrow)



G-38 Interplane separation



G-41 Plating separation (extending beyond vertical edge
of external foil)



G-39 Interplane separation



G-42 Plating fold, inclusion, and nodule

G — PLATED-THROUGH HOLES (continued)



G-43 Plating anomaly



G-46 Horizontal microsection
Pink ring



G-44 Plating anomaly

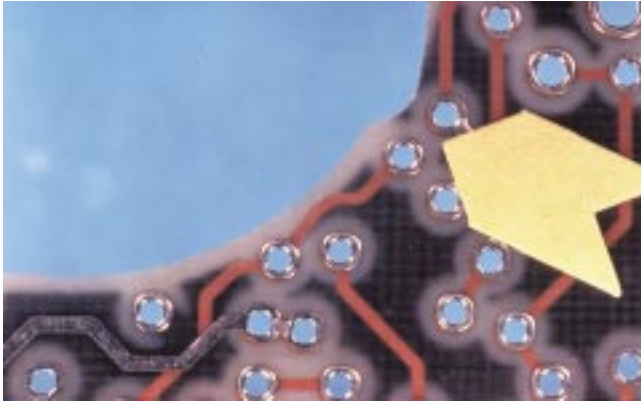


G-47 Horizontal microsection
Plating anomaly

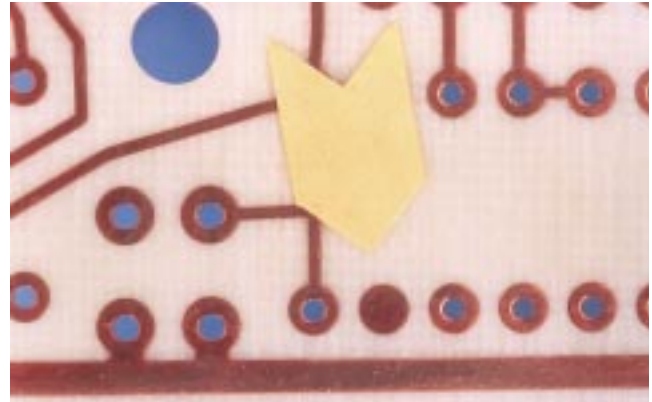


G-45 Plating anomaly

H — MACHINING



H-1 Machining inconsistencies



H-4 Missing hole



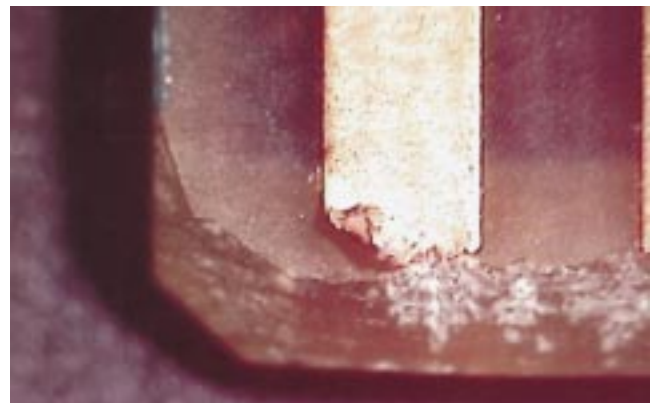
H-2 Slot (protruding fibers)



H-5 Burr (drilling)



H-3 Rough edges



H-6 Edge condition - burrs (routing)

H — MACHINING (continued)



H-7 Nicked edge on printed contact

J — FLATNESS



J-1 Twist

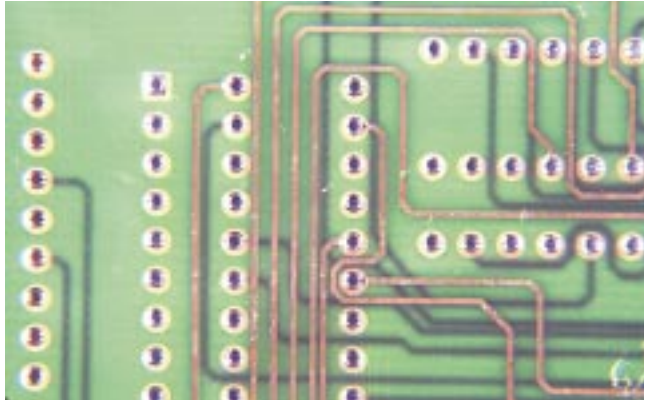


J-2 Bow and twist

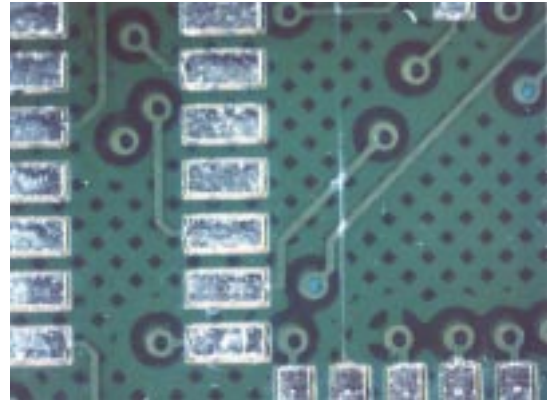


J-3 Bow and twist

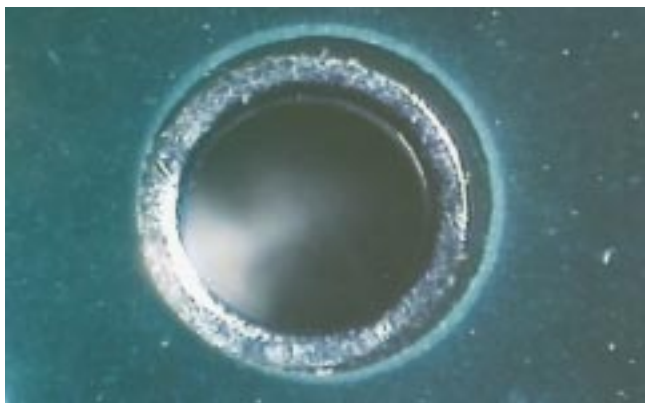
K — SOLDER RESIST (Mask)



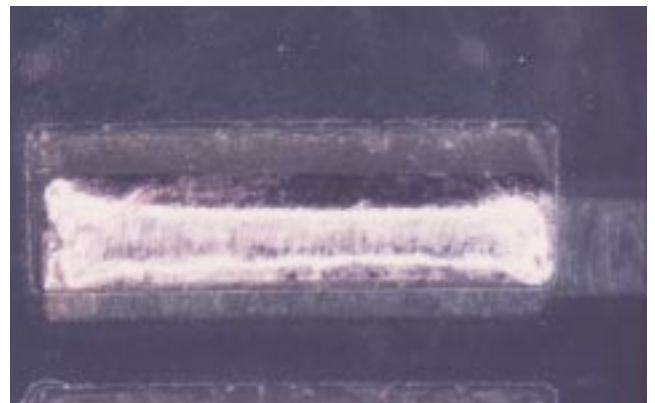
K-1 Typical solder resist



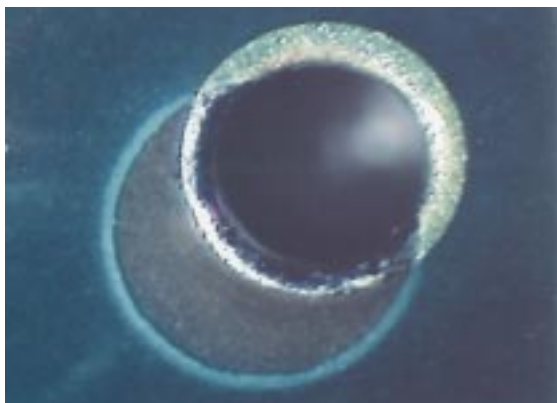
K-4 Solder resist misregistration, surface mount



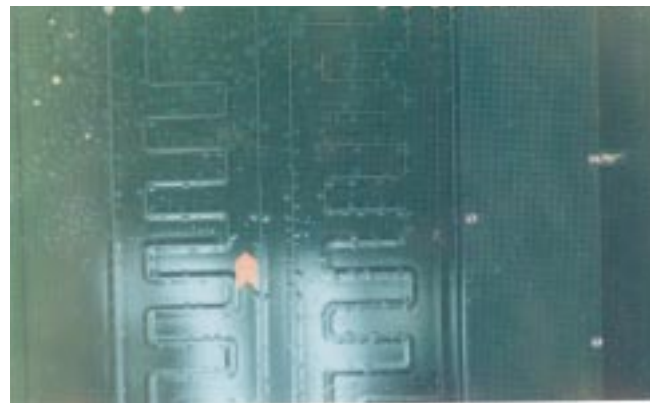
K-2 Solder resist misregistration



K-5 Solder resist misregistration, surface mount

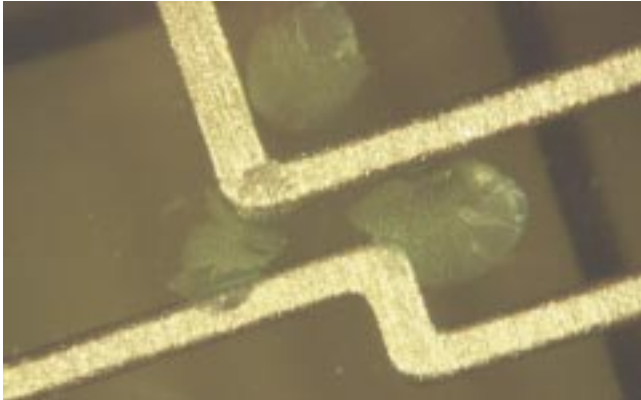


K-3 Solder resist misregistration

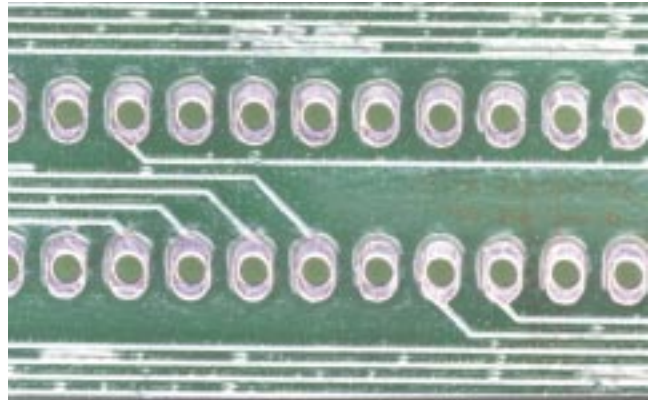


K-6 Solder resist blisters

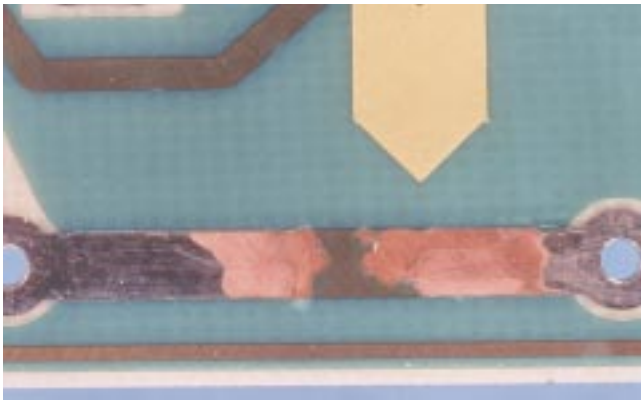
K — SOLDER RESIST (Mask) (continued)



K-7 Solder resist blisters/delamination



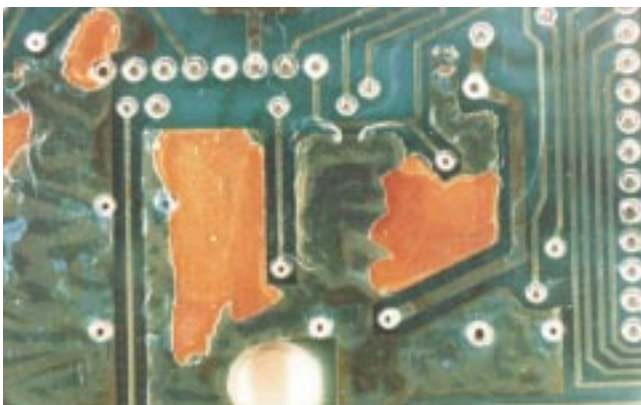
K-10 Skip coverage - solder resist bubbles



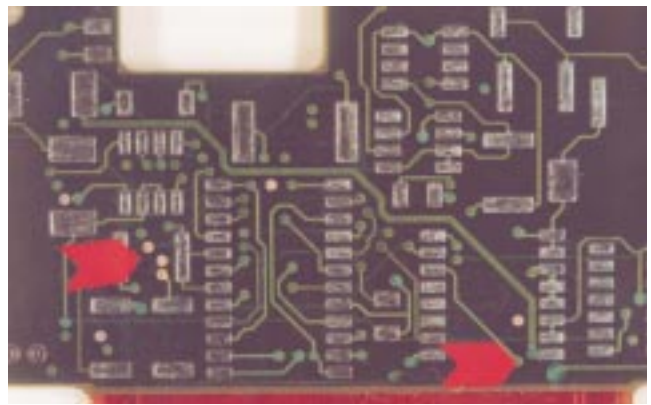
K-8 Flaking/peeling



K-11 Waves/ripples/wrinkles

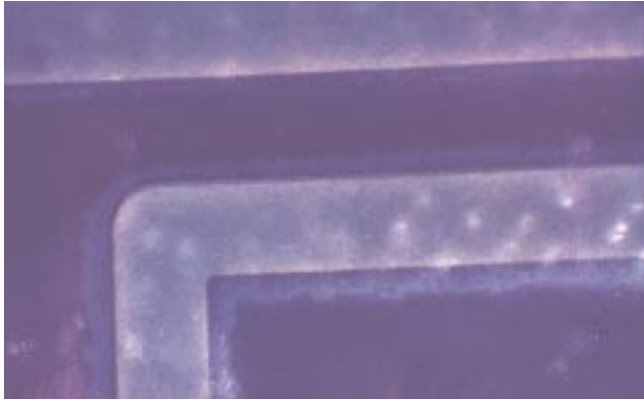


K-9 Flaking/peeling



K-12 Incomplete via tenting

K — SOLDER RESIST (Mask) (continued)



K-13 Soda strawing

L — MARKING



L-1 Good ink marking



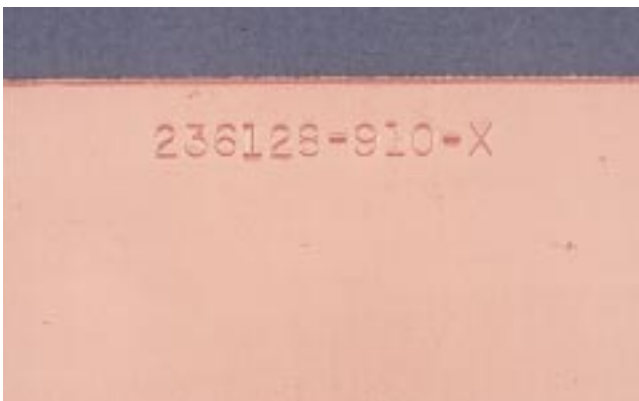
L-4 Impression stamped (illegible)



L-2 Smearred marking



L-5 Etched marking

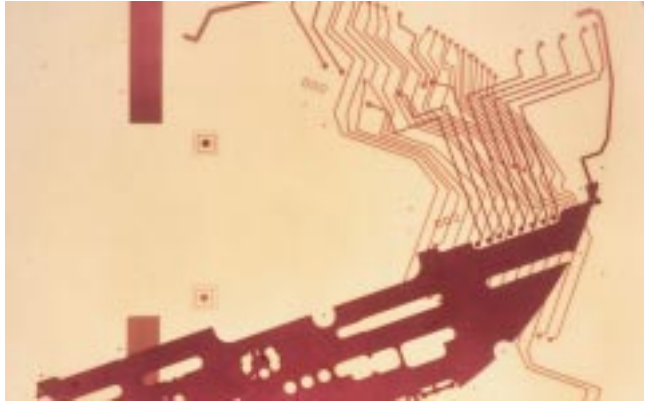


L-3 Impression stamp marking

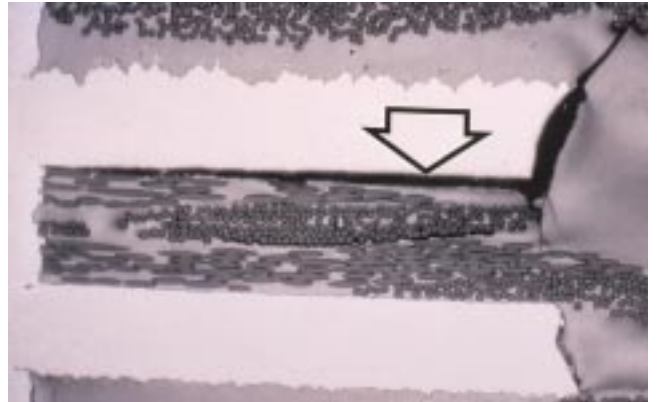


L-6 Etched marking (missing)

M — RIGID MULTILAYERS



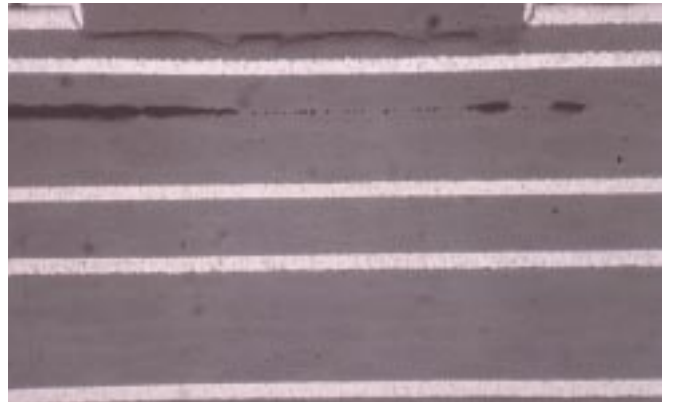
M-1 Innerlayer image reversed



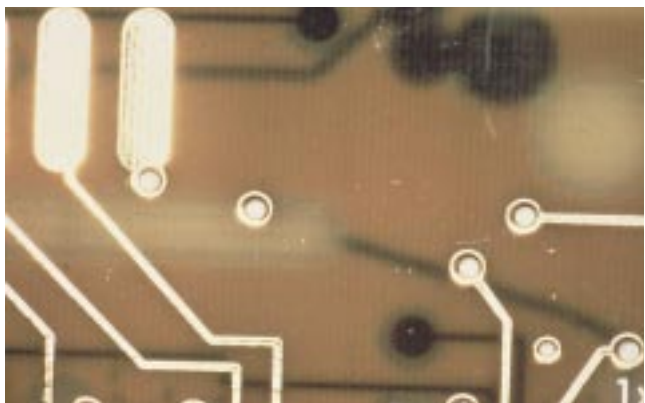
M-4 Delamination (thermal zone)



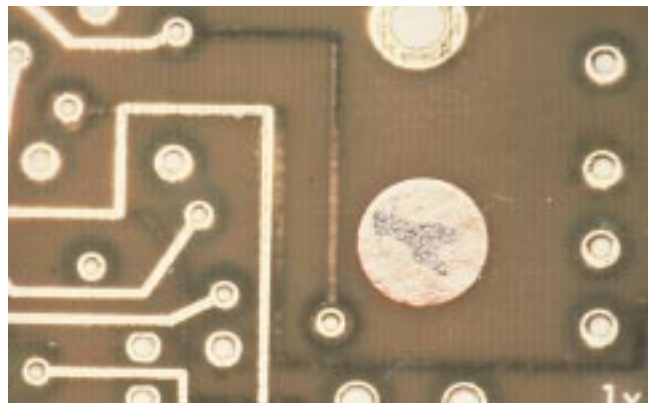
M-2 Wrong layup, multilayer board



M-5 Internal laminate delamination in prepreg area

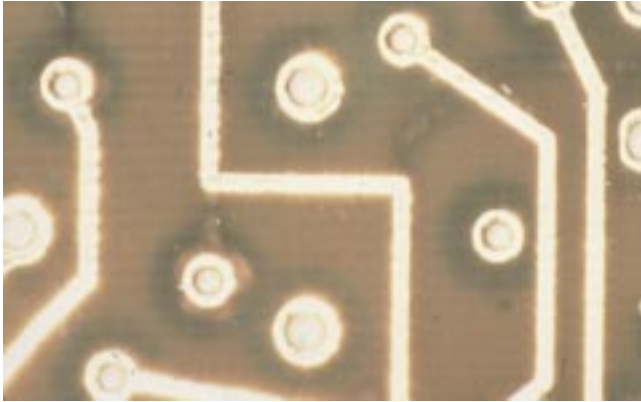


M-3 Wrong layup, multilayer board

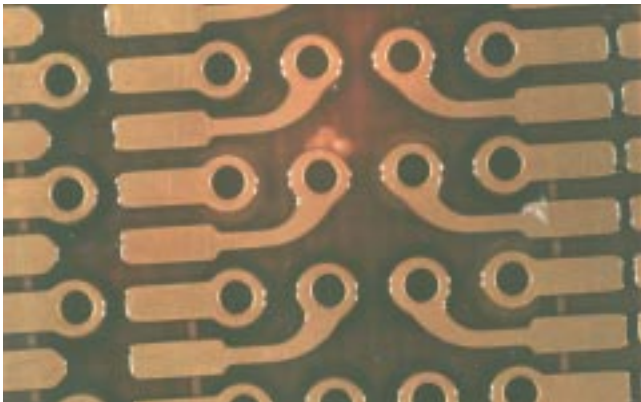


M-6 Missing or discolored oxide

M — RIGID MULTILAYERS (continued)

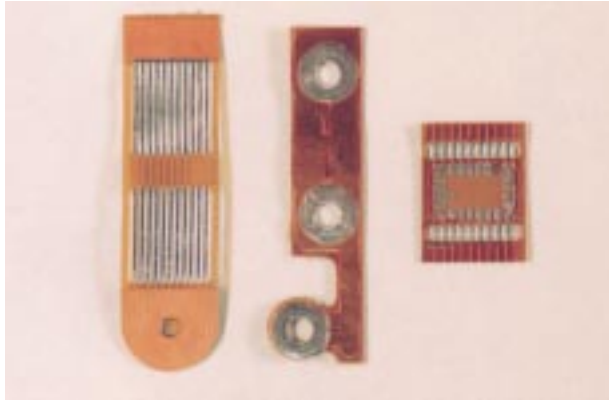


M-7 Pink ring



M-8 Pink ring

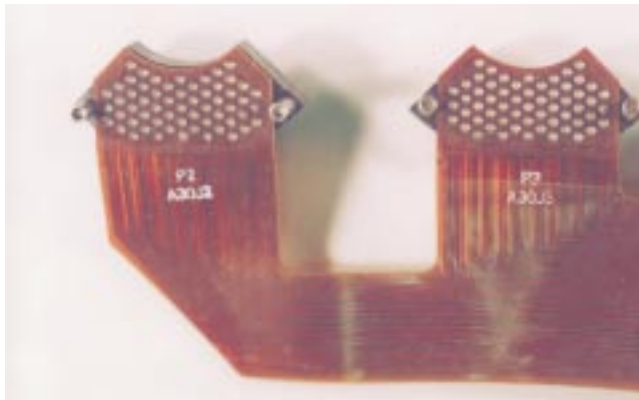
N — FLEXIBLE/RIGID-FLEX



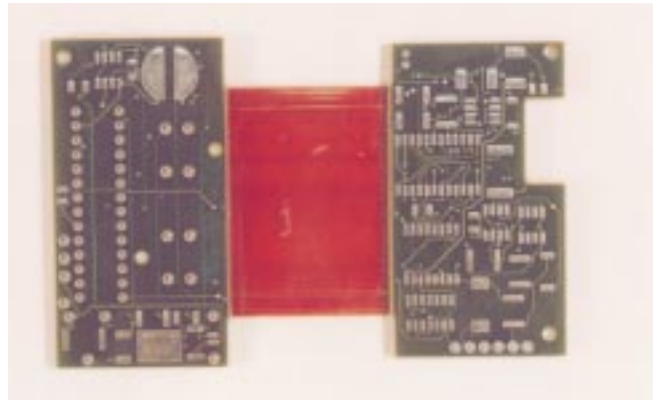
N-1 Typical flex



N-4 Poor trimming



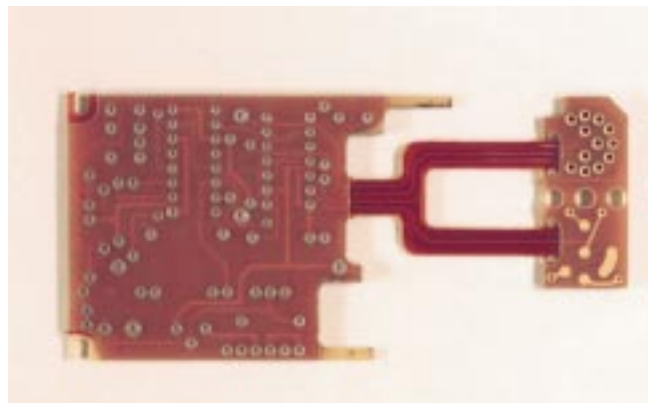
N-2 Typical flex (with stiffener)



N-5 Typical rigid-flex

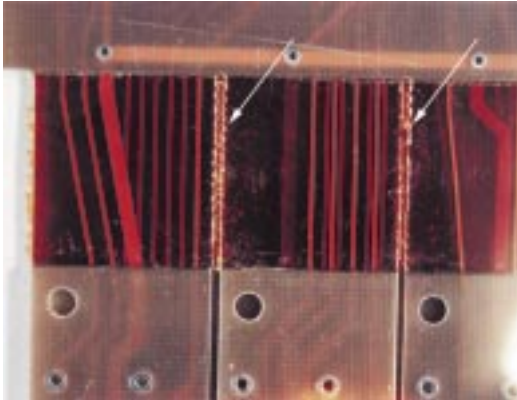


N-3 Poor trimming

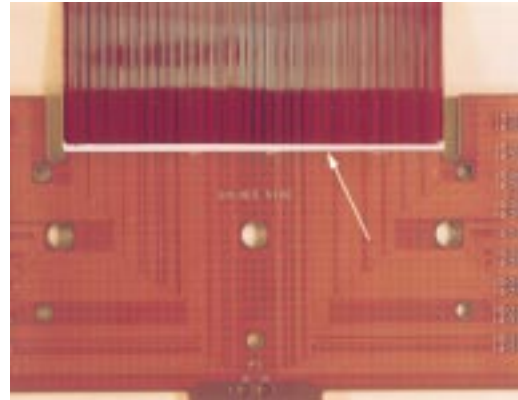


N-6 Typical rigid-flex

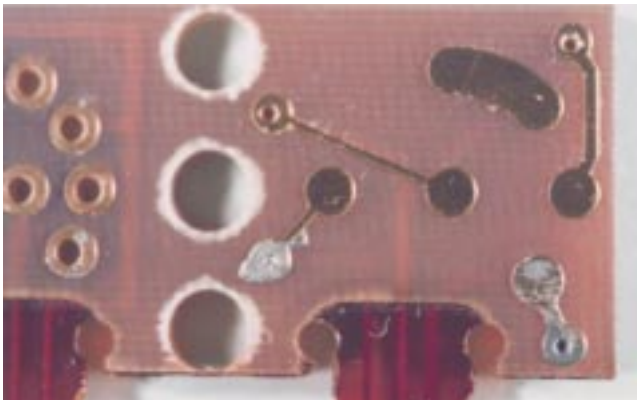
N — FLEXIBLE/RIGID-FLEX (continued)



N-7 Trimming burrs



N-10 Strain relief



N-8 Rigid-flex anomalies (unsupported hole haloling, solder on gold, trimming burrs, etc.)

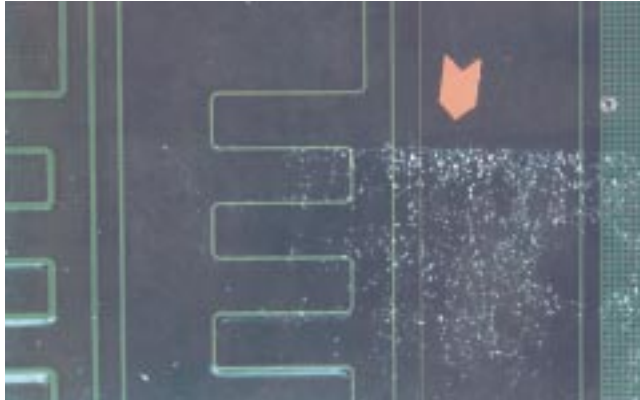


N-11 Foreign material in covercoat

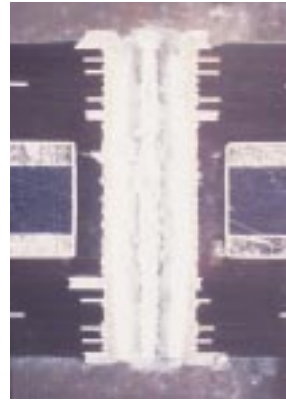


N-9 Soda strawing

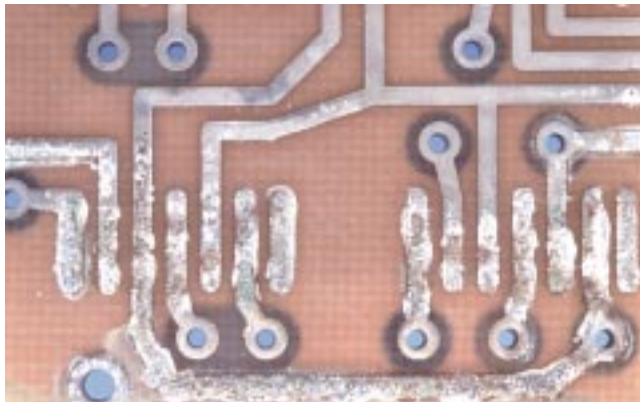
P — MISCELLANEOUS



P-1 Tape residue



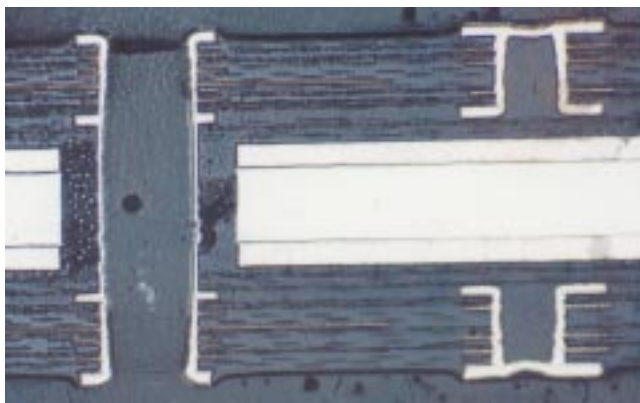
P-4 Metal core through-hole



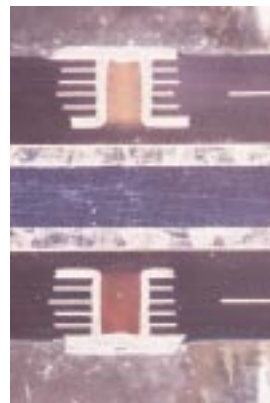
P-2 Corrosion



P-5 Void in backfill dielectric material of metal core board
Plating crack



P-3 Metal core board with through-hole and blind vias

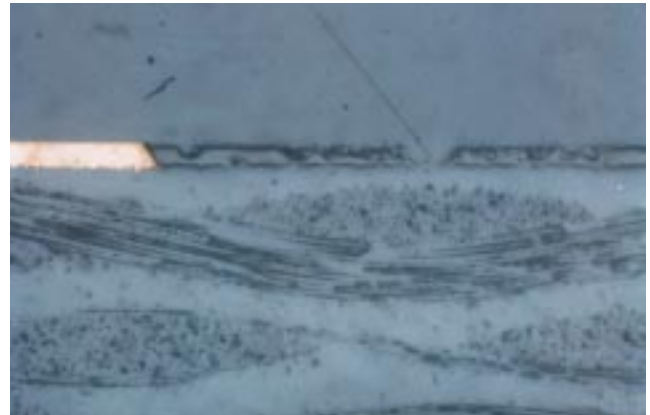


P-6 Blind via

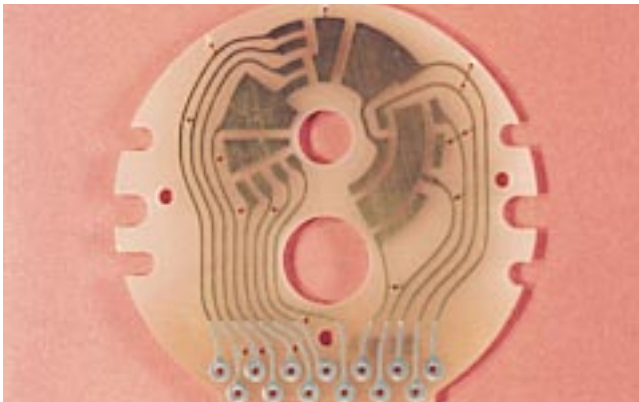
P — MISCELLANEOUS (continued)



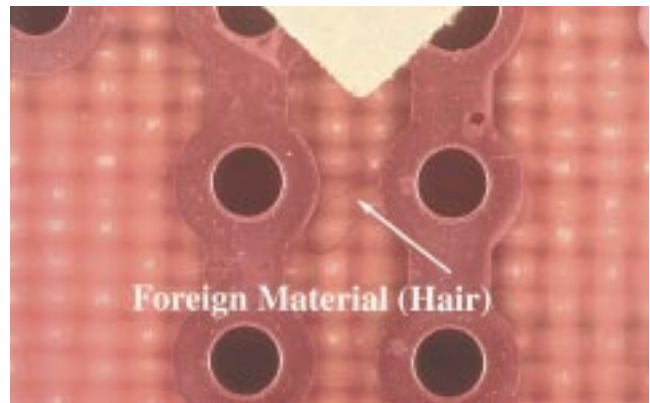
P-7 Burr on metal core



P-10 Uneven resin fill flush circuit



P-8 Typical flush circuit



P-11 Foreign material - hair

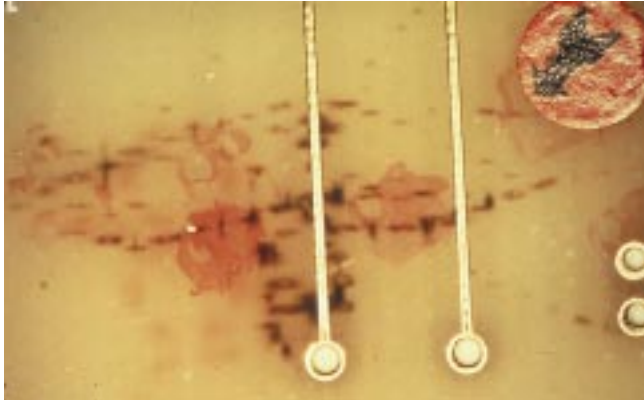


P-9 Typical flush microsection

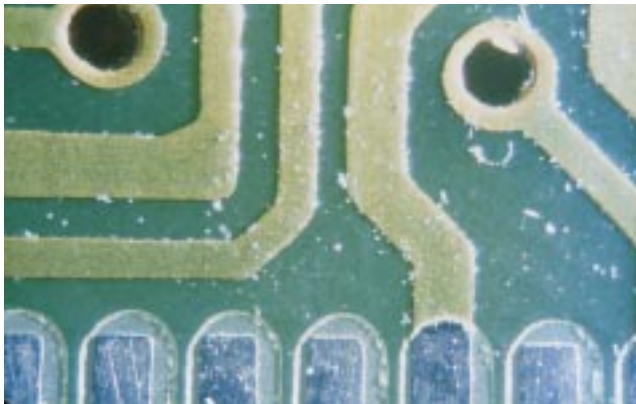


P-12 Foreign material - hair

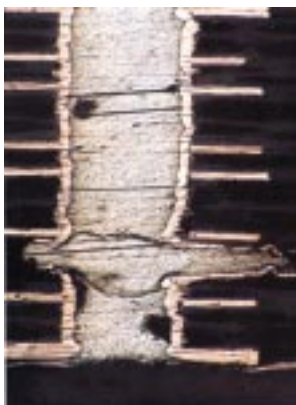
P — MISCELLANEOUS (continued)



P-13 Foreign material - stained



P-14 Surface contamination



P-15 Gross multiple problems

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Standard Improvement Form

IPC-QE-605A

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

IPC
2215 Sanders Road
Northbrook, IL 60062-6135
Fax 847 509.9798

1. I recommend changes to the following:

- Requirement, paragraph number _____
- Test Method number _____, paragraph number _____

The referenced paragraph number has proven to be:

- Unclear
- Too Rigid
- In Error
- Other _____

2. Recommendations for correction:

3. Other suggestions for document improvement:

Submitted by:

Name _____ Telephone _____

Company _____ E-mail _____

Address _____

City/State/Zip _____ Date _____

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ANSI/IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits Definition Submission/Approval Sheet

The purpose of this form is to keep current with terms routinely used in the industry and their definitions. Individuals or companies are invited to comment. Please complete this form and return to:

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Northbrook, IL 60062-6135
Fax: 847 509.9798

SUBMITTOR INFORMATION:

Name: _____
Company: _____
City: _____
State/Zip: _____
Telephone: _____
Date: _____

- This is a **NEW** term and definition being submitted.
- This is an **ADDITION** to an existing term and definition(s).
- This is a **CHANGE** to an existing definition.

Term	Definition

If space not adequate, use reverse side or attach additional sheet(s).

Artwork: Not Applicable Required To be supplied

Included: Electronic File Name: _____

Document(s) to which this term applies: _____

Committees affected by this term: _____

Office Use	
IPC Office	Committee 2-30
Date Received: _____	Date of Initial Review: _____
Comments Collated: _____	Comment Resolution: _____
Returned for Action: _____	Committee Action: <input type="checkbox"/> Accepted <input type="checkbox"/> Rejected
Revision Inclusion: _____	<input type="checkbox"/> Accept Modify

IEC Classification
Classification Code • Serial Number
Terms and Definition Committee Final Approval Authorization: Committee 2-30 has approved the above term for release in the next revision.
Name: _____ Committee: <u>IPC 2-30</u> Date: _____

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Technical Questions

The IPC staff will research your technical question and attempt to find an appropriate specification interpretation or technical response. Please send your technical query to the technical department via:

tel 847/509-9700 fax 847/509-9798
 www.ipc.org e-mail: answers@ipc.org

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IPC technical forums are opportunities to network on the Internet. It's the best way to get the help you need today! Over 2,500 people are already taking advantage of the excellent peer networking available through e-mail forums provided by IPC. Members use them to get timely, relevant answers to their technical questions.

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ChipNet forum is for discussion of flip chip and related chip scale semiconductor packaging technologies. It is cosponsored by the National Electronics Manufacturing Initiative (NEMI).

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ComplianceNet forum covers environmental, safety and related regulations or issues.

DesignerCouncil@ipc.org

Designers Council forum covers information on upcoming IPC Designers Council activities as well as information, comment, and feedback on current design issues, local chapter meetings, new chapters forming, and other design topics.

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The IPC Roadmap forum is the communication vehicle used by members of the Technical Working Groups (TWGs) who develop the IPC National Technology Roadmap for Electronic Interconnections.

IPCsm840@ipc.org

This peer networking forum is specific to solder mask qualification and use.

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The associated e-mail message text will be distributed to everyone on the list, including the sender. Further information on how to access previous messages sent to the forums will be provided upon subscribing.

For more information, contact Hugo Scaramuzza
 tel 847/790-5312 fax 847/509-9798
 e-mail: scarhu@ipc.org www.ipc.org/html/forum.htm

IPC World Wide Web Page www.ipc.org

Our home page provides access to information about upcoming events, publications and videos, membership, and industry activities and services. Visit soon and often.

Education and Training

IPC conducts local educational workshops and national conferences to help you better understand emerging technologies. National conferences have covered Ball Grid Array and Flip Chip/Chip Scale Packaging. Some workshop topics include:

Printed Wiring Board Fundamentals	High Speed Design
Troubleshooting the PWB Manufacturing Process	Design for Manufacturability
Choosing the Right Base Material Laminate	Design for Assembly
Acceptability of Printed Boards	Designers Certification Preparation
New Design Standards	

IPC video tapes and CD-ROMs can increase your industry know-how and on the job effectiveness.

For more information on programs, contact John Riley

tel 847/790-5308 fax 847/509-9798
e-mail: rilejo@ipc.org www.ipc.org

For more information on IPC Video/CD Training, contact Mark Pritchard

tel 505/758-7937 ext. 202 fax 505/758-7938
e-mail: markp@ipcvideo.org
www.ipc.org

Training and Certification

IPC-A-610 Training and Certification Program

"The Acceptability of Electronic Assemblies" (ANSI/IPC-A-610) is the most widely used specification for the PWB assembly industry. An industry consensus Training and Certification program based on the IPC-A-610 is available to your company.

For more information, contact John Riley

tel 847/790-5308 fax 847/509-9798
e-mail: rilejo@ipc.org www.ipc.org/html/610.htm

IPC Printed Circuits Expo

IPC Printed Circuits Expo is the largest trade exhibition in North America devoted to the PWB industry. Over 90 technical presentations make up this superior technical conference.



March 16-18, 1999
Long Beach, California



April 4-6, 2000
San Diego, California

For exhibitor information,
Contact: Ken Romeo
tel 630-434-7779

For registration information:
tel 847/790-5361 fax 847/509-9798
e-mail: registration@ipc.org www.ipc.org

How to Get Involved

The first step is to join IPC. An application for membership can be found on page 74. Once you become a member, the opportunities to enhance your competitiveness are vast. Join a technical committee and learn from our industry's best while you help develop the standards for our industry. Participate in market research programs which forecast the future of our industry. Participate in Capitol Hill Day and lobby your Congressmen and Senators for better industry support. Pick from a wide variety of educational opportunities: workshops, tutorials, and conferences. More up-to-date details on IPC opportunities can be found on our web page: www.ipc.org

For information on how to get involved, contact:

Jeanette Ferdman, Membership Manager
tel 847/790-5309 fax 847/509-9798
e-mail: JeanetteFerdman@ipc.org
www.ipc.org

Application

for Site Membership

Thank you for your decision to join IPC. IPC Membership is site specific, which means that IPC member benefits are available to all individuals employed at the site designated on the other side of this application.

PLEASE CHECK
APPROPRIATE
CATEGORY

To help IPC serve your member site in the most efficient manner possible, please tell us what your facility does by choosing the most appropriate member category.

■
INDEPENDENT
PRINTED
BOARD
MANUFACTURERS

Our facility manufactures and sells to other companies, printed wiring boards or other electronic interconnection products on the merchant market.

WHAT PRODUCTS DO YOU
MAKE FOR SALE?

- | | | |
|---|--|--|
| <input type="checkbox"/> One-sided and two-sided rigid printed boards | <input type="checkbox"/> Flexible printed boards | <input type="checkbox"/> Discrete wiring devices |
| <input type="checkbox"/> Multilayer printed boards | <input type="checkbox"/> Flat cable | <input type="checkbox"/> Other interconnections |
| | <input type="checkbox"/> Hybrid circuits | |

Name of Chief Executive Officer/President _____

■
INDEPENDENT
PRINTED BOARD
ASSEMBLERS
EMSI
COMPANIES

Our facility assembles printed wiring boards on a contract basis and/or offers other electronic interconnection products for sale.

- | | | |
|--|---|--------------------------------------|
| <input type="checkbox"/> Turnkey | <input type="checkbox"/> Through-hole | <input type="checkbox"/> Consignment |
| <input type="checkbox"/> SMT | <input type="checkbox"/> Mixed Technology | <input type="checkbox"/> BGA |
| <input type="checkbox"/> Chip Scale Technology | | |

Name of Chief Executive Officer/President _____

■
OEM –
MANUFACTURERS
OF ANY END
PRODUCT USING
PCB/PCAs
OR CAPTIVE
MANUFACTURERS
OF PCBs/PCAs

Our facility purchases, uses and/or manufactures printed wiring boards or other electronic interconnection products for our own use in a final product. Also known as original equipment manufacturers (OEM).

IS YOUR INTEREST IN:

- purchasing/manufacture of printed circuit boards
 purchasing/manufacturing printed circuit assemblies

What is your company's main product line? _____

■
INDUSTRY
SUPPLIERS

Our facility supplies raw materials, machinery, equipment or services used in the manufacture or assembly of electronic interconnection products.

What products do you supply? _____

■
GOVERNMENT
AGENCIES/
ACADEMIC
TECHNICAL
LIAISONS

We are representatives of a government agency, university, college, technical institute who are directly concerned with design, research, and utilization of electronic interconnection devices. (Must be a non-profit or not-for-profit organization.)

Please be sure to complete both pages of application.



Application for

Site Membership



Company Name _____

Street Address _____

City _____

State _____

Zip _____

Country _____

Main Phone No. _____

Fax _____

Primary Contact Name _____

Title _____

Mail Stop _____

Phone _____

Fax _____

e-mail _____

Senior Management Contact _____

Title _____

Mail Stop _____

Phone _____

Fax _____

e-mail _____

Please check one:

- \$1,000.00 Annual dues for Primary Site Membership (Twelve months of IPC membership begins from the time the application and payment are received)
- \$800.00 Annual dues for Additional Facility Membership: Additional membership for a site within an organization where another site is considered to be the primary IPC member.
- \$600.00** Annual dues for an independent PCB/PWA fabricator or independent EMSI provider with annual sales of less than \$1,000,000.00. **Please provide proof of annual sales.
- \$250.00 Annual dues for Government Agency/University/not-for-profit organization

TMRC Membership Please send me information on Membership in the Technology Marketing Research Council (TMRC)

AMRC Membership Please send me information for Membership in the Assembly Marketing Research Council (AMRC)

Payment Information

Enclosed is our check for \$ _____

Please bill my credit card: (circle one) MC AMEX VISA DINERS

Card No. _____ Exp date _____

Authorized Signature _____

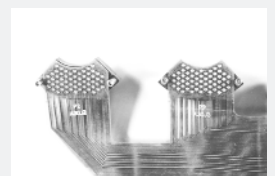
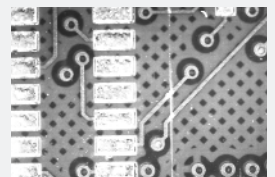
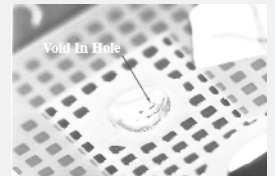
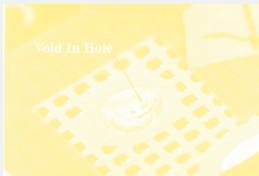
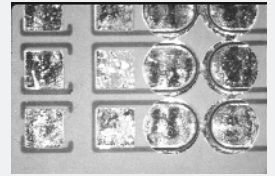
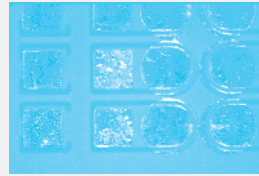
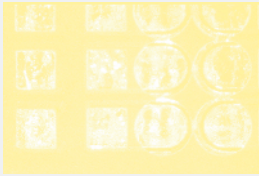
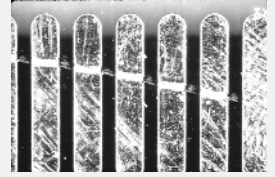
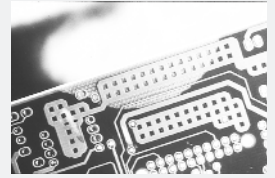
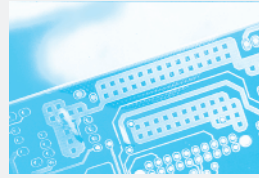
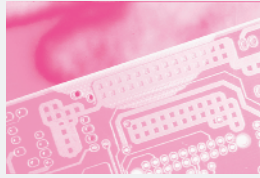
Mail application with
check or money order to:

IPC
Dept. 851-0117W
P.O. Box 94020
Palatine IL 60094-4020

Fax/Mail application with
credit card payment to:

IPC
2215 Sanders Road
Northbrook, IL 60062-6135
Tel: 847 509.9700
Fax: 847 509.9798

PLEASE ATTACH BUSINESS CARD
OF OFFICIAL REPRESENTATIVE HERE



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

2215 Sanders Road, Northbrook, IL 60062-6135
Tel. 847.509.9700 Fax 847.509.9798
www.ipc.org