

Transportation Safety Division

3M™ Liquid Pavement Marking Series 5000

Product Bulletin Series 5000
March 2021

Replaces Product Bulletin 5000 Dated April 2016

1 Description

3M™ Liquid Pavement Marking Series 5000 (“**Series 5000**”) has been designed for use as a durable pavement marking on roadways and highways. Series 5000 is a 2:1 ratio two-component, 100 percent solid polyurea coating material that cures rapidly to hardness after application. Series 5000 can be configured to provide desired levels of retroreflective performance using a number of different optics packages.

Applied to properly prepared road surfaces, Series 5000 markings can be used for long-lines (center, skip, and contrast), channelizing lines, gore markings, and intersection markings.

Series 5000 can also be applied over any type of well-adhered pavement marking. The required application thickness for Series 5000 is determined by the application surface or marking use, and discussed in Section 5 below. See [3M Information Folder 5.28](#) for detailed surface preparation recommendations.

For long line markings, Series 5000 is applied using a specialized mobile, truck-mounted or self-contained, pavement marking machine. This pavement marking machine applies the two-component liquid materials and reflective media simultaneously in continuous or skip patterns.

2 Product Features

- Track-free in less than two minutes over entire application temperature range.
- Low temperature application, down to 30 °F (-1 °C).
- Excellent adhesion to asphalt cement concrete (ACC) and properly prepared Portland cement concrete (PCC).
- Good dry and wet weather performance when Connected Roads All Weather Elements (“Elements”) are used.
- Very low shrinkage, which enables quality installations on most common pavement surfaces.
- Resists discoloration caused by ultraviolet exposure and dirt pickup.
- Elements are colored, which helps provide a true yellow color under nighttime illumination.
- Typical volatile organic compound (VOC) content is 2.1 grams/liter or less.
- No intentional use of heavy metals, lead chromate pigments, or other similar lead-containing materials.
- Good color retention (Per MUTCD color requirements).

3 Component References

Components available from 3M:

- 5000 Part A White
- 5001 Part A Yellow
- 5050 Part B
- Series 90, Series 50, and Dry White Elements
- Series 91, Series 51, and Dry Yellow Elements

Components available from other suppliers

- Non-reflective Black Particles.
- Glass beads specifically designed for Series 5000 markings are available from a number of suppliers. Contact 3M Technical Service at 1-800-553-1380 for sources and specifications.

4 Specifications

Table 1 presents typical retroreflectivity values for Series 5000 pavement markings Elements. Some variance should be expected across applications, and all values represent initial properties unless otherwise noted.

Table 1. Typical average initial coefficients of retroreflected luminance^a [mcd/m²/lx].

Property/test method	Series Dry	Series 50	Series 90	Series Wet
Retroreflectivity, Dry Average ASTM E1710	White: 1250 Yellow: 900	White: 700 Yellow: 525	White: 500 Yellow: 375	N/A
Retroreflectivity, Wet Recovery Average ASTM E2177	N/A	White: 275 Yellow: 225	White: 375 Yellow: 300	White: 400 Yellow: 325
Retroreflectivity, Wet Continuous Average ASTM E2832	N/A	White: 200 Yellow: 150	White: 275 Yellow: 225	White: 300 Yellow: 250

a. Typical retroreflectivity results represent average performance for smooth pavement surfaces. Results may vary due to differences in pavement type and surface roughness. Increased Elements drop rate may be necessary to compensate for increased surface area characteristic of rough pavement surfaces. Wet retroreflectivity testing of markings applied in grooved or recessed surfaces is difficult since water pools in recesses. In such cases, consider installing sections of pavement markings for testing on either a smooth section of the pavement surface, or on rigid panels (50 mil aluminum). If markings are applied to panels, allow them to cure, then move them carefully for retroreflectivity testing - make sure to protect the optics when transporting.

Table 2 presents typical initial properties for Series 5000 markings. Some variance should be expected across applications, and all values represent initial properties unless otherwise noted.

Table 2. Typical initial properties of Series 5000 pavement markings.

Property	Specification		Test Details	
	Initial	After 1000 hrs		
Color	White Cap Y		ASTM E1349 -45/0 (0/45) and CIE Illuminant D65 and CIE1931 (2°) Standard Observer.	
	Coating only	>90		>89
	With beads	>63		
	Yellow Cap Y			
	Coating only	54–60	54–60	
	With beads	39–45		
Adhesion to Portland Cement Concrete	Portland cement concrete failure: PASS		ACI Method 503. Samples should be conditioned at room temperature (75 ± 2 °F) for 24–72 hours prior to testing.	
Adhesion to Asphalt Cement Concrete	Asphalt cement concrete failure: PASS		ACI Method 503. Samples should be conditioned at room temperature (75 ± 2 °F) for 24–72 hours prior to testing.	
No Track Time (Laboratory)	No pick-up condition within two minutes		ASTM D711; 15 mil binder thickness, insensitive to temperature, AASHTO Type 1 beads coated at 0.099 pounds per square foot.	
No Track Time (On the Road)	No track condition within two minutes; insensitive to temperature		ASTM D711 with 77 °F air temperature; 15 mil thick binder coated with normal bead and Element loading; no visible tracking from a distance of 50 feet.	
Skid Resistance	Greater than or equal to 45 BPN beads only >60 beads and Elements		ASTM E303	
Volatile Organic Compound (VOC) Content	Upon mixing liquid components in appropriate ratio, the VOC content is equal to 2.1 grams/liter or less.		Testing of mixed liquid components should be conducted in accordance with EPA Reference Method 24 - determination of volatile architectural coatings and paints. Matter content, density, volume solids.	
TiO₂ Content (White)	>16%		By weight.	
Acid Resistance of Glass	No more than 15% of beads showing distinct opaque surface upon microscopic examination (20x)		Expose microcrystalline ceramic beads to 1% solution (by weight) of sulfuric acid.	

5 Application

5.1 Required Weather and Pavement Conditions

- o Dry weather only.
- o Minimum 24 hour dry period.
- o Air/road temperature of at least 30 °F (-1 °C).
- o Road surface completely dry with no dew or frost.
- o Road surface free of dirt, sand, dust, oil, grease, and all other contaminants.
- o Curing compound and latents removed from new PCC surfaces.
- o Users are encouraged to evaluate the substrate for intersection markings. The recommended substrate for intersection markings is ACC.
- o Poorly adhered pavement marking must be removed to expose 80% of the pavement surface prior to application of Series 5000.
- o See [3M Information Folder 5.28](#) for additional application guidelines.

5.2 Requirements

The marking installer is responsible for meeting all application requirements presented in Table 3.

Table 3. Binder application requirements.

Application Surface Description or Marking Use	Recommended Series 5000 Liquid Binder Thickness (1 inch = 1000 mils) & Usage Rates ^a
Smooth (variation $\leq 0.125"$) pavement (asphalt, concrete, grooved or surface treatment)	20 to 22 mils (240–220 linear feet for 4-inch line width per gallon)
Textured or variation $\geq 0.125"$ (open graded, large stone mixes, tined or sawn concrete, chip seal)	25 to 30 mils (190–160 linear feet for 4-inch line width per gallon)
Well-worn and well adhered existing markings, see Information Folder 5.28	20 to 22 mils (240–220 linear feet for 4-inch line width per gallon)
For use as temporary markings (prior to durable marking application)	10 to 15 mils (480–320 linear feet for 4-inch line width per gallon)

a. Application rates calculated using a conversion of 231 cubic inches per US liquid gallon.

5.3 Application Rates

Elements, or other first drop glass beads, and second drop glass beads must be applied at the rates shown in Table 4 and Table 5, respectively. The preferred second drop glass bead type for use with Series 5000 is Missouri Type P or 18/50 (Utah).

Table 4. 3M Connected Roads All Weather Elements application rates.

Units	Minimum for Durable Markings on Smooth Surface
Pounds per 4-inch lineal foot	0.018
Pounds per mile, 4-inch width	93
Grams per 4-inch lineal foot	8
Grams per square foot	24
Grams per square meter	260
Pounds per gallon - 20 mils ~240 ft/gal	4.2
Pounds per gallon - 25 mils ~190 ft/gal	3.4
Pounds/100 Sq ft	5.3

Table 5. Second drop glass bead (Missouri Type P or 18/50 (Utah) preferred) or black particle application rates.

Units	Application Rate
Grams per 4-inch lineal foot	15–20
Grams per square meter	485–646
Pounds per 4-inch lineal foot	0.033–0.044
Pounds/100 Sq ft	9.92–13.23
Pounds per gallon - 20 mils ~240 ft/gal	8.0–10.7
Pounds per gallon - 25 mils ~ 190 ft/gal	6.4–8.5

5.4 Bead Types

Many different glass bead gradations are currently used for pavement markings. Table 6 presents glass bead gradations of several bead types commonly used with liquid pavement markings.

Table 6. Bead gradations of bead types commonly used with liquid pavement markings.^a

Common bead types with liquid pavement markings Bead gradations - mass percent passing (ASTM D1214)						
US Mesh	Micron	AASHTO M247 Type 1 ^b	Missouri Specification Type P	18/50 Blend (former Utah Performance Specification)	AASHTO M247 Type 3 ^b	AASHTO M247 Type 4 ^b
10	2000					100
12	1700				100	95–100
14	1410				95–100	80–95
16	1180	100			80–95	10–40
18	1000			65–80	10–40	0–5
20	850	95–100	90–97		0–5	0–2
25	710				0–2	
30	600	75–95	60–87	0–30		
40	425					
50	300	15–35	0–15	0–5		
70	212		0.5			
80	180					
100	150	0–5				

- a. A minimum of 15% of the total weight will be from direct melt glass. All +30 US Mesh beads will be 85% minimum rounds and minimum crush strength of 30 lbs. in accordance with ASTM D1213.
b. Bead types used as in double drop or in triple drop optics package.

5.5 Marking Dimensions

Marking dimensions must be in accordance with the “Manual on Uniform Traffic Control Devices” and the project plans.

5.6 Proportioning and Mixing

Ensure that application equipment provides continuous proportioning at two volumes of Part A to every one volume of Part B, and sufficient mixing to ensure that markings are hardened throughout and free of soft and uncured or “blackened” areas and streaks. See [3M Information Folder 5.28](#) for detailed recommendations.

5.7 Control of Overspray

Series 5000 markings must not exhibit excessive overspray.

5.8 Placement of Beads and Elements

Elements and beads must be dropped onto Series 5000 such that their upper exposed portions are free of binder material. Target embedment for beads and Elements is 40–60%.

6 Equipment

The installer is responsible for procuring equipment suitable for applying Series 5000 markings, as well as maintaining and operating the equipment in a manner that ensures that the application requirements are met. Equipment for applying Series 5000 markings is available from suppliers independent of 3M. The application machines pump the two binder components in the correct volumetric ratio through a mixing device and airless spray nozzle. Prior to mixing, the two liquids are heated and filtered. Elements, and then beads, are dropped onto the binder immediately after it is sprayed. Some application machines are capable of applying multiple lines at the same time, and can stripe at speeds of up to eight miles per hour, depending upon application dimensions (thickness and width).

7 Storage

Store Series 5000 binder components in a cool, dry, well ventilated, indoor area, at a temperature of 40–100 °F (4–38 °C). Use within six months of receipt. If Part A has been exposed to high temperature, and/or stored for an extended period of time, it may require remixing. Inspect Part A before use. If separation is noted, remix. If Part B is exposed to high heat for an extended period, the container can pressurize and possibly rupture. Proper disposal of empty drums is the responsibility of the user. For more information, see [3M Information Folder 5.28](#) Appendix B, Series 5000 Safe Handling Procedures.

Note: 3M fills containers with Series 5000 liquid components by weight. This is done to ensure the accuracy and consistency of shipped quantities, regardless of temperature. 3M has shown this filling method to be more accurate than the volume markings on the product containers. Volume markings on containers are for reference only.

8 Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets (SDSs), [3M Information Folder 5.28](#) Appendix B and/or product labels prior to handling or use. Follow all precautions on the SDSs during the filling, use, or cleaning of application equipment. This product is intended for outdoor use only. Application in tunnels or enclosed areas may necessitate the use of additional precautions. Purchaser acknowledges and agrees to follow recommended safety and handling procedures as provided in the SDSs. To obtain SDSs and Article Information Sheets for 3M products, go to 3M.com/SDS, contact 3M by mail, or for urgent requests call 1-800-364-3577.

9 Quality Policy and Warranty Information

9.1 3M Basic Product Warranty

3M has no control over application methods or the quality of the surface to which materials are applied. Therefore, 3M's warranty for Series 5000 shall be limited to the quality of materials supplied.

Series 5000 are warranted ("Basic Warranty") to be free of defects in materials and manufacture at the time of shipment and to meet the specifications stated in this product bulletin. If the Series 5000 is proven not to have met the Basic Warranty on their shipment date, then a buyer's exclusive remedy, and 3M's sole obligation, at 3M's option, will be refund or replacement of Series 5000.

9.2 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, 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.

9.3 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 the use of or the inability to use Series 5000 or 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. Before using, the user shall determine the suitability of Series 5000 for his/her intended use and the user assumes all risk and liability whatsoever in connection therewith.

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 our literature to a commercially available product made by another manufacturer (for example, application equipment), it shall be the user's responsibility to ascertain its effectiveness and to take any precautionary measures required for its use, as outlined by the product's manufacturer.

10 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>.

11 Literature References

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|------------------------------|---|
| 3M IF 5.18 | 3M™ Stamark™ Pavement Marking Tape and Liquid Pavement Markings Application Guidelines for Pavement Markings in Grooved Pavement Surfaces |
| 3M IF 5.23 | 3M™ Connected Roads All Weather Elements Application Guidelines for 3M Connected Roads All Weather Elements |
| 3M IF 5.28 | Liquid Pavement Marking Application Guidelines Series 5000 |
| 3M PB CR AWE | 3M™ Connected Roads All Weather Elements |

ASTM Test Methods are available from ASTM International, West Conshohocken, PA.

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>

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