

Traffic Safety and Security Division

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000

Product Bulletin Series 4000ESV
06/2017

1 Description

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000 features highly-efficient micro prismatic optics that return light to drivers under a diverse set of nighttime viewing geometries encountered by the driving public. Series 4000 as manufactured by 3M meets the stringent retroreflective requirements given in the UK Home Office Scientific Development Branch “Battenberg” Vehicle livery specification publication 14/04.

For detailed features and benefits of the Sheeting, please refer to the 3M Traffic Safety and Security Division website (<http://www.3m.co.uk/roadsafety>)

The Sheeting is available in the following colors.

Table 1. Product Codes by Color

Color	Product Code
White	4090
Red	4092
Blue	4095
Green	4097
Fluorescent Yellow-Green – FYG	4083
Fluorescent Orange – FO	4084

2 Specifications

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000 complies with the UK Home Office Scientific Development Branch “Battenberg” Livery Film Specification.

The product also meets the requirements of BS EN 12899-1:2007 Class R3B

2.1 Chromaticity

The chromaticity and the luminance factor shall comply with the limits defined in Table A when illuminated with CIE Standard Illuminant D65. The sample shall be illuminated at 0° to the surface and measure the reflected light in the direction of 45° to the normal to its surface (CIE O/45 geometry).

Table A

Colour	1		2		3		4		Luminance Factor, Y
	x	y	x	y	x	y	x	y	
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329	Y > 0.40
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472	0.45 > Y > 0.24
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346	0.15 > Y > 0.03
Blue	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216	0.10 > Y > 0.01
Interstate Green	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771	0.12 > Y > 0.01
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442	Y > 0.45
Fluorescent Yellow Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540	Y > 0.60
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355	Y > 0.25

2.2

Orientation

3M™ Diamond Grade™ DG³ is designed to be an effective wide angle reflective sheeting regardless of the orientation on the substrate or ultimate orientation after installation.

However, because the efficiency of light return from cube corner reflectors is not equal at all application angles, especially at increasing entrance angles, it is possible to get the widest entrance angle light return when the sheeting is orientated in a particular manner.

When extra wide entrance angle performance is important for a given situation, you may elect to apply the material with a specific orientation.

If high entrance performance is a requirement for your application, you can achieve this performance by positioning the applied sheeting at the 0° application angle.

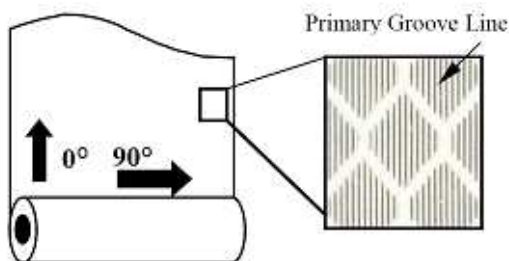


Figure 1 – Sheeting is positioned at 0° application angle.

When the “primary groove line” is vertical in the applied sheeting, Diamond Grade™ DG³ is said to be at a 0° orientation. When the “primary groove line” is horizontal in the applied sheeting, the Diamond Grade™ DG³ is said to be at a 90° orientation

However, unless the location and/or position calls for extra-wide entrance angularity performance, Diamond Grade™ DG³ can be manufactured and installed using the orientation that most efficiently utilizes the reflective sheeting.

NOTE: In cases where panels, strips and text are placed on the same surface, it is recommended they be placed in the same orientation.

2.3 Coefficient of Retroreflection (R_A)

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000 is a super-high efficiency, full cube retro-reflective sheeting and is designed to have the highest retro-reflective characteristics at medium and short road distances as determined by the R_A value at 0.5° and 1.0° observation angle in Table A. The performance at this angle represents the most common viewing geometries encountered by the driving public. 4000 series sheeting also provides brightness at high entrance angles shown in the values at 45° in Table B.

The minimum typical coefficient of retro-reflection R_A (cd/lux/m²) of 3M™ Diamond Grade™ DG³ 4083 Fluorescent Yellow - Green (measured at 0° rotation), when measured in accordance with the procedure specified in CIE Publication No. 54, using CIE standard illuminant A is shown in table B

Table B typical R_A values for 4083

observation angle	0.2°			0.33°			0.5°			1°		
entrance angle	5°	30°	45°	5°	30°	45°	5°	30°	45°	5°	30°	45°
Fl yellow Green	805	381	105	581	253	68	482	207	56	144	76	37

3 Physical Properties

3.1 Edge Seal

Unsealed Diamond Grade™ DG³ may gather water, etc. in uncut cells at the edge but this will not damage the rest of that block of material or reduce the overall conspicuity of the livery in any significant way.

3M recommends the product is ultrasonically edge sealed for aesthetic purposes when applied to vehicles.

3.2 Adhesive

3M™ Diamond Grade™ DG³ Series 4000 incorporates a pressure-sensitive adhesive and should be conditioned prior to application to provide a minimum sheeting temperature of 15°C throughout the material to be applied. Application should be conducted at at room temperature (15°C) or higher.

For hand application, firm pressure with a rubber roller, 3M squeegee PA-1 or equivalent should be applied to obtain maximum initial adhesion. Use multiple, heavy overlapping strokes. Re-roll/Squeegee all edges.

For further information please refer to the application instructions bulletin

3M does not warrant or recommend the use of Cyanoacrylate or other such adhesives to correct improper fitting.

4 Processing, Storage, Packaging, and Cleaning

4.1 Shelf life

1 year from date of purchase in controlled conditions (18-24°C / 30-50% relative humidity)

4.2 Storage

3M™ Diamond Grade™ DG³ sheeting should be stored horizontally in a cool, dry area and used within one year of purchase. An environmentally controlled area is preferable.

Rolls when removed from the shipping carton should be supported by means of a pipe or rod through the core, or returned to the shipping carton with end cores in position in a humidity controlled area or cabinet.

Cut sheets or panels should be stored flat

To protect cut sheets or panels against humidity and dust they should be wrapped in plastic and stored in closed boxes

Maximum height of stacked sheets or panels should not exceed 20cm.

Do not apply pressure to stacked sheets or panels.

4.3 Cleaning

3M™ Diamond Grade™ DG³ Series 4090 may be washed with a sponge or soft cloth using cold or warm water and soap or detergent, followed by a clean water rinse

When using pressure washing equipment, limit nozzle pressure to 80 bar (1160psi). Nozzle should be held at least 1 metre away from the vehicle using a wide fan pattern, and at an angle no more than 15 degrees from square on to the vehicle surface.

Caution: 

Any dirt collecting at the outer edges of the sheeting will not affect the products' overall performance. Do not attempt to remove this dirt with aggressive use of the pressure washing equipment as it may result in the edge lifting and/or top film layer delamination.

Acid brightening and cleaning solutions can have an adverse effect on Diamond Grade™ DG³ Series 4000 over time by lowering the surface gloss and retroreflection. These solutions should not be allowed to soak on the sheeting to avoid immediate damage.

For processing, storage, packaging, and cleaning information, please refer to the storage information folder

5 Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets (SDS) and Article Information Sheets for important health, safety and environmental information. To obtain SDSs and Article Information Sheets for 3M™ products, go to 3M.com/SDS, contact 3M by mail

5.1 3M Warranty

For full warranty information please refer to the current 3M Warranty documentation

5.2 3M Warranty Terms and Conditions

- The Sheeting must be stored, processed, applied, and maintained as described in this product bulletin and in accordance with all applicable, written 3M procedures provided in the applicable 3M Information Folders
- A failure to meet the 3M Warranty must be solely the result of design or manufacturing defect in the 3M Sheeting, and not a result of (a) outside causes including improper fabrication, handling, packing, storing, shipping, maintenance or installation; (b) non-vertical applications where the sheeting is more than +/- 10° from vertical; (c) use of any material or product not recommended by 3M in this product bulletin, in the 3M Information Folders, or in applicable 3M Technical Memorandums; (d) use of application equipment not recommended by 3M; (e) failure of substrate; (f) loss of adhesion due to incompatible or improperly prepared substrate; (g) exposure to chemicals, abrasion and other mechanical damage; (h) snow burial or any other type of burial; (i) collisions, vandalism or malicious mischief; or (j) an act of God.
- 3M is not responsible for any additional warranties that the converter offers to its customers that is beyond the 3M Warranty.

5.3 Disclaimer

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6 Other Product Information

Important Notice To Purchaser

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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.3m.co.uk/roadsafety>

For Information or Assistance

Call : 0800 032 95 97

Internet:

<http://www.3m.co.uk/roadsafety>

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