

Traffic Safety and Security Division

# 3M™ Scotchlite™ Long Term Removable Graphic Film with Comply Performance

Series 680CR E

March 2018

## 1 Description

### Advantages

- Durable, flexible, enclosed-lens, retroreflective film
- In accordance to the UN/ECE Regulation 104
- Up to 8 years removability on vertical surfaces with heat
- Comply™ performance feature for easier, high quality installations
- Positionable, pressure-activated adhesive
- Similar daytime and nighttime appearance
- Ideal for both large graphics and graphics applied to corrugated surfaces
- ECE104 approval marks are only visible perpendicular to the surface
- Up to 8 years exterior durability
- Retains 90% of its retroreflectivity when totally wet
- Screen printable
- Electrostatically imageable
- Piezo Ink Jet printable
- Film RG680CR E for use on Arizona™ Ink Jet
- Unprocessed film resists fuel vapors or occasional spills

### Application and Uses

Series 680CR E is intended for making removable, durable graphics when used with the listed Compatible Products in the following applications. These applications are warranted by the 3M™ MCS™ Warranty:

- Commercial vehicle and fleet graphics
- Vehicle emblems and markings

### Limitations of End 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:

- Use on stainless steel
- Permanent, regulatory traffic signs
- Graphics made for automotive Original Equipment Manufacturers (OEM); please contact 3M Automotive Division for alternatives.

## Compatible Products

### Screen Print Applications

- 3M™ Scotchlite™ Transparent Screen Printing Ink Series 2900 (line color and halftone)
- 3M™ Screen Printing Ink Series 9700UV (transparent color and halftone)

### Electrostatic Imaging Applications

- Scotchprint Electronic Graphics System
- 3M™ Image Transfer Media 8601 (all versions)
- 3M™ Trident Transfer Paper (ES)
- Scotchprint Toner Series 8700/8800 (ES)
- 3M™ Scotchcal™ Overlamine
  - Luster 8910 (ES)
  - High Gloss 8912 (ES) \*
- 3M™ Screen Print Clear 8920 (ES)

### Piezo Ink Jet Applications

- 3M™ Piezo Ink Jet Ink Series 4000
- 3M™ Piezo Ink Jet Ink Series 2300
- 3M™ Scotchcal™ Luster Overlamine 8519

### All Applications

- Selected 3M application tapes

\* 8912 (ES) is only recommended for flat surfaces without rivets.

## 2 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.

Property	Description
Number and color	680CR E <ul style="list-style-type: none"> <li>- 10 White</li> <li>- 14 Orange</li> <li>- 64 Gold</li> <li>- 71 Yellow</li> <li>- 72 Red</li> <li>- 75 Blue</li> <li>- 76 Light blue</li> <li>- 77 Green</li> <li>- 81 Lemon yellow</li> <li>- 82 Ruby red</li> <li>- 85 Black (reflects white)</li> </ul>

### 3 Characteristics

Property	Description
Adhesive color and type	Clear, positionable, pressure activated
Liner	Lay flat, polyethylene-coated paper
Application surfaces	Flat, flat with rivets, moderately curved or corrugated
Application substrates	Aluminum, automotive paint
Application temperature range for air and substrate	4°C to 38°C flat surfaces without rivets 7° to 38°C flat, curved or corrugated surfaces with rivets
Removal	Removable with heat from most surfaces within 8 years

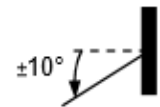
### 4 General Performance Characteristics

The durability of Scotchlite™ Removable Graphic Film 680CR E depends on the following:

- Correct combination of film, ink/toner, and overprint clear/overlamine
- Ink formulation (screen print)
- Ink drying/curing methods (screen print)
- Selection, preparation and temperature of the substrate
- Application methods
- Cleaning and maintenance methods
- Exposure conditions

#### Warranted Durability

The following tables show the warranties for exposure where the face of the graphic is vertical at  $90^\circ \pm 10^\circ$ .



#### Zone 1

Ink/toner printed on Film 680CR E	Overprint Clear or Overlamine	Fleet Graphics
Unprinted film	None	96 months
2900 line	2920DR	96 months
2900 halftone	2920DR	72 months
9700 UV line	9720	96 months
9700 UV halftone	9720	72 months
8700/8800 toner	2920DR	72 months
	8910 (ES)	72 months
	8912 (ES)	60 months
	8920 (ES)	60 months
3700, 4000; 2300; 1600	1920DR	60 months
	2920DR	60 months
	8519	60 months

#### Zone 2

Ink/toner printed on Film 680CR E	Overprint Clear or Overlamine	Fleet Graphics
Unprinted film	None	84 months
2900 line	2920DR	84 months
2900 halftone	2920DR	60 months
9700 UV line	9720	84 months
9700 UV halftone	9720	60 months
8700/8800 toner	2920DR	60 months
	8910 (ES)	60 months
	8912 (ES)	48 months
	8920 (ES)	48 months
3700, 4000; 2300, 1600	1920DR	48 months
	2920DR	48 months
	8519	48 months

**Zone 3**

<b>Ink/toner printed on Film 680CR E</b>	<b>Overprint Clear or Overlaminates</b>	<b>Fleet Graphics</b>
Unprinted film	None	60 months
2900 line	2920DR	60 months
2900 halftone	2920DR	48 months
9700 UV line	9720	60 months
9700 UV halftone	9720	48 months
8700/8800 toner	2920DR	48 months
	8910 (ES)	48 months
	8912 (ES)	36 months
	8920 (ES)	36 months
3700, 4000; 2300, 1600	1920DR	36 months
	2920DR	36 months
	8519	36 months

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

**Customers right**

In Europe 3M warrants for a period up to 96 months from date of application (concrete definition of the period is subject to the terms of sale) that Scotchlite™ Long Term Removable Graphic Film with Comply Performance Series 680CR E sold by 3M to be used for emblems, markings and graphics is free of defects in material and workmanship, subject to the following provisions: If Scotchlite™ graphic film is processed and applied to a vertical  $\pm 10^\circ$  surface in accordance with all 3M application and fabrication procedures provided in 3M's product and information bulletins, technical memos (which will be furnished to the agency upon request), including the exclusive use of 3M matched component systems, process colors, clear coatings, application tapes and recommended application equipment; and If the emblem, marking or graphic deteriorates due to natural causes; such as fading, cracking, peeling, lifting or discoloration; 3M's sole responsibility and purchaser's and user's exclusive remedy shall be that 3M will provide replacement of the 3M materials per the following table:

Total Warranty Period	Full Film Replacement	Pro-Rata Film Replacement	Monthly Reduction In Allowance
96 months	60 months	61th-96th month	1/36
84 months	52 months	53rd-84th month	1/32
60 months	36 months	37th-60th month	1/24

**Conditions**

Such failure must be solely the result of design or manufacturing defects in the Scotchlite™ series 680CR E film and not of outside causes such as: improper fabrication, handling, maintenance or installation; use of process colors, thinners, or coatings and sheeting not made by 3M; use of application procedures not recommended by 3M; applied to a surface at greater than  $\pm 10^\circ$  from vertical; failure of substrate; exposure to chemicals, abrasion and other mechanical damage; collisions, vandalism or malicious mischief. 3M reserves the right to determine the method of replacement. Replacement film will carry the unexpired warranty of the film it replaces.

Claims made under this warranty will be honored only if 3M is notified of a failure within a reasonable time, reasonable information requested by 3M is provided and 3M is permitted to verify the cause of the failure.

## 5 Fabrication

### Color match

For a multi sheet graphic application you should use reflective sheeting out of one material roll. If the use of more than one roll is necessary make sure that you use material of the same lot number. Check material which will be applied next to each other for day and night color appearance similarity. Contact Technical Service for details. Color-matched film Series 680CR E CM-10 is available by special order. Contact your 3M sales representative.

### Screen Printing

- **Durability**  
To obtain maximum durability, use only approved combinations of ink or toner and overprint clear or overlaminates. Formulations and processing conditions can affect the ink durability. Carefully follow the limitations of the specific inks and the instructions in the appropriate Product and Instruction Bulletins. Refer to the 3M Related Literature section.
- **Drying**  
It is recommended to check the proper temperature of the conveyor prior to screen printing by using irreversible temperature strips.

### Digital Printing

Series 680CR E-10 (white) can be used as graphic film for the transfer of an image. The image is electrostatically printed onto the transfer media and then heat transferred onto film 680CR E-10. A recommended overlaminate or overprint clear must be applied to the graphic.

## 6 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-rule die cutting
- Drum-type electronic cutting
- Flat-bed electronic cutting

### Weeding Considerations

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. Perform weeding carefully. Cut graphics do not readhere to the Comply performance liner if they are pulled off of it. For this same reason, do not attempt to exchange the liner. Refer to Instruction Bulletin 4.1 for more details.

## Design Factors

- Use a minimum letter height of 80 mm.
- Use a minimum stroke width of 10 mm.
- Use a minimum radius for a point of 1.6 mm.
- Order “roll applicator splices” for roll striping.  
Butt splices may have a small gap.

## 7 Application Tapes

The type of application tape to use depends on the type of graphic produced and the ink/toner and overprint clear/overlamine used. Refer to Instruction Bulletin 4.3 for more details.

- Use a prespacing tape if the graphic has large amounts of exposed liner.
- Use a premasking tape if very little of the liner is exposed.

Premasking IS NOT recommended for:

- Continuous rolls or striping wider than 300 mm
- Rolls wider than 310 mm that will be slit

Premasking IS recommended for:

- Graphics larger than 0.5 m<sup>2</sup>
- Striping greater than 100 mm wide

Overprint Clear or Overlamine	Premask Tape	Prespace Tape
Unprinted film	SCPS-100	SCPS-55
2920	SCPS-100	SCPS-55
8910 (ES) 8912 (ES)	None required, but may use SCPS-100	SCPS-55
8920 (ES)	SCPM-44X	SCPS-55

## Handling Prespaced Graphics

For the best results when using prespace tape, we recommend these practices:

- Store and ship prespaced film lying flat (do not roll it). This allows adhesion to build and minimizes the chance of the prespace tape from popping off of the liner or film.
- Handle the prespaced graphic as little as possible and keep it flat during processing.
- Remove as much liner as possible.

## 8 Application

This Bulletin does not contain detailed application procedures. Refer to the 3M Related Literature section near the end of this bulletin.

Temperature Check the proper substrate temperature using an Infrared-Thermometer like 3M Scotchtrak IR-500.

- 4°C to 38°C  
flat surfaces without rivets
- 7°C to 38°C  
Flat, flat with rivets, moderately curved or corrugated

### Positioning

This film has a positionable adhesive. This 3M technology is a mechanical feature, not an adhesive property. Application pressure bonds the adhesive to the substrate and destroys the positionability feature.

This film loses its positionability feature at application temperatures above 38°C.

### Application Method

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

Film 680CR E has the Comply performance feature. This 3M technology is also a mechanical feature rather than an adhesive property. This feature allows air to travel through the adhesive, resulting in fewer air bubbles. Due to this feature it is important to re-squeegee the edges. Refer to Instruction Bulletin 5.31 for complete information on the application of films with Comply performance.

### 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 clear coats may stop curing when the air and surface temperatures are lower than 24°C. Film 680CR E shows an ability to minimize bubbles due to outgassing. Film 680CR E can be applied over other recommended 3M graphic systems. See Instruction Bulletin 5.1 for details.

## 9 Maintenance and Cleaning

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

Note: Do not use alcohol to clean graphics protected by 3M Screen Print Clear 8920 (ES).

## 10 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.

You can use heat to remove Scotchlite™ Long Term Removable Graphic Film Series 680CR E from flat and riveted surfaces within the stated warranty period. Also refer to Instruction Bulletin 6.5 for details on how to remove graphics.

### Warranted Removal on Vertical Applications

Film 680CR E is removable from vertical surfaces using only heat. Removing film 680CR E from an underlying graphic will damage the underlying graphic.

Removability is defined as leaving no more than 10% of the adhesive on the surface. If the applied graphic cannot be removed within the warranted period, 3M will reimburse the end user for the documented excess costs incurred beyond the anticipated normal removal costs. The reimbursed amount shall not exceed the current low net selling price for the film.

### Requirements for Warranted Removal on Vertical Applications

The ease and rate of removal depends on a number of factors. See Instruction Bulletin 6.5 for details.

- The 3M recommended removal method, including pull off angle, is used.
- Removal is performed when the air and surface temperature is above 15°C.
- The type and condition of the substrate.
- The amount and type of ink or toner used.
- The graphic age and weathering conditions.

### Removability Exceptions

These applications are not warranted for removal. A significant amount of adhesive may remain on these non-warranted surfaces. Contact Technical Service for further details or assistance.

- Exterior, horizontal applications.
- Corrugated substrates
- Rivet heads
- Bare aluminum substrates
- Aged paint and metals must be tested to ensure removability. Surface oxidation or chalking may result in adhesive residue upon removal.
- Paint that is not firmly bonded to the substrate may be damaged when removing the film.
- Paint that is not properly cured may prevent the film from being removed.



## 11 Shelf Life and Storage

- The combined shelf life as processed and unprocessed film series 680CR E 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.
- Graphics should be stored at a temperature lower than 38°C.
- Ship the finished graphics lying flat or in a roll. To roll the graphic, wrap it film-side-out on a minimum 150 mm diameter core. These methods help prevent the film and premasking from wrinkling or popping off the liner.

## 12 Product Data

### Retroreflection

At a 5° entrance angle and a 0,33° observation angle, unprinted film 680CR E has the following typical coefficient of retroreflection. It is expressed in candelas per lux per square meter [cd/(lx·m<sup>2</sup>)].

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.

Film and Color	Typical Coefficient of Retroreflection
680CR E	
- 10 White	50
- 14 Orange	25
- 64 Gold	50
- 71 Yellow	50
- 72 Red	25
- 75 Blue	10
- 76 Light blue	10
- 77 Green	20
- 81 Lemon yellow	50
- 82 Ruby red	15
- 85 Black	35

### Physical Characteristics

The data is for unprinted and printed film with overprint clear.

Property	Metric Units
Thickness (film and adhesive)	0,18 to 0,20mm
Service temperature range	-34°C to +93°C
Applied shrinkage	0,4 mm
Tensile strength	44N/25mm at 23°C

### Adhesion Characteristics (24 hours after application)

Substrate	Metric units (N/25mm)
Aluminium, anodized	22
Aluminium, etched	22
FRP	17
Fruehauf painted panels	14,7

### Chemical Resistance

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

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

## 13 Related Literature

Subject	Bulletin No.
3M™ Transparent Scotchlite™ Screen Printing Ink Series 2900	2900
3M™ Image Transfer Media 8601 (ES)	8601
Scotchprint® Toner Series 8700/8800	8700/8800
3M™ Scotchcal™ Overlamine- Luster 8910 (ES)	8910
3M™ Scotchcal™ Overlamine -High Gloss Graffiti Resistant 8912 (ES)	8912
3M™ Screen Print Clear 8920 (ES)	8920
Design of graphics	2.1
Screen printing with ink series 2900	
- line color	3.18
- 4-color	3.19
Transferring electrostatically printed images	4.7
Clear coating and overlaminating	4.8
Using toner series 8700/8800	4.12
Scoring and cutting	4.1

Using 3M application tapes; premasking and prespacing for films and sheetings	4.3
Application, substrate selection, preparation and substrate-specific application techniques	5.1
Application, special applications and vehicles	5.4
Application, general procedures for interior and exterior dry applications	5.5
Applying 3M graphic films with Comply™ performance	5.31
Storage, handling, maintenance, removal	6.5
Worldwide 3M™ MCS™ Warranty Packet	
(includes all Commercial Graphics MCS Warranties)	9503
Worldwide 3M™ MCS™ Warranty OverviewFolder	9504
Scotchprint® Graphics Warranty (includes overview)	9505
3M™ MCS™ Graphics Warranty for Fleet Vehicle Applications (includes overview)	9506

## 14.1 Health and Safety Information

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

## 14.2 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF TRADE.

## 14.3 Limitation of Liability

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## 15 Other Product Information

Always confirm that you have the most current version of the applicable product bulletin, information folder or other product information from 3M's Website at <http://www.mmm.com/tss>.

### Important Notice to Purchaser

All statements, technical information and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. All questions of warranty and liability relating to this product are governed by the terms of the sale subject where applicable to the prevailing law. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

### For Further Assistance

For help on specific questions relating to 3M™ reflective products, please contact your local 3M Application Engineer or contact:



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