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Transportation Safety Division

3M™ All Weather Thermoplastic

Product Bulletin AWT
April 2020

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1 Description

3M™ All Weather Thermoplastic ("AWT") is a traffic marking system consisting of a high performance thermoplastic, 3M Connected Roads All Weather Elements ("Elements"), and an accompanying second drop of glass beads. Designed for use as long line markings, all weather thermoplastic delivers exceptional levels of all weather reflective performance in a thermoplastic marking.

Thermoplastic is available in two intermix options. Both options are part of a matched component system ("MCS") that includes surface drop Elements.

1 Intermediate performance product: AWT with Type 3. This product has Type 3 and Type 1 beads intermixed into the thermoplastic binder and should be applied at a thickness of at least 90 mils (2.3 mm).
2 Value product: AWT. This product contains Type 1 beads intermixed into the thermoplastic binder and should be applied at a thickness of at least 90 mils (2.3 mm).

Table 1 presents a comparison chart that summarizes the performance characteristics of the two available products.

Table 1. Product comparison chart.

	AWT with Type 3	AWT
Reflectivity Performance Initial all weather Retained dry	X X	X
Intermixed Optics Type 3 glass beads Type 1 glass beads	X X	X
Surface optics Element double drop	X	X
Standard thermo equipment	X	X

1.1 3M Connected Roads All Weather Elements

Elements consist of an outer layer of microcrystalline ceramic beads partially embedded into composite cores to provide optimal performance under dry and/or wet conditions. Elements are used in AWT as the first drop of a double drop system. Elements provide initial levels of all weather performance. Elements are visible when dry, during rainfall, and after rainfall, providing marking visibility for motorists under all weather conditions.

1.2 Thermoplastic

AWT has been specially formulated for the intended applications and consists of a mixture of high quality resins, pigments, and optics. Type 3 and Type 1 glass beads are intermixed into the thermoplastic binder in the highest performance product option, whereas only Type 1 glass beads are intermixed into the thermoplastic in the value product.

AWT is an ideal pavement marking system for situations where thermoplastic equipment is already available.

1.3 Second Drop Glass Beads

A second drop of glass beads is used to improve the durability of the finished marking and provide increased visibility during dry conditions.

2 Specifications

2.1 Retroreflectivity

Typical initial retroreflectance values are shown in Table 2 below. Some variance should be expected across applications, and all values represent initial properties unless otherwise noted.

Table 2. Typical average initial coefficients of retroreflected luminance[a] [mcd/m^2/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.

3 Installation

The installer of the markings is required to comply with the following installation conditions and procedures.

3.1 Weather and Pavement Conditions

Thermoplastic should be applied according to the established application guidelines, see 3M Information Folder 5.24 for details. Optimal performance is achieved when AWT is applied at an air and pavement temperature of at least 50 °F (10 °C) and rising. Thermoplastic should be applied at a temperature of 385–420 °F (196–227 °C), as measured at the die, to ensure proper adhesion to the pavement.

Note: Under some conditions, more restrictive application temperatures are required. Contact you 3M Application Engineer for details.

3.2 Equipment

AWT must be installed using a double-drop Element/bead delivery system. Install Elements as the first drop of the two-drop system. Elements must be installed using a truck speed of no more than 8 mph to minimize loss, prevent rolling, and ensure adequate sink into the thermoplastic. Use tank agitation to prevent beads from settling.

Contact 3M Technical Service at 1-800-553-1380 for additional information regarding equipment and modifications.

3.3 Thickness

Apply AWT at a thickness ≥90 mil (2.3 mm) for all system options. If applying AWT at a thickness of less than 90 mils, contact 3M technical service for product recommendations and additional application information and restrictions.

3.4 Marking Dimensions

Marking dimensions shall conform to the Manual on Uniform Traffic Control Devices and project specifications.

3.5 Placement of Elements and Beads

Elements and accompanying second drop beads should be applied to the thermoplastic pavement marking binder such that the Elements and beads do not roll, thus ensuring that their exposed portions are free of binder material. Elements and beads should be embedded (sunk) into the thermoplastic to a depth of approximately 50% of their diameter. Under-sinking the Elements and beads will result in their premature loss and the optical failure of the marking. Over-sinking the Elements will result in low dry and wet brightnesses.

3.6 Application Rates

Thermoplastic should be applied at a thickness of at least 90 mil (2.3 mm). Elements and glass beads should be applied at the rates shown in the Tables 3 and 4, respectively.

Table 3. 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/100 Sq ft	5.3

Table 4. Glass bead application rates.

Units	18/50 (Utah) or FP -3 #718.19 Type 3
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

4 Second Drop of Glass Bead

4.1 Gradation of the Second Drop of Glass Bead

The gradation of the second drop must meet or be within the limits in Table 5.

Table 5. Typical gradations of second drop glass beads.[a]

Common bead types with liquid pavement markings Bead gradations - mass percent passing (ASTM D1214)			
US Mesh	**Microns**	**FP03 718.19 Type 3**	**18/50 (Utah) Performance Specification**
12	1700	100	
14	1410	95–100	
16	1180	80–95	
18	1000	10–40	65–80
20	850	0–5	
25	710	0–2	
30	600		0–30
40	425		
50	300		0–5
70	212		
80	180		
100	150		

a. A minimum of 15% of the total weight shall be from direct melt glass. All +30 US mesh beads shall be 85% minimum rounds and have a minimum crush strength of 30 lbs. in accordance with ASTM D1213.

4.2 Quality of Second Drop Glass Beads

The required glass beads shall have an index of refraction of 1.5 when tested by the immersion method at 25 °C (77 °F). The glass beads shall be surface treated for optimal performance with the liquid binder traffic marking. The glass beads shall have a minimum of 70% rounds as measured according to ASTM D1155. The surfaces of the glass beads shall be free of pits and scratches. The glass beads retained on a #40 U.S. mesh sieve (425 microns) shall have a minimum crush strength of 30 pounds, in accordance with ASTM D1213.

5 Storage

For best results, store thermoplastic and Elements, covered and off the ground, in a cool (40–100 °F, 4–38 °C), dry area, indoors or outdoors. Use within one year of receipt.

Follow glass bead manufacturer recommendations for storage.

6 Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets (SDS), Article Information Sheets, and products labels of any materials for important health, safety, and environmental information prior to handling or use. Also refer to the SDSs for information about the volatile organic compound (VOC) content of chemical products. Consult local regulations and authorities for possible restrictions on product VOC content and/or VOC emissions. 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.

7 Quality Policy and Warranty Information

7.1 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 AWT shall be limited to the quality of materials supplied.

AWT is 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 AWT 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 AWT.

7.2 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.

7.3 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 the Elements 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 Elements 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.

8 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.

9 Literature References

3M IF 5.23	3M™ Connected Roads All Weather Elements Application Guidelines for 3M Connected Roads All Weather Elements
3M IF 5.24	3M™ All Weather Thermoplastic Pavement Markings Application Guidelines
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

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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