



Diamond Grade™ Translucent DG³ Reflective Sheeting

Series 4090T

Description

3M™ Diamond Grade™ Translucent DG³ Reflective Sheeting Series 4090T is a wide angle prismatic lens translucent reflective sheeting designed for the production of internally illuminated traffic control signs. Translucent DG³ sheeting is intended for use on internally illuminated sign faces where it is desirable to have a high level of diffuse light transmission from internal sources and a powerful reflective backup in case of light system failure. Translucent DG³ sheeting uniquely provides high retroreflective sign brightness at short sight distances for close-in conspicuity and legend clarity. This white sheeting can be imaged using 3M™ Process Colors Series 880 or 3M™ ElectroCut™ Film Series 1170. Applied to properly prepared sign substrates, translucent DG³ sheeting series 4090T will provide long term service.

Color	Product Code
White	4090T

Transmission

Diamond Grade translucent DG³ reflective sheeting series 4090T has been designed to provide higher levels of luminous transmittance but identical retroreflectance performance as 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090. When applied to a 3mm LEXAN[®] polycarbonate substrate and tested in accordance with ASTM D1003 and with the substrate facing the incident light, the total luminous transmittance (T_t) for illuminant C, will be greater than 30% of said incident light.

Photometric - Coefficients of Retroreflection

The values in Table A are minimum coefficients of retroreflection expressed in candelas per foot candle per square foot (candelas per lux per square meter). Measurements are made in accordance with ASTM E810 “Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting.”

Table A - Minimum Coefficient of Retroreflection

		R _A for new sheeting			
		Candelas per Foot Candle per Square Foot		Candelas per Lux per Square Meter	
0° Orientation					
-4° Entrance Angle					
		Observation Angle			
		0.2°	0.33°	0.5°	1.0°
White		500	350	300	100
30° Entrance Angle					
		Observation Angle			
		0.2°	0.33°	0.5°	1.0°
White		250	175	150	60
90° Orientation					
40° Entrance Angle					
		Observation Angle			
		0.2°	0.33°	0.5°	1.0°
White		125	85	50	30

(These angles are illustrated in Figure 1 and 2)

Table B - CIE Chromaticity Coordinate Limits* for new sheeting

Color	1		2		3		4		Limit Y (%)	
	x	y	x	y	x	y	x	y	Min.	Max.
White	.305	.305	.355	.355	.335	.375	.285	.325	35	-

Observation (Divergence) Angle

The angle between the illumination axis and the observation axis.

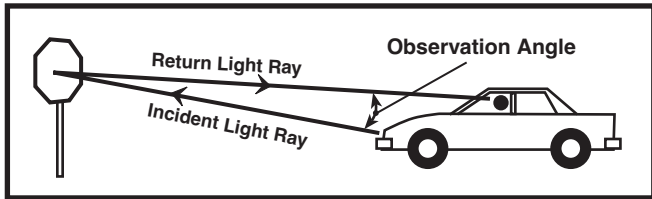


Figure 1

Entrance (Incidence) Angle

The angle between the illumination axis and perpendicular to the retroreflective surface.

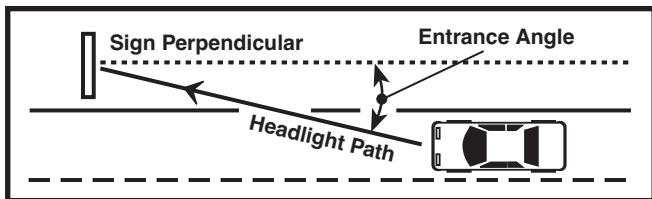


Figure 2

Color

The color of the white translucent retroreflective sheeting conforms to Table B.

*The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 standard colorimetric system measured with standard illuminant D65.

For screenprinted transparent or opaque color areas on white sheeting, or white sheeting covered with ElectroCut film series 1170 when processed according to 3M recommendations, the ratios of the R_A for the color to the R_A for the white shall be 5:1 to 15:1 for red and not less than 5:1 for green and blue.

Adhesive

Series 4090T sheeting has a pressure-sensitive adhesive that is recommended for room temperature application. Room temperature application is defined as 65°F (18°C) or higher.

Interlocking Diamond Seal Pattern

Series 4090T sheeting has an interlocking seal pattern. This design is unique to 3M wide angle prismatic retroreflective sheetings.

Tooling Lines

The manufacturing of a prismatic sheeting requires tooling lines. In DG³ sheeting these lines, slightly thicker than the seal pattern legs, occur down the web every 35 inches for 36 inch material and 52 inches for 48 inch material. Tooling lines are noticeable in shop light but are not observable on the road either in daylight or at night under typical use conditions. (Figure 3)

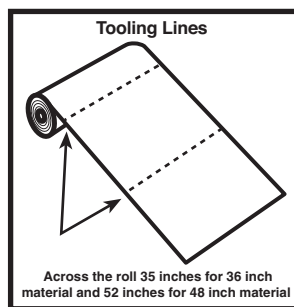


Figure 3

Test Methods of Adhesive and Film

Standard Test Panels

Unless otherwise specified, the reflective sheeting shall be applied according to the manufacturer's recommendations to smooth 0.125 inches (3mm) minimum thickness or equivalent panels. Lack of contamination of test panels must be confirmed by passing the water break test and tape snap test as described in Information Folder 1.7.

Properties

Standard Conditioning - all mounted and unmounted test specimens shall be conditioned for 24 hours at 73°F ± 2°F (23°C ± 1°C) and 50% ± 4% R.H. before testing.

1. Adhesion

Test Weight 1-3/4 lbs. (0.8 kg) Test Method - Apply 4 inches (10cm) of 1 inch x 6 inches (2.54x15cm) strip to panel and condition, face panel down and suspend test weight from free end.

Requirement - Not more than 2 inches (5.0cm) of peel in 5 minutes.

2. Impact Resistance

Test Method - Apply sheeting to a standard panel 3 inches x 6 inches (7.6x15.2cm) and condition. Subject sheeting to a 50 inch pounds (5.7Nm) impact in accordance with ASTM D-2794.

Requirement - No separation from panel or cracking outside immediate impact area.

3. Shrinkage

Test Method - Following conditioning of 9 inches x 9 inches samples, remove liner, place specimen on flat surface with adhesive side up.

Requirement - Shrinkage not greater than 1/32 inch (0.8mm) in 10 minutes or more than 1/8 inch (3.2mm) in 24 hours in any dimension.

4. Flexibility

Test Method - Following conditioning of 1 inch x 6 inches sample, remove liner and dust adhesive with talc. At standard conditions, bend in one second around 1/8 inch (3.2mm) mandrel with adhesive side facing mandrel.

Requirement - No cracking, peeling or delamination.

5. Gloss

Test Method - Test in accordance with ASTM D523 using an 85° glossmeter.

Requirement - Rating not less than 50.

Application

Sign Fabrication Methods

Translucent DG³ sheeting series 4090T incorporates a pressure-sensitive adhesive and should be applied to the sign substrate at room temperature (65°F/18°C) or higher by any of the following methods:

Mechanical squeeze roll applicator - IF 1.4*

Hand squeeze roll applicator - IF 1.6

Hand application - IF 1.5

*Note - never direct the Calrod™ heater at the sheeting during application. If the heater is needed to warm to the minimum application temperature of 65°F, direct it at the substrate only.

Orientation - Translucent DG³ sheeting series 4090T employs cube corner lens elements. Because these lens elements are not round they impart a directional nature to the retroreflective system. Therefore, translucent DG³ sheeting is considered to have an orientation on the finished sign.

Vertical Orientation - Sheeting applied such that primary groove lines are perpendicular to the ground (vertical) on the finished sign. This orientation is equal to 0° on Table A.

Horizontal Orientation - Sheeting applied such that primary groove lines are parallel to the ground (horizontal) on the finished sign. This orientation is equal to 90° in Table A.

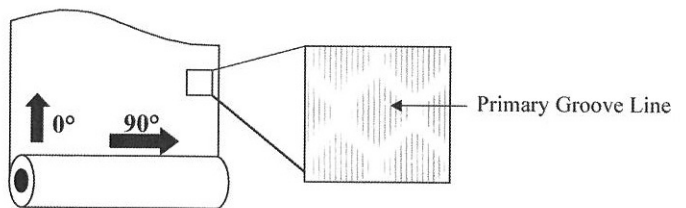


Figure 4

Signs can be fabricated with the orientation that results in the greatest productivity. However, for very high entrance angle sign situations (beyond 35°) the vertical orientation gives the best angular performance.

Splicing - Translucent DG³ sheeting series 4090T should be butt spliced when more than one piece of sheeting is used on one piece of substrate. The sheeting pieces should not touch each other at the splice. Exposed horizontal splices are not recommended. All pieces must be applied with the same orientation on the finished sign.

Substrates

Translucent DG³ sheeting series 4090T has a pressure sensitive adhesive designed for use with the most common flat substrates. See Information Folder 1.7 for proper substrate preparation. Users are urged to carefully evaluate all substrates for adhesion and sign durability. Sign failures caused by the substrate or improper surface preparation are not the responsibility of 3M.

Screen Processing

Translucent DG³ sheeting may be screen processed into traffic signs before or after mounting on a sign substrate, using process colors series 880 or 840 (see Product Bulletin 880/840). Series 880 and series 840 process colors can be screen processed at 60-100°F (16-38°C) with relative humidity of 20-50%. A PE 157 screen mesh with a fill pass is recommended. See Information Folder 1.8 for details.

3M assumes no responsibility for failure of sign face legends or backgrounds that have been screened with process colors other than those listed above. Care should be taken to avoid creasing or folding the translucent DG³ sheeting before and especially after screening to eliminate the possibility of cracking from improper handling techniques.

3M™ ElectroCut™ Film Series 1170 can be used in place of screen processing for low volume legends or large background areas with reversed out legends.

Cutting and Matching

The sheeting may be hand cut or die cut one sheet at a time, and band sawed or guillotined in stacks. The sheeting can be hand cut from either side with a razor blade or other sharp hand tool. Like all reflective sheetings, when two or more pieces are used side by side on a sign, they must be matched to assure uniform day color and night appearance.

Multi-piece signs should have all sheeting pieces or copy oriented identically for uniform appearance.

Note that the maximum stack height for cutting DG³ sheeting is 1-1/2 inch or 50 sheets.

Cutting equipment such as guillotines and metal shears which have pressure plates on the sheeting when cutting may damage the optics. Padding the pressure plate and easing it down onto the sheets being cut will eliminate damage. Details on cutting and color matching can be found in Information Folder 1.10.

Prespacing

Use prespacing tape SCPS-2 as a carrier for die cut letters, numerals or symbols for rapid, accurate application of legends. See Information Folder 1.10.

Cleaning

Signs that require cleaning should be flushed with water, then washed with a detergent solution and bristle brush or sponge. Avoid pressure that may damage the sign face. Flush with water following washing. Do not use solvents to clean signs. See Information Folder 1.10.

Storage and Packaging

Translucent 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. Finished signs and applied blanks should be stored on edge.

Screen processed signs must be protected with

SCW-82 slipsheet paper. Place the glossy side of the slipsheeting against the sign face and pad the face with closed cell packaging foam. Double faced signs must have the glossy side of the slipsheet against each face of the sign.

Unmounted screened faces must be stored flat and interleaved with SCW-82 slipsheet, glossy side against the sign face. Packages of finished sign faces must include sufficient nylon washers for mounting.

Avoid banding, crating, or stacking signs.

Package for shipment in accordance with commercially accepted standards to prevent movement and chafing. Store sign packages indoors on edges.

Panels or finished signs must remain dry during shipment and storage. If packaged signs become wet, unpack immediately and allow signs to dry. See Information Folder 1.11 for instructions on packing for storage and shipment.

Installation

Finished sign faces may be slid into channels in internally lighted cabinets or installed with edges held by fasteners, if such is the practice of the light box manufacturer. When twist fasteners are used, nylon washers (available from 3M) are recommended between the heads (such as screw heads, bolts, or nuts) and the sheeting to protect the sheeting from the twisting action of the bolt heads.

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

The durability of 3M™ Diamond Grade™ Translucent DG³ Reflective Sheeting Series 4090T will depend upon substrate selection and preparation, compliance with recommended application procedures, geographic area, exposure conditions, and maintenance.

Maximum durability of series 4090T sheeting can be expected in applications subject to vertical exposure on stationary objects when processed and applied to properly prepared transparent/translucent substrate according to 3M recommendations provided in Information Folder 1.7 on Sign Substrate Surface Preparation.

The user must determine the suitability of any sign substrate for its intended use. Exposure to severe or unusual conditions can shorten the durability of such applications.

Signs in mountainous areas that are covered by snow for prolonged periods may also have reduced durability.

Process colors, when used according to 3M recommendations, are generally expected to provide performance comparable to colored reflective sheeting, except for certain lighter colors, such as yellow, gold, or heavily toned colors or blends containing yellow or gold, whose durability depends on how much of each color is used. Dilution of color and atmospheric conditions in certain geographic areas may result in reduced durability.

3M™ Scotchcal™ Film 7755-12, Scotchcal film 3655 Black, Scotchcal film 7720-12, and 3M™ Controltac™ Film 180-12 Black, and 3M™ ElectroCut™ Film Series 1170 can be expected to perform satisfactorily for the life of the sign when direct applied to series 4090T sheeting, except where shortened durability is stated in the literature.

Warranty

3M warrants that 3M™ Diamond Grade™ Translucent DG³ Reflective Sheeting sold by 3M and used as components for traffic control and guidance signs in the United States and Canada will remain effective for its intended use and meet the stated minimum values for coefficient of retroreflection for seven years, subject to the following provisions:

Minimum Coefficient of Retroreflection (R_A) Seven Year Performance

Candelas per Foot Candle per Square Foot
Candelas per Lux per Square Meter
0° Orientation

-4° Entrance Angle²

Observation Angle°

0.2°

1.0°

White

250

45

All measurements shall be made after sign cleaning according to 3M recommendations and in accordance with ASTM E810 "Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting." For screenprinted transparent colored areas on white sheeting, the coefficients of retroreflection shall not be less than 70% of the values for the corresponding color in Product Bulletin 4000.

If a Diamond Grade translucent DG³ sign surface is processed and applied to sign blank materials in accordance with all 3M application and fabrication procedures provided in 3M's product bulletins, information folders, and technical memos (which will be furnished to the agency upon request), including the exclusive use of 3M matched com-

ponent systems, process colors, clear coatings, electronic cuttable films, protective overlay films, and recommended applications equipment; and

If the sign deteriorates due to natural causes to the extent that: 1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions by a driver with normal vision, or 2) the coefficient of retroreflection is less than the minimum herein specified, 3M's sole responsibility and purchaser's and user's exclusive remedy shall be:

If the failure occurs within the first 5 years from the date of fabrication, 3M will, at its expense, restore the sign surface to its original effectiveness.

If the failure occurs from the 6th through the 7th years from the date of fabrication, 3M will furnish the necessary amount of Diamond Grade translucent DG³ sheeting to restore the sign surface to its original effectiveness.

Conditions

Such failure must be solely the result of design or manufacturing defects in the Diamond Grade translucent DG³ reflective sheeting and not of outside causes such as: improper fabrication, handling, maintenance or installation; use of process colors, thinners, coatings, or overlay films and sheetings not made by 3M; use of application equipment not recommended by 3M; failure of sign substrate; exposure to chemicals, abrasion and other mechanical damage from fasteners used to mount the sign; sign burial; collisions, vandalism or malicious mischief.

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

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

Claims made under this warranty will be honored only if the signs have been dated at the time of sheeting application, which constitutes the start of the warranty period.

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.

Limitation of 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 revenue 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.

Literature

- IF 1.3 Instructions for Squeeze Roll Applicator
- IF 1.5 Hand Application Instructions
- IF 1.6 Instructions for Hand Squeeze Roll Applicator
- IF 1.7 Sign Base Materials
- IF 1.8 Color Application Instructions
- IF 1.10 Cutting, Matching, Premasking, and Prespacing Instructions
- IF 1.11 Storage Maintenance, and Removal Instructions
- IF 6.1 Sign Fabrication Guidelines for Maximizing Legibility and for High Entrance Angle Signs

FOR INFORMATION OR ASSISTANCE

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