



Scotchlite™

Reflective Graphic Film

Series 680

For Screen Printing and Electrostatic Imaging Only

Description

Film series 680 are flexible, enclosed lens, 7-mil retroreflective films. These films feature 3M's slideable and repositionable, pressure-activated adhesive to aid in large graphic application. These long term durable films are designed for commercial vehicle graphics, railroad graphics, corrugated surfaces and striping, and are screen printable. Film 680-10 can also be electrostatically imaged.

Advantages

- Similar daytime and nighttime appearance
- Excellent angularity
- Retains 90% of its retroreflectivity when totally wet
- Unprocessed film resists fuel vapors or occasional spills

Recommended Types of Graphics and End Uses

These types of graphics and end uses may be warranted by the 3M™ MCS™ Warranty. Please read the entire bulletin for details.

- Multi-color commercial vehicle graphics, railroad graphics, commercial signs and striping
- Vertical indoor and outdoor signage

Limitations of End Uses

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

Unsuitable End Uses for This Film

- Graphics applied to:
 - FRP without a Tedlar® coating
 - Permanent, regulatory traffic signs
 - Stainless steel; contact Technical Service
- Graphics made for automotive Original Equipment Manufacturers (OEM); contact 3M Automotive Division at 1-800-328-1684 for alternatives.

Compatible Products

Screen Printing Inks

- 3M™ Screen Printing Ink Series 1900
line color
- 3M™ Screen Printing UV Ink Series 9800
line color and four color
- 3M™ Scotchlite™ Screen Printing Ink Series 2900
line color and four color

Screen Printing Graphic Protection Options

- 3M™ Screen Print Gloss Clear 2920DR
- 3M™ Screen Print Low Gloss Clear 1920DR
- 3M™ Screen Print Gloss Clear 9720UV
- 3M™ Screen Print UV Gloss Clear 9800CL

Electrostatic Imaging

- Scotchprint® Toner Series 8700/8800 ES
- 3M™ Trident Transfer Media ES

Electrostatic Imaging Graphic Protection Options

- 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
- 3M™ Premasking Tape SCPM-3
- 3M™ Premasking Tape SCPM-44X
- 3M™ Prespacing Tape SCPS-2
- 3M™ Prespacing Tape SCPS-53X

Characteristics

All values given are typical for unprocessed film unless noted otherwise and are not for use in specifications. Processing film may change certain values. If you have questions about your construction, contact the Technical Service helpline at 1-800-328-3908.

Physical Characteristics

Characteristic	Description																																				
Material	Vinyl																																				
Colors	680-10 White 680-14 Orange 680-64 Gold 680-71 Yellow 680-72 Red 680-75 Blue 680-76 Light blue 680-77 Green 680-81 Lemon yellow 680-82 Ruby red 680-85 Black																																				
Colors & Typical Retroreflection	<table border="1"> <thead> <tr> <th>Film</th> <th>Color</th> <th>Typical Coefficient of Retroreflection</th> </tr> </thead> <tbody> <tr> <td>680-10</td> <td>White</td> <td>100</td> </tr> <tr> <td>680-14</td> <td>Orange</td> <td>25</td> </tr> <tr> <td>680-64</td> <td>Gold</td> <td>65</td> </tr> <tr> <td>680-71</td> <td>Yellow</td> <td>60</td> </tr> <tr> <td>680-72</td> <td>Red</td> <td>20</td> </tr> <tr> <td>680-75</td> <td>Blue</td> <td>10</td> </tr> <tr> <td>680-76</td> <td>Light blue</td> <td>10</td> </tr> <tr> <td>680-77</td> <td>Green</td> <td>15</td> </tr> <tr> <td>680-81</td> <td>Lemon yellow</td> <td>40</td> </tr> <tr> <td>680-82</td> <td>Ruby red</td> <td>20</td> </tr> <tr> <td>680-85</td> <td>Black</td> <td>30</td> </tr> </tbody> </table> <p>At -4° entrance angle and 0.2° observation angle. <i>See further explanation to the right.</i></p>	Film	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
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Thickness	With adhesive: 7-8 mils (0.18 to 0.20 mm)																																				
Adhesive type	Pressure-activated, positionable																																				
Adhesive color	Clear with silver underneath																																				
Liner	Polyethylene-coated paper																																				

Characteristic	Description
Adhesion <i>24 hours after application</i>	Aluminum (etched or anodized): 5.0 pounds/inch (0.9 kg/cm) FRP: 3.9 pounds/inch (0.7 kg/cm) Fruehauf painted panels: 4.5 pounds/inch (0.8 kg/cm)
Chemical resistance	Resists mild alkalis, mild acids, and salt Excellent resistance to water <i>(this does not include immersion)</i> Resists occasional fuel spills

Application Characteristics

Characteristic	Description
Finished graphic application recommendation	Surface type: Flat, with and without rivets; moderate curves; corrugations Substrate type: Aluminum, FRP, paint Application temperature: 50° to 100°F (10° to 38°C) flat surfaces without rivets 55° to 100°F (13° to 38°C) flat, curved or corrugated surfaces with rivets
Graphic in use temperature range	-30° to +200°F (-34° to +93°C)
Removal	Permanent

Retroreflection Definition

The typical coefficient of retroreflection defined in Physical Characteristics is measured at a -4° entrance angle and a 0.2° observation angle. 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.

Warranty Information

See the 3M Graphics Center Warranty Brochure for the complete warranty and remedy details. The warranty given in the Product Bulletin that is current at the time you purchased the film is the one that 3M will honor.

3M™ MCS™ Warranty for Finished Graphics

Warranted Durability for Graphic Constructions in a Vertical Exposure

Warranties shown in years	Ink Series 2900 line color			Ink Series 2900 4-color		Ink Series 1900 line color			Ink Series 9800 line color			Ink Series 9800 4-color		
	Vehicle	Railroad	Sign	Vehicle	Sign	Vehicle	Railroad	Sign	Vehicle	Railroad	Sign	Vehicle	Railroad	Sign
Graphic Protection	Film 680													
2920DR	7	5	5	5	5	—	—	—	—	—	—	—	—	—
4430	7	5	5	5	5	7	5	5	—	—	—	—	—	—
9720UV	7	5	5	5	5	7	5	5	7	5	5	5	—	5
1920DR	—	—	—	—	—	7	5	5	—	—	—	—	—	—
9800CL	—	—	—	—	—	—	—	—	5	5	5	5	—	5

Warranties shown in years	No Printing			Toner Series 8700	
	Vehicle	Railroad	Sign	Vehicle	Sign
Graphic Protection	Film 680				
8908	—	—	—	0	1
8519	—	—	—	5	5
8912	—	—	—	4	5
8920	—	—	—	5	4
None	7	5	5	—	—

Formulas for Other U.S. Warranted Durabilities

Use the following formulas to determine other durabilities, based on a percentage of the U.S. Warranted Durability for vertical exposure

Exposure	Percentage of U.S. Vertical Exposure	Example
Desert Southwest Vertical	70% (0.7)	0.7 x 5 years = 3.5 years

Reduced Warranty for Graphics Exposed to Heat

Long exposure to continuous high heat decreases the 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.

Fleet Labor Reimbursement

3M will reimburse 100% of the labor costs associated with the removal, remanufacture and reapplication of a **commercial fleet graphic only** 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.

Labor Reimbursement Remedy for Removable and Changeable Films

If the film cannot be successfully removed or an excessive amount of adhesive residue remains on the surface, 3M will reimburse a portion of extra removal costs.

Removal requires heat and/or chemicals. The ease and rate of removal depends on a number of factors. See Instruction Bulletin 6.5 for details.

See warranty removal limitations on page 1.

Orientation	Remedy
Vertical—Most of U.S.	8 years or the Warranted Durability, whichever comes first
Vertical—Desert Southwest	5 years or the Warranted Durability, whichever comes first

Warranty Notes

Terms



face of graphic

Vertical exposure

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

Desert southwest exposure. Graphics exposed to solar energy more than half of the time in Arizona, New Mexico and the desert areas of California, Nevada, Utah and Texas. A detailed map is available upon request.

Signs. Graphics applied outdoors and exposed to the elements.

Railroad. Graphics applied on railroad cars but not railroad engines.

Fleet vehicle. Straight trucks and trailers used in commercial fleets.

Standard vehicle. Buses, vans, automobiles, recreational vehicles.

Removable. Film is removable within the specified time period and leaves no more than 10% of the adhesive on the surface.

Graphic Performance Life

The actual performance depends on the:

- Correct combination of 3M–recommended products
- Ink formulation (screen printing)
- Adequate ink drying or UV curing (screen printing)
- Selection and preparation of the substrate
- Surface texture
- Application methods
- Angle and direction of sun exposure
- Environmental conditions
- Cleaning or maintenance methods

Application Outside the U.S.

Contact the 3M organization for that country.

Tenting Around Rivets

This film may tent around rivets, which is not covered by the MCS warranty

Graphics Made with Components Not Sold or Recommended by 3M

The 3M MCS warranty does not cover finished graphics made with other manufacturers' inks, film, graphic protection and/or application tapes, except as noted in this Bulletin. The user is solely responsible for the graphic appearance, performance and durability of graphic constructions that include non-3M graphic products.

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 or implied warranty arising out of a course of dealing, custom or usage of trade: all 3M products are 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. 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.**

See the Graphics Market Center Warranty Brochure, which gives the terms, additional limitations of the warranty, if any, and limitations of liability.

Screen Printing

Formulations and processing conditions can affect ink durability. Refer to the Product and Instruction Bulletins for your ink for limitations and proper usage.

Ink Considerations

- Ink series 1900 and some colors in ink series 9800 are opaque. Be aware that opaque ink can prevent the film from retroreflecting in the screen printed areas. Ink series 2900 and the transparent colors from ink series 9800 are good choices 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.

Graphic Protection

Apply clears with screen printing methods.

Apply overlaminates with a cold roll laminator. See Instruction Bulletin 4.22.

Electrostatic Imaging

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

An electrostatically printed image can be transferred with heat and pressure to film 680-10. Graphic protection is required.

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 1 inch (2.54 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.

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

Graphic Protection	Premasking Tape	Prespacing Tape
Unprinted film	SCPM-3	SCPS-
1920DR	SCPM-3	SCPS-2
2920DR	SCPM-3	SCPS-2
4430R	SCPM-3	SCPS-2
9720UV	SCPM-44X	SCPS-53X
9800CL	SCPM-44X	SCPS-53X
8519	None required, but may use SCPM-3	Usage not recommended
8912 ES		
8920 ES	SCPM-44X	SCPS-2

Application

Refer to the **3M Related Literature** section, located at the end of this bulletin, for a list of the Instruction Bulletins that may be needed to apply or install this film.

Adhesive

The pressure-activated adhesive on this film allows you to position, slide and reposition it on the application substrate when tacked with light hand pressure. Applying firm pressure bonds the adhesive to the substrate, and by design, destroys the positionability feature.

The adhesive characteristics may be reduced under these conditions:

- The film has been removed, even partially, from the original liner and reapplied to the same liner or another liner.
- Application at higher than 100°F (38°C) causes the film to lose its positionability even with light hand pressure.

Application Method

Use a dry application method. Do not use a detergent and water or a commercial application liquid to position the graphic.

Substrate

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 screen print clears may stop curing when the air and surface temperatures are lower than 75°F (24°C).

This film can be applied over other recommended 3M graphic systems. Graphics printed with ink series 2920DR must be weathered for at least one year before applying this film over it. See Instruction Bulletin 5.1 for details.

Finishing Overview

- 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

Maintenance and Cleaning

Use a cleaner such as the kind used for high-quality painted surfaces. The cleaner must be wet, non-abrasive, without strong solvents, and have a pH value between 3 and 11 (neither strongly acidic nor strongly alkaline.)

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, Storage and Shipping

Activity	Recommendation
Shelf life	Total shelf life: 2 years Up to 2 years unprocessed, OR process within 1 year and apply within 1 year of processing
Storage conditions	<ul style="list-style-type: none">• 100°F (38°C) maximum• Out of sunlight• Clean dry area• Original container or suspend rolls horizontally• Cut sheets must lie flat
Shipping finished graphics	Flat, or rolled printed side out on 6 inch (15 cm) or larger core; processed film may block if wound too tightly

See Instruction Bulletin 6.5 for details.

Health and Safety

Caution

When handling any chemical products, read the manufacturers' container labels and the Material Safety Data Sheets (MSDS) for important health, safety and environmental information.

To obtain MSDS sheets for 3M products:

- 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 www.3m.com/msds.
- By mail, or in case of an emergency, call 1-800-364-3577 or 1-651-737-6501.

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

Attention: Authorized Graphics Manufacturers

Visit our password-protected website for exclusive product information. Certain restrictions apply.

1. Go to www.3mgraphics.com.
 2. Select a country.
 3. Click *Login* on upper left side of screen.
 4. Click Register.
 5. Enter authorization code: **CGD_SGN**.
 6. Complete the information and submit. An e-mail will be sent when your authorization is completed.
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3M Related Literature

Before starting any job, be sure you have the most current Product and Instruction Bulletins.

The information in 3M Product and Instruction Bulletins is subject to change. Current Bulletins, as well as a list of all Bulletins updated within the last three months, are available at www.3mgraphics.com or through our Fax-on-Demand system. Any warranty, if offered, is based on information in the appropriate Bulletin(s) that was current at the time you purchased the 3M products. The following Product and/or Instruction Bulletins provide the information and processes you need to properly make the graphics described in this Bulletin.

Fax-on-Demand phone numbers:
 United States or Canada: 1-800-364-0768
 International: 1-651-732-6506

Subject	Bulletin No.	FOD No.
Product Bulletins		
3M™ Screen Printing Ink Series 1900 and Screen Print Clear VI0402	1900	2509
3M™ Scotchlite™ Screen Printing Ink Series 2900	2900	2512
3M™ Screen Printing Ink Series 9700UV	9700	2507
3M™ Screen Printing UV Ink Series 9800 (line color and 4-color)	9800	2513
3M™ Scotchcal™ Overlaminates 8519 and 8520	8519 /8520	4524
Instruction Bulletins		
Design of markings	2.1	5501
Screen printing with ink series 1900 line color	3.12	6012
Screen printing with ink series 2900 - line color - 4-color	3.18 3.19	6018 6019
Screen printing with ink series 9700UV	3.4	6004
Screen printing with UV ink series 9800 - line color - 4-color	3.20 3.21	6020 6021
Cold roll lamination	4.22	6522

Subject	Bulletin No.	FOD No.
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
Warranties		
3M Graphics Market Center Warranty Brochure		9503

3M, MCS, Scotchlite and Scotchcal are trademarks of 3M.
 Tedlar is a registered trademark of Dupont.

Bulletin Change Summary

This bulletin has been updated to provide more clarity to the Warranty section (see pages 3–4).



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Fax-on-Demand document number: 2007 Fax-on-Demand ordering: 1-800-364-0768 US/Canada; 1-651-732-6506 International
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