

*Primary Imaging*

## LAMINAR 5000

LAMINAR 5000 is a negative working aqueous dry film resist. Specific advantages include:

- superior, instant adhesion to copper surfaces and an
- excellent printout image on exposure,
- improved ammoniacal and acid etch resistance with
- good tenting properties,
- in-line processability,
- high photosensitivity,
- high resolution,
- excellent plating behaviour and a
- broad processing window.

### Product Use:

Print and Etch  
Acid Plating

Acid/Alkaline  
Cu, Sn/Pb, Ni, Au

## Product Preparation and Operation

### Surface preparation

Optimum adhesion can only be achieved on metallic surfaces which are free of grease and oxides. Such conditions can be obtained by using mechanical or chemical processes.

The surface must be free of contaminants such as chromate conversion coatings (Inner layers), residual water and acid stains. Other contaminants to be watchful of include oil in air lines, nylon brush smear, fingerprints, chemical residues and airborne contaminants generated by the environment in the wet chemistry areas.

Copper substrate imperfections must also be taken into consideration. These include pits, dents, deep scratches and epoxy bleed through. The presence of these imperfections will result in poor photo resist adhesion in these areas, resulting in low yields, reduced productivity and quality especially on fine line boards. It is recommended that all materials be edge bevelled to minimise particulate contamination from debris on the board edges.

### Anti Tarnish

An acidic based anti-tarnish is preferred (if use of an anti-tarnish is necessary), although an anti-tarnish with a neutral pH is acceptable. The use of an alkaline based anti-tarnish may cause poor resist adhesion to the surface.

### Lamination

The holding time between pretreatment and lamination should not exceed 60 minutes because the reformation of oxides can adversely influence resist adhesion.

Lamination of LAMINAR 5000 dry film must be performed in an environment that is free from dust and dirt. Pre-lamination cleaning with a Hi-Tac "ST" Panel Cleaner is highly recommended. The condition and maintenance of the lamination equipment is also important for high quality production and yields.

The lamination parameters listed in Table I are general guidelines for Shipley lamination equipment. Parameters for other equipment must be established according to the manufacturer's recommendations.

**Table I - Lamination**

#### Model 300/360 Hot Roll Laminators

Roll Temperature	113-118°C
Exit Temperature	O/L 43-60°C I/L 63-71°C
Laminating Speed	0.9-1.5 m/min

#### Automatic Cut Sheet Laminators\*

Roll Temperature	113-118°C
Roll Speed	1.8-2.3 m/min
Roll Pressure	2-5 bar(29-73 psi)
Tack Bar Temperature	50-60°C
Tack Time	2-4 sec
Panel Entrance Temperature	20-49°C
Panel Exit Temperature	O/L 43-60°C I/L 63-71°C

\*Note: Refer to applicable Automatic Cut Sheet Laminator Manual for specific operating parameters.

## Exposure

To avoid contaminating the resist surface with dust and other particles, the laminated boards should be placed in a vertical position. Prior to exposure boards should be cooled down to room temperature.

Pre-exposure cleaning of the resist cover sheet using a Hi-Tac "FB" Panel Cleaner is highly recommended. LAMINAR 5000 dry film has a maximum photosensitivity in the spectral range between 340 and 420 nm. Imaging of the resist is achieved with exposure in high UV output exposure equipment.

The values in Table II provide a guideline for the exposure of LAMINAR 5000 dry film with 5kW lamps:

**Table II - Exposure**

Resist Type mJ/cm <sup>2</sup>	Laminar 5025	Laminar 5032	Laminar 5038	Laminar 5050
	20-30	30 - 40	45 - 55	65 - 75
	Stouffer 21 Step Tablet		Stouffer 41 Step Tablet	
Resist	7 - 9		19 - 25	
Copper	8 - 10		22 - 28	

### Notes:

Millijoule measurements were obtained with a UV Radiometer in a ORC Model HMW 201B Exposure Unit. Readings will vary depending on the type of radiometer and exposure equipment used. It is recommended that parameters be established for the equipment.

All measurements were made through the artwork for both the radiometer and density tablet.

Stouffer 41 Step Density Tablet is preferred for fine line reproduction to control exposure levels more accurately. To assure the exposure process is optimum, the following conditions are recommended:

1. The exposure unit must be clean and free from dust.
2. The phototool (diaz or silver halide) must be of high quality.
3. Use bleeder strips to assure the intimate contact required for optimum resolution.
4. Use a radiometer in conjunction with the Stouffer Density Tablet to confirm correct exposure levels.

## Development

LAMINAR 5000 dry film is developed in Shipley brand chemistry, sodium carbonate or potassium carbonate solutions. Parameters which affect the development include:

- Temperature
- Solution Concentration
- Spraying Pressure
- Nozzle Type
- Nozzle Position
- Chamber Length
- Resist Thickness

Removal of the cover sheet is required before development. Tables III and IV provide guidelines for resist development. For in-line processing, the Shipley Automatic CSR-2600 Cover Sheet Remover can be used.

**Table III - Developing**

<b>Solution</b>	<b>Temperature</b>	<b>Breakpoint</b>
Sodium carbonate 0.75%-1.0% (monohydrate)	28-33°C	50-60%
Potassium carbonate 0.75%-1.0%	28-33°C	50-60%
REsolve 211 0.75%- 1.0%	28-33°C	50-60%

<b>Developing time (sec)</b>	<b>Laminar 5025</b>	<b>Laminar 5032</b>	<b>Laminar 5038</b>	<b>Laminar 5050</b>
REsolve 211 30°C Breakpoint @ 50% (4-ft chamber)	37	45	55	75

**Table IV. - Development Conditions**

<b>Condition</b>	<b>Optimum</b>	<b>Acceptable</b>
Pressure	1.4-2.0 bar (20-29 psi)	1.2-2.2 bar (18-32 psi)
Temperature	27°C	28-33°C
Concentration	0.85%	0.75-1.00%
Breakpoint	50%	50-60%
Rinse Pressure	>1.4 bar (20 psi)	1.1-1.7 bar (16 - 25 psi)
Rinse Temp	22°C	18-25°C
Rinse length	50% of Development Chamber	Same

(Note: 1 bar = 14.5 psi)

To determine the exact developing time (=breakpoint), a board laminated with LAMINAR 5000 dry film is developed (after removal of the polyester cover sheet) at a speed that will completely remove all resist from the copper surface. In production, the determined developing breakpoint time should be increased by 50-100%. This provides sufficient safety margins in the process to compensate for any fluctuations of development parameters.

The development must be followed by a thorough water rinse at a temperature greater than 18°C, nozzle pressure 1.0-1.5 bar (14-22 psi) and subsequent drying. The pH value of the rinsing water should not be below 6.8 pH to avoid redepositing of dissolved resist components. Good drying after development offers advantages in subsequent process steps.

No developer solution should be allowed to dry on the board between development and rinsing.

Should foaming occur during development, a suitable antifoaming agent can be added at a ratio of 0.1-0.5 ml per litre. We recommend FOAMklear AF 2750 or other products suggested by Shipley Technical Personnel. For details please refer to the separate data sheets for these products. Do not use antifoams containing water miscible solvents, such as butyl cellosolve.

To ensure even distribution of the antifoam, it should be continuously added to the tank by means of a feed pump. Best results are obtained when the antifoam is added to the backflow of the developer. Developing equipment made of both stainless steel and plastic (PVC, PP) are suitable.

## Tenting

Selection of LAMINAR 5000 dry film resist thickness should be based on the diameter of holes to be tented. Thickness is only one of many factors that contribute to integrity of tented holes. Process controls and conditions, hold times, and plating parameters also affect tenting results. It is not recommended that LAMINAR 5000 dry film be used for processes that tend to exhibit prolonged hold times or for holes larger than 5mm.

## Etching

**Table V - Etching**

Etchant	pH range
Alkaline	7.8-9.0
Acid	1 - 3N

Boards can be processed immediately in-line from development through etching. Etching can be achieved by either acid or alkaline etchants as shown in Table V.

## Plating

LAMINAR 5000 dry film can be processed through acid plating solutions in pattern plating applications. A typical preplate cleaning process is given in Table VI.

**Table VI - Plating**

Preplate Cleaning Process	Time
RONAclean PC 590	2-3 min
Rinse Counterflow	1-2 minutes
Rinse Counterflow (Optional)	1-2 minutes
Microetch	As Required
Spray Rinse	1-2 minutes
Sulphuric Acid (10% by volume)	1-2 minutes
Spray Rinse (Optional)	1-2 minutes

(Pattern Plating: Acid copper, tin/lead, nickel or gold solutions.)

## Stripping

LAMINAR 5000 dry film was designed to have high chemical resistance for optimum process latitude, so aggressive stripping chemistry is needed for removal.

Stripping can be achieved in conventional immersion or conveyORIZED equipment using Shipley brand strippers, or other commercially available proprietary strippers. **SURFACEstrip 5100 STRIPPER at 10% make-up is recommended for overplated boards.** Stripping in 1-5% potassium hydroxide or sodium hydroxide requires long immersion times. Stripping should be followed by an immediate water rinse to reduce oxidation.

Stripping times are strongly influenced by the height of the metal deposition and the PCB layout. High spray pressure improves the stripping process. Since stripped resist flakes do not dissolve in the stripper solution, the application of modules with easy sump removal and filtration are recommended.

## Product Data

LAMINAR 5000 dry film is offered in three film thicknesses:

Nominal Thickness	Laminar 5025	Laminar 5032	Laminar 5038	Laminar 5050
Mils	1.0	1.3	1.5	2.0
Microns	2.5	32	38	50

## Printout image:

Unexposed colour	Light Blue
Exposed colour	Dark Blue

## Storage

Please read and understand this product's current Material Safety Data sheet before use.

It is the customer's responsibility to ensure that disposal of this product complies with national and local guidelines

Flush empty containers thoroughly with water before discarding

LAMINAR 5000 Dry Film Photopolymer should be stored in a limited access area between 5-21°C. LAMINAR 5000 Dry Film Photopolymer is sensitive to sunlight and indirect white light. Gold or yellow fluorescent "safety lights" are required in the immediate work area.

For optimum performance, the recommended storage temperature is 5 -15°C. Rolls should be kept in a dry area, and should be equilibrated to room temperature before use.

## Illumination of Working Areas

For the illumination of working areas, yellow fluorescent lamps are recommended for low UV emission. Windows are to be coated by a non-bleachable yellow film which must be non-transparent for light of wavelengths below 450nm. Alternatively, yellow Plexiglass made by Rohm and Haas (type Yellow 303) is equally suitable.

Waste material disposal will vary with local requirements. It is suggested that enquiries be made to local, state and federal authorities.

## Disposal Information

Utilize Shipley waste treatment chemistry RS 1240. The Shipley 2000 System will automatically compensate for the alkalinity of the waste material and add the Shipley 2000 chemistry to the stripper/developer waste in the correct proportion. After the treatment is completed, the solution is pumped to a filter press.

## Handling Precautions

**Before using this product, refer to the current Material Safety Data Sheet and the Laminar Photoresist Safe Handling Guide for detailed safety, handling and storage information.**

LAMINAR 5000 Dry Film Photopolymer should be applied in a well ventilated area. Commercial lamination equipment may cause vapours to be generated from the dry film, and these vapours should be removed by conventional exhaust techniques.

Wash thoroughly after handling. Contact of the unexposed resist with the skin may cause irritation and should be avoided. Sensitization may occur in some individuals. If contact occurs, wash thoroughly with soap and water. If irritation occurs or persists, consult a physician.

Avoid reuse of or contact with the dry film release sheets and cover sheets, since they may retain small amounts of unpolymerized photoresist components.

During cleaning, developing, stripping and etching operations, follow the safety precautions pertaining to the particular solution(s) being used.

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### For Industrial Use Only

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