



Scotchlite™ Flexible Reflective Film Series 680

For Screen Printing and Electrostatic Imaging Only

Description

Advantages

- Versatile printing capabilities
 - Traditional screen printing
 - Electrostatic imaging (film 680-10 only)
- Durable, flexible, enclosed-lens, retroreflective film
- Positionable, pressure-activated adhesive (a 3M technology that is a mechanical feature, not an adhesive property)
- Resists cracking in cold climates
- Ideal for both large graphics and graphics applied to corrugated substrates
- Film 680-85 has a black daytime appearance but reflects white at night
- Excellent angularity
- Retains 90% of its retroreflectivity when totally wet
- Similar daytime and nighttime appearance

Applications and Uses

3M™ Scotchlite™ Flexible Reflective Film Series 680 is intended for making permanent, durable graphics when used with the listed Compatible Products in the following applications. These applications are warranted by the 3M™ MCS™ Warranty.

- Multicolor commercial vehicle graphics, railroad graphics, commercial signs, and striping

Limitations of Uses

We do not normally warrant other applications, but please contact us to discuss your needs or let us suggest other 3M products.

Specifically, we do not warrant this film for the following:

- Permanent, regulatory traffic signs
- Graphics made for automotive Original Equipment Manufacturers (OEM); contact 3M Automotive Division at 1-800-328-1684, Ext. 444, for alternatives.

Note: For use on stainless steel, contact Technical Service at 1-800-328-3908.

Compatible Products

Screen Printing

- 3M™ Screen Printing Ink Series 1900
(line color and four color)
- 3M™ Screen Printing Ink Series 9700UV
(line color and four color)
- 3M™ Scotchlite™ Screen Printing Ink Series 2900
(line color and four color)

Electrostatic Imaging

- Scotchprint® Toner Series 8700/8800 ES
- 3M™ Trident Transfer Media ES
- 3M™ Scotchcal™ Luster Overlamine 8519
- 3M™ Scotchcal™ High Gloss, Graffiti Resistant Overlamine 8912 ES *(not for use on rivets)*
- 3M™ High Luster Protective Clear 8920 ES
(not for use on corrugations)

Other Products

- 3M™ Scotchlite™ Edge Sealer 4433
- Selected 3M application tapes

Note: For the full product names of the 3M products listed on this page, please see page 1.

Product Line

This information is subject to change. Be sure this is the most current Product Bulletin. See 3M Related Literature at the end of this bulletin.

Characteristic	Description
Number and color	680-10 White 680-77 Green 680-14 Orange 680-81 Lemon 680-64 Gold yellow 680-71 Yellow 680-82 Ruby red 680-72 Red 680-85 Black 680-75 Blue 680-76 Lt. blue
Thickness	0.007 to 0.008 inch (0.18 to 0.20 mm) <i>(film and adhesive)</i>

Characteristic	Description
Adhesive type	Positionable, pressure activated
Adhesive color	Clear, with silver underneath
Liner	Polyethylene-coated paper
Application surfaces	Flat, flat with rivets, moderate compound curves, corrugated
Application substrates	Aluminum, FRP, paint
Application temperature range for air and substrate	50° to 100°F (10° to 38°C) <i>flat surfaces without rivets</i> 55° to 100°F (13° to 38°C) <i>flat, curved or corrugated surfaces with rivet</i>

Effective Performance Life

The effective performance life for 3M™ Scotchlite™ Plus Flexible Reflective Film Series 680 is based on field experience and exposure tests conducted throughout the United States. When the graphics are processed and used according to 3M recommendations, they should have the following performance life. The actual performance depends on the:

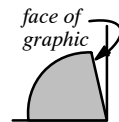
- Correct combination of film, ink/toner, and screen print clear or overlaminate
- Ink formulation (screen print only)
- Drying methods (screen print only)
- Selection and preparation of the substrate
- Application methods
- Exposure conditions
- Cleaning methods

Warranted Durability



Vertical Exposure

The face of the graphic is $\pm 10^\circ$ from vertical.



Non-Vertical Exposure

The face of the graphic is greater than 10° from vertical.

Vehicle Applications					
Graphic Construction		Vertical Exposure		Non-Vertical Exposure	
Film 680 with Toner or Ink	Screen Print Clear or Overlaminate	U.S. ¹ years	S.W. ² years	U.S. ¹ years	S.W. ² years
Unprinted film	None	7	5	5	0
3M™ Screen Printing Ink Series 2900 (line color)					
All film colors	2920DR 4430R 9720UV	7	5	5	0
3M™ Screen Printing Ink Series 2900 (4-color)					
All film colors	2920DR 4430R 9720UV	5	4	3	0
3M™ Screen Printing Ink Series 9700UV (line color)					
All film colors	9720UV	7	4	3	0
3M™ Screen Printing Ink Series 9700UV (4-color)					
All film colors	9720UV	5	4	3	0

Vehicle Applications continued on the next page

Note: For the full product names of the 3M products listed on this page, please see page 1.

Vehicle Applications <i>(continued)</i>					
Graphic Construction		Vertical Exposure		Non-Vertical Exposure	
Film 680 with Toner or Ink	Screen Print Clear or Overlaminated	U.S.¹ years	S.W.² years	U.S.¹ years	S.W.² years
3M™ Screen Printing Ink Series 1900 (line color)					
All film colors	1920DR 4430R 9720UV	7	5	5	0
3M™ Screen Printing Ink Series 1900 (4-color)					
All film colors	1920DR 4430R 9720UV	6	5	4	0
Scotchprint® Toner Series 8700/8800					
Film 680-10 white only	8519	5	4	0	0
	8920 ES <i>(no corrugations)</i>				
	8912 ES <i>(no rivets)</i>	4	3	0	0
Commercial Signs and Non-Vehicle Applications					
Unprinted film	None	5	3	0	0
Printed film series 680 all ink and clear combinations listed for Vehicle Applications		5	3	0	0
Scotchprint Toner® Series 8700/8800					
Film 680-10 white only	8519	5	2	0	0
	8912 ES <i>(no rivets)</i>				
	8920 ES <i>(no corrugations)</i>				
Railroad Applications					
Unprinted film	None	5	4	3	0
3M™ Screen Printing Ink Series 1900 (line color only)					
All film colors	1920DR 4430R 9720UV	5	4	3	0
3M™ Scotchlite™ Screen Printing Ink Series 2900 (line color only)					
All film colors	2920DR 4430R 9720UV	5	4	3	0
3M™ Screen Printing Ink Series 9700UV (line color only)					
All film colors	9720UV	5	4	3	0

¹ For warranty periods outside the United States, contact the 3M sales organization for that country.

² The U.S. Desert Southwest includes Arizona, New Mexico, and the desert areas of California, Nevada, Utah, and Texas. A detailed map is available by request. The warranty for this area is reduced because there is more solar energy. This warranty applies to graphics that are exposed more than 50% of the time in the U.S. Desert Southwest.

³ Also read the Warranty Limitations on page 3.

Warranty Limitations

- 3M warrants film series 680 for non-vertical applications in the U.S. (except not in the Desert Southwest) for graphics applied at 10° to 45° from vertical. Film that is exposed at these angles may have a shorter life. The customer must assume the responsibility for testing and approving other exposures.
- Long exposure to continuous high heat decreases the effective performance life of this film by 2 years. High heat is a temperature above 150°F (65°C). It may occur in areas such as railroad locomotives, vehicle engine compartments, non-insulated tankers exposed to frequent internal steam cleaning, or compartments that carry hot cargo.

Note: For the full product names of the 3M products listed on this page, please see page 1.

3M™ MCS™ Warranty

3M warrants the performance of the Product from the date of installation for the number of years stated in the Warranted Durability chart. In the event that the Product does not perform as stated within the warranted time, and the graphics are fabricated as specified by the 3M MCS Warranty, then 3M shall at 3M's option either (a) refund the entire purchase price of the material, or (b) replace all 3M materials consumed in the manufacture of the graphics. In addition, *for fleet applications only*, 3M will reimburse 100% of the labor costs associated with the removal, remanufacture, and reapplication of the graphic to the extent that 3M determines such amount is reasonable and necessary in the circumstances. This labor cost reimbursement will be determined by 3M on a case-by-case basis taking into account the expected amount of labor needed to make such repairs and other considerations.

Screen Printing

Durability

To obtain the durability given in the Effective Performance Life section, use only approved combinations of ink and overprint clear.

Formulations and processing conditions can affect ink durability. Carefully follow limitations of specific inks and the instructions in the appropriate Product and Instruction Bulletins. Refer to the 3M Related Literature section.

Ink Considerations

- Ink series 1900 and 9700UV are opaque. Be aware that it prevents the film from retroreflecting in the screen printed areas. Ink series 2900 is transparent, which is a good choice when retroreflection is important in the screen printed areas.
- For graphics subjected to fuel vapors or occasional spills, use screen printing ink 2900 and clear 4430R.
- Oven dry the last color and the clear when using solvent-based inks on graphics needed for any corrugated application.

Electrostatic Imaging

Refer to the 3M Related Literature section for Instruction Bulletins that discuss digital printing methods.

Film 680-10 can be used as marking film for the transfer of an image. The image is electrostatically printed onto the transfer media and then heat transferred onto film 680-10. An approved overlamine or screen print clear must be applied to the graphic.

Cutting

Caution

When using any equipment, always follow the manufacturers' instructions for safe operation.

Recommended Cutting Methods

- Band sawing
- Hand cut
- Hot kiss cutting
- Guillotine
- Cold and hot steel-ruled die cutting
- Drum-type electronic cutting
- Flat-bed electronic cutting

Note: Electronically-cut graphics may be difficult to cut and weed. The customer must assume responsibility for testing and approving this cutting method.

Weed the film within 24 hours of cutting it. The adhesive may flow after cutting.

Refer to Instruction Bulletin 4.1 for more details.

Design Factors

- Use a minimum letter height of 3 inches (7.6 cm).
- Use a minimum stroke width of 3/8 inch (1.0 cm).
- Use a minimum radius for a point of 1/16 inch (1.6 mm).
- For uniform color and brightness when making a graphic with multiple pieces of film 680-10 together, be sure the pieces are properly color matched. See Instruction Bulletin 2.1 for details. Color-matched film 680CM-10 is available by special order. Contact your 3M representative.
- Order "roll applicator splices" for roll striping. Butt splices may have a small gap.

Note: For the full product names of the 3M products listed on this page, please see page 1.

Application Tapes

Select a 3M application tape to suit your graphic and the screen print clear that is used. Use a prespace tape for graphics that have large amounts of exposed liner or are kiss cut. Use a premask tape if there is very little exposed liner. Refer to Instruction Bulletin 4.3 for more details.

Premasking IS NOT recommended for:

- Continuous rolls or striping wider than 12 inches (31 cm)
- Rolls wider than 12 inches (31 cm) that will be slit

Premasking IS recommended for:

- Graphics larger than 4 square feet (0.4 m²)
- Striping greater than 4 inches (10 cm) wide

Clear or Overlaminates	Premask Tape	Prespace Tape
Unprinted film	SCPM-3	SCPS-2
1920DR 2920DR 4430R	SCPM-3	SCPS-2
9720UV	SCPM-44X	SCPS-53X
8519 8912 ES	None required, but may use SCPM-3	None
8920 ES	SCPM-44X	SCPS-2

Application

This Bulletin does not contain detailed application procedures. Refer to the 3M Related Literature section for further information.


- The adhesive on film series 680 is positionable when tacking, but not after applying pressure. The pressure used to apply the film bonds the adhesive to the substrate.
- Do not apply graphics if the air or surface temperature is lower than 50°F (10°C) on a flat surface without rivets, or 55°F (13°C) on riveted or corrugated surfaces.
- At surface temperatures higher than 100°F (38°C), the film loses its positionability.
- Some substrates such as under-cured polyurethane paint, fiberglass, and some paint systems may continue to outgas for some time. Two-part polyurethane paints and clear coats may stop curing when the air and surface temperatures are lower than 75°F (24°C). Be aware that outgassing causes this film to bubble.
- Use edge sealer 4433 on processed and unprocessed graphics subjected to fuel vapors or occasional fuel spills.

- Edge sealing in the following applications is not required, but it may help keep the edges adhered when subjected to external sources such as abrasion and/or high pressure washing. Edge sealer 4433 is recommended for processed and unprocessed graphics.

- graphics exposed to severe abrasion or high pressure washing (see Note, below)
- graphics applied to chrome substrates
- graphics applied to locomotives and rolling railroad stock
- graphics applied to truck roll-up doors

Note: Refer to Instruction Bulletin 6.5 for details on pressure cleaning. Exceeding 3M's recommendations will void the warranty whether or not an edge sealer was properly used.

Removal

 Caution
Solvents may ignite near heat or open flame. Do not use heat sources near solvents. Failure to avoid the use of heat sources near solvents can cause flash fire.

Film series 680 is not a removable product. Heat helps take off the top layer, but removing the adhesive requires a solvent-based remover.


Refer to Instruction Bulletin 6.5 for more details.

Shelf Life and Storage

- The combined shelf life as processed and unprocessed film series 680 cannot exceed 2 years from the date of receipt from 3M. However, the film must be used within 1 year of processing even if the combined shelf life is less than 2 years.
- Leave the rolls of film in the original shipping carton or suspend the rolls horizontally.
- Store cut sheets lying flat.
- Store the film and the processed graphics in a clean, dry area and away from direct sunlight.
- If the graphic has clear 4430R, on it and it is pre-masked, store it at a temperature less than 85°F (30°C). Other graphics should be stored at a temperature lower than 100°F (38°C).
- Ship the finished graphics lying flat or in a roll. To roll the graphic, wrap it film-side-out on a minimum 6 inch (15 cm) diameter core. These methods help prevent the film and premasking from wrinkling or popping off the liner.

Note: For the full product names of the 3M products listed on this page, please see page 1.

Health and Safety

 Caution
<p>When handling any chemical products, read the manufacturers' container labels and the Material Safety Data Sheets (MSDS) for important health, safety and environmental information.</p> <p>To obtain MSDS sheets for 3M products:</p> <ul style="list-style-type: none"> By fax, call 1-800-364-0768 in the US and Canada or 1-650-556-8417 for all other locations. Electronically, visit us at http://www.3M.com/MSDS. By mail, or in case of an emergency, call 1-800-364-3577 or 1-651-737-6501. <p>When using any equipment, always follow the manufacturers' instructions for safe operation.</p>

Product Data

These are typical values for film series 680 and are not intended for use in specifications. Your local 3M sales representative can help you get a custom specification.

Retroreflection

At a -4° entrance angle and a 0.2° observation angle, unprinted film 680 has the following typical coefficient of retroreflection. It is expressed in candlepower per foot-candle per square foot (candela/lux/square meter) per ASTM E 810.

The entrance angle is formed by a light beam striking the surface at a point and at a line that is perpendicular to the surface at the same point.

An observation angle is formed by the light beam striking the reflective surface and returning to the observer. From 800 feet (249 meters), a motorist normally views a graphic at a 0.2° angle.

Film and Color	Typical Coefficient of Retroreflection
680-10 White	100
680-14 Orange	25
680-64 Gold	65
680-71 Yellow	60
680-72 Red	20
680-75 Blue	10
680-76 Light blue	10
680-77 Green	15
680-81 Lemon yellow	40
680-82 Ruby red	20
680-85 Black	30

Physical Properties

The data is for unprinted and printed film with screen print clear.

Property	Value
Service temperature range	-30° to $+200^\circ\text{F}$ (-34° to $+93^\circ\text{C}$)

Chemical Resistance

- Resists mild acids, mild alkalis and salts
- Excellent water resistance
- Resists occasional fuel spills

Warranty and Limited Remedy

The following is made in lieu of all other express or implied warranties, including any implied warranty of **merchantability** or **fitness for a particular purpose**: 3M™ Scotchlite™ Plus Flexible Reflective Film Series 680 is warranted to be free of defects in materials and manufacture at the time of shipment and to meet the specifications stated in this Product Bulletin. 3M will replace or refund the price of any 3M materials that do not meet this warranty within the specified time periods. See the worldwide 3M™ MCS™ Warranty bulletin, which gives the terms and limitations of the warranty.

These remedies are exclusive. In no case shall 3M be liable for any direct, indirect, or consequential damages, including any labor or non-3M materials charges.

Attention:

Scotchprint® Graphics Authorized Manufacturers

Visit our password-protected website for exclusive product information, profiles and services.

www.scotchprint.com, then *Login*

To register, login and click "Register" on the right side of the screen. Certain restrictions apply.

3M Related Literature

Before starting any job, be sure you have the most recent product and instruction bulletins.

The following bulletins provide the information you need to properly use the 3M products that may be used in your graphic. You can find these bulletins on our Web site at www.scotchprint.com. Or, call one of these phone numbers to order the desired bulletins via our Fax-on-Demand (FOD) system.

United States or Canada: 1-800-364-0768
International: 1-651-732-6506

Subject	Bulletin No.	FOD No.
Product Bulletins		
3M™ Scotchcal™ Screen Printing Ink Series 1900 and Screen Print Clear V10402	1900	2509
3M™ Scotchlite™ Screen Printing Ink Series 2900	2900	2512
3M™ Scotchcal™ Screen Printing Ink Series 9700UV (line color and 4-color)	9700	2507
3M™ Scotchcal™ Overlamine 8519 and 8520	8519/8520	4524
Instruction Bulletins		
Design of markings	2.1	5501
Screen printing with ink series 1900 - line color - 4-color	3.12 3.11	6012 6011
Screen printing with ink series 2900 - line color - 4-color	3.18 3.19	6018 6019
Screen printing with ink 9700UV - line color - 4-color	3.4 3.13	6004 6013
Cold roll lamination	4.22	6522
Scoring and cutting	4.1	6501
Using 3M application tapes; premasking and prespacing for films	4.3	6503
Application, substrate selection, preparation and substrate-specific application techniques	5.1	7001
Application, special applications and vehicles	5.4	7004
Application, general procedures for interior and exterior dry applications	5.5	7005
Storage, handling, maintenance, removal	6.5	8505

Bulletin Change Summary

Overlamine 8910 has been replaced by overlamine 8519 with no difference in performance or warranty.



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