



Technical Data Sheet

August 2020

3M™ Scotchlite™ Reflective Material Consumer Solutions Products

Description

3M™ Scotchlite™ Reflective Material – Consumer Solutions Products are designed for use on safety garments and in athletic and casual wear. When properly used, Scotchlite reflective material – transfer films help enhance the visibility of the wearer in nighttime or low-light conditions when illuminated by a light source such as headlights, by returning the light back toward the original source and reaching the automobile driver’s eye. Scotchlite reflective material – consumer solutions products are composed of wide angle, exposed retroreflective lenses and are available as transfer films, footwear films, and a fabric.

3M™ Scotchlite™ Reflective Material				
Product Number	Film or Fabric	Adhesive Side Liner	Reflective Side Liner	Primary Method of Application
C420 Silver Footwear Film ¹	NA	Clear Polyethylene	Paper	See Below Paragraph
C425 Silver Footwear Film	TPU ³	None	Paper	R/F Welding
C490 Carbon Black Adhesiveless Film ¹	NA	Clear Polyethylene	Paper	See Below Paragraph
C725 Silver Transfer	Heat Transfer Polyurethane Adhesive	Rose Polyethylene	Paper	Heat Lamination
C750 Silver Transfer Film	Heat Transfer Polyester Adhesive	None	Paper	Heat Lamination
C750R Silver Transfer Film ²	Heat Transfer Polyester Adhesive	None	Paper	Heat Lamination
C790 Carbon Black Stretch Transfer Film ²	Heat Transfer Polyurethane Adhesive ³	Polypropylene	Paper	Heat Lamination
C925 Silver Fabric	Cotton/ Polyester Fabric	N/A	None	Sewing

¹ This material requires the addition of a customized adhesive.

² Preferred customer product for manufacturing sites located in hot and humid regions. See the “Handling Precautions” section below.

³ Thermoplastic polyurethane

3M™ Scotchlite™ Reflective Material – C420 Silver Footwear Film and 3M™ Scotchlite™ Reflective Material – C490 Carbon Black Adhesiveless Film exposed retroreflective lenses are protected by a white paper carrier layer. This product does

not contain an adhesive layer; converters can apply various adhesive systems and substrates onto the backside of the film to get the desired attributes required by the designer. A clear plastic liner protects the backside of the film and must be removed before an adhesive system is added.

3M™ Scotchlite™ Reflective Material – C425 Silver Footwear Film contains exposed retroreflective lenses bonded to a TPU film, and protected by a white paper carrier layer. Scotchlite reflective material – C425 silver footwear film is available in six thicknesses of TPU to best fit your application. This product is designed for high-frequency or radio-frequency (R/F) welding application onto various substrates including fabrics or synthetic leather.

3M™ Scotchlite™ Reflective Material – C425 Silver Footwear Film			
Product Number	Typical thickness (with paper carrier)	Typical thickness (without paper carrier)	Thickness Tolerance
C425 Silver Footwear Film 0.15 mm	0.31 mm	0.15 mm	± 0.02 mm
C425 Silver Footwear Film 0.4 mm	0.56 mm	0.4 mm	± 0.05 mm
C425 Silver Footwear Film 0.6 mm	0.76 mm	0.6 mm	± 0.05 mm
C425 Silver Footwear Film 0.8 mm	0.96 mm	0.8 mm	± 0.05 mm
C425 Silver Footwear Film 1.0 mm	1.16 mm	1.0 mm	± 0.05 mm
C425 Silver Footwear Film 1.2 mm	1.36 mm	1.2 mm	± 0.05 mm

3M™ Scotchlite™ Reflective Material – C790 Carbon Black Stretch Transfer Film contains a stretchy polyurethane adhesive. This reflective transfer film has a black daytime appearance while is highly reflective at nighttime. Due to its high reflectivity and high angularity, the daytime appearance of the black color may change based on your viewing angle. The product is designed for lamination over a wide variety of fabrics, including those requiring high stretch such as spandex. Please refer to 3M Technical Bulletin on laminating conditions guide for additional details.

Retroreflective Performance

The coefficient of retroreflection (R_A , in $cd/lux/m^2$) of 3M™ Scotchlite™ Reflective Material is measured by methods based on either of the following retroreflective intensity testing procedures:

ASTM E809-02 and E810-03 (R_A)

CIE 54.2:2001 (R')

Retroreflective performance data were generated by 3M and are based on testing new product. The R_A values listed in the following tables were measured at +5.0° entrance and 0.2° observation angles.

It is important to note that use, wear, laundering, and environmental conditions will affect performance.

3M™ Scotchlite™ Reflective Material			
Product Number	Daytime Color	Reflected Color	Initial Average R_A^4
C420 Silver Footwear Film	Silver	White	500
C425 Silver Footwear Film	Silver	White	500
C490 Carbon Black Adhesiveless Film	Black	White	300
C725 Silver Transfer	Silver	White	500
C750 Silver Transfer Film	Silver	White	500
C750R Silver Transfer Film	Silver	White	500
C790 Carbon Black Stretch Transfer Film	Black	White	300
C925 Silver Fabric	Silver	White	500

⁴ Measured by 3M on new product at +5.0° entrance and 0.2° observation angles

Not Certified for Occupational Use

The 3M™ Scotchlite™ Reflective Material – Consumer Solutions Products are designed for consumer garment use. If you require Scotchlite reflective material designed for occupational use, please consult the 3M website at Scotchlite.com or contact 3M Technical Service for additional assistance with product selection.

Scotchlite reflective material – consumer solutions products are not certified for marine safety applications requiring IMO type approval.

Performance

While use of Scotchlite reflective material enhances visibility, no reflective material can guarantee absolute visibility, particularly in adverse weather conditions. Performance will vary depending upon actual use, exposure conditions and maintenance. Customers should be aware that 3M presents a Scotchlite reflective material product

portfolio that offers a range of product attributes, and users should test the reflective material on their finished garments to satisfy conformance to their own requirements.

The following Scotchlite reflective material – consumer solutions products will have a minimum reflectivity R_A^4 greater than 100 after the listed wash cycles when washed per ISO 6330:2000 Textiles – Domestic washing and drying procedure for textile testing, Method 2A (60 °C /140 °F) or Method 5A (40 °C /105 °F) as noted.

Scotchlite reflective material		
Product Number	Wash Cycles	Wash Method ISO 6330
C420 Silver Footwear Film	N/A	N/A
C425 Silver Footwear Film	N/A	N/A
C490 Silver Footwear Film	N/A	N/A
C725 Silver Transfer	25	Method 6N (60 °C /140 °F)
C750 Silver Transfer Film	50	Method 6N (60 °C /140 °F)
C750R Silver Transfer Film	50	Method 6N (60 °C /140 °F)
C790 Carbon Black Stretch Transfer Film	50	Method 4N (40 °C /105 °F)
C925 Silver Fabric	50	Method 6N (60 °C /140 °F)

3M recommends that all customers, in accordance with good manufacturing practices, establish an ongoing quality system which includes maintaining lot/roll identification throughout the garment production process. Customer should also store input materials and final products in accordance with manufacturer recommendations, as well as implement continuous testing throughout production and on finished garments that reflects the garment needs. For lamination operations, customers should periodically check their equipment to ensure that the temperature set point matches the platen or roll temperature and that the temperature is uniform across the lamination area.

Please visit our website, Scotchlite.com for new or updated technical literature as well as contacting your local 3M Personal Safety Division Technical Service.

Application Instructions

Whenever two or more pieces of Scotchlite reflective material are used together on a single surface or as a set, they should be matched to ensure uniform daytime color and nighttime retroreflectivity. All high visibility safety garments should be constructed in accordance with the appropriate standard(s).

Cutting: Die-cutting is recommended, although it can also be hand-cut or guillotined. For 3M™ Scotchlite™ Reflective Material – Transfer Films with a white paper liner, the protective white paper liner should not be used as the carrier when applying (laminating) plotter cut and weeded images; the exposed liner may adhere to certain fabrics at recommended lamination temperatures. For these applications, 3M™ Scotchlite™ Reflective Material – 5807 Custom Cuttable Transfer Film is recommended.

Sewing of Reflective Fabrics: For the best results, sew in place with no more than 12 stitches per inch (2.54 cm), and not less than 5/64" (2 mm) from the edge of the reflective fabric.

Heat Lamination:

1. Work on a flat surface where uniform heat and pressure can be applied. Avoid applying film over seams and stitches.
2. Remove adhesive side liner (if the product has one), exposing dry adhesive. Do not remove reflective side liner. See table above to determine which liner is adhesive side liner.
3. Place Scotchlite reflective material – transfer film on substrate with the adhesive side down and apply heat and pressure as described in the table below. Place a non-stick slip sheet between the platen and laminating surface to prevent any excess adhesive transfer contamination.
4. Allow application to cool to room temperature before removing the liner covering the reflective side (if the product has one). Place application on a flat surface and remove the paper liner by lifting one corner and pulling (about 45° angle) in a continuous, smooth manner. Some products may not have a reflective side liner; see the table for information.

3M™ Scotchlite™ Reflective Material – Transfer Films			
Product Number	Temperature	Dwell Time (seconds)	Line Pressure
C725 Silver Transfer Film	165-190 °C (325-375 °F)	10-20	Firm 2-3 kgf/cm ² (30-45 psi)
C750 Silver Transfer Film	165-177 °C (325-350 °F)	10-20	Firm 2-3 kgf/cm ² (30-45 psi)
C750R Silver Transfer Film	165-177 °C (325-350 °F)	10-20	Firm 2-3 kgf/cm ² (30-45 psi)
C790 Carbon Black Stretch Transfer Film*	149-160 °C (300-320 °F)	20-25	Firm 2-3 kgf/cm ² (30-45 psi)

* It is recommend not to laminate this product lower than 149 °C (300 °F).

Additional Precautions for Heat Lamination:

1. Do not exceed lamination temperatures listed above as the paper liner may become difficult to remove. If high temperatures are required for bond durability, follow lamination steps 1-3 using recommended temperature, remove paper liner, and then laminate again at the higher temperature (using a non-stick slip sheet to protect reflective surface).
2. The lamination temperature, time, and pressure listed above should be used as a guide. Each substrate and reflective film combination should be tested to determine the best set of conditions that will meet customer requirements.
3. Other lamination methods, such as roll to roll, heat fusing, and HF welding can also be used unless noted. The proper temperature, time, and pressure conditions must be tested for each fabric to ensure adequate adhesion and physical performance.
4. 3M™ Scotchlite™ Reflective Material – C790 Carbon Black Stretch Transfer Film and 3M™ Scotchlite™ Reflective Material – C490 Carbon Black Adhesiveless Film should not be used for HF welding.
5. 3M™ Scotchlite™ Reflective Materials can adhere to many fabrics. However, some fabrics such as nylons and those treated with a durable water repellent (DWR) finish can be difficult to adhere to. For the best adhesion in these cases, sewing is recommended by using 3M™ Scotchlite™ Reflective Material – Fabric. When transfer films are used, continuous testing should be done to ensure acceptable adhesion is maintained as input materials may vary. For specific application assistance, contact 3M Technical Service.
6. 3M™ Scotchlite™ Reflective Material – C725 Silver Transfer Film performs best when laminated to polyester and polyester blend fabrics. It should not be used on knitted T-shirts or 100% cotton fabrics where good adhesion is required for extended use.
7. The reflective surface of Scotchlite reflective material can be difficult to adhere to and caution is required when applying other materials to it. If you are laminating a Scotchlite reflective material – transfer film to the surface of Scotchlite reflective material, then testing is recommended to ensure the attachment meets the customer’s specifications. It is also recommended that continuous testing be done to ensure acceptable adhesion is maintained throughout the manufacturing process. If acceptable adhesion cannot be achieved, then contact your local 3M Technical Service for assistance.

8. 3M recommends that all customers, in accordance with good manufacturing practices, periodically check their lamination equipment to ensure that temperature set point agrees with the platen or roll temperature and that the temperature is uniform across the lamination area. Customers should also store input materials and final products in accordance with manufacturer recommendations, as well as implement continuous testing throughout production.

R/F Welding Application Guideline

1. 3M™ Scotchlite™ Reflective Material – C425 Silver Footwear Film can be welded onto many substrates including: mesh fabric, webbing, and synthetic leather. Recommended welding condition is as follows:
 - a. Die temperature: The operational temperature range is 80 °C to 100 °C, depending on the type of substrate and the complexity of the die.
 - b. The die temperature should be kept within +/- 5 °C to maintain consistent quality of the welded pieces.
 - c. Dwell time: 0.5 to 3 seconds depending on the substrate being used and the size and the shape of the die.
 - d. Output of the R/F: Adjust according to the thickness or the total conductivity of the substrate.
 - e. Pressure: Firm pressure (approximately 3 kg/cm²).
2. Die design: The cutting edge of the R/F welding die should be 0.1 mm ~ 0.2 mm deeper than the thickness of Scotchlite reflective material – C425 silver footwear film product that is being used. For example, if 3M™ Scotchlite™ Reflective Material – C425 Silver Footwear Film – J803 (0.4 mm thick) is being used, 0.5 mm~ 0.6 mm is the recommended cutting edge depth of the R/F die.
3. When welding on some soft synthetic leathers with a low melting point, a higher temperature die with a shorter welding time is recommended. Otherwise, weeding may become difficult after welding.
4. The proper temperature, pressure, and time conditions for different R/F welding machines may vary. The welding condition must be tested by the user for each substrate to ensure adequate adhesion. When a stretchable fabric substrate is used, it should be kept flat with as minimal possible stretch so as not to elongate the fabric during lamination.

NOTE: 3M™ Scotchlite™ Reflective Material – C790 Carbon Black Stretch Transfer Film and 3M™ Scotchlite™ Reflective Material – C490 Carbon Black Adhesiveless Film are **not** recommended for R/F welding applications.

Printing

Screen Printing – Images may be printed on the surface of some Scotchlite reflective material. All inks should be continuously tested to ensure acceptable adhesion in the event of changes occurring in the manufacturing process or composition of the ink. Prior to printing, wiping the surface with a soft cloth lightly dampened with isopropyl alcohol may help ink adhesion. Printed areas will not be retroreflective. Please refer to 3M Technical Bulletin “Recommendations for Screen Printing Inks for 3M™ Scotchlite™ Reflective Material – Transfer Films, Pressure Sensitive Adhesive Films, Fabrics and Trims” for ink and application recommendations.

Handling Precautions

1. Many Scotchlite reflective materials contain an aluminum layer as part of their construction. Blemishing of this aluminum layer can occur if the paper carrier is removed and the front surface of the product has direct contact from hands during application and is then exposed to hot and humid conditions, greater than 26.7 °C (80 °F) and greater than 70% relative humidity, for a period of weeks. These blemishes do not affect performance of the product. 3M™ Scotchlite™ Reflective Material – C790 Carbon Black Stretch Transfer Film and 3M™ Scotchlite™ Reflective Material – C490 Carbon Black Adhesiveless Film are highly resistant to staining. Please refer to 3M Technical Bulletin “Care Guidelines to Reduce Staining on 3M™ Scotchlite™ Reflective Material.”
2. Scotchlite reflective material – transfer films may not be compatible with some polyvinyl chloride (PVC, vinyl) films, especially those containing phosphate plasticizers. It is possible that some plasticizers might be able to migrate into the reflective material, making the reflective surface soft and sticky. We recommend that substrates always be tested prior to production to ensure that they meet your specific needs. For alternate products and additional information, please refer to 3M Technical Bulletin “Plasticizer Migration in 3M™ Scotchlite™ Reflective Material – 8712 Silver Transfer Film and Related Products.”

Care and Maintenance Instructions

Important: Test each application according to appropriate care instructions required for the finished product. Actual life of 3M™ Scotchlite™ Reflective Material depends on cleaning methods and wear conditions.

Home Wash Guidelines

Home laundering means using a top or front loading consumer type home washing machine with a consumer detergent at moderate water temperatures (up to 60 °C, 140 °F). Garment finishing such as tumble

drying at high temperatures can limit garment life and should be considered as part of the cleaning process.

High alkaline treatments such as stain removal products should not be used. Garment care label guidelines need to consider the garment fabric as well as the recommendations for garment components such as retroreflective trim.

Care label recommendations for Scotchlite reflective material are below:



Bleach: Non-chlorine bleach when needed.

3M™ Scotchlite™ Reflective Material					
Product	Maximum Wash Temp	Dry	Iron	Dry-Cleaning	
C420 Silver Footwear Film C490 Carbon Black Adhesiveless Film	Do not wash	Do not tumble dry	Do not iron		Do not dry-clean
C425 Silver Footwear Film	Machine wash warm, 40 °C (105 °F)	Do not tumble dry	Do not iron		Do not dry-clean
C790 Carbon Black Stretch Transfer Film C725 Silver Transfer Film	Machine wash warm, 40 °C (105 °F)	Tumble dry low	Cool iron, 110 °C (230 °F)		Dry-clean, normal cycle
C750 Silver Transfer Film C750R Silver Transfer Film C925 Silver Fabric	Machine wash hot, 60 °C (140 °F)	Tumble dry low	Cool iron, 110 °C (230 °F)		Dry-clean, normal cycle

Product Availability

3M™ Scotchlite™ Reflective Material – Consumer Solutions Products are available in rolls with the following standard width and lengths:

Scotchlite reflective material		
Product Number	Roll Width	Standard Roll Length
C420 Silver Footwear Film	1270 mm (50 in.)	100 m (109 yd)
C425 Silver Footwear Film 0.15 mm C425 Silver Footwear Film 0.4 mm C425 Silver Footwear Film 0.6 mm C425 Silver Footwear Film 0.8 mm C425 Silver Footwear Film 1.0 mm C425 Silver Footwear Film 1.2 mm	1270 mm (50 in.)	12 m (13 yd) 18 m (20 yd) 23 m (25 yd)
C490 Carbon Black Adhesiveless Film C790 Carbon Black Stretch Transfer Film	1170 mm (46 in.)	50 m (55 yd)
C725 Silver Transfer Film C750 Silver Transfer Film C750R Silver Transfer Film C925 Silver Fabric	< 150 mm (< 6 in.)	100 m (109 yd) 200 m (218 yd)
	150 mm ≤ w < 900 mm (6 in. ≤ w < 36 in.)	50 m (55 yd) 100 m (109 yd)
	≥ 900 mm (≥ 36 in.)	50 m (55 yd) 100 m (109 yd)

Order and Product Information

To order Scotchlite reflective material products, contact Customer Service at 800-328-7098.

Storage and Shelf Life

Store in a cool (4 to 32 °C, 40 to 90 °F), dry area (less than 70% relative humidity) and use within one year after date of receipt. Store rolls in original shipping cartons. Ensure that the lot/roll identification remains with product rolls. Return partially used rolls to the carton or suspend horizontally through the core. Cut pieces should be stored flat.

Important Notice to User

WARRANTY, LIMITED REMEDY AND DISCLAIMER: 3M warrants that 3M™ Scotchlite™ Reflective Material that is stored, maintained and used in accordance with 3M's written instructions will meet the applicable 3M product specifications. 3M MAKES NO 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 OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If any Scotchlite reflective material does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

LIMITATION OF LIABILITY: Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

PRODUCT USE: Because of the variety of factors that can affect the use and performance of Scotchlite reflective material, user is solely responsible for evaluating the product and determining whether it is fit for a particular purpose and suitable for user's method of application. User is solely responsible for determining the proper amount and placement of the product. While reflective products enhance visibility, no reflective product can ensure visibility or safety under all possible conditions. 3M may change the product, specification and availability of the product as improvements are made; therefore, user should contact 3M for latest information before specifying the product.



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