

**MINNESOTA DEPARTMENT OF TRANSPORTATION  
SPECIFICATION  
HIGH SOLIDS WATER BASED TRAFFIC PAINT**

**I. SCOPE**

This specification covers fast-dry white and yellow acrylic latex traffic marking paints for use with drop-on glass beads for application on concrete and bituminous pavements at spray temperatures of up to 160<sup>0</sup>F. When applied with glass beads at pavement temperatures above 50<sup>0</sup>F and at relative humidities of up to 75 percent, the paint shall dry to a no-track condition within 3 minutes. The paints shall be free of lead, mercury, cadmium, hexavalent chromium or any other toxic heavy metals.

This paint is intended for use with dual coated drop-on glass beads, having both a silicone moisture resistance coating and a silane adherence coating. Glass beads are to be applied at a rate of eight pounds per gallon.

**II. GENERAL REQUIREMENTS**

**A. Quality**

The paint shall be formulated from first-grade materials and shall be suitable in all respects for application at elevated spray temperatures with drop-on glass beads using conventional traffic striping equipment.

The finished paint shall be smooth and homogeneous, free of coarse particles, skins or any other foreign materials that are detrimental to its application or appearance.

**B. Package Stability**

Within a period of twelve months from the time of delivery, the paint shall not cake, settle, liver, thicken, skin, curdle, gel or show any other objectionable properties which cannot readily be corrected with minimal stirring. Any paint with properties that make it unsuitable for use within the specified twelve months shall be returned to the supplier for credit.

It shall be the manufacturer's responsibility to add sufficient anti-settling agents, stabilizers and other additives to insure proper storage stability.

### C. Manufacturing and Packaging

Manufacturer shall be capable of producing paint in batches of 1,000 gallons or larger. The paint shall be screened with a 40 mesh or finer screen to remove any coarse particles, skins or foreign material.

The paint shall be packaged in lined, new 55 gallon or 5 gallon containers as specified. To prevent formation of "skins", the manufacturer shall use a "float" of ammonia water on the paint surface, or a "floating type" plastic liner on the top of the filled container, or some other means that will effectively prevent skinning.

Drums shall be Full Removable-Head Universal meeting the requirements of DOT-17H; covers shall have one 2-inch and one 3/4 inch fitting. Each container shall be marked with the manufacturer's name, type of paint, batch number, date of manufacture, gross weight and container weight.

### III. SPECIFIC REQUIREMENTS

#### Properties of the finished paint.

The exact composition of the paints shall be left to the discretion of the manufacturer, provided the finished paint meets the requirements of this specification.

The vehicle shall be composed of a 100% acrylic polymer such as Rohm and Haas E-2706, or an approved equal.

Wgt per gal, 77 <sup>0</sup> F, lbs, min	12.0
Viscosity, Krebs Stormer, 77 <sup>0</sup> F, K.U.	80 - 100
Grind, Hegman, minimum	3
Total Solids, % by weight, minimum	73
Non-volatile vehicle, % by weight, minimum	43
Pigment, % by weight	45 - 62
Titanium Dioxide, white paint, lbs/gal, minimum	1.0
Dry Time, 12 mil wet film, @ 65% RH, minutes, max	12
Dry Through, @ 90 % RH, minutes, max	130
Daylight Directional Reflectance, white, minimum	83
Daylight Directional Reflectance, yellow, minimum	50
Contrast Ratio, minimum	0.98
Bleeding Ratio, minimum	0.97

Flexibility and Adhesion	No cracking or flaking
Water Resistance	No blistering or loss of adhesion
Settling	Rating of 6 or better
Skinning, 48 hrs	None
Track Free Time, minutes, maximum	3
pH, minimum	9.6
Lab Retro-reflectivity, white, minimum, mcd/m <sup>2</sup> /lux	300
Lab Retro-reflectivity, yellow, minimum, mcd/m <sup>2</sup> /lux	200
Field Retro-reflectivity, white, minimum, mcd/m <sup>2</sup> /lux	275
Field Retro-reflectivity, yellow, minimum, mcd/m <sup>2</sup> /lux	180

Organic Yellow Pigment. The prime pigment in the organic yellow paint shall be Colour Index Pigment Yellow Number 65 or Number 75.

Color. The color of the dry white paint shall be a pure flat white, free of tint. The color of the yellow paint shall closely match Color Number 33538 of Federal Standard 595 and shall conform to the following CIE Chromaticity limits using illuminant "C" :

x	0.470	0.485	0.520	0.480
y	0.440	0.460	0.450	0.420

Heavy Metals. The white and organic yellow paints shall be free of lead, mercury, cadmium, hexavalent chromium and other toxic heavy metals as defined by the United States Environmental Protection Agency.

#### **IV. TESTING**

Weight Per Gallon	ASTM D 1475
Viscosity	ASTM D 562
Fineness Of Grind	ASTM D 1210
Total Solids	ASTM D 2369
Total Pigment	ASTM D 2371
Titanium Dioxide	ASTM D 4563 ; D 1394
Dry Time(12 mils wet)	ASTM D 711 (modified)
Daylight Directional Reflectance	ASTM D 2805
Contrast Ratio(15 mils wet)	ASTM D 2805
Bleeding Ratio	Federal Specification TT-P-85
Color	ASTM D 2805
pH	ASTM E 70
Retro-reflectivity	Mn/DOT Method

Flexibility and Adhesion. Apply 15 mil wet film thickness to 3" by 5" tin panel. Dry at 77<sup>0</sup>F for 24 hrs followed by 2 hrs at 122<sup>0</sup> F. When bent over a 1/2" mandrel the paint shall adhere firmly without evidence of cracking or flaking.

Water Resistance. Apply 15 mil wet film thickness to 4" by 8" glass plates; dry at 77<sup>0</sup>F for 72 hrs. Immerse in distilled water at 77<sup>0</sup>F for 24 hrs. Allow to air dry for 2 hrs on a flat surface. Paint shall show no blistering or loss of adhesion.

Skinning. After 72 hrs in a tightly sealed 3/4 filled container, the paint shall be free of lumps and skins when strained through a 100 mesh screen.

Settling. A homogeneous sample of paint in a full one-pint friction-top can shall be inverted for one hour to insure a complete seal between the cover and body of the can. After one hour the can shall be placed upright in a 120<sup>0</sup>F oven. After 5 days the can shall be cooled to room temperature for 4 hours. When evaluated according ASTM D 869, the degree of settling shall have a rating of 6 or better.

Track Free Time. When applied under the following conditions, the line shall show no visual tracking when viewed from 50 feet after driving a passenger vehicle over the line at a speed of 25-35 mph.

Fifteen mils wet film thickness.  
Eight pounds of glass beads per gallon of paint.  
Paint temperature at nozzle between 110 - 160<sup>0</sup> F.  
Pavement temperature of 50 to 120<sup>0</sup> F.

Dry Time. Tested according to ASTM D 711, except wet film thickness shall be 12±1 mils. The applied film shall be immediately placed in an humidity chamber controlled at 65±3 % R.H. and 72.5±2.5<sup>0</sup>F and with minimal air flow.

Dry Through. The film shall be applied to a non-absorbent substrate at a wet film thickness of 12±1 mils and placed in a humidity chamber controlled at 90±5 % R.H. and 72.5±2.5<sup>0</sup>F. The dry through time shall be determined according to ASTM D 1640, except that the pressure exerted shall be the minimum needed to maintain contact with the thumb and film.

Retro-reflectivity. The lab will draw three - 4 inch wide lines, with wet film thickness of 15±1 mils. Glass beads will be dropped on at a rate of 8 pounds per gallon. A total of 3 readings will be conducted on each sample with a 30 meter geometry LTL 2000. The average of those 9 readings will be the retro-refectivity of the system (paint and beads). The Field studies will be conducted using a 30 meter geometry Laserlux®. These studies will be conducted at random throughout the year.

## **V. MANUFACTURERS CERTIFICATION**

Manufacturer shall submit certified test results with each batch of paint produced for use in Minnesota under this specification. Tests conducted on each batch shall include; weight per gallon, viscosity, and drying time. Testing for all other parameters in this specification shall be carried out annually at the start of production. Certified test results shall be promptly submitted to the Mn/DOT Materials Laboratory at 1400 E. Gervais, Maplewood, Minnesota, 55109.

**VI. SAMPLING**

All paint manufactured under contract for Mn/DOT shall be inspected at the factory by Mn/DOT personnel or representatives at a frequency determined by Mn/DOT. When the place of manufacture is located outside the boundaries of the State of Minnesota, the manufacturer shall bear all costs of sampling and plant inspection.

For paint ordered by private contractors for use on Minnesota painting contracts, the manufacturer shall submit a one-pint sample of each batch along with a letter certifying the sample represents the full manufactured batch.

The department reserves the right to base acceptance upon samples taken at the point of delivery or from a contractors supply. Sample size shall be one pint.