



Diamond Grade™ Conspicuity Markings for Rail Car Reflectorization

Series 983RR

Product Bulletin 983RR

March 2006

Replaces PB 983RR dated February 2005

Description

3M™ Diamond Grade™ Conspicuity Markings Series 983RR are highly retroreflective microprismatic markings designed to mark rail cars and locomotives 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 substrates Diamond Grade markings should provide ten year field performance.

Product Code

983-21FRA
983-71FRA
983-10FRA

Color

Fluorescent Yellow
Yellow
White

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 983-21 fluorescent yellow, 983-71 yellow and 983-10 white markings meet or exceed:

- ASTM D4956-01A Type VII
- FRA 49 CFR Part 224 requirements

Features

- High brightness
- Wide angularity
- Durable fluorescent yellow, yellow, and white
- 10 year warranty
- Pre-sealed edges
- Non-metallic construction - no corrosion

Easy to apply

- Aggressive pressure sensitive adhesive for application down to 35°F
- Available in 4 x 18 inch kiss cut pieces on a roll for easy application (50 yd. length)

Fluorescence

Fluorescent materials absorb short wavelength, invisible, incident radiation (solar energy) and re-emit the radiation as longer wavelength, visible light. This re-emitted energy continues as long as incident radiation is present.

- Fluorescent markings are especially effective during dawn, dusk, and overcast days.
- Fluorescence adds to daytime luminance and enhances the visibility and safety of rail cars when motorist headlights may not be in use.

Coefficient of Retroreflection

The typical coefficient of retroreflection values of these sheetings when new are given in Table A in terms of candelas per lux per square meter. Measurements are made in accordance with ASTM E-810 “Standard Test Method for Coefficient of Retroreflective Sheeting.”

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

² Entrance Angle	¹ Observation Angle					
	0.2°			0.5°		
	-4°	30°	45°	-4°	30°	45°
983-21 Typical Values Fluorescent Yellow	400	220	120	150	75	50
983-71 Typical Values Yellow	600	420	225	350	180	65
983-10 Typical Values White	800	500	300	450	225	85

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	Series 983RR Typical Value
Thickness (Caliper)	0.014 inch - 0.018 inch (.36 - .46mm)
Gloss ASTM D523 @ 85°	100
Dimensional Stability ASTM D4956	No measurable change on 9 x 9 inch panel
Flexibility - wrap around 0.125 inch mandrel @ 32°F (0°C)	No cracking
High pressure wash test 45° angle, 1200 psi, 8 inch nozzle distance	Passes
Adhesion 90° Hanging Weight ASTM D4956-01_A	Passes
Minimum Application Temp.	35°F (1.7°C)
Chemical Resistance SAE J1967	Not affected by toluene, #2 diesel fuel, gasoline (leaded) kerosene, TSP detergent, xylene, dilute metal brighteners
Corrosion Resistance ASTM B-117 Salt Spray	No effect-1000 Hours
Impact Resistance Room Temperature 100 in-lb, 5/8 inch tip	No damage outside impact
Cold temperature 60 in-lbs at -20°F (-29°C)	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.
- Standard high-pressure hand spray:
Maximum pressure-1200 PSI/ 80 bar.
Maximum water/wash solution temperature-140°F/60°C.
Minimum of 12 inches/ 30 cm distance between cleaning jet(s) and markings.
Cleaning wand or jets to be at **no greater** angle than 45 degrees from perpendicular to the markings surface.
- When using metal brighteners, follow manufacturer's recommendations for dilution. Thoroughly rinse from marking after soaking rail car or other 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.
- Markings are applied to vertical surfaces.

Actual durability will be based on actual customer use conditions. Durability can be reduced if recommended techniques are not followed, including:

- Improper application or surface preparation.
- Improper use of high pressure cleaning.
- Spillage of chemicals or solvents.

Warranty

3M warrants that 3M™ Diamond Grade™ Conspicuity Marking Series 983 sold by 3M to be used for markings in the United States and Canada will remain effective for its intended use for ten years. If the 3M reflective marking is applied in accordance with all 3M application and fabrication procedures provided in 3M's product bulletins, information folders, technical memos (that will be furnished upon request), including the exclusive use of 3M recommended application equipment; and if the emblem or marking deteriorates due to natural causes; such as fading, cracking, peeling, lifting, or discoloration; 3M's sole responsibility and purchaser's and user's exclusive remedy shall be that 3M will provide replacement of the 3M material.

Conditions

Such failure must be solely the result of design or manufacturing defects in the 3M reflective markings and not of outside causes such as: improper handling, maintenance or installation; use of application procedures not recommended by 3M; 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 markings they replace.

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 4.18 Application Instructions for 3M™
Diamond Grade™ Conspicuity
Marking on Rail Cars Series 983

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