Science.
Applied to Life.™

Transportation Safety Division

3M™ Diamond Grade™ Reflectors Series 989

Product Bulletin Series 989
June 2019

Replaces Product Bulletin 989 Dated December 2018

1 Description

3M Diamond Grade Reflectors Series 989 (“Reflectors”) features highly retroreflective prismatic lenses in a durable transparent synthetic resin that is backed with an aggressive pressure sensitive adhesive and clear polymer liner. Reflectors are available in vivid red and amber, providing bright and reflective demarcation.

- 2” x 3.5” rectangular reflectors are available on rolls, 500 reflectors per roll.
- 3” diameter round reflectors available in packages of 50.

Reflectors are available in the following colors.

Table 1. Product codes by color.

Color	Product Code
Red	989-72
Amber	989-74

2 Application

Reflectors must be applied to clean, dry surfaces applying pressure with a plastic squeegee. Per Federal Motor Vehicle Safety Standard 108 (“FMVSS 108”) and Canada Motor Vehicle Safety Standard 108 (“CMVSS 108”), red Reflectors are to be applied only to rear-facing surfaces and back corners of trailers, and amber Reflectors are to be applied only to side and front-facing surfaces of trailers.

3 Product Features

Table 2 describes the features of Reflectors.

Table 2. Reflector features.

Feature	Description
Low Profile	Reflectors are not easily knocked off and continue to function when damaged
Adhesive type	Pressure sensitive
Easy to apply	Apply using pressure; no drilling or mechanical fasteners required
Liner	Clear polymeric
Application substrates	Aluminum, stainless steel, fiberglass reinforced plastic, painted surfaces, and painted/sealed wood
Application temperature range	50 to 100 °F (10 to 38 °C)
Retroreflectivity standards	Meet photometric requirements of FMVSS 108 and SAE J594 for Reflex Reflectors when mounted in the 0° orientation. Excellent angularity - beyond 60°
Warranty period	7 years

4 Retroreflection

When mounted to the substrate in the 0° orientation, Reflectors comply to the FMVSS 108 and SAE J594 photometric requirements for red and amber reflex reflectors presented in Table 3.

Table 3. Minimum retroreflection values, R_I, for new Reflectors in the 0° orientation, as defined by FMVSS 108 and SAE J594.

		Minimum for Red 989-72		Minimum for Amber 989-74	
Observation Angle[a]	**Entrance Angle[b]**	**(Cd/incident ft·c)**	**(mcd/lux)**	**(Cd/incident ft·c)**	**(mcd/lux)**
0.2°	0°	4.5	420	11.25	1050
	10° Up	3.0	280	7.5	700
	10° Down	3.0	280	7.5	700
	20° Left	1.5	140	3.75	350
	20° Right	1.5	140	3.75	350
1.5°	0°	0.07	6	0.175	15
	10° Up	0.05	5	0.125	12.5
	10° Down	0.05	5	0.125	12.5
	20° Left	0.03	3	0.075	7.5
	20° Right	0.03	3	0.075	7.5

a. Observation Angle - the angle between the illumination axis and the observation axis.
b. Entrance Angle - the angle between the illumination axis and the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

4.1 Entrance Angularity Performance and Orientation

Reflectors have been designed to be effective regardless of orientation on the substrate. However, because the efficiency of light return from cube corner reflectors is not equal at all application orientations, compliance to the photometric requirements of FMVSS 108 and SAE J594 requires that Reflectors be positioned at the 0° orientation. When the flat side of the diamond (direction of diamond chain links) is vertical, a reflector is said to be at a 0° orientation. See Figure 1 for details.

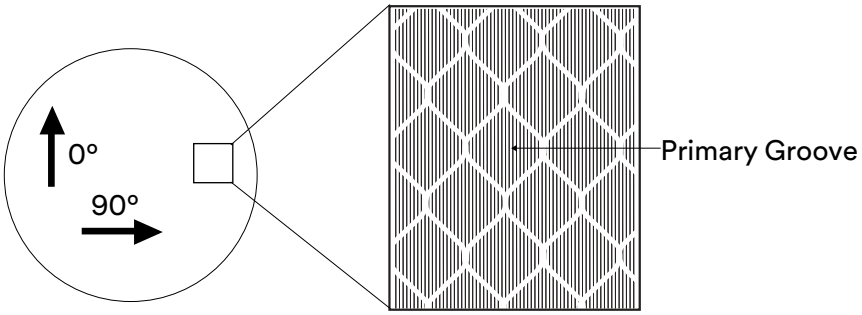


Figure 1. Primary groove line.

If FMVSS 108 and SAE J594 compliance is not required for a specific installation, Reflectors can be installed in any orientation.

5 Durability

Reflectors achieve maximum durability when:

- 3M recommended procedures are followed and
- Reflectors are applied to vertical surfaces.

Actual durability is dependent on use, and can be evaluated through field testing, exterior exposed testing, and artificial weathering testing. The following have been found to significantly diminish Reflector durability:

- Improper high pressure cleaning
- Exposure to solvents or other harsh chemicals
- Improper application, including improper surface preparation

6 Storage

Reflectors should be stored in a cool, dry area, preferably at 65-75 °F (18-24 °C) and 30-50% relative humidity, and applied within two years of date of manufacture.

7 Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheet (SDS), Article Information Sheet, and/or product labels of chemicals prior to handling or use. Consult local regulations and authorities for possible restrictions. Visit us at www.3M.com/us and select SDS search to obtain current Safety Data Sheets.

8 Warranty Information

8.1 3M Warranty

Reflectors sold by 3M for use on trucks, trailers and other vehicles in the United States and Canada will remain effective for their intended use by resisting fading, cracking, peeling, lifting, and or discoloration, for a period of seven (7) years (“Warranty Period”), as measured from the date of original installation (“Installation Date”).

8.2 Terms and Conditions

- Reflectors must be processed and applied to a vertically-mounted (±20°) 3M recommended substrate as described in this product bulletin and in accordance with all 3M application, fabrication, and cleaning procedures provided in 3M's product bulletins, information folders, and applicable technical memos (which will be furnished to the manufacturer upon request).
- Any third-party imaging or altering of Reflectors not endorsed by 3M will void the 3M Warranty.
- A Reflector's failure to meet the 3M Warranty must be solely the result of design or manufacturing defects in the Reflector and not of (a) outside causes including improper storage, fabrication, handling, maintenance, or installation; (b) failure of substrate; (c) use of application procedures not recommended by 3M; (d) exposure to chemicals or solvents not recommended by 3M; (e) abrasion and other physical damage, including damage from fasteners used to mount the Reflector; (f) collisions, vandalism, or malicious mischief; or (g) an act of God.
- 3M reserves the right to determine the method of replacement. Replacement product will carry the unexpired warranty of the Reflector it replaces.
- Claims made under this warranty will be honored only if 3M is presented with a traceable record of the Reflector's Installation Date, 3M is notified of a potential failure within thirty days of discovery, reasonable information requested by 3M is provided, and 3M is permitted to verify the cause of the failure.

8.3 Exclusive Limited Remedy

If a Reflector is proven not to have met the 3M Warranty during the Warranty Period, then the purchaser's and user's exclusive remedy, and 3M's sole obligation, at 3M's option, shall be that 3M will provide replacement of the Reflector.

8.4 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM, OR USAGE OF TRADE.

8.5 Limitation of Liability

Except for the limited remedy stated above, and except where prohibited by law, 3M will not be liable for any loss or damage arising from any 3M product, whether direct, indirect, special, incidental, or consequential damages (including but not limited to lost profits, business, or revenue in any way), regardless of the legal theory asserted including warranty, contract, negligence, or strict liability.

9 Other Product Information

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.com/roadsafety.

10 Literature References

3M IF 4.9 3M™ Diamond Grade™ and Flexible Prismatic Conspicuity Markings Application Instructions for Trucks, Trailers, and Specialty Vehicles

For Information or Assistance
Call: 1-800-553-1380
In Canada Call:
1-800-3M HELPS (1-800-364-3577)

Internet:
http://www.3M.com/roadsafety

3M, Science. Applied to Life., Scotchlite, and Diamond Grade are trademarks of 3M. Used under license in Canada.
All other trademarks are the property of their respective owners.

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.

Important Notice

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable at the time of this publication, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, or conditions express or implied. Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct, indirect, special, or consequential, arising out of the use of or the inability to use the product. Before using, user shall determine the suitability of the product for his/her intended use, and user assumes all risk and liability whatsoever in connection therewith. Statements or recommendations not contained herein shall have no force or effect unless in an agreement signed by officers of seller and manufacturer.

Transportation Safety Division
3M Center, Building 0225-04-N-14
St. Paul, MN 55144-1000 USA

Phone 1-800-553-1380
Web 3M.com/roadsafety

Please recycle. Printed in USA © 3M 2019.
All rights reserved. Electronic Only