



Process Color Series 700, 880, and 990

Instructions for use on Diamond Grade™, High Intensity Prismatic, Engineer Grade Prismatic and Engineer Grade Reflective Sheeting

Information Folder 1.8

July 2010

Replaces IF 1.8 dated October 2008

Description

3M™ Process Colors Series 700, 880 and 990 have been developed to provide maximum durability, color-fastness, and adhesion to reflective sheeting when used in the processing of traffic control signs.

Series 700 and 990 process colors are designed to be applied by conventional screen processing to 3M™ Engineer Grade Reflective Sheeting (see Product Bulletin 3200).

Series 880 process colors are designed to be applied by conventional screen processing to 3M™ Engineer Grade Prismatic, 3M™ High Intensity Grade Prismatic and 3M™ Diamond Grade Reflective Sheatings.

See the following product bulletins:

PB 3430 – 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430

PB 3930 – 3M™ High Intensity Prismatic Reflective Sheeting Series 3930

PB 3990 – 3M™ Diamond Grade™ VIP Reflective Sheeting Series 3990

PB 4000 – 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000

These process colors were developed and designed as matched components for specific grades of 3M sheetings; use on other sheetings or surfaces is not recommended. 3M assumes no responsibility for premature failure of sign face legends that have been processed with non-3M process colors. Since 3M has no control over colors made by other manufacturers, the user should check with the manufacturer for processing recommendations and assurance of performance prior to any extensive use.

For a description of the available colors, see Product Bulletin 880I, Product Bulletin 880N, Product Bulletin 700, or Product Bulletin 990. See Table 1 for recommended usage.

Table 1

Color	Sheeting	Thinner	Stencil	Screen Fabric
700	EG (3200)	711	All Types	PE157
990	EG (3200)	T11A 991*	Lacquer	PE157 Resistant
880I	DG/HIP/EGP	891	Lacquer Resistant	PE157
880N	DG/HIP/EGP	711N	Lacquer Resistant	PE157

*Thinner/Retarder

3M™ 892 Flow Additive

3M™ 892 Flow Additive is a silicone polymer solution intended to be added to Series 700, 880 and 990 process colors to improve flow characteristics. Incomplete coverage of color (spots where the color does not flow out properly, nonwets or fisheyes) can be improved by its use.

3M's 892 flow additive will cause nonwets of subsequent inks if the screened areas are overlapped. 3M does not recommend 892 as a flow additive in these cases unless it is added to both inks. Example: if (or when) 885I screened on top of 894I, do not add 892 flow additive to the 894I or nonwets will occur in the 885I. The nonwets in 885I can be eliminated with the addition of 892 flow additive into both process colors.

CAUTION: Do not exceed recommended maximum quantity and mix thoroughly. Use only when incomplete coverage of colors occurs.

Usage

Minimum/Maximum Usage: Begin with 5 grams of 892 flow additive per 1 gallon of process color. If necessary, up to 19 grams of 892 flow additive per 1 gallon process color may be used.

Mix well for 5 minutes using a high-speed power mixer. A propeller type paint-mixing blade is recommended.

Equipment

Screen Fabric – Use a high grade of polyester monofilament screen fabric, in mesh size PE 157. The use of other screen fabric and mesh sizes may not produce satisfactory color, reflectivity or durability and are not recommended.



Figure 1

Screen Frame – Use a rigid wood or metal frame which is large enough to provide a 6 to 10 inch (15 to 25cm) well area between the frame and the open design, (Figure 1). The screen fabric must be tightly and uniformly stretched and fastened onto the frame.

Stencil – For processing high intensity prismatic and Diamond Grade sheetings with series 880 colors, or engineer grade with Series 990 colors, use only water soluble films or direct stencil materials which resist ketones and lacquer solvents.

For processing engineer grade sheeting with Series 700 colors any type of stencil film or photo stencil material may be used. However, use of lacquer stencils requires clean-up with mineral spirits, and this takes more time than with stronger solvents.

Check with screen fabric suppliers for compatibility of the stencil materials with synthetic screen fabrics.

Do not use masking tape to block out areas on the screen. The solvents in the process color and the movement of the squeegee may cause the adhesive in the tape to come loose and clog the screen and possibly contaminate the colors. Commercially available, water soluble blackout materials are recommended.

Squeegee – For Series 700 and 880, use a sharp, medium to hard (70-80 durometer) rubber or plastic blade. For Series 990 use a soft to medium (50-60 durometer) rubber or plastic blade. The squeegee should be long enough to completely cover the area being screened, with a 2 inch (5 cm) or greater overlap on each end (Figure 1).

NOTE: For Series 990 the squeegee should be placed at a 70°– 80° contact angle to the screen for proper ink transfer.

Screening Method

Off contact screen process method – The screen should be raised approximately 1/4 to 3/8 inch (6 to 10 mm) above the table surface by adjusting the frame hinges, and by using 1/2 to 1-1/2 inch (1.25 to 3.7cm) soft foam rubber blocks (or spring loaded mechanical devices) under the leading edge, depending on screen size. See Figure 2.

The screening table must be perfectly flat, with no nicks or scratches. When screening unapplied sheets, hold the sheets in place using a vacuum table.

If a vacuum table is not available, the sheets can be held in place on a non-porous table surface using a thin, uniform layer of low tack pressure sensitive adhesive (such as 3M™ Scotch™ Sandblast Filler No. 2). Place the sheeting or film in register under the screen frame and mark the outline with a marker. Apply a thin solution of Scotch Sandblast Filler No. 2¹, using a brush or piece of cardboard to smooth it out. The adhesive will be dry enough to use, without transferring onto the sheet stock, in approximately 10 to 15 minutes.

¹Available from 3M. If necessary, the tackiness of Scotch Sandblast Filler No. 2 can be rejuvenated by dampening (not soaking) the surface with a rag soaked in VM&P Naphtha or white gasoline.

Clamp the screen into position (see Figure 1) and apply tape guides along two edges of the sheet. Use guides the same thickness as the blank for mounted signs. Recheck the position carefully before beginning, and at intervals during the run to insure accurate color registry. Repeat this procedure for each additional color.

Direct contact screen process method – This method should not be used, because the uneven contact with the sheeting by the screen may cause variations in color layer thickness, which may appear as swirls or shadows, particularly when transparent colors on reflective sheeting are viewed under reflective light.

Conditioning For Processing

Sheeting – It is important that the sheeting and process color be brought to ambient temperature [above 60°F (15°C)] and humidity before processing. Unprocessed sheets of engineer grade, high intensity prismatic or diamond grade sheeting may be stacked temporarily on a smooth, rigid base to a maximum height of 40 inches (102cm).

Process Colors – **Do not** mix or apply any series with any other series of process colors produced by 3M or any other manufacturers. **Do not** add extenders, drying agents or other materials as the field performance of the colors will be reduced.

Series 700 Colors:

If cans are not tightly sealed, the process colors may “skin” over. This skin must be removed and disposed of before thinning and mixing.

Mixing – Mix Series 700 colors thoroughly until the process color is uniform throughout. The mixing should be done before any process color is removed from the can. This is accomplished by mixing mechanically for 1-2 minutes at 1000-2000 RPM until the process color begins to roll in the can. If the process color is mixed more than 5 minutes, it tends to bubble and this requires that the process color sit for a minimum of 2 hours until the air bubbles disappear. The mixer should be the equivalent of a 3 blade, 2 inch (5.1 cm) diameter propeller, driven by an air motor. If a portion of a can of process color is left over and used at a later date, the above procedure for mixing should be followed again.

Thinning – Use 711 to thin Series 700 colors, as necessary. This is a thinner especially designed to work with Series 700 process colors.

Generally, up to 10% thinner by volume may be added, dependent upon screen mesh, stencil, climate condition and user preference. Thorough mixing is required after adding thinner, but it is recommended that only a spatula be used for

mixing the thinner into the process color.

Series 990 Colors:

Mixing – Process colors must be mixed prior to use. Shake for at least one minute by paint shaker or three minutes by hand if a paint shaker is unavailable. For best results, after shaking, pour into an open can and mix mechanically for at least five minutes at 1000 - 2000 rpm with the equivalent of a 3 blade, 2 inch (5.1 cm) diameter propeller powered by an air-driven motor. Let stand for one hour. Cover as soon as possible after mixing and during use.

Thinning – Series 990 process colors are formulated to be at screening viscosity directly out of the can. If a lower viscosity process color is needed for screening, there are two choices for thinners. The T11A is a general purpose thinner that will work in most applications. The 991 thinner/retarder is a more specialized thinner that will slightly increase drying times and should be used if drying in the screen is a problem. Thinners should be added sparingly and only to a point that results in a good quality screened image. Over-thinning may result in screening errors such as non wets, or “fisheyes.” A good general rule is to add thinner until the color lifted with the stationary propeller “piles,” just slightly, on the surface as it flows back into the container.

NOTE: If at all possible, the mixing and thinning should be done the night before and then, just before screening, hand mix with a spatula.

Series 880 Colors:

Mixing – Series 880 colors require mixing on a paint shaker or roller mixer for 1 to 5 minutes. If a paint shaker or roller mixer is not available, shake the can by hand for at least 2 minutes. This process color requires no thinner initially and should be used as supplied. Some thinning may be needed to replace solvent that evaporates during screening. Use the appropriate thinner for the Series 880 ink being screened.

Series 700, 990 and 880 Colors:

Straining – Strain the colors if needed through a standard paint strainer or several layers of cheesecloth. Allow to stand for one hour to eliminate bubbles. Re-stir with a clean spatula before use.

Storage – To store colors, tightly close or cover to prevent loss of solvent or potential contamination of the process color. Stored colors should be mixed prior to usage according to mixing instructions. Colors over one year old or showing signs of contamination should be replaced.

Color Application

Avoid rapid squeegee passes, since this stirs up the color and introduces air bubbles.

When screening large areas, it may be necessary to have a second person gradually raise the frame from the foam blocks to get the proper screen “snap”, see Figure 2. The screen should lift immediately behind the squeegee; if it lifts from the surface gradually there may not be sufficient off-contact and the thickness of the foam blocks must be increased, or the helper on large screens must lift the screen slightly higher as the screening pass is made.

The applied color must be properly positioned on the sheeting (registered) to permit accurate cutting (see Information Folder 1.10) and for proper application of subsequent colors when printing multicolored markings. This is accomplished by putting registry marks on the original artwork and including them in each screen when the stencil is made.

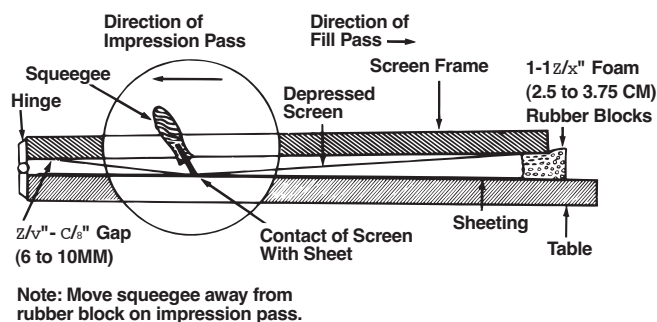


Figure 2

The sheets must be accurately cut to the same size. Position the first sheet on the screening table and mark the position using tape guides along two adjacent edges. Use this same corner as a guide to position the sheets during screening subsequent colors. After the first color has been dried, place one of the screened sheets on the table and carefully position the new screen over it, using the registry marks as guides.

Pour a small amount of color across the “well” at the hinge end of the screen, Figure 3. Add color as needed during the run.

Place the sheeting in registry under the screen and hold in place as described under “Table Set-Up”; wipe the surface lightly with a tack rag² to remove any dust or foreign matter.

With the screen held **above the foam blocks**, make a fill pass with the squeegee, **towards the foam block** to fill the screen with color.



Figure 3

Lower the screen onto the foam blocks **without touching the sheeting**. Then make an impression pass **toward the hinges**. The squeegee should be pressed firmly to the screen (and ultimately to the sheeting), leaning slightly forward (See Figure 2) so that only the leading edge of the blade contacts the screen surface.

Screening Errors

Previously dried colors cannot be removed. Unless cleaning is done **immediately**, hidden damage to the sheeting may leave a visible outline or shadow where the color had been applied. After removing errors, the sheeting must be wiped completely clean and dried. After removing errors, the user must determine the suitability of the refurbished sheeting for the intended use.

Treatment of Errors

Table 2

	Clean WhileWet	Clean AfterDrying	Cleaner (2)	Can Be Rescreened
Series 700	Yes	No	711 or Xylol	Yes
Series 990	Yes	No	T11A	Yes
Series 880I	Yes ¹	No	891	Yes
Series 880N	Yes ¹	No	711N	Yes

1. Do not get cleaner in partially cut cells along edges.
2. Wipe with rag saturated with cleaner.

Clear Coat

Clear coat is not required on Series 700, 900 or 880 process colors.

² Varnish impregnated cloth commercially available from 3M (3M Painters Cloth No. 5804). Tack cloths are available from autobody supply or paint stores.

Clean-Up Solvents

The following companies have solutions and systems to clean screens:

1. Easiway Systems, Inc.
540 River Street
P.O. Box 70
Delano, MN 55328
Tel. 800-950-3279
Fax 612-972-6206
2. Intercontinental Chemical Corporation (ICC)
4660 Spring Grove Ave.
Cincinnati, OH 45232
Tel. 800-543-2075

The following solvents or mixtures may be used for cleaning screens and equipment.

1. Four parts DPM³, one part methylethylketone.
2. Xylol (Xylene)
3. Mineral Spirits. (For Series 700 process color only)
4. The thinner for the appropriate process color series.

Note:

The first three solvents listed above are for cleaning only and should not be used as thinners for process colors. Choice of lacquer stencils requires clean-up with mineral spirits, which is a slower process.

For all cleaners, a final wipe with the thinner of the process color series being used is recommended.

All areas where solvents are used must have proper ventilation.

Air Drying

Air drying is best done at temperatures of 60-100°F (15-38°C) and relative humidity of 20-50%. Drying rates may be slowed by high humidity, low temperature, poor air circulation, a too heavy coat of color, or excessive thinning. [Exhaust ventilation must also be provided in the screening or drying room to prevent a build up of solvent vapors which may affect drying or create a health or fire hazard.]

Addition of drying agents is not recommended since they adversely affect color adhesion and durability.

Note: If screen printed materials are not sufficiently dried, blocking, sticking or severe surface impressions of the screened images may occur when stored or packaged for shipment. If adequate drying is in question, the following steps are recommended to determine if the image has been sufficiently dried.

- A. Press a dried screen printed area face to another dried screen printed face with moderate hand pressure.
- B. Place the touched area close to your ear and separate by pulling apart.
- C. If the process color is dry, there will be slightly discernible or no sound heard.
- D. If the color is not adequately dried a crackling sound will be heard. The louder the sound the more additional drying will be required.

Series 700, 990 and 880 Colors:

It is imperative that the newly processed sheets be placed on racks with adequate air flow (approximately 125 lin. ft./min. minimum) through the racks while they are being filled, so as to rapidly remove and exhaust solvents. Follow these procedures.

1. Signs should be racked with at least 2 inches of unobstructed space for air flow between layers. See Figure 4 and Figure 5.
2. Fans should be placed 4-6 ft. in front of and air directed through all parts of the racks with horizontal air flow between the layers. Two fans per rack are required for most commercial racks.
3. Racks should not be placed in a corner or near a wall where the air flow or exhaust is restricted.

Minimum Dry Times

	880/990	700
Between Colors	2 hrs.	16 hrs.
Before Packaging	3 hrs.	24 hrs.

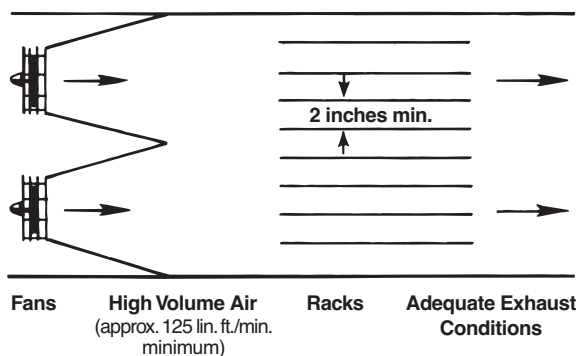


Figure 4: Schematic Drying Set-up For Air Drying

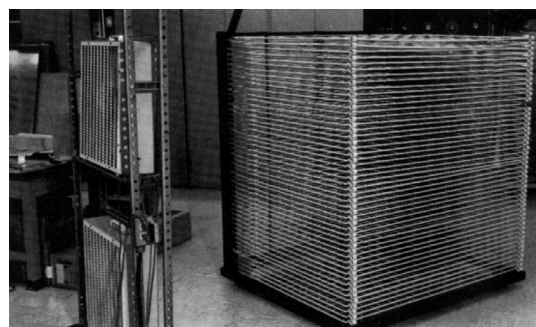


Figure 5

³Dipropylene glycol monometh ether, available from Arco Chemical Co., Ashland Chemical Co., Dow Chemical USA, and Olin Corp.

Oven Drying

Processed sheeting must be racked individually with sufficient unobstructed air flow space between layers and at the end of rack. Ovens must be designed to provide adequate horizontal air flow through the oven (125 lin. ft./min. minimum).

The freshly screened processed sign must be allowed to flow-out (air dry with fans) before it is placed in the oven. (See Table 3).

Table 3

Oven Drying Details				
Sheeting Type	Flow-Out Time(1)	Bake Each Color (2)	Bake Final Color (2)	Oven Temp.(3)
Engineer Grade Sheeting 3200 Series 700				
	1/2 hr.	1hr.	2 hrs.	175° ± 5°F (80°C ± 3°C)
Engineer Grade Sheeting 3200 Series 990				
	10-20 min.	30 min.	30 min.	150°F (65°C)
Diamond Grade™, High Intensity Prismatic and Engineer Grade Prismatic				
880 Series	10 min.	30 min.	30 min.	105° ± 5°F (41° ± 3°C)
1. Before placing in oven, rack individually to permit flow-out of color. 2. Excessive baking can deaden adhesive. 3. Oven must be provided with horizontal air flow of adequate volume.				

Conveyor Drying

Signs to be dried must be placed to allow unobstructed air flow. The conveyor speed must be able to be adjusted to meet the requirements for flow-out times and heat. If immediate packaging is planned, a cooling zone capable of cooling the sign faces to room temperature of 65°-75° F (18°-24° C) is needed. Typically, the cooling zone should be the same length as the heating zone. The temperatures stated are at the sign face and not the oven temperatures.

Table 4

	990	880
Flow-Out Time	15 seconds	30 seconds
Between Colors	90 seconds @ 185° F (65° C)	2 minutes @ 185° F (65° C)
Final Color	90 seconds @ 185° F (65° C)	2 minutes @ 185° F (65° C)

Following are examples of the many companies manufacturing conveyor dryers. For a full listing refer to the internet and search on “conveyor dryers.”

M&R Sales & Services Glen Ellyn, Ill 800-736-6431 www.mrprint.com	Despatch Minneapolis, MN 612-469-5424 www.despatch.com
Cincinnati Industrial Machinery Cincinnati, OH 513-769-0700 www.cinind.com	Svecia USA Fair Lawn, NJ 201-337-7786 www.svecia.com

⁴Microfoam - available from Dupont packaging distributors like Tekra Corp., St. Paul, MN.
 Jiffyfoam - available from Jiffy Mfg. Co., 360 Florence Ave., Hillside, NJ 07025

Storage

Unmounted Processed Faces

Slip-Sheeting (Max. Stack Height - 5 inches)

Engineer Grade Sheeting

Use SCW-568 or the liner from Series 3200 Reflective Sheeting.

Engineer Grade Prismatic, High Intensity Grade Prismatic Series and Diamond Grade sheetings.

Protect with SCW-568 glossy side against the sign face or the glossy side of the sheeting liner.

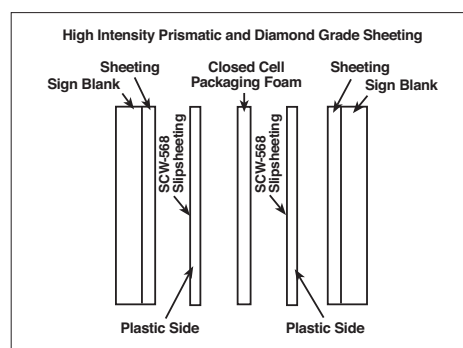


Figure 6

Mounted Processed Signs

Slip-Sheeting (Max. Stack Height - 5 inches)

Engineer Grade Sheeting

Use SCW-568 or the liner from Series 3200 reflective sheeting.

Engineer Grade Prismatic, High Intensity Prismatic and Diamond

Grade Sheetings. Use SCW-568 paper padded with 1/8" thick, closed cell packaging foam⁴ as shown in Figure 6.

Note: Signs processed on both sides must have the plastic side of the slipsheet against each sign face. See Information Folder 1.11 for details of packaging for shipment and handling at the installation site.

The final colors must be completely dry before storage. Always store mounted signs on edge. Figure 7 and 8.

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.

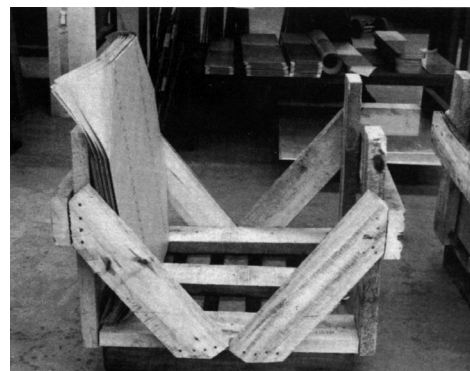


Figure 7

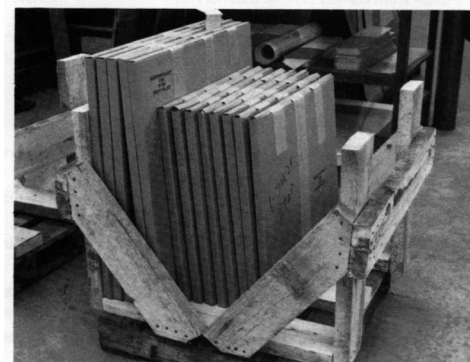


Figure 8

Trouble Shooting

Screen Processing

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
1. Incomplete coverage of colors (spots where color does not flow out properly, nonwets and fisheyes.)	A. Need addition of thinner or 892 flow additive. B. Be sure all equipment and areas are free of contaminants.	1. Thin as directed in text and mix well. 2. Avoid masking out open screen area with pressure sensitive tape. Squeegee action will often pull bits of tape adhesive or release coating into image area causing spotting. 3. If shop is using any of the temporary films with soft, oozy adhesive, check cutting, jogging, and screening areas closely for evidence of adhesive transfer. This type of adhesive transfers very easily to cutting and screening equipment and is a common cause of spotting. 4. Avoid use of silicone release agents, silicone hand creams, silicone lubricants, etc. in shop. 5. Keep screening and stock conditioning area separate from any equipment using large amounts of lubricant (e.g. vacuum applicators, which use oil.) 6. Use new wiping rags and if reused by the screen shop, have them laundered separately from other rags and clothing. Relaundered rags used by other industries may often retain some silicone or oil contaminants. 7. Ensure that color and thinner are thoroughly mixed and strained. Mix with a high speed mixer (see color separation). 8. Avoid, as much as possible, touching a sheet in the area to be screened. Handle sheets only in waste edge area. It may be helpful to wear clean cotton gloves during sheeting, cutting or handling operations. 9. Tack rag each sheet lightly just before screening. 10. If non-wetting still appears, it can be reduced or eliminated by wiping each sheet with clean rags dampened with Isopropyl Alcohol. The sheet should be wiped with a dry rag and allowed to dry before screening.

Note: The source of color spotting (non-wetting) has many potential causes. This problem occurs due to some contamination finger oils, lubricants, airborne oil or soap particles, protective hand cream, silicones, residue from incompletely cleaned wiping rags, etc. – on the sheeting surface or in the color. The color pulls away from such contaminated areas, leaving open spots. In general, transparent colors are more subject to this condition than opaques. The listed recommendations should help minimize occurrence of this condition.

Trouble Shooting

Condition

Possible Causes

Corrective Steps

		11. Do not spray vacuum applicator diaphragm or bed plate with silicone or other release agents. If signs are screened after application, this can cause severe non-wetting. 12. Use color at higher viscosity. See Color Preparation. 13. Warm sheeting above dew point to avoid condensation. 14. Add 892 flow additive per directions. If corrective steps 1-14 above do not eliminate problem, contact 3M Technical Service.
2. Smeared Copy	C. Highly toned and/or certain dark color formulations may be more susceptible to non-wetting.	
	A. Color running through screen because of: 1. excessive thinning 2. careless fill pass 3. incorrect screen mesh B. Too much or too little off-contact. C. Frame loose in hinges. D. Loose screen fabric. E. Dull squeegee. F. Dirty or poor quality stencil.	A. Remix and add more color; see Color Preparation. Use a firm, clean fill pass; do not allow color to drip onto the screen from the squeegee blade. B. Set off-contact so that only the edge of the squeegee blade contacts the surface; the screen should lift cleanly from the surface directly behind the squeegee. See Screening Method. C. Tighten hinges. D. Remake screen; fabric must be taut and uniform. E. Sharpen or replace blade. F. Remake stencil. Stencil must have clean edges.
3. Mis-registry on multiple colors.	A. Loose screen fabric. B. Loose hinges. C. Loose edge guide. D. Sheets not conditioned. E. Misplaced sheet guides. F. Indirect stencil shrinks on screen fabric. G. Block out filler applied after stencil application causes screen shrinkage.	A. Remake screen; fabric must be taut and uniform. B. Tighten hinges. C. Reposition and tighten edge guide. D. Condition sheets; see Conditioning of Stock. E. Guides must contact each sheet at the same spot. F. Use a direction emulsion stencil. G. Block out most of well area before applying stencil.

Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
	H. Oven drying between colors.	H. Air dry only between colors on tight registry work.
	I. Too much off-contact (or excessive or uneven lift on large screens).	I. Use foam rubber off-contact block. Reduce off-contact and lift large screens evenly so that the screen fabric “breaks” just behind the squeegee.
	J. Pulling squeegee in opposite directions on alternate sheets.	J. Make squeegee pass in one direction on all colors.
4. Color bubbles excessively.	Minor bubbling of the process color on the sheeting may remain after screening but should flow out the first 5 minutes of dry time. Bubbles are caused by such things as:	
	A. Rapid movement of squeegee.	A. Make a slow, uniform impression pass.
	B. Too much or too little off-contact.	B. Set off-contact so that only the edge of the squeegee blade contacts the surface; the screen should lift cleanly from the surface directly behind the squeegee. See Screening Method.
	C. Color too thick or too thin.	C. Remix with more thinner or more color. See Color Preparation. If necessary, mix with a high speed mixer; allow to stand overnight, then hand mix before using.
	D. No fill pass.	D. Always use a fill pass.
	E. Incomplete cleaning of screen.	E. Thoroughly clean with appropriate solvent.
	F. Bubbles do not flow out.	F. See Note below.
Note: If bubbles occur during screening, a strong air flow on processed areas can dry the bubbles quickly and prevent them from flowing out properly. To rectify this situation, immediately switch to a slower speed on the fans or increase the distance of the fans from the racks but DO NOT STOP AIR FLOW COMPLETELY . Reducing the air flow too much will tend to allow solvents to concentrate and slow evaporation, causing cracking as the colors dry. After 20 minutes, reset or reposition fans for maximum air flow.		
5. “Orange Peel” (Small uniform scaling pattern).	A. Color too thick.	A. Remix with more thinner.
	B. Color not thoroughly mixed.	B. Mix thoroughly. If necessary, use a high speed mixer.
	C. Wrong thinner.	C. Use only a recommended thinner. See Color Preparation.
	D. Screen lag (not lifting directly behind squeegee blade) caused by:	
	1. Too little off-contact.	1. Use foam rubber blocks, increase amount of off-contact.
	2. Loose screen fabric.	2. Remake screen; fabric must be taut and uniform.
	3. Color too thick.	3. Remix with more thinner. See Color Preparation.

Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
	E. Pulling squeegee toward off-contact blocks. F. No fill pass. G. Not allowing time for color flow-out before placing in oven.	E. Always screen away from off-contact blocks, toward the hinges. F. Always use a fill pass. G. Always allow 1/2 hour air dry before oven drying.
6. Applied color appears mottled.	A. Color too thick. B. Color not thoroughly mixed. C. Wrong thinner. D. Color drying in screen. E. Improper off-contact. F. Pulling squeegee toward off-contact blocks. G. Table surface not flat.	A. Remix with more thinner. B. Mix thoroughly. If necessary use a high speed mixer. C. Use only recommended thinner. See Color Preparation. D. See Number 7 below. E. Use foam rubber off-contact blocks. Set off-contact so that only the area under the edge of the squeegee blade contacts the surface; the surface should lift cleanly from the surface directly behind the squeegee. See Screening Method. F. Always screen away from off-contact blocks, towards the hinges. G. Refinish or replace table top. It must be flat and smooth.
7. Color drying in screen.	A. Delay between screening passes.	A. If screen has been left unused for more than 1 or 2 minutes, make a fill pass and then screen several passes onto waste paper. If a longer delay is necessary; 1. Wash bottom of screen with thinner, 2. Leave the screen open without a fill pass and cover screen with paper. When resuming run, screen several passes onto waste paper. Before removing the screened sheet, make a fill pass for the next sheet.

Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
	B. Color too thick. C. Air draft on screening area. D. Low shop humidity and/or high temperature. E. Wrong thinner.	B. Remix with more thinner. C. Arrange circulation to avoid air drafts. D. Increase humidity. If possible have screen shop environmentally controlled. E. Use only recommended thinners. See Color Preparation.
8. Color “cobwebs” at copy edges.	A. Static electricity.	A. Ground the table, screen and sheeting with rope tinsel and/or increase shop humidity.
9. Excessive dust pick-up.	A. Airborne dust and lint; static electricity.	A. Seal floors, keep floors and work area clean. Ground the table, screen and sheeting with rope tinsel and/or increase shop humidity.
10. Streaks or marks in screened area.	A. Color trailing from squeegee blade and running through screen. B. Color drying in screen. C. Screen doesn’t lift from sheeting immediately behind squeegee. D. Nick in squeegee. E. Nick or scratch in table top. F. Squeegee too sharp. G. Squeegee too hard (990 Series).	A. Move squeegee from side in well area to “blot” it before beginning impression pass and prevent color from trailing from rear edge of blade. B. See Number 7 above. C. Increase off-contact. If necessary, remix color, adding more thinner. D. Check squeegee blade and sharpen or replace if necessary. E. Refinish or replace table top. It must be flat and smooth. F. Sand leading edge of freshly sharpened squeegee with fine sandpaper or emery cloth. G. Replace with a softer (50-60) durometer rubber blade.

Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
11. Blurred edges on screened edges.	A. Color too thin, and runs under the stencil edges. B. Color drying at stencil edge. C. Squeegee not making a firm impression at stencil edge. D. Too much pressure on squeegee folds the blade over and forces process color under edge of screen.	A. Remix with more color. B. See Number 7 above. C. 1. Increase size of well between frame and open area of stencil, or 2. Use thinner stencil film, or 3. Increase pressure on impression pass, or D. 1. Use a harder squeegee blade, or 2. Reduce amount of off-contact.
12. Screened color does not hide sheeting background, or color is too light.	A. Inherent low hiding power in certain opaque colors; a thin layer of transparent color will be light or pastel in color.	A. Use coarser mesh screen; or screen twice, drying between passes.
13. Colors do not air dry properly.	A. Concentration of solvent vapors between trays on drying rack retards rate of evaporation. B. High humidity and/or low temperature. C. Use of coarser mesh screen.	A. Use high volume fans directed into drying racks to remove solvent vapor. B. Decrease humidity, increase temperature, or oven dry if equipment is available and oven drying is recommended for the sheeting or film and the particular use condition. See Drying. C. Use recommended screen mesh.
14. Cracks in the screened areas.	A. Insufficient horizontal air flow in drying area. B. Insufficient exhaust air flow in drying area. C. High Humidity or Low Temperature. D. Using coarse mesh screen. E. Rough handling of sheeting.	A. Improve air flow. See Air drying Series 880 colors. B. Improve exhaust to remove solvents from drying area. C. Start dehumidification. Install heater. D. Use recommended mesh screen. E. Do not flex or bend when cold. Design better packaging.

Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
	F. Excess tension during squeeze roller application. G. Using wrong series inks. H. Flexing of wet diamond grade sheets.	F. Monitor brake and clutch during ISRA application. G. Use only recommended ink. H. Use loading boards.
15. Engineer Grade 3200 sheeting: sheets curl toward face.	A. Liner has lost moisture. B. "Roll set" remains in sheets.	A. Rack sheets face down or two sheets face to face on open racks until they stabilize. If area is environmentally controlled, gradually increase humidity. B. Roll sheet gently against curl. (Do not roll sheets with scored liner parallel to score lines.)
16. Engineer Grade 3200 sheeting: sheets curl toward face.	A. Liner has absorbed moisture.	A. Rack sheets face down on two sheets face to face on open racks until they stabilize. If area is environmentally controlled, gradually decrease humidity.
17. Engineer Grade 3200 sheeting: sheets do not lie flat in stacks.	A. Liner has absorbed moisture at the sheet edges, but not in the center.	A. Rack sheets face down or two sheets face to face on open racks until they stabilize.
18. Engineer Grade 3200 sheeting: ridges in sheets at score lines.	A. Liner sections are absorbing moisture independently and overlapping at score line.	A. Use sheets with unscored liner. If scoring is required score after processing. If area is environmentally controlled, gradually decrease humidity.
19. Engineer Grade 3200 sheeting: wavy pattern in sheeting surface or at edges.	A. Inherent liner variations are being accentuated by moisture absorption.	A. 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.

Trouble Shooting

Condition

Possible Causes

Corrective Steps

Handling Unmounted Screened Sheets

1. Processed sheets block together in stacks.	A. Final color or clear coat not thoroughly dry. B. Material subjected to excessive heat and/or pressure. C. No, or incorrect slipsheet between Engineer Grade 3200 sheeting faces.	A. Color and clear coats must be completely dry before packaging. Increase air dry time with high volume fans blowing through racks or oven cure if necessary. See Drying Colors and Clears. B. 1. Avoid exposing material to excessive or direct heat during storage or shipping, and 2. Reduce stock size to avoid high pressure on lower sheets. C. If processed Engineer Grade sheeting is stored, mounted or shipped, SCW-568, or the liner from 3200 sheeting between sheets, should be used.
2. Surface impressions on processed sheets.	A. Final color or clear coat not dry. B. Stack under pressure or processed sheets stacked in presence of excessive heat. C. Clear coat too heavy.	A. Check drying before stacking. B. Avoid exposing stacks to pressure, excessive or direct heat. C. Reduce clear coat thickness by using finer mesh screen, adjusting roller coater, or using more thinner.

Handling Finished Signs

1. Finished signs stick together.	A. Signs were stacked flat with no slipsheet - heavy stack pressure causes blocking. B. Clear coat or color not completely dry.	A. Store signs on edge, with spacers between signs and slipsheet. B. Follow instructions under Drying Colors and Clears, above.
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Trouble Shooting

<u>Condition</u>	<u>Possible Causes</u>	<u>Corrective Steps</u>
2. Stored signs show dark spots or blotches on face.	A. Signs stored in damp area or on damp surface with pressure on sign face. B. Signs became wet during storage with slipsheet in contact with sign face.	A. Store signs on edge in cool dry area, with spacers to allow good air circulation and prevent moisture from being trapped between closely stacked signs. B. Signs that become wet in storage should be unpacked and stored as above.
3. Unapplied faces wrinkle and separate from liner.	A. Sheet incorrectly rolled (liner side out).	A. If sheets must be rolled for shipment, roll face side out around core with minimum 3-1/4" (8.3cm) diameter, or ship emblems packed flat in crate.
4. Cracked edges on emblems.	A. Sheets packaged loosely in shipping container. B. Using dull cutting tool. C. Faces bent when temperature is low. Cold causes brittleness.	A. Sheets must be packaged to prevent movement within shipping container. B. All cutting tools must be sharp. C. Faces must be handled carefully when cold.

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