



# Transparent Screen Printing Ink

## Series 990 For Face Adhesive Verification Sheeting

Information Folder 9.7

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### Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Material Safety Data Sheet, and/or product label of chemicals prior to handling or use.

### Description

3M™ Transparent Screen Printing Inks Series 990 are fast dry inks which can be conveyer dried. These weather resistant inks have excellent color retention and are intended exclusively for use on 3M™ Face Adhesive Verification Sheeting.

**Substrate:** 3M™ Face Adhesive Verification Sheeting Series 2500

Screen Printing Ink	
990-00	Toner
990-05	Black
990-06	Orange
990-08	Green
990-03	Blue
990-12	Red
990-04	Yellow
990-14	Lemon Yellow
990-15	Magenta Red

### Stock Preparation - Conditioning of Stock

For best results, sheets should be allowed to stabilize under normal shop humidity and temperature conditions before a run is started by racking sheets individually, liner side up, or two sheets face to face overnight in the shop.

Proper stock conditioning is especially important where hairline registry or multiple colored markings are involved. It is advisable to finish the run as quickly as possible and to screen print small sheets with a few markings up rather than large sheets with many markings up.

### Sheet Cutting

To avoid registration problems during fabrication, all sheets should be cut from the roll in the same direction. Generally, this can be done by cutting sheets with the longest dimension parallel to the roll edges. If hairline registry is required in one direction, and where sheet size permits, cut sheets so that the critical dimension is parallel to the roll edges.

**Caution:** Close color matching of large multi-sheet graphics on retroreflective materials is difficult due to production lot variability for both day and night color and processing variabilities when using transparent process inks.

Reflective materials, even if from identical production lots, must be checked for both day and night appearance where adjoining panels are needed.

Contact your 3M Tech Service Representative for information and assistance.

### Storage

Inks should be stored at a temperature between 70°F (21°C) and 90°F (32°C) and should be used within one year of the date of receipt.

### Coverage

The coverage of thinned inks will vary with the screen mesh used and the amount of thinning; however, coverage of approximately 1200 square feet per gallon can usually be expected when using a PE-157 mesh screen.

## Close Tolerances

Ambient air drying is generally recommended when die cutting to close tolerances in order to minimize sheeting dimension change; however, cutting sheets with the critical dimension perpendicular to the core of the roll, will reduce the amount of edge to edge dimension change after conveyer drying.

## Ink Preparation

### Toning

990-00 Overprint Clear/Toner  
Up to 50% by weight of total mixture

### Blending

1. Blending of full strength colors may require toning.
2. By experimenting it is possible to obtain intermediate colors by overprinting toned colors. This overprinting provides an additional color. Overprinting without toning produces an opaque color.
3. Avoid blends containing 990-05 Opaque Black.

### Thinning of Inks

Thin screen printing inks and toner 990 with T-11A. Do not exceed 10% by weight.

### Mixing

Before thinning, it is necessary to mix inks on a high speed power mixer or paint shaker for 10 minutes. Inks should then be thinned as necessary and thoroughly mixed by hand. To store, inks should be tightly sealed to prevent loss of solvent or potential contamination of the ink. Stored inks which have been previously thinned should be mixed prior to usage according to instructions above.

## Screen Printing

### Screen Fabric

PE157 to PE 280\*

\*Note: A screen mesh finer than PE-245 will provide less color saturation than will a coarser mesh and may result in a reduction in weathering performance.

### Screen Frame

Use a rigid wood or metal frame which is large enough to provide a 6 to 10 inch (15 to 25 cm) well between the frame and the open design area. The screen fabric must be tightly and uniformly stretched and fastened onto the frame.

### Stencil

Any type of stencil film or photostencil or hand-cut material may be used. It must be a water soluble type which resists ketone and strong lacquer solvents.

### Squeegee

Use a sharp, medium to hard rubber or plastic blade. The squeegee should be long enough to completely cover the area being screen printed with a 2 inch (5 cm) or greater overlap on each end. A 50-60 durometer squeegee is recommended.

### Screen Printing Method

To get uniform impression, the "off-contact" method of screen printing is recommended.

A fill pass, before the impression pass, is recommended.

Position the sheeting under the stencil and hold in place by vacuum or with Scotch™ No. 2 Sandblast Filler. Do not use aerosol adhesives since ink non-wetting could result.

Prior to screen printing, remove any dust or foreign matter from the fabric and stencil area and from each piece of sheeting with a "tack rag" (varnish impregnated cloth).

If an error is made in screen printing of 3M sheeting, the freshly printed ink can be removed with a rag saturated with mineral spirits. Previously dried inks cannot be removed.

## Drying Conditions

Dryness Test - The conveyer and air drying times given below will vary with the equipment being used, the amount of thinner, temperature and humidity conditions, etc.

Insufficient drying can result in blocking or severe surface impression. Therefore, it is important to check for insufficient dryness when printing starts. It is recommended that the following procedures be followed to determine if adequate drying has occurred.

1. This test is used to set conveyer dryer conditions and approximate dryness:
  - A. Touch a printed sheet face to face.
  - B. Place the touched area close to your ear and separate.
  - C. If the marking is adequately dried, there will be a slight discernible sound. If the marking is not sufficiently dried, a crackling sound will be heard. The louder the sound, the greater the amount of additional drying that will be required.
2. This test is used to definitely determine if adequate drying has taken place:
  - A. Take several sheets and place them under a one foot (30 cm) stack of film or under a weight of 2 lbs/sq in (135 gr/sq cm).  
*Note: Sheets must not be stacked face to face.*
  - B. After 10 minutes, remove the sheets and check for blocking or surface impression.
  - C. If blocking or severe surface impression is noted, additional drying is required. If conveyer drying, either the temperature should be increased or the belt speed slowed down.
3. If markings are to be premasked, several sheets should be premasked and stacked using procedure "2" above.

Conveyer Drying - The time required will vary with the equipment being used, the amount of thinning, the ink thickness, etc. Suggested drying conditions:  
single color - 45 seconds at 150° F (65° C);  
overprinted color - 55 seconds at 150° F (65° C).

If the drying tests indicate insufficient drying, the printed sheets should be subjected to either longer times, higher temperatures, or a combination of the two.

When two colors are overlapped by more than 1/2 inch (1cm), they are considered overprinted colors. When screen printing multiple colors, overlaps and overprints should be kept to a minimum to minimize the need for additional drying time. The greater the amount of overprinting, the greater the amount of drying needed.

Air Drying - The minimum recommended drying times with high volume fans directed at the racks:

Between Colors:	30 Minutes
Final Color:	1 Hour
Overprinted Colors:	2 Hours

## Screen Cleaning Solvents

### Screen Washup

Use a commercially available lacquer thinner. A suitable substitute may be formulated by blending xylol, ketones (MEK, MIBK or a mixture) and VM&P Naphtha.

Caution: When using solvents follow all manufacturer's instructions and review and follow all health and safety information. Refer to container labels and MSDSs for health, safety, and handling instructions.

### Screen Opener

Should the screen become clogged or dried with ink, the screen can be reopened by washing using xylol or 50/50 mixture of xylol and isophorone.

## Packaging

The inks must be completely dry before packaging. It is not necessary to slip-sheet printed markings for packaging.

## Troubleshooting Stock Conditioning

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
Sheets curl toward liner.	<ol style="list-style-type: none"> <li>1. Liner has lost moisture.</li> <li>2. "Roll set" remains in sheets.</li> </ol>	<p>Rack sheets face down or two sheets face to face on open racks until they stabilize. If area is environmentally controlled, gradually increase humidity.</p> <p>Roll sheet gently against curl. Do not roll sheets parallel to score lines.</p>
Sheets curl toward face.	Liner has absorbed moisture.	Rack sheets face down or two sheets face to face on open racks until they stabilize. If area is environmentally controlled, gradually decrease humidity.
Sheets do not lie flat in stacks.	Liner has absorbed moisture at the sheet edges, but not in the center.	Rack sheets face down or two sheets face to face on open racks until they stabilize.
Wavy pattern in sheeting surface or at edges.	Inherent liner variations are being accentuated by moisture absorption.	Rack sheets face down or two sheets face to face on open racks until they stabilize. This will minimize the condition, but may not eliminate it. If area is environmentally controlled, gradually decrease humidity.
<b>Screen Printing</b> Smearred copy.	<ol style="list-style-type: none"> <li>1. Ink running through screen because of               <ol style="list-style-type: none"> <li>a. Excessive thinning</li> <li>b. Careless fill pass</li> </ol> </li> <li>2. Too much or too little off-contact.</li> <li>3. Frame loose in hinges.</li> <li>4. Loose screen fabric.</li> </ol>	<p>Add more ink and remix. Use a firm, clean fill pass; do not allow ink to drip onto the screen from the squeegee blade.</p> <p>Set-off contact so that only the area under the squeegee blade contacts the surface; the screen should lift cleanly from the surface directly behind the squeegee.</p> <p>Tighten hinges and use screen edge guide.</p> <p>Remake screen; fabric must be taut and uniform.</p>

**Condition**

**Possible Causes**

**Corrective Steps**

Misregistry on multiple colors.

1. Loose screen fabric.
2. Loose hinges.
3. Loose edge guides.
4. Sheets not conditioned.
5. Misplaced sheet guides.
6. Indirect stencil shrinks on screen fabric.
7. Block filler applied after stencil application causes screen shrinkage.
8. Oven drying between.
9. Too much off-contact (or excessive or uneven lift on large screens).
10. Pulling squeegee in opposite directions on alternate sheets.

- Remake screen; fabric must be taut and uniform.
- Tighten hinges.
- Reposition and tighten edge guides.
- Condition sheets.
- Guides must contact each sheet at the same spot.
- Use a direct emulsion stencil.
- Block out most of well area before applying stencil.
- Air dry only between colors on tight.
- Use foam rubber off-contact blocks. Reduce off-contact, and lift large screens evenly so that the screen fabric “breaks” just behind the squeegee.
- Make squeegee pass in one direction on all colors.

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Ink bubbles excessively.

1. Squeegee pass is too fast.
2. Improper screen snap.
3. Ink too thin.
4. No fill pass.

- Slow down impression pass.
- Set off-contact so that only the area under the squeegee blade contacts the surface; the screen should lift cleanly from the surface directly behind the squeegee.
- Remix with more ink.
- Use a fill pass.

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“Orange Peel” (small uniform scaling pattern).

1. Ink too thick.
2. Ink not thoroughly mixed.
3. Wrong thinner.
4. Screen lag (not lifting directly behind squeegee blade) caused by:
  - a. Too little off-contact.
  - b. Loose screen fabric.
  - c. Ink too thick.
5. No fill pass.
6. Not allowing time for ink flow-out before placing in oven.

- Remix with more thinner.
- Mix thoroughly. Use a high speed mixer.
- Use only the recommended thinner.
- a. Increase amount of off-contact.
  - b. Remake screen; fabric must be taut and uniform.
  - c. Remix with more thinner.
- Use a fill pass.
- Always allow 1/2 hour air dry before oven drying.

<b><u>Condition</u></b>	<b><u>Possible Causes</u></b>	<b><u>Corrective Steps</u></b>
Applied ink appears mottled.	<ol style="list-style-type: none"> <li>1. Ink too thin.</li> <li>2. Ink not thoroughly mixed.</li> <li>3. Wrong thinner.</li> <li>4. Ink drying in screen.</li> <li>5. Improper off-contact.</li> </ol>	<p>Add more ink and remix.</p> <p>Mix thoroughly. Use a high speed mixer.</p> <p>Use only the recommended thinner.</p> <p>See “Pinholing” (A) below.</p> <p>Set off-contact so that only the area under the squeegee blade contacts the surface; the screen should lift cleanly from the surface directly behind squeegee.</p> <p>Follow given recommendation.</p>
<b>Pinholing</b> A. Ink drying on screen.	<ol style="list-style-type: none"> <li>1. Delay between screen printing passes.</li> <li>2. Ink too thick.</li> <li>3. Air draft on screen printing area.</li> <li>4. Low shop humidity and or high temperature.</li> <li>5. Wrong thinner.</li> </ol>	<p>If screen has been left unused for more than 1 or 2 minutes, make a fill pass and then screen print several waste passes onto paper. If a longer delay is necessary: 1) wash bottom of screen with thinner; or 2) leave the screen open without a fill pass and cover screen with paper. When resuming run, print several waste passes onto paper.</p> <p>Remix with more thinner.</p> <p>Arrange circulation to avoid air drafts.</p> <p>Increase humidity. If possible, have screen printing shop environmentally controlled.</p> <p>Use only the recommended thinner.</p>
B. Poor flow-out	<ol style="list-style-type: none"> <li>1. Wrong thinner.</li> <li>2. Ink too thick.</li> <li>3. Ink not thoroughly mixed.</li> <li>4. Ink overtoned.</li> <li>5. Contamination</li> </ol>	<p>Use only the recommended thinner.</p> <p>Remix with more thinner.</p> <p>Mix thoroughly. Use a high speed mixer.</p> <p>Maximum 50% toner recommended.</p> <p>Wipe stock with isopropyl alcohol (rubbing alcohol) using lint free paper towel. Clean screen equipment thoroughly.</p>
Ink “cobwebs” at copy edges.	Static electricity.	Ground the table, screen, and sheeting with rope tinsel and/or increase shop humidity.

<b><u>Condition</u></b>	<b><u>Possible Causes</u></b>	<b><u>Corrective Steps</u></b>
Streaks or marks in screen printed area.	<ol style="list-style-type: none"> <li>1. Ink trailing from squeegee blade running through screen.</li> <li>2. Ink drying on screen.</li> <li>3. Screen doesn't lift from sheeting immediately behind squeegee.</li> <li>4. Nick in squeegee.</li> <li>5. Nick or scratch in table top.</li> </ol>	<p>Move squeegee from side to side in well area to "blot" it before beginning impression pass and prevent ink from trailing from rear edge of blade.</p> <p>See "Pinholing" (A) above.</p> <p>Increase "off-contact". If necessary remix ink adding more thinner.</p> <p>Check squeegee blade and sharpen or replace, if necessary.</p> <p>Refinish or replace table top. It must be flat and smooth.</p>
Blurred edges in screen printed area.	<ol style="list-style-type: none"> <li>1. Ink too thin, and runs under the stencil edges.</li> <li>2. Ink drying at stencil edge.</li> <li>3. Squeegee not making a firm impression at stencil edge.</li> </ol>	<p>Remix with more ink.</p> <p>See "Pinholing" (A) above.</p> <ol style="list-style-type: none"> <li>1. Increase size of well between frame and open area of stencil, or</li> <li>2. use thinner stencil film, or</li> <li>3. increase pressure on impression pass, or</li> <li>4. use a harder squeegee blade, or</li> <li>5. reduce amount of off-contact.</li> </ol>
Screen printed color does not hide sheeting background, or color is too light.	Inherent low hiding power in certain opaque colors.	Use coarser mesh screen; or print twice, drying between passes.

**FOR INFORMATION OR ASSISTANCE**

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