Scotchlite™ Reflective Graphic Film

Series 5100R for Screen Printing and Thermal Mass Transfer
IJ5100R-10 for Inkjet Printing

1. Product Description

A. Product Features and Advantages

- 7-mil, enclosed lens, retroreflective, engineer grade films that offer flexibility and versatility
- Pressure-sensitive adhesive
- Removable with heat and/or chemicals
- Available in 15 colors, including black (which reflects white)
- Similar daytime and nighttime appearance that retains most of its reflectivity when wet
- Excellent angularity
- Versions for screen printing and thermal mass transfer and inkjet printing
- Designed for excellent cutting and weeding with computer sign cutting equipment
- For vertical, flat or curved surfaces with or without rivets
- Unprocessed film resists fuel vapors or occasional spills

B. Recommended Types of Graphics and End Uses

When constructed and used as described in this Bulletin, these types of graphics and end uses may be warranted by the 3M™ MCS™ Warranty or the 3M Performance Guarantee. Please read the entire Bulletin for details.

- Most standard vehicle, straight trucks, semi-tractors, semi-trailers markings and graphics
- Cut letters and decals
- Non-regulated signage

C. Performance Overview

3M tests the performance of both individual products and finished graphic constructions. This table shows the best performance expected from this product both without a Warranty Period and with a Warranty Period.

For detailed graphic construction and application options along with specific Warranty Periods, please see the Warranty Information, Section 5.

Expected Performance Life. This is the estimated period of time the product should perform satisfactorily.	
Unprinted film with no graphic protection, applied to a flat vertical outdoor surface.	7 years Unwarranted Period
3M™ MCS™ Warranty. This is the maximum period of time 3M will warrant the finished graphic performance.	
Printed film with the best 3M ink and graphic protection option, applied to a flat, vertical, vehicle type surface.	4 years Warranty Period
3M Performance Guarantee. This is the maximum period of time 3M will warrant the performance of the 3M materials used.	
Printed film with the best ink and graphic protection option, applied to a flat, vertical, vehicle type surface.	2 years Warranty Period

D. Limitations of End Uses

This 3M product is not designed or recommended for the following uses. Please contact us to discuss other options.

(1) Unsuitable End Uses for This Film

- Do not apply this film on:
  - walls.
  - corrugated or highly irregular surfaces.
  - substrates with compound curves.
  - substrates without a clean, smooth surface or poor paint-to-substrate adhesion.
  - stainless steel.
  - unpainted metal other than aluminum: contact 3M Technical Service for details.
  - paint that is not fully cured.
  - FRP with a Tedlar® coating.
  - flexible substrates.
- Low surface energy substrates (some plastics, powder-coated paints, etc.)
- Also see limitations of graphic removal, page 8.

2. Compatible Products

This section provides a list of products that are approved by 3M for use with the base film covered in this Bulletin, and used for the creation of a graphic that is covered by the 3M™ MCS™ Warranty. Refer to the Product and Instruction Bulletins listed in 3M Related Literature at the end of this Bulletin for more information about the compatible products.

See the **Warranty Information** section to determine which compatible products are approved for your graphic construction.

A. Solvent Inkjet Inks and Printers for the 3M™ MCS™ Warranty

Ink Series	Printer
• 3M™ Piezo Inkjet Ink Series 1500v2	EFI™ VUTEk® 150, 2360/3360, 3300/5300 & 3000/5000 Printers
• 3M™ Piezo Inkjet Ink Series 4400	HP XL1200, XL1500 Printers
• 3M™ Piezo Inkjet Ink Series 4800	HP Scitex TJ8300, TJ8350 Industrial Presses
• 3M™ Piezo Inkjet Ink Series 6200	Agfa :Jeti 3312, 3318, 3324, 5024 [Gandinnovations] Printers
• SIIT GX 3M Ink Series	Seiko I Infotech ColorPainter™ H-74s, H2-74s, H-104s, H2-104s W-54s & W-64s Printers

B. Latex Inkjet Inks and Printers for the 3M™ MCS™ Warranty

• HP 3M LX600 Specialty Latex Ink	HP Designjet L65500 Printer and Scitex LX600, LX800, LX820 & LX850 Printers
• HP LX610 Latex Ink a 3M™ MCS™ Warranty Component	HP Designjet L65500 Printer and Scitex LX600, LX800, LX820 & LX850 Printers
• HP 792 Latex Ink a 3M™ MCS™ Warranty Component	HP Designjet L26100, L26500, L28500; and Latex 210, 260 & 280 Printers
• HP 881 Latex Ink a 3M™ MCS™ Warranty Component	HP Latex 3000 Printer

C. UV Inkjet Inks and Printers for the 3M™ MCS™ Warranty

• 3M™ Piezo Inkjet UV Ink Series 2200UV	EFI™ VUTEk® PV200 Printer
• 3M™ Piezo Inkjet UV Ink Series 2700UV	Durst Rho 160R & 351R Printers
• 3M™ Piezo Inkjet UV Ink Series 2800UV	EFI™ VUTEk® QS2000, QS3200, QS3220 and QS220 Printers
• GSr 3M™ Premium UV Inks	EFI™ VUTEk® GS5000r & GS3250r Printers
• GS 3M™ Premium UV Inks	EFI™ VUTEk® GS2000, GS3200 & GS3250 Printers, including GS Pro Series
• EFI™ R3225 3M™ UV Ink	EFI™ R3225 UV Roll-to-Roll Printer
• Mimaki Ink Series LF-200 *Manufactured by 3M*	Mimaki UJV-160, JFX-1631 & 1615R Printers
• Mimaki UV Ink LUS-200 *Manufactured by 3M*	Mimaki UJV500-160 Printers
• EFI™ VUTEk® GSLXr 3M™ SuperFlex UV Ink	EFI™ VUTEk® GS3250LXr Printer

D. OEM Inkjet Printers and Inks for the 3M Performance Guarantee

- For the most current information, please click here: 3M Performance Guarantee Matrix.

A. Screen Printing

- 3M™ Screen Printing Ink Series 1900 (Solvent)
- 3M™ Scotchlite™ Screen Printing Ink Series 2900 (Solvent)
- 3M™ Screen Printing UV Ink Series 9800

B. Graphic Protection

- 3M™ Screen Print Gloss Clear 1920DR
- 3M™ Screen Print UV Gloss Clear 9740i
- 3M™ Scotchcal™ Gloss Overlaminate 8518
- 3M™ Scotchcal™ Luster Overlaminate 8519
- 3M™ Screen Printing Gloss Clear 9800CL
- 3M™ Scotchcal™ Optically Clear Overlaminate 8914

C. Other Products

- 3M™ Prespacing Tape SCPS-2
- 3M™ Prespacing Tape SCPM-53X
- 3M™ Premasking Tape SCPM-3
- 3M™ Premasking Tape SCPM-44X
- 3M™ Edge Sealer 3950

3. Characteristics

These are typical values for unprocessed product; processing may change the values. Contact your 3M representative for a custom specification.

A. Physical Characteristics

Characteristic	Value
Material	Vinyl
Thickness	**With adhesive:** 7 to 8 mils (0.18 to 0.20 mm)
Film colors & typical retroreflection	At -4° entrance angle and 0.2° observation angle.

Film Number	Color Name	Typical Coefficient of Retroreflection
IJ5100R-10	White	100
5100R-10	White	100
5100R-14	Orange	20
5100R-64	Gold	70
5100R-65	Rich Gold	65
5100R-71	Yellow	65
5100R-72	Red	20
5100R-74	Royal Purple	5
5100R-75	Blue	10
5100R-76	Light Blue	10
5100R-77	Green	20
5100R-78	Light Green	20
5100R-79	Brown	5
5100R-81	Lemon Yellow	75
5100R-82	Ruby Red	15
5100R-85	Black	30

A. Physical Characteristics, continued

Retroreflection Definition	The typical coefficient of retroreflection defined 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 E810. The entrance angle is formed by a light beam striking the surface at a point and 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.
Material	Vinyl
Adhesive color	Clear with silver underneath
Adhesive type	Pressure-sensitive
Liner	Polyethylene-coated paper
Safety Standards	See Section 13 for ASTM, NFPA® and AAR information.

B. Application Characteristics

Characteristic	Value
Finished graphic application recommendation	**Surface type:** Flat, with or without rivets, moderate curves **Substrate type:** Aluminum, FRP, paint **Graphic orientation:** Vertical only **Application method:** Dry **Application temperature:** *air and substrate* • 50° – 85°F (10° – 29°C) for flat surfaces without rivets • 55° – 85°F (13° – 29°C) for flat surfaces with rivets
Adhesion *24 hours after application*	**Aluminum:** 4.8 lb/in (0.86 kg/cm) **FRP (Fiberglass Reinforced Plywood):** 3.7 lb/in (0.7 kg/cm) **Painted aluminum panels:** 2.6 pounds/inch (0.5 kg/cm)
Temperature range after application	-30° – +200°F (-34° – +93°C)
Graphic removal	Removable with heat and/or chemicals from most substrates within specified warranty period

4. Definitions

A. Exposure

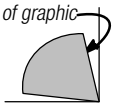
U.S. Vertical Exposure

The face of the graphic is +/- 10° from vertical.

U.S. Desert Southwest Exposure

Any outdoor graphic exposed to solar energy more than half of the daylight hours in Arizona, New Mexico and the desert areas of California, Nevada, Utah and Texas is subject to reduced warranties. Click here for a detailed map.

U.S. Non-vertical Exposure



For reflective films only: The face of the graphic is greater than 10° from vertical and greater than 45° from horizontal. This includes non-vertical surfaces of vehicle or fleet graphics.

B. Graphic Construction

The products used to make a graphic, which may include film and/or flexible substrate, graphic protection, ink, printer and application tape.

C. Graphic Protection

Overlaminate films or clear coats used to protect the graphic and/or change gloss.

D. Graphic Types

As identified in Warranty Period Tables

Indoor Signs Stationary graphics applied indoors and *not* exposed to the elements.

Outdoor Signs Stationary graphics applied outdoors and exposed to the elements.

OEM Labels and decorative graphics produced for and used by original equipment manufacturers. May also be called decals.

Decals A small graphic used indoors or outdoors for decoration, information or identity.

Vehicle Types

Vehicle. Buses, vans, passenger vehicles, delivery trucks, pickup trucks, enclosed trailers.

Straight Trucks. Semi-Tractors and Semi-Trailers. Straight trucks, semi-tractors and semi-trailers used for commercial business purposes. Excludes air shields.

5. Warranty Information

A. Warranty Coverage Overview

The warranty coverage for each graphic is based on the user(s) both reading and following all applicable and current 3M Product and Instruction Bulletins. 3M will honor the Warranty Period stated in the base film's Product Bulletin that is current when the film was purchased. The Warranty Period may be reduced and stipulations may apply for certain constructions and applications, as covered in this Bulletin.

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.

B. 3M Basic Product Warranty

This product 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 and as further set forth in the 3M Commercial Graphics Warranties Brochure.

C. Limited Remedy

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.

D. Limitation of Liability

Except where prohibited by law, 3M SHALL NOT UNDER ANY CIRCUMSTANCES BE LIABLE TO PURCHASER OR USER FOR ANY DIRECT (EXCEPT FOR THE LIMITED REMEDY PROVIDED ABOVE), INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LABOR, NON-3M MATERIAL CHARGES, LOSS OF PROFITS, REVENUE, BUSINESS, OPPORTUNITY, OR GOODWILL) RESULTING FROM OR IN ANY WAY RELATED TO SELLER'S PRODUCTS, SERVICES OR THIS BULLETIN. This limitation of liability applies regardless of the legal or equitable theory under which such losses or damages are sought including breach of contract, breach of warranty, negligence, strict liability, or any other legal or equitable theory.

E. Additional Limitations

See the 3M Commercial Graphics Warranties Brochure at www.3Mgraphics.com, which gives the terms, additional limitations of the warranty, if any, and limitations of liability.

F. 3M Performance Guarantee Warranty Period

Subject to Stipulations set forth in Section H., below

Graphics constructed with the 3M materials specified and in the exposure specified in the Warranty Period, Section F.(1), are eligible for the 3M Performance Guarantee. This warranty only covers the performance of the recommended 3M products used in the graphic construction when imaged with the printers and OEM inks listed in the most current version of the Performance Guarantee Matrix. The Matrix may also list certain restrictions for using the film covered in this Bulletin. For warranties for other exposures, see Section H.(2).

VEH = Vehicles, Straight Trucks. Semi-Tractors and Semi-Trailers
OUT = Indoor and Outdoor Signs
DEC = Cut letters and Decals
See Section 4.D. for further definition.

(1) Warranty Period Table for 3M Product Performance Only in a Standard U.S. Vertical Exposure

Warranty Period for 3M Product Performance Only, in Years

Film	Graphic Protection	VEH	IN	OUT	Inks and Printers*
IJ5100R-10	8518 8519 1920DR 9740i	2	2	2	See the Performance Guarantee Matrix

* Some of the graphic protection products and graphic types may not be approved for this film on certain printing platforms. Always refer to the Performance Guarantee Matrix.

G. 3M™ MCS™ Warranty

Subject to Stipulations set forth in Section H.

Finished graphics constructed with the materials specified and the exposure specified in the Warranty Period, Section G.(1), are eligible for the 3M™ MCS™ Warranty. For warranties for other exposures, see Section H.(2).

(1) Warranty Period for Finished Graphics in a Standard U.S. Vertical Exposure

VEH = Vehicles, Straight Trucks. Semi-Tractors and Semi-Trailers
OUT = Indoor and Outdoor Signs
DEC = Cut letters and Decals
See Section 4.D. for further definition.

a. 3M Inkjet Printing For Film IJ5100R

Warranty Period for Finished Graphics, in Years

Solvent Inks and Printers	EFI™ VUTEk® 150, 2360/ 3360, 3300/5300, 3000/5000			HP XL1200, XL 1500 Printers			HP Scitex TJ8300 and TJ8350 Industrial Presses		
	3M™ Ink Series 1500v2			3M™ Ink Series 4400			3M™ Ink Series 4800		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	4	3	4	4	3	4	4	3	4
1920DR	3	3	3	—	—	—	3	3	4
9740i	4	3	4	4	3	4	4	3	4

Solvent Inks and Printers	Agfa :Jeti 3312, 3318, 3324, 5024 [Gandinnovations] Printers			Seiko I Infotech ColorPainter™ H-74s, H2-74s, H-104s, H2-104s W-54s, & W-64s Printers		
	3M™ Ink Series 6200			GX 3M Ink Series		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	4	3	4	4	3	4
1920DR	4	3	4	3	3	3
9740i	4	3	4	4	3	4

a. 3M Inkjet Printing For Film IJ5100R *continued*

Warranty Period for Finished Graphics, in Years

Latex Inks and Printers	HP Designjet L65500 Printer and Scitex LX600, LX800, LX820 & LX850 Printers			HP Designjet L65500 Printer and Scitex LX600, LX800, LX820 & LX850 Printers			P Designjet L26100, L26500, L28500; Latex 210, 260 & 280 Printers		
	HP 3M LX600 Specialty Latex Ink			**HP LX610 Latex Ink** a 3M™ MCS™ Warranty Component			**HP 792 Latex Ink** a 3M™ MCS™ Warranty Component		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	3	2	3	3	2	3	3	2	3
1920DR	2	2	2	2	2	2	2	2	2

Latex Inks and Printers	HP Latex 3000 Printer		
	HP 881 Latex Ink a 3M™ MCS™ Warranty Component		
Graphic Protection	VEH	OUT	IN
8518, 8519	3	2	3
1920DR	2	2	2

Warranty Period for Finished Graphics, in Years

UV Inks and Printers	EFI™ VUTEk® PV200 Printer			EFI™ VUTEk® GS5000r and GS3250r Printers			EFI™ VUTEK® GS2000, GS3200, GS3250 Printers, including GS Pro Series		
	3M™ Ink Series 2200UV			**GSr 3M™ Premium UV Inks**			**GS 3M™ Premium UV Inks**		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	4	3	4	4	3	4	4	3	4
1920DR	—	—	—	2	2	2	2	2	2
9740i	4	3	4	3	2	3	3	2	3

UV Inks and Printers	EFI™ VUTEk® QS2000, QS3200, QS3220, QS220 Printers			EFI™ R3225 UV Roll-to-Roll Printers			Durst Rho 160R & 351R		
	3M™ Ink Series 2800UV			**R3235 3M™ UV Ink**			**3M™ Ink Series 2700UV**		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	4	3	4	4	3	4	4	3	4
1920DR	—	—	—	3	3	3	—	—	—
9740i	4	3	4	4	3	4	4	3	4

UV Inks and Printers	Mimaki UJV-160, JFX-1631 & 1615R Printers			Mimaki UJV500-160 Printer			EFI™ VUTEk® GS3250LXr Printer		
	Mimaki Ink Series LF-200 *Manufactured by 3M*			**Mimaki UV Ink LUS-200** *Manufactured by 3M*			**EFI™ VUTEk® GSLXr 3M™ SuperFlex UV Ink**		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
8518, 8519	4	3	4	4	3	4	3	2	3
1920DR	—	—	—	2	2	2	—	—	—
9740i	—	—	—	3	2	3	3	2	3

b. Screen Printing For Film Series 5100R

Warranty Period for Finished Graphics, In Years

	SOLVENT 3M™ Ink Series 2900			SOLVENT 3M™ Ink Series 1900			UV 3M™ Ink Series 9800		
Graphic Protection	VEH	OUT	DEC	VEH	OUT	DEC	VEH	OUT	DEC
1920DR	4	3	4	4	3	4	—	—	—
9740i	4	3	4	4	3	4	4	3 *	4
9800CL	—	—	—	—	—	—	4	3 *	4

* Ink series 9800 with 9800CL OR 9740i is removable for up to 3 years for outdoor signs

H. General Warranty Stipulations for 3M™ MCS™ Warranty and 3M Performance Guarantee

These stipulations apply to the 3M™ MCS™ Warranty and 3M Performance Guarantee. General provisions for these stipulations are covered in the 3M Commercial Graphics Warranties Brochure.

(1) Removal Warranty

a. For the 3M™ MCS™ Warranty and 3M Performance Guarantee

Within the stated Warranty Period, if this film cannot be removed with heat and/or chemicals, or if more than 30% of the adhesive residue remains on the substrate, 3M will reimburse a reasonable portion of extra removal costs.

b. Removal Warranty Exceptions

The following exceptions are not covered by the Removal Warranty.

- Substrate damage due to:
  - removing film from a pre-existing graphic.
  - removing film that was applied to painted wallboard or unapproved substrates.
  - removing film from paint that is not firmly bonded to the substrate.
- No guarantee is made for:
  - ease or speed of removal of any graphic.
  - removal from railroad cars or engines (even when the graphic is a recommended use), or stainless steel or bare aluminum.
  - removal from paint that is improperly cured.
  - removal from aged paint or metals, surface oxidation or chalking; user must test, approve and accept liability for such applications.

c. Removal Factors

The ease and rate of removal using heat and/or chemicals depends on several factors. Also see Instruction Bulletin 6.5 .

- Substrate type and condition
- Graphic age and weathering conditions
- Removal is performed when the air and surface temperature is above 60°F (15°C)
- Angle of removal, which should be less than 90 degrees

(2) Reduced Warranty Period for Selected Graphic Exposures

For each exposure shown below, multiply the Warranty Period (in years) in the applicable warranty, Section F.(1) or Section G.(1), for your graphic construction by the percentage shown for the intended graphic exposure. This is the reduced warranty.

If the Outdoor Graphic Exposure is:	Multiply Warranty Period by this Percentage:	Examples
Desert Southwest Vertical	70% (0.7)	0.7 x 4 years = 2.8 years 0.7 x 2 years = 1.4 years
Non-vertical	0	0

(3) Reduced Warranty Period for Graphics Exposed to Heat

Long exposure to continuous high heat decreases the Warranty Period 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.

(4) Application to Glass

3M accepts no liability for glass breakage when using this film for window graphics. See Instruction Bulletin 5.1 for details.

(5) Application Outside the U.S.

Contact the 3M organization for that country.

(6) Graphics Made with Components Not Sold or Recommended by 3M

The 3M™ MCS™ Warranty does not cover finished graphics made with inks, film, graphic protection and/or application tapes that are not sold or recommended by 3M. The user is solely responsible for the graphic appearance and performance of graphic constructions that include any other products.

The 3M Performance Guarantee covers selected 3M branded graphics products when used with qualified printers and inks.

(7) Graphic Protection

- Graphic protection can improve the appearance, performance and durability of your graphics. It is required for many warranted constructions. Refer to the Warranty Period tables for details.
- Any printed graphic exposed to abrasive conditions (including vehicles), harsh cleaners or chemicals must include graphic protection in order to be warranted. Abrasion damage and gloss loss are not covered.

(8) Rivets

This film may tent when applied over rivets. If the rivets are closely spaced, the film will likely bridge between rivets. Tented or bridged film may fail prematurely, which is not covered by any 3M warranty.

6. Factors that Affect Graphic Performance Life

The actual performance life of a graphic is affected by all of the following.

- The combination of graphics materials used
- Adequate ink drying or curing
- Selection, condition and preparation of the substrate
- Surface texture
- Application methods
- Angle and direction of sun exposure
- Environmental conditions
- Cleaning or maintenance methods

7. Graphics Manufacturing

⚠ CAUTION

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

A. Inkjet Printing

Always read and follow the ink manufacturer's written instructions on usage.

(1) Total Ink Coverage for 3M™ MCS™ Warranty Solutions

250% is the maximum recommended total ink coverage for this film for all solvent, latex and UV inks.

Too high a total physical ink amount on the film results in media characteristic changes, inadequate drying, overlaminate lifting, and/or poor graphic performance. Make sure that the ink lay down is within the limits of what the dryer can handle to prevent ink smearing. The Product & Instruction Bulletin for each 3M ink series includes additional details about total ink coverage.

(2) Total Ink Coverage for 3M Performance Guarantee Solutions

Refer to the Performance Guarantee Matrix for details.

(3) Color Consistency

Be sure to check the consistency of color on reflective film as it may appear different in daytime and nighttime lighting.

(4) Adequately Dry Graphics

Important Note!

Inadequate drying can result in graphic failure including curling, increased shrinkage and adhesion failure, which are not covered under warranty.

Always build enough time into your process to ensure adequate drying of the graphic. Poorly dried film may become soft and stretchy, and the adhesive may become too aggressive. This can cause difficulty when applying an overlaminate, rolling or applying the graphic. See the ink's Instruction Bulletin for more details.

B. Screen Printing

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

- Solvent ink series 1900 and some colors in UV ink series 9800 are opaque. Be aware that opaque ink can prevent the film from retroreflecting in the screen printed areas. Solvent ink series 2900 and the transparent colors from UV 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 solvent ink series 2900 and clear 1920DR.
- Oven dry the last color and the clear when using solvent-based inks on graphics needed for any corrugated application.

C. Cutting

The following are common cutting methods for this film. See Instruction Bulletin 4.1 for details.

(1) Methods

- Cold and hot steel-ruled die cutting
- Hot kiss cutting
- Drum-type electronic cutting
- Flat-bed electronic cutting
- Guillotine
- Hand cut
- Knifeless™ Tape
  3M recommends using this product with our cast vinyl films. See http://knifelesstech-systems.com/Home.aspx for details, including videos and ordering information.

(2) Minimum Cutting Sizes

- Use a minimum letter height of 1 inch (2.5 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).
- Order “roll applicator splices" for roll striping. Butt splices may have a small gap.

(3) Weeding Considerations

- For the best results, weed the film within 24 hours of cutting it.
- Refer to Instruction Bulletin 4.1 for more details.

D. Application Tapes

(1) When to Use Premasking Tape

- As an application aid to increase stiffness, and prevent stretching and damage during application.
- Graphics larger than 4 square feet (0.4 m^2).
- Striping greater than 4 inches (10 cm) wide.

(2) When NOT to Use Premasking Tape

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

(3) When to Use Prespacing Tape

- Hold cut and weeded letters or graphics in registration after removing the film liner.
- Protect cut graphic parts from scratching or damage during application.
- Use when large amounts of liner are exposed.

(4) How to Select an Application Tape

Determine whether you want to premask the graphic or prespace cut graphics. Then select the application tape that corresponds to the graphic protection used. See Instruction Bulletin 4.3 for complete details.

a. Screen Printing

	Select the tape based on what is on top of the graphic		
Application Tape	**Screen Print Inks**	**1920DR**	**9740i, 9800CL**
Premasking SCPM-3	1900 2900	■	—
Premasking SCPM-44X	9800	—	■

— = Use of application tape not recommended for this construction

b. Inkjet Printing

	Select the tape based on what is on top of the graphic			
Application Tape	**Inkjet Inks**	**1920DR**	**9740i**	**8518, 8519**
Premasking SCPM-3	All Specified in this Bulletin	■	—	■
Prespacing SCPS-2		■	—	■
Premasking SCPM-44X		—	■	—
Prespacing SCPS-53X		—	■	—

— = Use of application tape not recommended for this construction

c. No Printing or Graphic Protection

- Premasking Tape SCPM-3
- Prespacing Tape SCPS-2

8. Application and Installation

Install the film using the dry application method.

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.

A. Adhesive

This film has a pressure-sensitive adhesive. It bonds to the surface even with light pressure and cannot be repositioned.

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

B. Substrate Considerations

This film is not recommended for use on low surface energy substrates such as some plastics, powder-coated paint, etc. The user must assume responsibility for testing and approving these substrates.

This film can be applied over other recommended 3M graphic systems. Graphics printed with clear 1920DR must be weathered for at least one year before applying this film over it. See Instruction Bulletin 5.1

C. Graphics Printed with UV Inkjet Inks are Heat Sensitive

UV inkjet inks may crack if too much heat is used during graphic application to complex curves and deep contours as well as around rivets. When using a heat gun or other heat source during application, make sure the film surface temperature does not exceed 212°F (100°C).

Using additional heat in the post-application process may cause UV inkjet ink to crack.

For the best results ***always do a test application*** of a UV inkjet printed graphic to determine how much heat can be used without damaging the image.

D. Edge Sealing

- Most graphics made with these films do not require an edge sealer, although certain applications may benefit from its use.
- If needed or recommended, use edge sealer 3950.
- All processed and unprocessed graphics subjected to fuel vapors or occasional fuel spills do require edge sealer.
- 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.
  - Graphics exposed to severe abrasion or high pressure washing.
  - Graphics applied to locomotives and rolling railroad stock.
  - Graphics applied to truck rollup doors.

9. Maintenance and Cleaning

Use a cleaner designed 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.

10. Removal

These films are removable with heat and/or chemicals from most substrates within the warranty period specified for your construction. Read Section 5.H.(1) in this Bulletin, and see Instruction Bulletin 6.5 for details on how to remove graphics.

11. Shelf Life, Storage and Shipping

A. Shelf Life

Total shelf life: 3 years from the date of manufacture on the original box.
If you do process the film, do so within 2 years and apply within 1 year.
If you do not process the film, apply it within 3 years.

B. Storage Conditions

for Unprocessed Film or Unapplied Finished Graphics

- 40° to 100°F (4° to 38°C)
- Out of sunlight
- Clean dry area
- Store unprocessed film in original container
- Cut sheets must lie flat
- Bring the film to print room temperature before using

C. Shipping Finished Graphics

Flat, or rolled printed side out on 6 inch (15 cm) or larger core. This helps prevent the application tape, if used, from popping off.

See Instruction Bulletin 6.5 for details.

12. Health and Safety

⚠ CAUTION

When handling any chemical products, read the manufacturers' container labels and the Safety Data Sheets (SDS) for important health, safety and environmental information. To obtain MSDS sheets for 3M products go to 3M.com/MSDS, or 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.

A. Standards

This information is important for applications that are regulated by ASTM or NFPA® standards, for example, traffic control signs, emergency vehicles and certain railroad graphics. The user is solely responsible for determining and complying with all current and applicable local, state and federal regulations regarding the use and application of graphics materials.

B. ASTM D4956-11a: Standard Specification for Retroreflective Sheeting for Traffic Control

ASTM D-4956-11a covers flexible, non-exposed glass bead lens and microprismatic retroreflective sheeting designed for use on traffic control signs, delineators, barricades and other devices. For Type I sheeting it specially covers these colors: white, yellow, orange, green, red, blue and brown. As defined in ASTM D-4956-11a, classified as Type I sheeting (section 4.2.1) with a Class 1 adhesive (section 4.3.1). For corresponding colors covered by ASTM D-4956-11a, the aforementioned films (except orange) meet the requirements specified in section 6.1.1 (minimum performance requirements for Type I sheeting).

C. NFPA® 1901: Standard for Automotive Fire Apparatus (2009 Edition)

According to NFPA® 1901, section 15.9.3.3 specifies that all retroreflective materials required by section 15.9.3.1 and 15.9.3.2 shall conform to the requirements of ASTM D 4956, *Standard Specification for Retroreflective Sheeting for Traffic Control*, Section 6.1.1 for Type I sheeting. Section 15.9.3.3.1 specifies that colors not listed in ASTM D-4956 can be used on the front and sides of the fire apparatus as long as the sheeting has a minimum coefficient of retroreflection of 10 when measured with an observation angle of 0.2° and an entrance angle of -4°.

	Red	Ruby Red	Yellow	Lemon Yellow	White	Blue	Light Blue	Green	Gold	Black
Color Number	72	82	71	81	10	75	76	77	64	85
Section 15.9.3.1 (Front & Sides)	●	●	●	●	●	●	●	●	●	●
Section 15.9.3.2 (Chevrons)	●	●	●	●						

D. AAR: Standard and Recommended Practices

This product is approved for use by the Association of American Railroads (AAR), Safety and Operations, as listed in the Manual of Standards and Recommended Practices, Section L - Lettering and Marking of Cars, Specification M-947, Adhesive-Backed Films.

13. 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 are available at 3Mgraphics.com. The following applicable Bulletins provide information and processes you need to properly make the graphics described in this Bulletin. Additional Bulletins may be needed as indicated in the 3M Related Literature section of other 3M components you use.

Bulletin types: PB = Product Bulletin; PB-IB = Product & Instruction Bulletin; IB = Instruction Bulletin

Subject	Type	Bulletin No.
3M™ Piezo Inkjet Ink Series 1500v2	PB-IB	1500
3M™ Piezo Inkjet Ink Series 4400	PB-IB	4400
3M™ Piezo Inkjet Ink Series 4800	PB-IB	4800
3M™ Piezo Inkjet Ink Series 6200	PB-IB	6200
SIIT GX 3M Ink Series	PB-IB	GX
HP 3M LX600 Specialty Latex Ink	PB-IB	LX600
HP LX610 Specialty Latex Ink a 3M™ MCS™ Warranty Component	PB-IB	LX610
HP 792 Latex Ink a 3M™ MCS™ Warranty Component	PB-IB	792
HP 881 Latex Ink a 3M™ MCS™ Warranty Component	PB-IB	881
3M™ Piezo Inkjet UV Ink Series 2700UV	PB-IB	2700UV
3M™ Piezo Inkjet UV Ink Series 2200UV	PB-IB	2200UV
3M™ Piezo Inkjet UV Ink Series 2800UV	PB-IB	2800UV
GS 3M™ Premium UV Inks	PB-IB	GS
GSr 3M™ Premium UV Inks	PB-IB	GSr
EFI™ VUTEk® GSLXr 3M™ SuperFlex	PB-IB	GSLX
Mimaki Ink Series LF-200 *Manufactured by 3M*	PB-IB	LF200
Mimaki UV Ink LUS-200 *Manufactured by 3M*	PB-IB	LUS-200

Bulletin types: PB = Product Bulletin; PB-IB = Product & Instruction Bulletin; IB = Instruction Bulletin

Subject	Type	Bulletin No.
EFI™ R3225 3M™ UV Ink	PB-IB	R3225
3M™ Screen Printing Ink Series 1900 and Clear 1920DR - Screen printing with ink series 1900- line color	PB IB	1900 3.12
3M™ Scotchlite™ Screen Printing UV Ink Series 2900 - Screen printing with Ink Series 2900 - line color - 4-color	PB IB IB	2900 3.18 3.19
3M™ Screen Printing UV Ink Series 9800 - Screen printing with UV ink series 9800 - line color - 4-color	PB IB IB	9800 3.20 3.21
3M™ Screen Print UV Clears 9740i, 9730UV	PB-IB	UV Clears
3M Graphic Protection Products - Hot and cold roll lamination	PB IB	GP-1 4.22
Design of graphics	IB	2.1
Edge Sealer 3950 and 4150S, Edge Sealer Tape 8914	PB-IB	Edge Sealers
Sheeting, scoring and film cutting	IB	4.1
Using 3M application tapes; premasking and prespacing for films	PB-IB	4.3
Application, substrate selection, preparation, substrate-specific techniques	IB	5.1
Application, special applications and vehicles	IB	5.4
Application, general procedures for indoor and outdoor dry applications	IB	5.5
Storage, handling, maintenance, removal	IB	6.5
3M Graphics Warranties Brochure		

14. Bulletin Change Summary

Black bars in margins indicate new or changed information. New Compatible Products: Mimaki UV Ink LUS-200, manufactured by 3M, for Mimaki UJV500-160 Printer; HP 881 Latex Ink for HP Latex 3000 Printer; HP 792 Latex Ink is now approved for use with HP Latex 210, 260 and 280 Printers as well as HP Designjet L26100, L26500, L28500 Printers; EFI™ VUTEk® GSLXr 3M™ SuperFlex UV Ink for the EFI™ VUTEk® GS3250LXr Printer. Changed: The adhesive is now clear with silver underneath. Successful removal of this film now may require chemicals as well as heat. See Section 5.H.(1) in this Bulletin for details. Safety Data Sheets (SDS) were previously called Material Safety Data Sheets (MSDS). Removed from bulletin: Electrostatic products.

3M

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