



Diamond Grade™

DG³ Reflective Sheeting 4083 for Emergency Vehicle Applications

Product Bulletin 4083

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Description

3M™ Diamond Grade™ DG³ Fluorescent Yellow Green Reflective Sheeting 4083 is a high efficiency, full cube retroreflective sheeting designed for emergency vehicles. DG³ sheeting is designed to have the highest retroreflective characteristics at medium and short sight distances as determined by the R_A values at 0.5° and 1.0° observation angles in Table B. Performance at these observation angles represents the most common nighttime viewing geometries encountered by the driving public. During the daytime, Diamond Grade DG³ fluorescent reflective sheeting provides higher visibility than ordinary (non-fluorescent) colored sheetings. Applied to properly prepared substrates 3M Diamond Grade DG³ reflective sheeting provides long-term retroreflectivity and durability.

Test for Coefficients of Retroreflection

Conformance to coefficient of retroreflection requirements shall be determined by instrumental method in accordance with ASTM E-810 “Test Method for Coefficient of Retroreflection of Retroreflective Sheeting”, and per E-810 the values of 0° and 90° rotation are averaged to determine the R_A in Table B.

Table B - Minimum Coefficient of Retroreflection R_A for new sheeting (cd/lux/m²)

	Observation Angle ³		
	0.2°	0.5°	1.0°
-4° Entrance Angle²			
Fluorescent Yellow Green	460	320	96
30° Entrance Angle²			
Fluorescent Yellow Green	170	120	36

² Entrance Angle - The angle from the illumination axis to the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

³ Observation Angle - The angle between the illumination axis and the observation axis.

Table A - Daytime Color Specification Limits¹

Color	x		y		x		y		x		y		Daytime Luminance Limit (Y%)	
													Min.	Max.
Fluorescent Yellow Green	.387	.610	.369	.546	.428	.496	.460	.540					60	

¹The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Colorimetric System.

Fabrication Lines

The manufacture of prismatic sheeting results in lines being present in the product. In 3M Diamond Grade DG³ sheeting these lines are slightly thicker than the seal pattern legs. Fabrication lines are noticeable in shop light but are not observable in daylight or at night under typical use conditions (Figure 2).

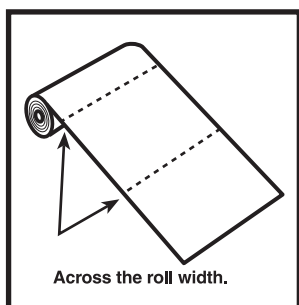


Figure 2 - Fabrication Lines

General Performance Considerations

The durability of 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4083 will depend upon substrate selection and preparation, compliance with recommended application procedures, geographic area, exposure conditions, and maintenance. The user must determine the suitability of any substrate for its intended use. Applications to unprimed, excessively rough or non-weather-resistant surfaces, or exposure to severe or unusual conditions, can shorten the performance of such applications.

Edge Sealing

Edge sealing is not required for 3M Diamond Grade markings.

Typical Physical Properties

The following technical information should be considered typical only and should not be used for specification purposes.

Property	FMVSS 108 Requirement	Series 4083 Typical Value
Thickness (Caliper)	No requirement	0.014 inch - 0.018 inch
Gloss ASTM D523 @ 85°	No requirement	100
Dimensional Stability ASTM D4956	< 1/8 inch change on 9 x 9 inch panel	No measurable change
Flexibility - wrap around 0.125 inch mandrel @ 32°F (0°C)	No cracking	No cracking
High pressure wash test 45° angle, 1200 psi, 8 inch away	No requirement	Passes
Adhesion 90° Hanging Weight ASTM D4956	< 2 inch (55 mm) movement	0.2 inch (4 mm)
Minimum Application Temp.		60°F (15°C)
Instron Peel Adhesion 12 inch/minute, 90° pullback	No requirement	Degreased aluminum 5.3 lb/in (.95 kg/cm) Prepainted panel 3.0 lb/in (0.55 kg/cm) Stainless steel 6.0 lb/in (1.1 kg/cm) FRP 2.5 lb/in (0.52 kg/cm) Tedlar™ 3.0 lb/in (0.54 kg/cm) Aluminum Rail 3.5 lb/in (0.56 kg/cm)

Property	FMVSS 108 Requirement	Series 4083 Typical Value
Chemical Resistance SAE J1967	No requirement	Not affected by toluene, #2 diesel fuel, gasoline (leaded) kerosene, TSP detergent, xylene, dilute metal brighteners
Corrosion Resistance ASTM B-117 Salt Spray	No requirement	No effect 1000 Hours
Impact Resistance Room Temperature 100 in-lb, 5/8 inch tip	No damage outside impact	No damage outside impact
Cold temperature 60 in-lbs at -20°F	No requirement	No damage outside impact

Cleaning

Marking applied to emergency vehicles can be hand washed with sponge, cloth or soft brush using warm water and detergent. Rinse thoroughly. Automatic truck/car wash machines will not adversely affect series 4083 markings. When using hand spray wash wands, hold the nozzle at least 12 inches from the surface and at an angle less than 45° from perpendicular to the marking to avoid damaging the marking. Acid brightening and cleaning solutions can have an adverse affect on 4083 markings over time by lowering the surface gloss and retroreflection. These solutions should not be allowed to soak on the marking to avoid immediate damage.

Storage and Packaging

3M™ Diamond Grade™ DG³ Sheeting should be stored in a cool, dry area, preferably at 65-75°F (18-24°C) and 30-50% relative humidity and should be applied within one year of purchase.

Rolls should be stored horizontally in the shipping carton. Partially used rolls should be returned to the shipping carton or suspended horizontally from a rod or pipe through the core. Unprocessed sheets should be stored flat.

Warranty - Fluorescent Sheeting

3M warrants that 3M™ Diamond Grade™ DG³ Fluorescent Reflective Sheeting sold by 3M to be used as components for emergency vehicles markings in the United States and Canada will remain effective for its intended use for up to 7 years.

If the 3M™ Diamond Grade™ DG³ Fluorescent Reflective Sheeting is applied in accordance with all 3M application and fabrication procedures recommended by 3M,

including the exclusive use of 3M recommended application equipment; and if the marking deteriorates due to natural causes to the extent that the coefficient of retroreflection measured in accordance with ASTM E810 at 0.2° observation and -4° entrance is less than 370 cd/lx/m² or the Daytime Luminance Factor (Y%) is below 60; 3M's sole responsibility and purchaser's and user's exclusive remedy shall be that 3M will provide replacement of the 3M materials.

Conditions for Warranties

Failure must be solely the result of design or manufacturing defects in the Diamond Grade DG³ reflective sheeting and not of outside causes such as: improper fabrication, handling, maintenance or installation; use of process colors, thinner, coatings, or overlay films and sheetings not made by 3M; use of application equipment not recommended by 3M; failure of substrate; exposure to chemicals, abrasion and other mechanical damage; collisions, vandalism or malicious mischief. Maximum durability of 4083 sheeting can be expected in applications subject to +/- 20° from vertical exposure when processed and applied to properly prepared surface.

3M reserves the right to determine the method of replacement.

Replacement sheeting will carry the unexpired warranty of the sheeting it replaces.

3M™ ElectroCut™ Film Red

3M™ ElectroCut™ Film Series 1172 is a durable, transparent, acrylic colored film coated with a transparent, pressure-sensitive adhesive that is protected by a removable liner.

Series 1172 is intended for use on 3M Reflective Sheeting as part of 3M's Matched Component System™ for emergency vehicle markings. Series 1172 film is compatible with 3M™ Diamond Grade™ DG³ Reflective Sheeting 4083 Fluorescent Yellow Green.

ElectroCut film is designed with a special film liner for kiss-cutting on electronic cutting machines. Rolls are available prepunched for sprocket fed cutters or unpunched for flatbed or friction fed cutters.

Properties

Due to the high transparency of ElectroCut films, give equal or better retroreflective performance than sheetings screened with transparent inks.

Storage

Store in a cool, dry area 65-75°F (18-24°C), 30-50% relative humidity, and use within one year from date of receipt.

Fabrication - Cutting and Application Procedures

Important Note: It is recommended that inside radius corner fonts be used when cutting series 1172 film. Read and follow the manufacturer's operating manual carefully for proper use of cutting equipment.

1. Adjust knife pressure to cut cleanly through the film without cutting into the liner. A 30 degree blade works best. Spacing between letters or numbers should be adjusted to the aesthetic preference of the user. Consult the operating manual for instructions on how to regulate spacing. **Note:** Do not cut at high speed on variable speed machines.
2. Avoid sharp bends when cutting and handling film as this may cause film to release from the liner.
3. After cutting is complete, lay sheets flat, face to face, back to back. Always store sheets in this manner until the sheeting has been weeded and transfer tape has been applied to sheeting.
4. Use a stripping tool designed for weeding films that has a blunt (not a sharp) edge.
5. After weeding is completed, store sheets flat, face to face and back to back, until transfer tape is applied.

6. TPM-5 Clear Transfer Tape is recommended for best results. SCPM-3 Application Tape is also satisfactory for use on small signs. Other transfer tapes are not recommended.
7. Transfer tape can be applied either by hand using a plastic squeegee or through a hand squeeze roll laminator. If applying the transfer tape by hand, care must be taken to **always** squeegee from the center to the outside in both directions. If applying the transfer tape through the HSRA, the "lead" edge must be cut square and fed into the nip very carefully to avoid wrinkles in the ElectroCut film.
8. After series 1172 film and sheeting have been applied, remove the transfer tape by carefully removing the tape at as low an angle as possible.
9. A clean cutting blade is required. To remove adhesive build-up use a soft cloth dampened with mineral spirits, isopropyl alcohol or 3M Natural Cleaner.

Health and Safety Information

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

General Performance Considerations

All existing field performance warranties for the reflective sheetings remain in effect when series 1172 film is applied over recommended reflective sheetings.

Limitation and Liability

3M's liability under this warranty is limited to replacement as stated herein, and 3M assumes no liability for any incidental or consequential damages, such as lost profits, business or revenues in any way related to the product regardless of the legal theory on which the claim is based. **THIS WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE, AND ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF TRADE.**

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Important Notice

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