# RISTON® MM750

RISTON® PHOTOPOLYMER FILMS

## Performance Data and Processing Information

### PRODUCT FEATURES/APPLICATIONS

- Negative working, aqueous processable dry film photoresist
- Suitable for UV-LASER 355nm direct imaging and conventional exposure
- Vivid print out image after exposure for easy inspection
- Suitable for print and etch, tent and etch with acid or alkaline etching and plate/etch application
- Available in 50 and 62 µm thickness (other thicknesses also available) depends on line space required

### STORAGE

Temperature: 5-21°C (40-70°F)

Relative Humidity: 30-70%

### PRODUCT DESCRIPTION

**Physical Parameters**

| Available Thickness | 50µm (2.0 mils) |
|---|---|
| Unexposed Color in Yellow Light | Green |
| Exposed Color in Daylight | Blue |
| Exposed Color in Yellow Light | Dark Green |
| Print-Out (Phototropic) Image | Strong |
| Contrast to Copper | Strong |
| Odor | Low |

### SAFE HANDLING

Note safety and industrial hygiene precautions. Consult the Material Safety Data Sheet (MSDS) of any chemical used. MSDSs for Riston® dry film photoresists are available.

This data sheet documents specific process information for Riston® MM750. For more background on general Riston® processing, see the General Processing Guide.

### COPPER SURFACES AND SURFACE PREPARATION

**Brush Pumice**

3F or 4F grade, fused, 15-20% v/v, 9-12 mm (3/8-1/2") brush foot print, fines removal and replenishment per vendor recommendations; high pressure (10 bar) final rinse (pH 6-8); hot air dry.

**Jet Pumice**

3F or 4F grade, unfused, 15-20% v/v, fines removal and replenishment per vendor recommendations; high pressure (10 bar) (147 PSI) final rinse (pH 6-8); hot air dry.

**Jet or Brush Aluminum Oxide ($Al_2O_3$)**

Follow vendor recommendations.

**Compressed Pad Brushing**

500 grit; 7-9 mm (1/4- 3/8") brush foot print; high pressure (8-10 bar) final rinse (pH 6-8).

**Bristle Brushing**

500 grit; 7-9 mm (1/4-3/8") brush foot print; final rinse (2-3 bar), (pH 6-8).

**Note:** Electroplated copper surfaces for tent-and-etch applications are frequently “de-noduled” e.g. by compressed pad brushing prior to pumice scrubbing.

**Control Tests**

Water break test: 30 seconds

Ra: 0.10-0.3 µm Rz: 2-3 µm

To remove antitarnish conversion coatings (e.g. chromate conversion coatings) and/or copper tarnish (oxides), it is recommended to precede pumice or aluminum oxide scrubbing with a spray acid cleaner or 10-15% sulfuric acid or a microetch.

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### Chemically Cleaned Copper

Use Alkaline Spray Cleaner (e.g. VersaCLEAN® 415) for removal of organic contaminants followed by a spray microetchant (e.g. SureETCH® 550) for conversion coating (chromate) and/or copper oxide removal (about 2-2.5 μm; 80-100 microinch etch). A 10% sulfuric acid spray may be used between alkaline cleaner and microetchant to help with the conversion coating removal. In this case only, 1.5 μm (60 microinch) microetch depth is required. To remove residual salts after microetching from the copper surface, an acid rinse or efficient water spray rinsing have been employed successfully.

### Electrochemically Cleaned Copper

Conveyorized systems combining reverse current electrochemical cleaning and microetching are offered to effectively remove chromate conversion coatings with minimal copper removal. The alkaline electrochemical cleaner first removes trace organics and chromates. After a rinse, a microetch removes about 0.8μm (30 microinches) of copper. Following a second rinse, an antitarnish may be applied.

### Double-Treated Copper Surfaces

Normally no prelamination cleaning required; vapor degreasing or chemical cleaning to remove organics is optional. Tacky roller cleaning recommended to remove particles.

## LAMINATION

### Lamination Conditions DuPont HRL-24

| | |
|---|---|
| Pre-Heat | Optional |
| Roll Temperature | 105 °C ±5°C (221 ±9°F) |
| Roll Speed | 0.6-1.5 m/min (2-5 ft/min) |
| Air Assist Pressure | 0-2.8 bar (0-40 psig) |

**Note:** For 1.4 bar use heavy-duty rolls

### Post-Lamination Hold Time

- Panels may be exposed immediately after lamination; however, allow enough time for panels to cool to room temperature before lamination (about 15 minutes; use accumulator in in-line systems)
- Minimize hold time (guidelines): 30 mins ~ 1 hr
- Maximum hold time (guidelines):
  Lamination: Up to 2 days. Hold times should be determined empirically based on the temperature and relative humidity of the storage area

**Note:** Guideline–strip within 5 days after lamination.

### Laminator Conditions DuPont ASL-24

| | |
|---|---|
| Seal Bar Temp. | 60 ± 10°C (140 ± 18°F) |
| Lam. Roll Pressure | 3.0-5.0 bar (43-72 psig) |
| Lamination Temp. | 105 ±5°C (220 ± 9°F) |
| Seal Time | 1-4 seconds |
| Seal Bar Pressure | 3.5-4.5 bar (50-65 psig) |
| Lamination Speed | 1.5-3 m/min (5-10 ft/min) |

**Note:** Reduced lamination roll pressure and/or temperature may be required in tenting applications to avoid tent breakage and resist flow into through-holes.

### Panel Handling/Racking/Stacking

Preferred: Vertical racking in slotted racks

Less desirable: Stacking

To minimize adverse effects: Stack on edge vertically after cooling; avoid dust and dirt trapping between panels; insert unlaminated panel between stack support and first laminated panel to protect laminated panel. Unlaminated support panel should be at least as big as the laminated panels. Thin flexible innerlayers usually cannot be racked. Preferred techniques: Hanging panels vertically or stacking on edge after cool down. If innerlayers are stacked horizontally in trays, the stack height should be limited especially for panels with thin photoresist and fine circuitry.

## EXPOSURE

### Resolution (Lines & Spaces)

- In Optimized Production Environment with good development and rinse control: Aspect ratio 1:1.2 (60 micron/1.2mil L/S for 50 μm resist)
- In Lab Environment: Aspect ratio 1:1 (50 micron/1.6 mil L/S for 50 μm resist)

### Exposure Energy vs "Steps Held"For Recommended Exposure Range

| Riston® MM700 | MM750 |
|---|---|
| $mJ/cm^2$ | 28-45 |
| RST | 10-14 |
| SST | 6-8 |

- Steps held can vary by +/-1 RST depending on the development breakpoint used
- Energy is set by 5KW conventional collimated light source exposure machine

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## DEVELOPMENT

### Chemistries/Make-up

**Sodium carbonate, anhydrous, (soda ash), $Na_2CO_3$**

- Working solution: 0.85-1.0 wt%. (Prefer 0.85 wt%) Use 8.5-10 g/l (0.071 lb./gal)

**Sodium carbonate, monohydrate; $Na_2CO_3 \bullet H_2O$**

- Working solution: 1.0-1.17 wt%. (Prefer 1.0 wt%) Use 10-11.7 g/l

**Potassium carbonate (potash; $K_2CO_3$)**

- Working solution: 1.07-1.26 wt%. (Prefer 1.07 wt%) Use 10.7-12.6 g/l

### Defoamers

Riston® MM700 has been successfully used without defoamer. The need for defoamer and the amount required are dependent on water quality, carbonate purity, photoresist loading, and equipment design. If required, add 0.80 ml/liter (3 ml/gallon) of FoamFREE™ 940 , or equivalent polyethylene-polypropylene glycol block co-polymer.

- For batch operation: Add defoamer during initial make up
- For automatic replenishment systems: Add defoamer directly to the sump in a high turbulence area at a predetermined rate

Do not add defoamer to the supply tank or to the replenishment solution.

### Development Conditions

- Spray Pressure: 1.4 –2.1bar (20-30psig)
- Spray Nozzles: High impact direct-fan nozzles preferred; a combination of cone and fan nozzles may be preferred if film tent breakage is experienced
- Chemistry:
  - $Na_2CO_3$: 0.85 - 1.0 wt%; 0.85 wt% preferred
  - 1.00 - 1.17 wt%; 1.00 wt% preferred
  - $K_2CO_3$: 1.07 - 1.26 wt%; 1.07 wt% preferred
- Temperature: 8-29°C (82-84°F); 29°C (84°F)
- Dwell Time
  - Breakpoint: 35~65%
  - Time in Developer (Dwell Time), at 1.4 bar (20 psig) spray pressure, 50% breakpoint. 30°C, fresh developer solution at recommended carbonate concentrations
  - Riston® MM750: 74 seconds with 50% break point

**Note:** Total time in developer = Time to clean divided by breakpoint

- Time to clean (time in developer to wash off unexposed resist): 37 Seconds for Riston® MM750 in our lab (might vary by different conditions)
- Shorter times to clean are achieved at higher temperatures, higher carbonate concentrations, and higher pressures
- If developer conveyor speed is too fast for match with other in-line equipment: Lower soda ash concentration down as far as 0.5wt%; consider lowering temperature. Do not lower spray pressure below recommended levels

### Resist Loading

Resist loading: 0-0.4 mil-$m^2$/l(0-12 mil-$ft^2$/gal)

**Note:** This range gives a fairly constant time to clean; lower loadings result in shorter time to clean; higher loadings increase the time to clean.

### Rinsing & Drying Recommendations

- Rinse water: Hard water (150-250 ppm $CaCO_3$ equivalent) Softer water can be hardened by the addition of calcium chloride or magnesium sulfate. If hard water is not available, a first soft water rinse may be followed by a dilute acid rinse, followed by a water rinse
- Rinse temperature: 15-25°C (60-80°F)
- Rinse spray pressure: 1.4-2.1 bar (20-30 psig). Use high impact, direct-fan nozzles
- Effective rinse length: 1/3-1/2 of length of developer chamber; >1/2 preferred
- Drying: Blow dry thoroughly; hot air preferred

### Controls

- For batch processing: Adjust conveyor speed to maintain desired breakpoint; dump developer solution when development time has become 50% longer than for fresh solution
- Developer conveyor speed: see "**Dwell Time**"
- Feed & bleed: To keep loading at about 0.2 mil-$m^2$ l (8 mil-$ft^2$/gal), activate addition of fresh developer at pH 10.5; stop addition when pH 10.7 is reached

### Hold Time after Development before Plating

0-5 days

**Note:** Minimize white light exposure during post development hold to prevent film embrittlement.

### Developer Maintenance

Clean at least once a week to remove resist residue, calcium carbonate (scale), defoamer, and dye from developed resist. Dye build-up can be minimized by the use of anti-foam.

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## ETCHING

Riston® MM750 resists are compatible with most acid etchants, e.g. cupric chloride (free HCl normality < 3.0 N), $H_2O_2/H_2SO_4$, ferric chloride and alkaline etching under proper PH control.

## PLATING (ACID COPPER SULFATE)

- Riston® MM700 series resists can be used for pattern plating processes with acid copper and tin. Riston® MM700 has good resistance to lifting and underplating

### Recommendations: Pre-plate Cleaning Process Sequence

- Acid cleaner: 38-50°C (100-120°F; 1-3 Minutes)
- Spray and/or tank rinse: 2 minutes
- Microetch to remove 0.15-0.5 µm (6 - 20µm) copper (or as required)
- Spray and/or tank rinse: 2 Minutes
- Sulfuric acid (5-10 vol%) dip: 1-2 Minutes
- Optional: Spray rinse, (1-2 minutes)

## STRIPPING

### Aqueous Caustic (NaOH or KOH) Conveyorized Stripping

Time to strip (TTS in seconds) at 55°C (130°F), dipping in recommended exposure range:

| | MM750 |
|---|---|
| 3 wt% NaOH | 90 ~ 96 sec |

**Notes:**

- Dwell Time = 2x Time to strip resist
- High caustic concentrations produce larger skin sizes and higher loading capabilities
- KOH generally produces smaller skin sizes than NaOH

**Particle Size at 3.0% NaOH: Sheet**

- Solubility of stripped particles: Non-Soluble
- Physical characteristics of stripped particles (e.g. stickiness): Non-Sticky
- Higher stripping temperature increases the stripping rate
- Stripping rate can be increased with higher impact sprays. Use higher pressures and/or high-impact spray nozzles. Avoid low impact deflector nozzles
- Time to strip increases with white light exposure. A 20% increase in strip time over 8 days exposure is not unusual
- Higher levels of exposure increase time-to-strip: Slightly

### Defoamers

Additives for foam control may not be required depending on equipment design and operation. However, if defoamer is needed, use DuPont™ FoamFREE™ 940 at 0.8 ml/liter (3 ml/gallon) for resist loadings up to 0.6 mil-$m^2$/liter (25 mil-$ft^2$/gal).

### Controls/Solution Maintenance

- Preferred: Continuous replenishment (feed & bleed) using board count. Maintain resist loading at <0.4 mil-$m^2$/liter (<15 mil-square feet/gallon)
- Batch: Up to 0.5 mil-$m^2$/liter (20 mil-square feet/gallon) Maintain breakpoint at <50% by lowering conveyor speed or by starting batch stripping with a lower breakpoint and changing the solution once breakpoint moves above 50%. However, low breakpoints can lead to attack of solder on plated work, or cause copper oxidation
- Filtration systems spray stripping equipment should contain a filtration system to collect and remove resist skins to avoid nozzle clogging, to extend stripper life, and to avoid resist skins from reaching the rinse chamber. The most effective filter systems collect the stripper skins immediately after they were generated, before entering recirculation pumps, and they feature continuous removal of skins from the stripper solution

### Equipment Cleaning

Cleaning of equipment: Drain and flush with water. Fill unit with 5 wt% KOH or NaOH, heat to 55°C (130°F), and circulate (spray) for 30 minutes to dissolve photoresist particles. Then drain the unit. Repeat procedure if required to remove heavy residues. Remaining blue dye stains on equipment may be removed by circulating 5 vol.% HCl at 55°C (130°F) for 30 minutes (HCl can damage stainless steel). Then drain the unit, fill with water, recirculate for 30 minutes, and drain. There are also proprietary cleaners available which may offer better results.

### Proprietary Strippers

Used for higher strip speed, higher strip speed, higher resist loading, to minimize chemical attack on tin or tin/lead, or to reduce copper oxidation, e.g. to facilitate AOI.

### Reworking Panels for Re-Use

Stripped panels may contain organic residues from photoresist or defoamers. After stripping, regenerate a fresh copper surface as follows, before mechanically cleaning the panels:

- Soak for three minutes in a hot soak cleaner at the recommended temperature
- Rinse thoroughly
- Etch 0.13 µm (5 microinches) of copper if panels are deeply oxidized
- Rinse thoroughly
- Dip in 5-10% sulfuric acid
- Rinse thoroughly
- Dry

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## SAFE LIGHTING

Protect photoresist through lamination and development steps from UV radiation and visible light up to 450nm by use of yellow, amber or gold fluorescent “safe lights”.

High intensity (<70 footcandles) yellow “safe light” causes a change in steps held and should be avoided.

## WASTE DISPOSAL

For questions concerning disposal of photoresist waste, refer to the latest DuPont literature and Federal, State, and Local Regulations.

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*CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see “DuPont Medical Caution Statement,” H-50102-5*

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