

3M Marker

Series 190

Product Bulletin 190

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Replaces PB 190 November 2006

Description

The 3M™ Snowplowable Marker Series 190 is designed for application in cast-iron holders (castings). The markers provide highly effective, long-term nighttime visibility in snow plow regions.

The marker bodies are produced from an engineered polymer selected for superior impact resistance and weatherability. The marker incorporates either one or two abrasion-resistant, retroreflective elements, typically in white, yellow/amber, red, blue or green colors. The retroreflective elements are designed to provide long-lasting nighttime visibility by resisting breakage, providing optimal angularity, and adhering firmly to the casting.

The markers are manufactured with an adhesive layer and peel away liner, and are intended for application in a casting using Liquid Nails™ LN-602¹ adhesive on LN-950 adhesive (where VOC compliance is required).

For application information, refer to 3M Information Folder 190, “Application Procedures for 3M™ Snowplowable Marker.” For situations not specifically covered, it is the responsibility of the installer to contact the appropriate 3M sales representative or 3M technical service representative at 1-800-553-1380.

Markers	190 (100 per box)	194 (600 per box)	198 (100 per box)
One-way white	RPM-190-W	RPM-194-W	RPM-198-W
One-way yellow	RPM-190-Y	RPM-194-Y	RPM-198-Y
Two-way white	RPM-190-2W		RPM-198-2W
Two-way yellow	RPM-190-2Y		RPM-198-2Y
Two-way white/red	RPM-190-WR		RPM-198-WR
Two-way yellow/red	RPM-190-YR		RPM-198-YR

Product Features

- Durable
- Wet and dry retroreflective
- Impact resistant
- Abrasion resistant
- Lightweight
- Lens Hardcoat

Type Retroreflectance

Type retroreflectance refers to marker luminance measured using simplified viewing conditions as a convenient means of describing uniformity of marker characteristics. Type retroreflectance is used for quality control purposes when specifying a unique marker type. The white, yellow/amber, red, blue or green markers have initial minimum retroreflectance values specified in Table 1 when measured in accordance with ASTM E809.

The photometric quantity to be measured is the coefficient of retroreflected luminous intensity (RI), expressed as millicandelas per lux (mcd/lx).

Table 1: Minimum R_i Values

Entrance angle β_2 ($\beta_1 = 0^\circ$)	0°		±20°	
	Observation angle			
	0.2°		0.2°	
Color	Minimum R _i (mcd/lx)	Minimum R _i (cd/ftcd)	Minimum R _i (mcd/lx)	Minimum R _i (cd/ftcd)
White	279	3.0	112	1.2
Yellow/Amber	167	1.8	67	0.7
Red	69	0.8	28	0.3
Blue	28	0.3	11	0.1
Green	92	1.0	37	0.4

¹Liquid Nails is a trademark of Macco

Performance Retroreflectance

Performance retroreflectance refers to marker luminance as viewed by the driver under standardized road and vehicle conditions. This property is often called “Driver Geometry Retroreflection.” Measurement under simulated use conditions ensures that all geometric viewing angles are taken into account during testing, including the rotation angle, which is an important consideration when evaluating markers with prismatic retroreflective lenses. The markers have initial minimum retroreflectance values specified as the product of the values in **Table 2** and **Table 3** when measured in accordance with ASTM E809. In **Table 2**, the angles referenced correspond to the entrance, rotation and observation geometry for a driver in a standard vehicle with pavement

markers placed on a lane line to the left of the vehicle. The measured value at each simulated distance is the sum of the marker retroreflection from the incident illumination of the left and right headlights. Test set up and measurement geometry is illustrated in **Figure 1**.

Retroreflected Color

The retroreflected color of the markers lies within the respective retroreflected color gamut coordinates, plotted on the 1931 CIE Chromaticity (x,y) diagram, described in **Table 4** and **Figure 2** when tested in accordance with ASTM E811 using CIE Illuminant Source A and viewing conditions of 0.2° observation angle, 0° entrance angle. The source and receptor angular apertures are each 6 minutes of arc.

Table 2: R_1 “Driver Geometry”

Simulated Distance		Headlight	Observation Angle (α) (degrees)	Rotation Angle (ϵ) (degrees)	Entrance Angle (β)		Minimum R_1 (mcd/lux) left + right	Typical R_1 (mcd/lux) left + right
Feet	Meters				β_1	β_2		
100	30	Left	0.95	19	-2.0	-1.6	40	80
		Right	2.91	-72	4.6	-2.9		
300	91	Left	0.35	24	-0.7	-0.5	350	500
		Right	0.90	-69	1.4	-1.0		
500	152	Left	0.22	24	-0.4	-0.3	600	1000
		Right	0.53	-68	0.8	-0.6		

Note: In laboratory testing Entrance Angles β_1 and β_2 are set to equal 0° and Left/Right Rotation Angles ϵ are set to 20°/-70° as an approximation with little loss of accuracy.

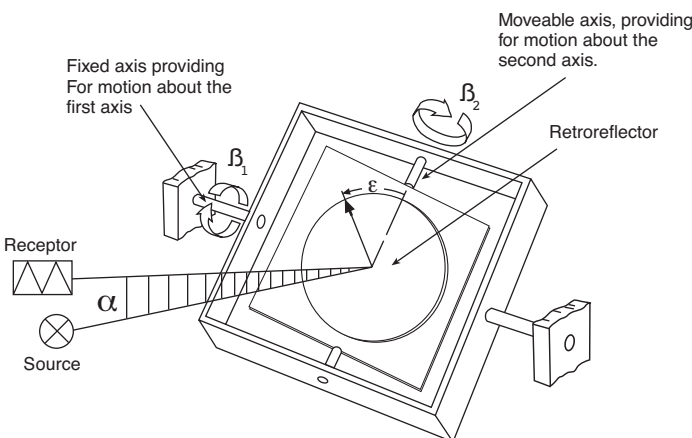


Figure 1: Driver Geometry (CIE Notation)

**Table 3:
Color Multiplying Factors**

<u>Color</u>	<u>Multiplying Factor</u>
White	1
Yellow/Amber	0.6
Red	0.25
Blue	0.1
Green	0.33

Table 4: Retroreflected Color Gamut Coordinates

Point Number	White		Yellow/Amber		Red		Blue		Green	
	x	y	x	y	x	y	x	y	x	y
1	0.310	0.348	0.545	0.424	0.650	0.330	0.039	0.320	0.009	0.733
2	0.453	0.440	0.599	0.439	0.668	0.330	0.160	0.320	0.288	0.520
3	0.500	0.440	0.609	0.390	0.734	0.265	0.160	0.240	0.209	0.395
4	0.500	0.380	0.597	0.390	0.721	0.259	0.183	0.218	0.012	0.494
5	0.440	0.380	—	—	—	—	0.088	0.142	—	—
6	0.310	0.283	—	—	—	—	—	—	—	—

If two points lie on the spectrum locus line, they must not be connected by a straight line but rather should, in this case, be joined by the boundary of the spectrum locus.

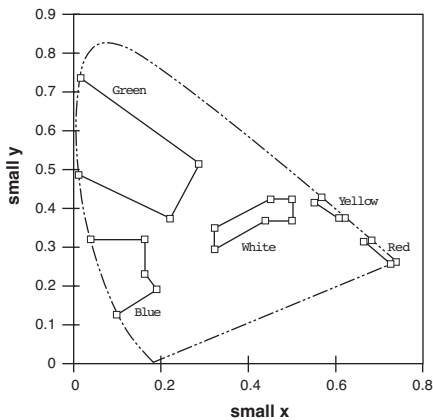


Figure 2: CIE 1931 Chromaticity Chart

Scratch Resistance

The markers comply with ASTM D4383.

Temperature Resistance

The marker shall comply with the initial minimum brightness requirements as specified in **Table 1** and the product of the values in **Tables 2 and 3** after conditioning for 12 hours at $145^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($62.7^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$).

Impact Resistance

The marker body displays no cracking or breakage when tested according to ASTM D2444 Tup A, using a 1000 gm weight from a height of 1 meter. The marker is positioned in such a way that the Tup strikes the top of the marker.

The marker lens displays no cracking outside

the impact area when tested according to ASTM D2444 Tup A, using a 1000 gm weight from a height of 1 meter. The marker is placed in a steel fixture designed to hold the marker lens horizontal and positioned such that the Tup strikes the center of the lens.

Resistance to Penetration of Water

The markers are conditioned for 10 minutes at $145^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($62.7^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$) and then immediately submerged in a water bath at $70^{\circ}\text{F} \pm 5^{\circ}\text{C}$ ($21^{\circ}\text{F} \pm 2.5^{\circ}\text{C}$) for 10 minutes. The markers should then be removed from the water bath, wiped dry with a soft cloth, visually inspected for penetration of water behind the lens, and measured for reflectivity in accordance with ASTM E809. The markers meet the initial minimum retroreflectance specified values in **Table 1** and the product of the values in **Tables 2 and 3**.

General Performance Considerations

Maximum durability of retroreflective snowplowable pavement markers will be achieved when markers are properly applied according to the manufacturer's recommendations provided in product bulletins and information folders. Although reflective performance is reduced by wear, the lens of the raised pavement marker is coated with an abrasion-resistant material which provides acceptable reflective performance under normal traffic wear.

Warranty

3M Warrants that Series 290 and 190 Markers will meet the performance requirements contained in the current ASTM D 4280 – 04 for series 290 markers and ASTM D 4383 for series 190 markers – Raised Retro-reflective Pavement Markers.

This warranty excludes (without limitation) damage from improper installation, exposure to chemicals or mishandling. Physically missing markers are NOT considered under warranty.

If Series 290 and 190 markers, installed in accordance with 3M recommendations, fail to conform to this warranty, 3M's sole responsibility and purchaser's and user's exclusive remedy shall be that 3M will, at its expense for materials ONLY, furnish replacement markers for those non-conforming markers.

Customer will maintain and track all installation information. Claims made under this warranty will ONLY be honored if 3M is notified of a product failure within a reasonable amount of time of the failure, reasonable information requested by 3M is provided, or 3M is permitted to investigate and verify the cause of the failure.

Limitations of Liability

3M's liability under this warranty is limited to replacement or allowance as stated herein. 3M assumes no liability for incidental or consequential damages including but not limited to lost profits, business or revenue regardless of legal theory on which the claim is based.

THIS WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTY 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, EXCEPT OF TITLE AND AGAINST INFRINGEMENT.

Literature Reference

IF 190 Application Procedures for 3M™ Snowplowable Marker Series 190

FOR INFORMATION OR ASSISTANCE CALL:

1-800-553-1380

**IN CANADA CALL:
1-800-265-1840**

**Internet:
www.3M.com/tss**

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Traffic Safety Systems Division

3M Center, Building 235-3A-09
St. Paul, MN 55144-1000
1-800-553-1380
www.3M.com/tss

3M Canada Company

P.O. Box 5757
London, Ontario N6A 4T1
1-800-3MHELPS

3M México, S.A. de C.V.

Av. Santa Fe No. 55
Col. Santa Fe, Del. Alvaro Obregón
México, D.F. 01210

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