



# **PCB Fabrication Processes**

Brief Introduction

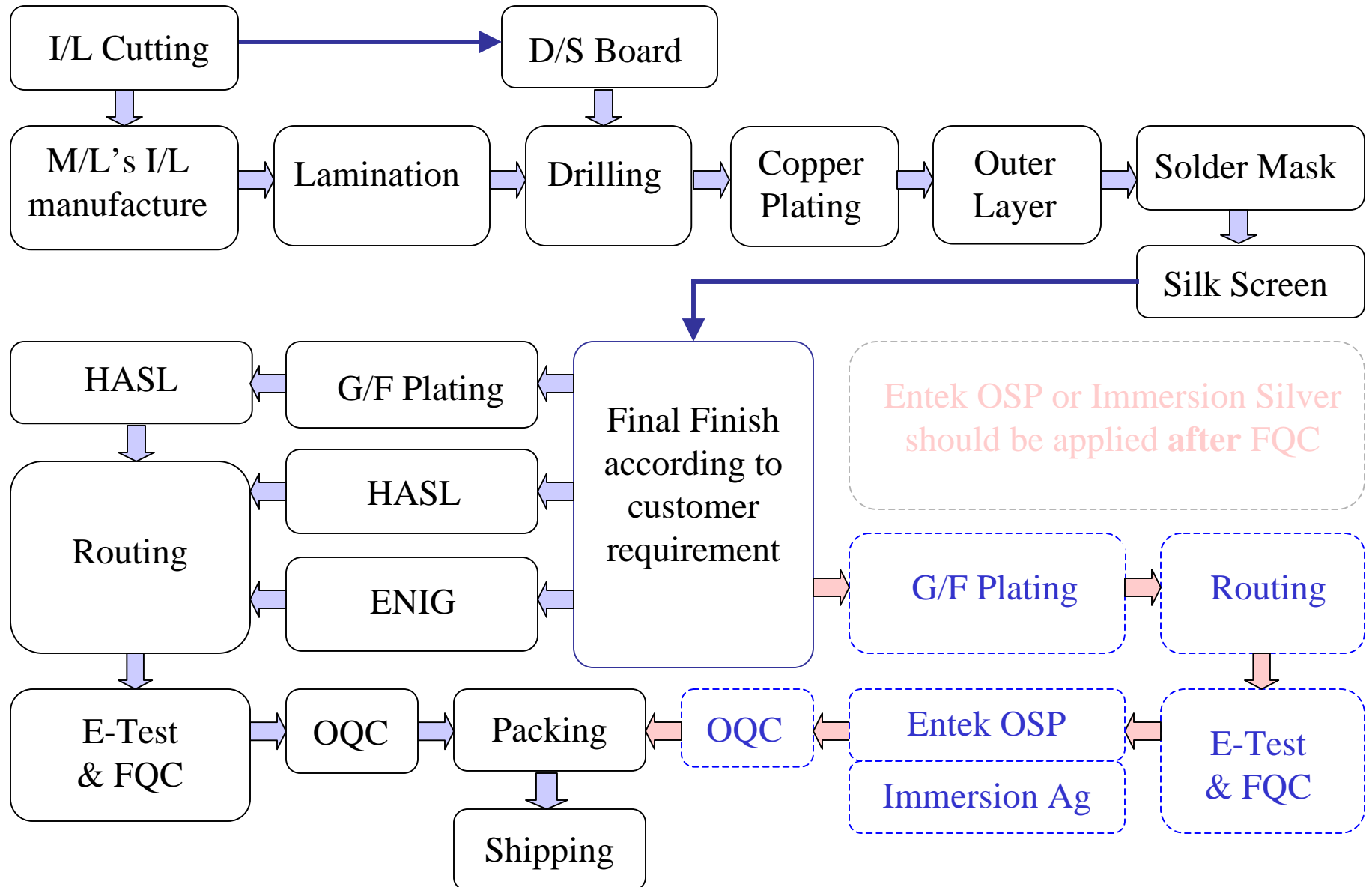
# Contents

PCB Processes Flow Chart .....	(001)	4
1. Inner Layer Processing .....	(002)	5
2. Mass Lamination .....	(032)	7
3. Drilling .....	(058)	10
4. Copper Plating .....	(071)	11
5. Outer Layer Processing.....	(102)	13
6. 1. Solder Mask .....	(123)	15
6. 2. Silk Screen .....	(147)	17
7. 1. Gold Finger Plating .....	(158)	18
7. 2. HASL .....	(173)	20
7. 3. Routing .....	(190)	21
8. Electrical Test & FQC .....	(205)	22

# **PCB Fabrication Processes**

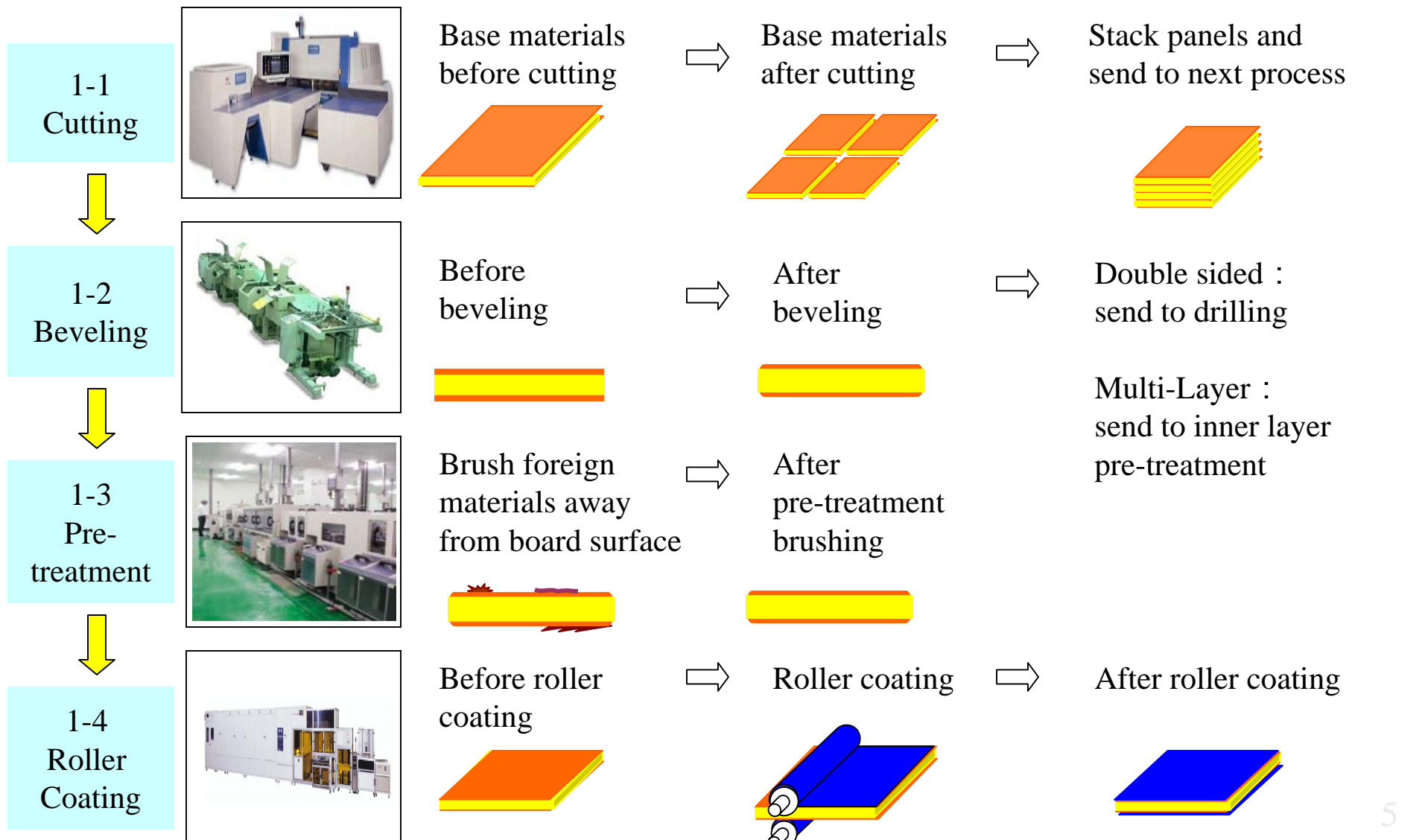
## Brief Introduction

# PCB Processes Flow Chart



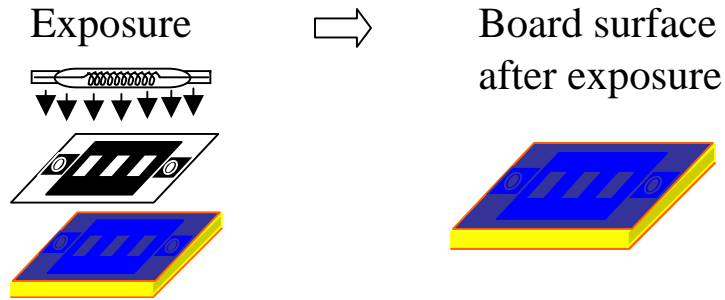
# Inner Layer Processing

I/L Flow      1-1 → 1-2 → 1-3 → 1-4 → 1-5 → 1-6 → 1-7  
 Cutting      Beveling      Pre-treatment      Roller Coating      Exposure      DES Line      I/L holes

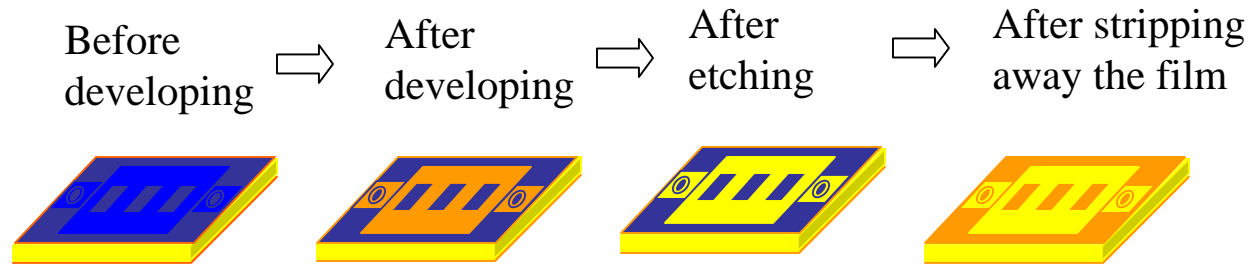


# Inner Layer Processing (continued)

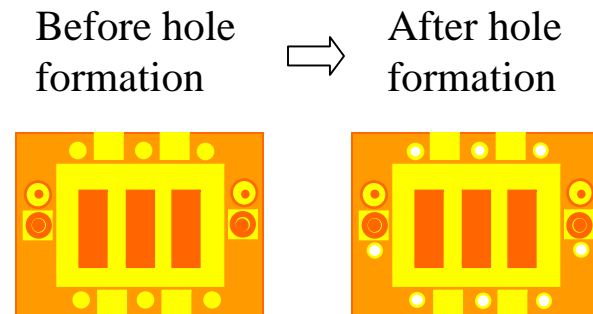
1-5  
Exposure



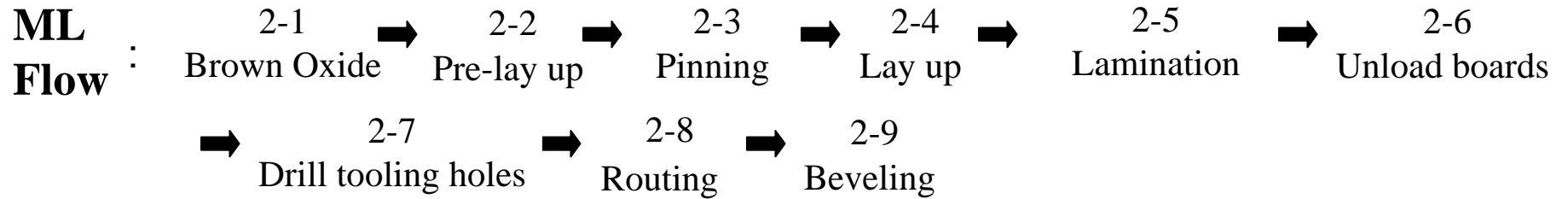
1-6  
DES Line



1-7  
I/L holes



# Mass Lamination Process



2-1  
Brown Oxide



2-2  
Pre Lay-up



Inner layer surface before brown oxidation → Inner layer surface after brown oxidation

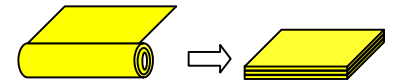


Cut prepreg before pre-layup

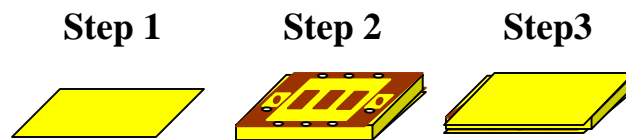
PrePreg Cutting



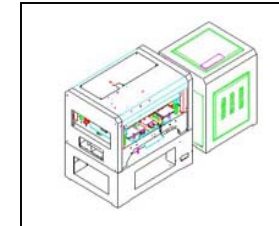
P/P roll is cut into pieces to prepare for pre-lay up



Multilayer board procedure:



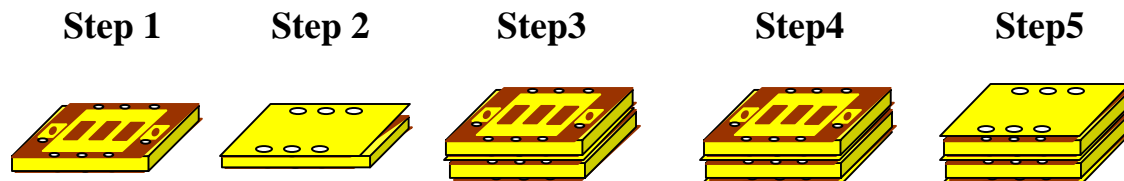
PrePreg Hole Punching



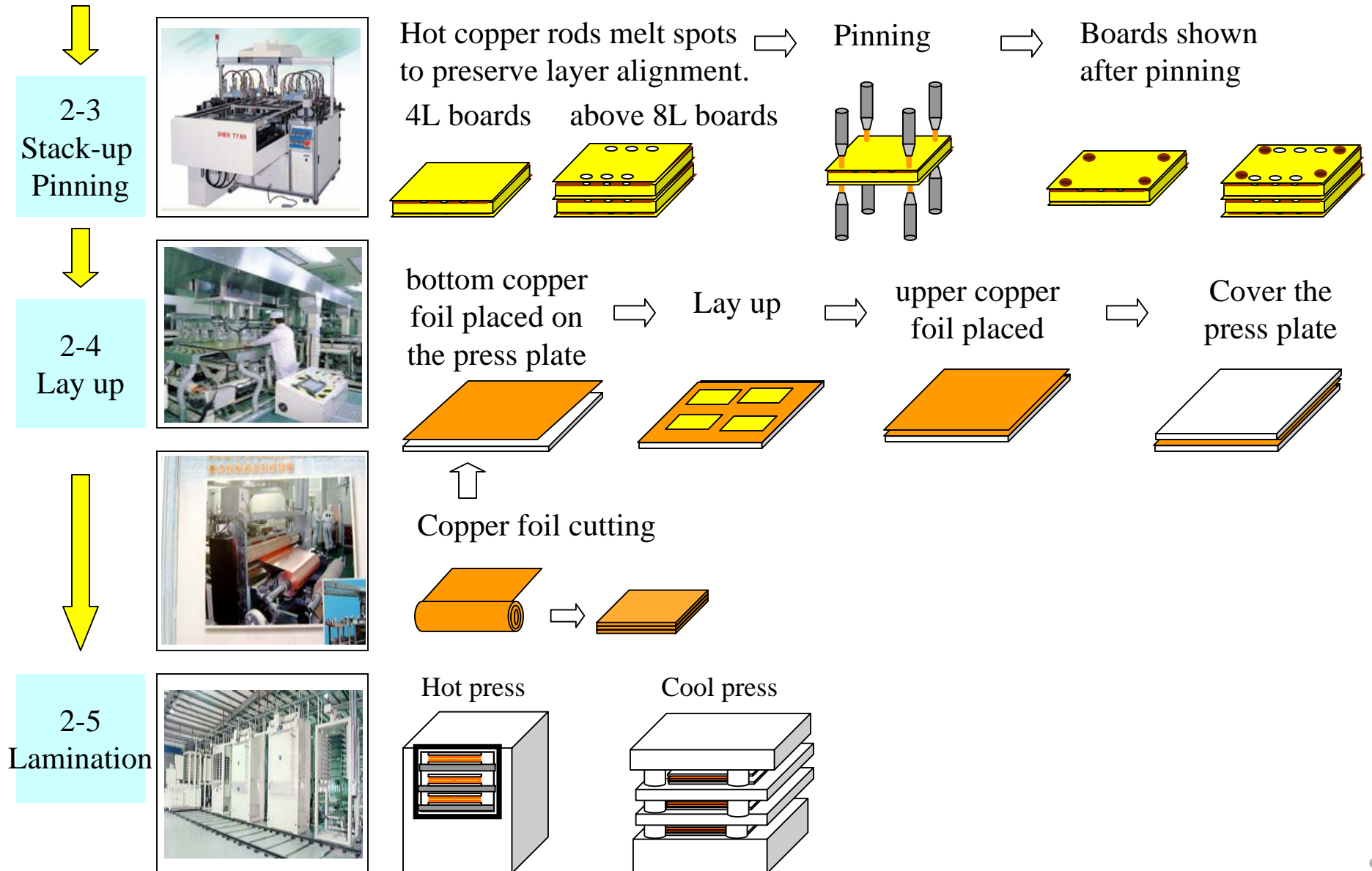
punch the holes used for lamination



Above 8L boards should punch holes before pre-lay up procedure.



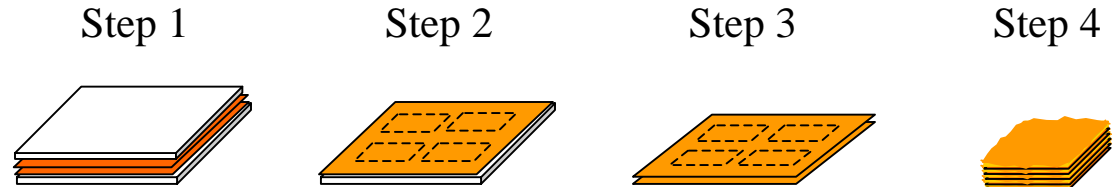
# Mass Lamination (continued)





# Mass Lamination (continued)

↓  
2-6  
Unload  
boards

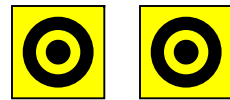


↓  
2-7  
Drill  
target  
holes



X-ray target  
hole drilling

⇒ Board surface after  
X-ray drilling

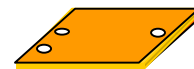


↓  
2-8  
Routing

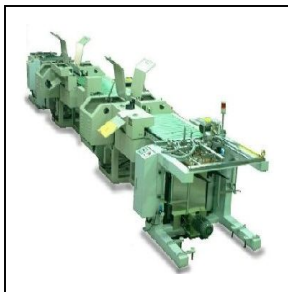


Before  
routing

⇒ After  
routing

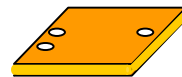


↓  
2-9  
Beveling



Before  
beveling

⇒ After  
beveling

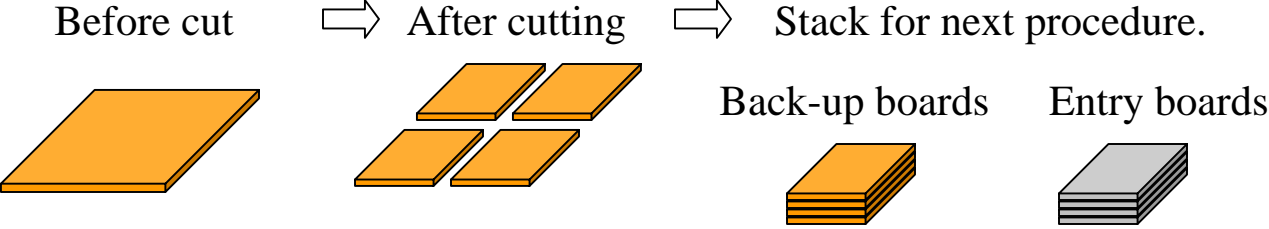


# Drilling Process

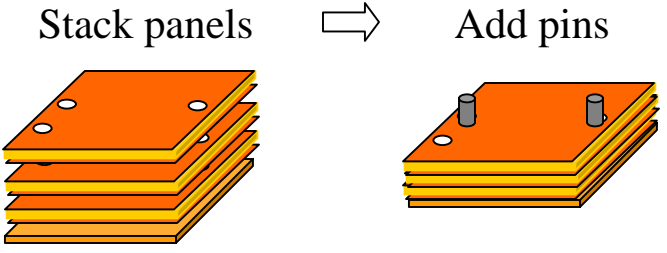
**Drilling Flow**



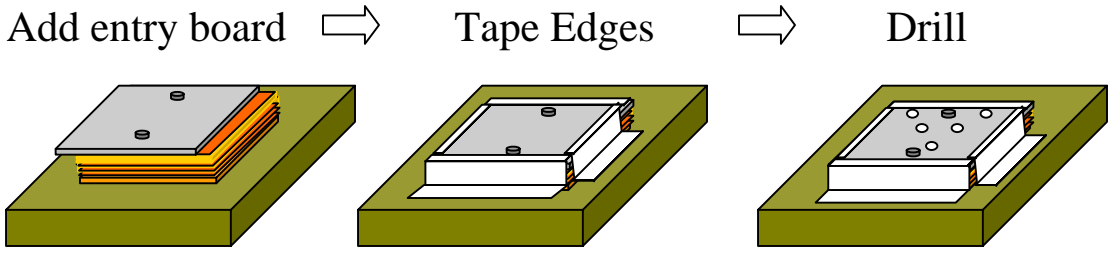
3-1  
Backing & Entry board cutting



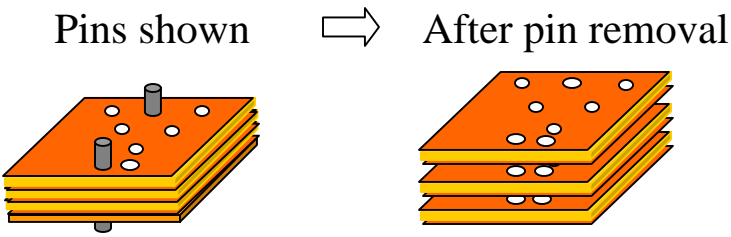
3-2  
Add pins



3-3  
Drilling



3-4  
Pin removal



# Copper Plating

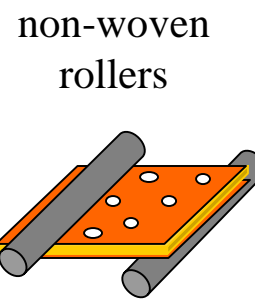
CP Flow : 4-1 Deburr → 4-2 Desmear → 4-3 PTH → 4-4 Copper Plating

4-1  
Deburr



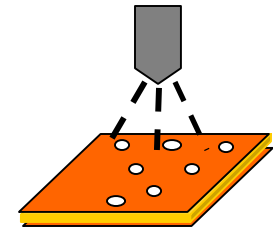
## Deburr pre-treatment:

Use the brushing & high pressure water rinse to clean away the fibers on the board surface and in the holes.



High pressure water rinse

Water column spray pressure 15kg/cm<sup>2</sup>

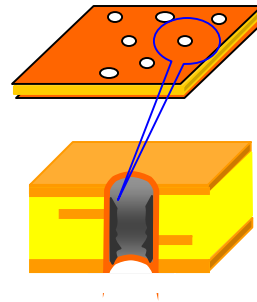


4-2  
Desmear



## 1. Swelling

Dip boards into high temperature alkali bath liquids (which contains organic solvent) to swell the resin smears.



## 2. Desmear

Cleaning away the resin smears attached on the hole wall to expose a clean copper surface.



resin smear on hole wall

hole wall after desmear

# Copper Plating (continued)



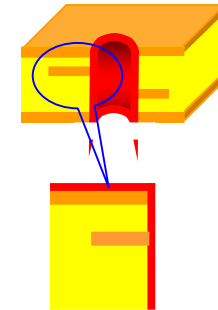
4-3  
PTH



PTH:  
Plated Through Holes  
provide conductive  
connections between  
layers, and mechanical  
support for components

PTH process :

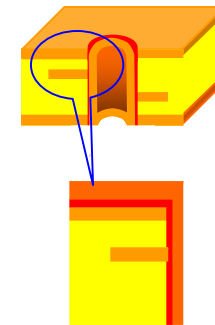
- Desmear
- Hole conditioning
- Micro-etch
- Activation
- Acceleration
- Electroless copper



4-4  
Plating



PTH plating must establish  
minimum hole wall thickness,  
and increase surface copper  
thickness to meet specification  
or customer requirement.



“ — ” indicates Electroless copper plating on base copper and hole wall

“ — ” indicates the plated copper layer

# Outer Layer Processing

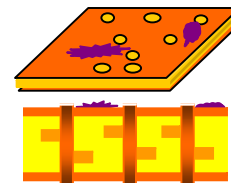


5-1  
Pre-treat

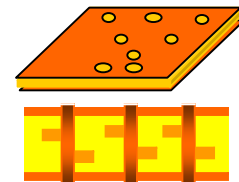


**Pumice Line :**  
Clean foreign material from board surface and roughen board surface to increase adhesion to dry film

Board surface before pre-treat



Board surface after pre-treat



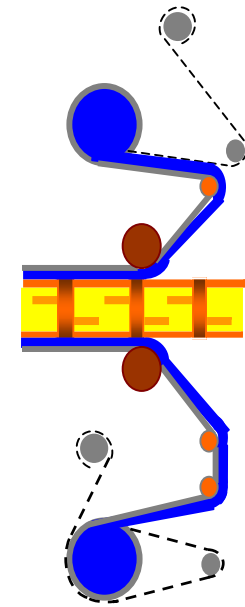
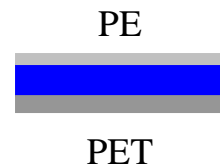
5-2  
Etch Resist



**Dry film :**  
consists of PE film, photopolymer film resist and PET film

**Laminator:**

Heat and sentering press to apply the dry film on the board surface.



# Outer Layers (continued)

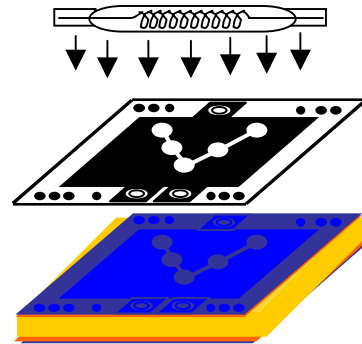


5-3  
Image  
Exposure



## Exposure:

Blue material is light-sensitive, so UV energy will cause a chemical reaction to “cure” the areas that are exposed by the image.



clean room



5-4  
DES Line



Before  
developing



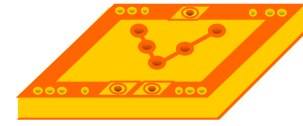
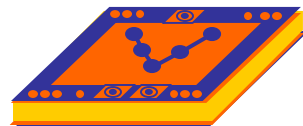
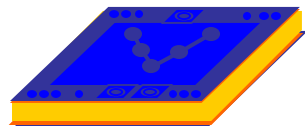
After  
developing



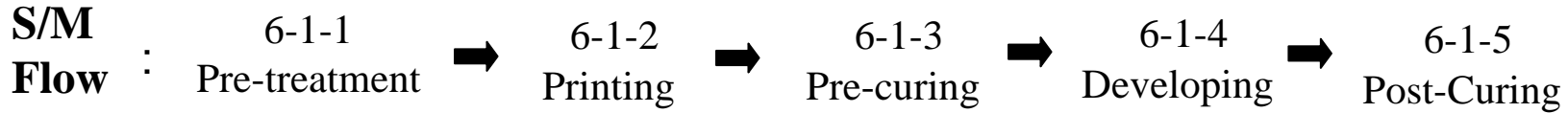
After  
etching



After stripping  
away the film



# Solder Mask Process

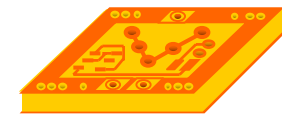
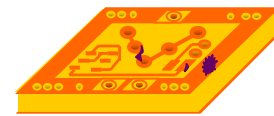


6-1-1  
Pre-treat



**Pumice Line:**  
Clean foreign material and roughen the board surface to increase solder mask adhesion

Before pre-treat → After pre-treat

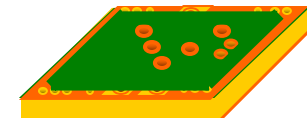
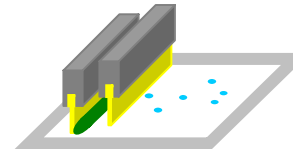


6-1-2  
Print



**Printing:**  
Apply photoimagible mask on board surface to protect circuitry, prevent copper surface oxidation and act as solder resist

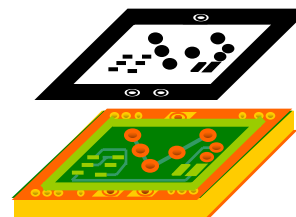
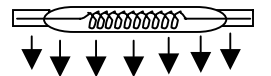
Before mask → After mask



6-1-3  
Pre-cure



**Pre-curing:**  
Partially remove solvent so surface is not tacky



# Solder Mask Process

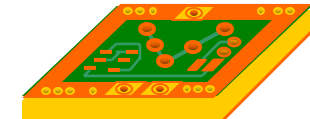
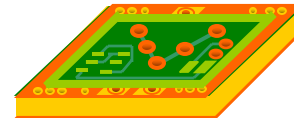


6-1-4  
Develop



**Developing:**  
Remove the solder mask  
which wasn't exposed to  
UV curing

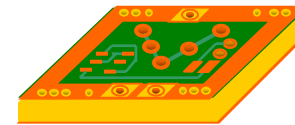
Before developing ⇨ After developing



6-1-5  
Post  
curing



**Post Cure :**  
Final cure to increase surface  
hardness and resist soldering



(board appears same  
as in previous step)



# Silk Screen Process

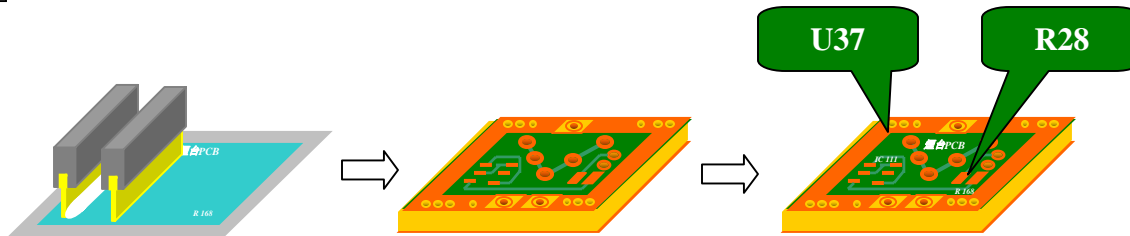
S/S Flow : 6-2-1 Screen printing → 6-2-2 Post curing

6-2-1  
Screen printing



## Legend:

Text and/or numbers printed on the final board surface using non-conductive ink. Commonly used to identify components (and orientation or polarity), and identifying board part number and revision level.



6-2-2  
Post curing



## Legend baking oven:

The ink used for silk screen printing contains hardening ingredients that are activated thermally, so it is cured at high temperature. This is called “Polymerization” or a “crosslinkage reaction”

# Gold Finger Plating

G/F  
Flow :

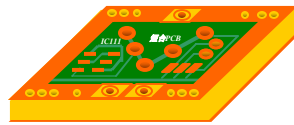
7-1-1 Blue Tape → 7-1-2 Expose → 7-1-3 Gold plating → 7-1-4 Tape removal

7-1-1  
Blue  
Tape

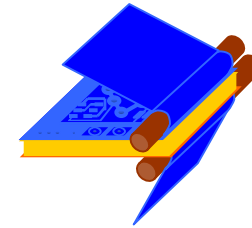


Cover entire board with semi-transparent film to mask from plating

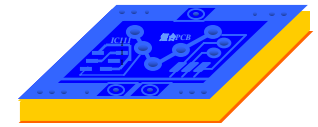
Before



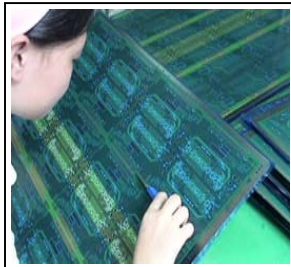
Apply Blue tape



After Covering

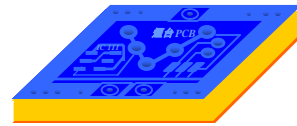


7-1-2  
Opening

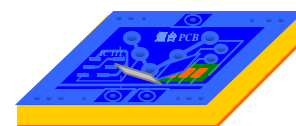


Expose the gold finger area.

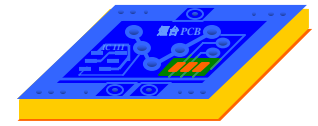
Before



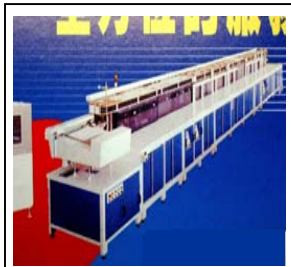
Remove for Plating



Exposed Fingers

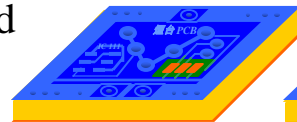


7-1-3  
Gold  
Plate

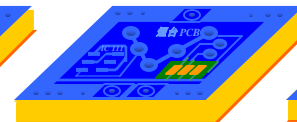


**Gold plating line:**  
→Pre-treat  
→Ni plating →Au activation →Gold Plate →Rinse  
→Bake

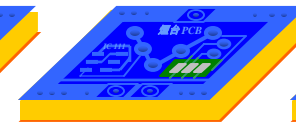
Before



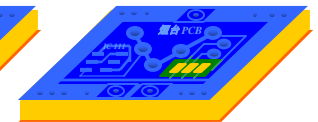
After pre-treat



After Ni-plating



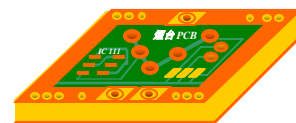
After gold plating



7-1-4  
tape  
removal



Remove the blue tape covering from the board



Board surface after gold finger plating

# Hot Air Solder Level (HASL)

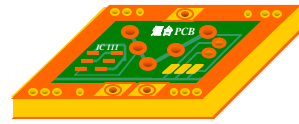
**HASL Flow** : 7-2-1 Tape Mask → 7-2-2 Tape Press → 7-2-3 Pre-Treat → 7-2-4 HASL → 7-2-5 Post Treat → 7-2-6 Tape Remove → 7-2-7 Hole Count

7-2-1  
Tape  
Mask

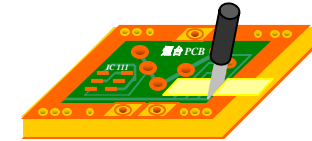
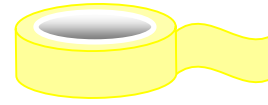


Mask areas that should not be coated with HASL

Before



Apply tape manually

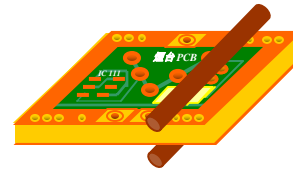


7-2-2  
Tape  
pressure



Increase temperature and pressure to make the tape adhere to the gold surface.

Press tape to board surface



7-2-3  
Pre-  
treat



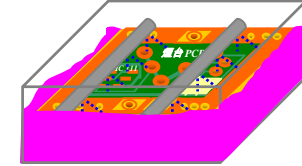
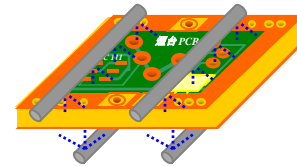
**HASL pre-treat:**

1. Clean copper surface
2. Flux coating

micro-etch spray



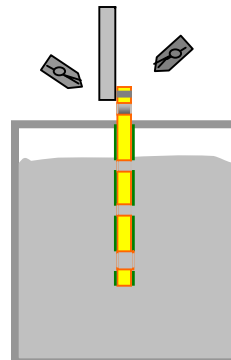
Flux coating & dip



7-2-4  
HASL



Hot Air knives blow excess solder from board surface



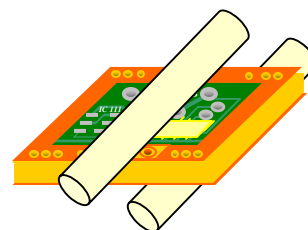
# HASL process (continued)



7-2-5  
Post  
Treat



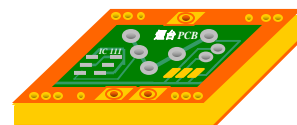
Post treatment  
cleaning line  
brushes debris  
from the board  
surface



7-2-6  
Tape  
Removal



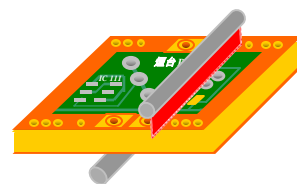
Solder board  
surface after  
removing tape



7-2-7  
Hole  
Count



**Hole Counter :**  
Uses light to perform  
automatic checking for  
correct hole count, will  
detect missed drilling  
and plugged holes



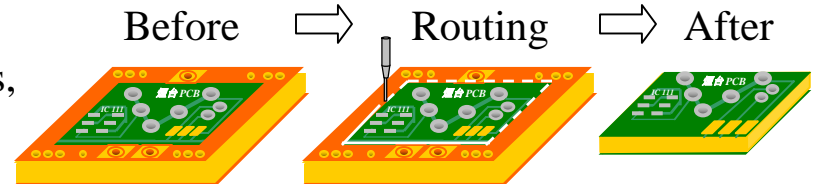
# Routing Process

**F/M Flow** : 7-3-1 Routing → 7-3-2 V-cut → 7-3-3 Beveling → 7-3-4 Water Rinse

7-3-1  
Routing



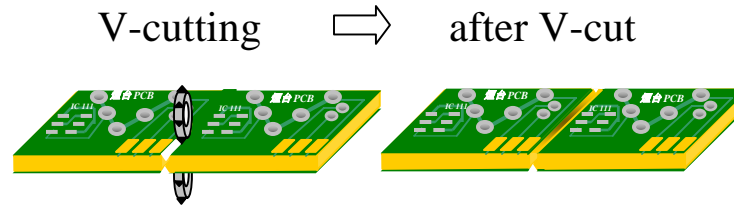
Route away the outer frame and board edge of the panels, and route slots if needed



7-3-2  
V-Cut



**V-Groove :**  
cutter creates grooves for easier de-panelization after assembly.

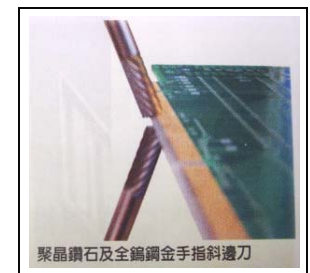
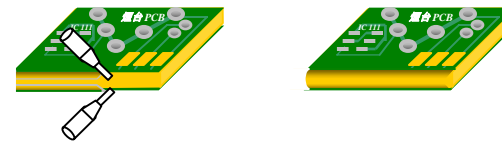


7-3-3  
Beveling



**Bevel:**  
To aid gold finger insertion into socket, board edge is bevelled to 30~45 degree angle

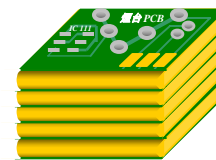
Beveling → edge after beveling



7-3-4  
Water Rinse



High pressure water rinse and brushes remove dust. Board are then stacked



# Electrical Test & FQC

ET Flow : 8-1 Electrical Test → 8-2 Repair

8-1  
Electrical  
Test



Test Fixture is developed using customer data, and will make sure finished board matches design. Test program will identify opens and shorts

Board loaded into fixture



Fixture engaged

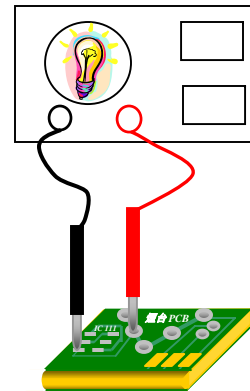


8-2  
Repair



Boards that didn't pass test are evaluated by the repair operator to determine whether the fault is "real" or "false", to avoid waste and cost caused by wrong judgment.

Repair work



# Final Finish (OSP and ImAg)

FQC Flow : 8-3 Entek → 8-4 Immersion Silver

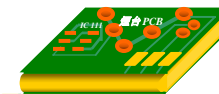
8-3 Entek



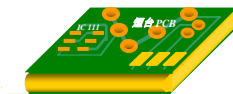
## Entek OSP:

Liquid bath of organic chemicals to protect copper from oxidation to preserve solderability

Before Entek



After Entek



Entek Flow :

Acid degrease → Micro-etch → Acid water rinse → Entek major bath → Blowing → Pure water rinse → Blowing

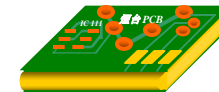
8-4 Immersion Silver



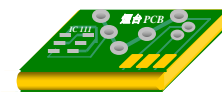
## Immersion Silver:

Apply a layer of organic silver on the copper surface to prevent oxidation and preserve solderability

Before ImAg



After ImAg



Immersion Silver Flow :

Acid degrease → Micro-etch → Pre-dip → Immersion Silver Bath → Hot water rinse → Blowing