



Diamond Grade™ Conspicuity Markings

Series 983

Product Bulletin 983

June 2004

Description

3M™ Diamond Grade™ Conspicuity Markings Series 983 are highly retroreflective micro-prismatic markings designed to mark the sides and rear of vehicles for enhanced visibility and detection. The reflective marking consists of prismatic lenses that are formed in a transparent, synthetic resin, sealed and backed with a pressure-sensitive adhesive and clear poly liner. Applied to properly prepared surfaces Diamond Grade markings should provide seven years of field performance.

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.

Series 983-10, 983-32, 983-326 and 983-72 meet or exceed all FMVSS 108 requirements, including DOT-C2 Certification Mark.

- 1, 1.5, 2, 3 and 4 inch wide x 50 yard rolls
- High brightness
- Wide angularity to almost 90° from perpendicular

Easy to apply

- Aggressive pressure sensitive adhesive
- Easy to remove liner
- Available in convenient rolls, packaged pieces, or kiss-cut pieces on a roll

Durable

- Pre-sealed edges
- Non-metallic construction to prevent corrosion
- 7 year warranty (non-prorated)

<u>Product Code</u>	<u>Color</u>	<u>Size</u>	<u>DOT Mark</u>
983-10	White	2, 3, 4 inch x 50 yards (Edge Sealed)	Yes
983-32	Red 11 inch/White 7 inch, (Alternating Pattern)	1-1/2, 2, 3, 4 inch x 50 yard (Edge Sealed)	Yes
983-326	Red 6 inch/White 6 inch (Alternating Pattern)	1, 1-1/2, 2 inch x 50 yards (Edge Sealed)	Yes
983-71	Yellow	1, 1-3/4, 2 inch x 50 yards (Edge Sealed)	No
983-72	Red	2, 3, 4 inch x 50 yards (Edge Sealed)	Yes

Coefficient of Retroreflection

Measurements are made in accordance with ASTM E-810 "Standard Test Method for Coefficient of Retroreflective Sheeting" in terms of candlepower per foot-candle per square foot (cd/lux/m²).

Table A. Typical Coefficient of Retroreflection (R_A) for New Sheeting (cd/lux/m²).

Entrance Angle ²	Observation Angle ¹					
	0.2°			0.5°		
	-4°	30°	45°	-4°	30°	45°
983 Typical Values White (FMVSS 108 Requirement)	800 (250)	550 (250)	345 (60)	460 (65)	215 (65)	85 (15)
983 Typical Values Red (FMVSS 108 Requirement)	160 (60)	110 (60)	60 (15)	95 (10)	40 (10)	16 (4)
983 Typical Values Yellow	645	420	235	360	180	65

¹Observation Angle - the angle formed by the light beam striking the reflective surface and the light beam returning to the observer (from 800 feet, a motorist normally views a marking at approximately an 0.2° observation angle).

²Entrance Angle - the angle formed by a light beam striking a surface at a point and a line perpendicular to the surface at the same point.

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 983 Typical Value
Thickness (Caliper)	No requirement	0.014 inch - 0.018 inch
Whiteness		
Reflective Limit Y	> 15 White	45 White
ASTM E1164	> 2.5 Red	5 Red
Gloss	No requirement	100
ASTM D523 @ 85°		
Dimensional Stability	< 1/8 inch change on 9 x 9 inch panel	No measurable change
ASTM D4956		
Flexibility - wrap around	No cracking	No cracking
0.125 inch mandrel @ 32°F (0°C)		
High pressure wash test	No requirement	Passes
45° angle, 1200 psi, 8 inch away		
Adhesion		
90° Hanging Weight	< 2 inch (55mm) movement	0.2 inch (4 mm)
ASTM D4956		
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)

<u>Property</u>	<u>FMVSS 108 Requirement</u>	<u>Series 983 Typical Value</u>
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

Maintenance

Cleaning

Routine washing is recommended for maximum performance. The following cleaning methods are recommended.

- Wash with sponge, cloth or soft brush using water and detergent.
- Automatic truck/car wash or standard high-pressure hand spray:
Maximum pressure-1200 PSI/ 80 bar.
Maximum water/wash solution temperature-140°F/ 60°C.
Minimum of 12 inches/ 30cm distance of cleaning jet(s) from markings.
Cleaning wand or jets to be at **no greater** angle than 45 degrees from perpendicular to the marking surface.
- When using metal brighteners, follow manufacturer's recommendations for dilution. Thoroughly rinse from markings after soaking vehicle.

Storage

- Cool, dry area out of direct sunlight.
- Temperature 65-75°F (18-24°C)
humidity 30-50%.
- Store rolls horizontally, in carton or in original packaging.

Shelf Life

- Apply series 983 markings within two years of receipt of material.

General Performance Considerations

Series 983 markings will provide maximum durability when:

- 3M recommended procedures are followed.
- Marking is applied to vertical surfaces.

Actual durability will be based on actual customer use, field testing, exterior exposed testing and artificial weathering testing.

Durability can be reduced if recommended techniques are not followed:

- Failure to cut markings around rivets, seams and body are panels.
- Improper use of high pressure cleaning.
- Spillage of chemicals or solvents.
- Improper application or surface preparation.

Warranty

3M warrants that 3M™ Diamond Grade™ Conspicuity Markings Series 983 sold by 3M to be used for truck and trailer conspicuity markings 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:

<u>Marking Color</u>	<u>Minimum Coefficient of Retroreflection Candelas per foot candle per Sq. Ft. Candelas per Lux per Square Meter (.2° Observation and -4° Entrance)³ (FMVSS 108 Requirement)</u>
White	250
Red	60

³All measurements shall be made after cleaning according to 3M recommendations and in accordance with ASTM E 810 "Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting."

If Diamond Grade conspicuity marking is processed and applied to a vertical $\pm 20^\circ$ surface in accordance with all 3M application and fabrication procedures provided in 3M's product bulletins, information folders, technical memos (which will be furnished to the agency upon

request), including the exclusive use of 3M process colors and clear coatings, and recommended application equipment; and If the marking deteriorates due to natural causes; such as fading, cracking, peeling, lifting, discoloration or 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 that 3M will provide full replacement of the 3M materials for seven years from the date of installation.

Conditions

Such failure must be solely the result of design or manufacturing defects in the 3M™ Diamond Grade™ Conspicuity Markings and not of outside causes such as: improper fabrication, handling, maintenance or installation; use of process colors, thinners, or coatings not made by 3M; use of application procedures not recommended by 3M; applied to a surface at greater than $\pm 20^\circ$ from vertical; failure of substrate; exposure to chemicals, abrasion and other mechanical damage from fasteners used to mount the marking; collisions, vandalism or malicious mischief.

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

Replacement markings will carry the unexpired warranty of the marking it replaces.

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 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.

Literature Reference

IF 4.9 Application Instructions for Diamond Grade Conspicuity Markings Series 983

FOR INFORMATION OR ASSISTANCE

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3M assumes no responsibility for any injury, loss or damage arising out of the use of a product that is not of our manufacture. Where reference is made in literature to a commercially available product, made by another manufacturer, it shall be the user's responsibility to ascertain the precautionary measures for its use outlined by the manufacturer.

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