

## TTP-1952F Type I & III Test Method Specifications (Traffic Marking Paint White and Yellow)

Characteristic	ASTM Method	Requirement Paragraph	USTC Results	Test Paragraph
Lead Content	D 3335	3.1.2	Pass	4.3.1.1
Chromium Content	D 3718	3.1.2	Pass	4.3.1.2
Appearance	---	3.2.2	Pass	4.3.3
Flexibility	D 522	3.2.4	Pass	4.3.4
Water Resistance	---	3.2.5	Pass	4.3.6
Freeze-thaw Stability	D 2242	3.2.6	Pass	4.3.8
Color	D 2244	3.2.7	Pass	4.3.9
Directional Reflectance	E 1347	3.2.7.2	Pass	4.3.9.2
Yellow Color Match	D 1729	3.2.7.3	Pass	4.3.9.4
Heat-shear Stability	---	3.2.8	Pass	4.3.13
Skinning	---	3.2.9	Pass	4.3.14
Dry-through (early washout)	D 1640	3.2.10	Pass	4.3.15
Abrasion Resistance	D 968	3.2.11	Pass	4.3.7
Accelerated Weathering	G 154	3.2.12	Pass	4.3.10
Scrub Resistance	D 2486	3.2.13	Pass	4.3.12
Volatile Organic Content	D 2369	Composition Spec Sheet	Pass	---

Consistency	D 562	Composition Spec Sheet	Pass	---
Volume Solids	D 2697	Composition Spec Sheet	Pass	---
Dry Opacity	D 2805	Composition Spec Sheet	Pass	4.3.11
Dry time (no pick up)	D 711	Composition Spec Sheet	Pass	---
Fineness of Dispersion	D 1210	Composition Spec Sheet	Pass	---
Bleeding Ratio	D 969	Composition Spec Sheet	Pass	---
Pigment Wt%	D 3723	Composition Spec Sheet	Pass	---
TiO2	D 1394	3.2.14	Pass	4.3.16

Requirement Paragraphs:

3.1.1 Materials. The non-volatile portion of the vehicle for all types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis. The acrylic resin used for Type III shall be a 100% cross-linking acrylic as evidenced by infrared peaks at wavelengths 1568, 1624, and 1672 cm<sup>-1</sup> with intensities equal to those produced by an acrylic resin known to be 100% cross-linking.

3.1.2 Prohibited material. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene-based glycol ethers and their acetates, nor any carcinogen, as defined in 29 CFR 1910.1200. When tested as specified in 4.3.1, the lead content shall not exceed 0.06 perc

3.2.1 Condition in the container. When tested, as specified in 4.3.2, the paint, as received, shall show no evidence of biological growth, corrosion of the container, livering, or hard settling. The paint shall be dispersible by hand stirring for 5 minutes to a smooth and homogenous consistency, exempt of gel structures, persistent foam or air bubbles.

3.2.2 Appearance. When tested as specified in 4.3.3, the paint shall produce a film which is smooth, uniform, and free from grit, undispersed particles, craters, and pinholes.

3.2.3 Accelerated package stability. After storage as specified in 4.3.4, the sample shall conform to the requirements of 3.2.1 and 3.2.2. The sample shall show no change in consistency greater than 5 KU (Krebs Unit) from the value in Table 1.

3.2.4 Flexibility. When tested as specified in 4.3.6, the paint film shall not crack, chip or flake after the test panel is bent 180 degrees over a 13 mm (1/2 in) mandrel.

3.2.5 Water resistance. When tested as specified in 4.3.5, the paint film shall not soften, blister, wrinkle, lose adhesion, change color, or show other evidence of deterioration.

3.2.6 Freeze-thaw stability. When tested as specified in 4.3.8, the paint shall show no coagulation or flocculation, change in consistency greater than 10 KU from the value in Table 1, or a decrease in scrub resistance by more than 10 percent of the requirement in 3.2.13.

3.2.7.1 Color match. For all colors except white and yellow, when tested as specified in 4.3.9.3, the paint shall match the specified Federal Standard 595 color number within a  $\Delta E$  or 6.0 CIELAB units.

3.2.7.2 Daylight directional reflectance. When tested as specified in 4.3.9.2, the white paint shall have the daylight directional reflectance specified in Table 1.

3.2.7.3 Yellow color match. The yellow traffic paint shall be an appropriate color match to Federal Standard 595 color number 33538 when tested in accordance with 4.3.9.4.

3.2.8 Heat-shear stability. When tested as specified in 4.3.13, the sample shall not show signs of gelling or other instability. The consistency shall be in compliance with Table 1.

3.2.9 Skinning. The paint shall not skin when tested as specified in 4.3.14.

3.2.10 Dry-through (early washout). For Type II only, the paint when tested as specified in 4.3.15 shall have a dry-through time less than 120 minutes.

3.2.11 Abrasion resistance. When tested as specified in 4.3.7, both baked and weathered paint films shall require not less than 150 liters of sand to abrade the paint film through to the substrate.

3.2.12 Accelerated weathering. When tested as specified in 4.3.10, the colored samples after weathering shall be in conformance with 3.2.7. The directional reflectance of white paint

shall meet the requirement in Table 1. After performing the scrub resistance test in accordance with 4.3.12, the paint shall be in conformance with 3.2.13.

3.2.13 Scrub resistance. When tested as specified in 4.3.12, it shall not take less than 500 cycles to remove the paint film.

3.2.14 Titanium dioxide content. When tested in accordance with 4.3.16, the yellow, green, and blue colored paint shall contain a maximum of 23.7 g/L (0.2 lb/gal) rutile titanium dioxide. The white paint shall contain a minimum of 120 g/L (1 lb/gal) rutile titanium dioxide.

#### Test Paragraphs:

4.3.1.1 Lead content. Determine lead in accordance with ASTM D 3335 or by the use of an X-ray fluorescence spectrometer in accordance with the manufacturer's manual. The X-ray method shall be used in case of dispute. Evaluate for compliance with 3.1.2.

4.3.1.2 Chromium (hexavalent) content. Add 5 ml of 25 percent aqueous KOH (potassium hydroxide) to 0.5 g of the extracted pigment contained in a centrifuge tube. Agitate by shaking and centrifuge. A yellow color in the supernatant liquid indicates the presence of hexavalent chromium. If the results of the above test are inconclusive, then use the procedure in ASTM D 3718 to test for chromium content. Evaluate results for compliance with 3.1.2.

4.3.3 Appearance. Draw down the paint on a clear glass panel to a wet film thickness of 0.33 mm (0.013 in), and allow to dry for 24 hours at standard conditions. Evaluate for conformance with 3.2.2.

4.3.4 Accelerated package stability. Fill a 550 mL (1 pint) resin-lined friction-top can with the sample. Ensure that the bulk sample from which the cans are filled is well stirred and uniform, that the containers used are clean, and that the lids are applied promptly to the cans to prevent evaporation losses. Store at a temperature of 52°C for 2 weeks. Evaluate following the procedure in ASTM D 1849, except allow hand stirring for 7 TT-P-1952E 5 minutes to ensure uniform distribution. Evaluate the consistency for conformance with Table 1. Draw down the paint as described in 4.3.3. Evaluate for conformance with 3.2.3.

4.3.5 Flexibility. Determine flexibility in accordance with Method B of ASTM D 522. Draw down the paint to a wet film thickness of 0.13 mm (0.005 in) on a clean, bare, cold-rolled

steel panel. Air-dry the panel for 24 hours at standard conditions, then bake for 5 hours at 105°C ± 2°C, and finally condition the panel for 30 minutes at standard conditions. Bend over a 13 mm (0.5 in) diameter cylindrical mandrel and examine under a magnification of 7 diameters for compliance with 3.2.4.

4.3.6 Water resistance. Prepare a 10 by 15 cm concrete panel as specified in Method 2051 Procedure B of FED-STD-141. Draw down to a wet film thickness of 0.33 mm (0.013 in) and allow it to dry in a horizontal position at standard conditions for 72 hours. Immerse one-half of the painted panel in distilled water at 25°C ± 1°C. After 18 hours, remove the panel from the water and allow it to dry for 2 hours at standard conditions. Evaluate for conformance with 3.2.5.

4.3.7 Abrasion resistance.

4.3.7.1 Sample preparation. Draw down the paint on four glass panels measuring approximately 100 by 200 mm to a dry film thickness of 0.102 mm to 0.107 mm.

4.3.7.2 Baked films. Air-dry two of the panels for 24 hours at standard conditions and then bake for 5 hours at 105°C ± 2°C. After baking, condition the panels for 30 minutes at standard conditions and then run the abrasion test as specified in 4.3.7.4.

4.3.7.3 Weathered films. Air-dry the other two panels for 48 hours at standard conditions then subject the panels to accelerated weathering in accordance with 4.3.10. Remove the panels and condition for 24 hours at standard conditions, then run the abrasion test as specified in 4.3.7.4.

4.3.7.4 Test. Subject the panels to the abrasion test in accordance with ASTM D 968, Method A, except that the inside diameter of the metal guide tube shall be from 18.97 to 19.05 mm. Five liters of unused sand shall be used for each test panel. The test shall be run on two test panels. (Note: Five liters of sand weigh 7.94 kg.) Evaluate for compliance with 3.2.11.

4.3.8 Freeze-thaw stability. Test in accordance with ASTM D 2243 for three freeze-thaw cycles. Perform the consistency test in accordance with ASTM D 562 and the scrub resistance test as described in 4.3.12. Check for conformance with 3.2.6.

4.3.9 Color.

4.3.9.1 Sample preparation. Use the test panels prepared for the accelerated weathering test (4.3.10.1).

4.3.9.2 Daylight directional reflectance. For the white paint, determine the directional reflectance before and after weathering in accordance with ASTM E 1347 using the 45/0 illumination. Evaluate for conformance with Table 1.

4.3.9.3 Color match. For colors other than white and yellow, determine the color difference of the paint before and after weathering in accordance with ASTM D 2244 using CIE Illuminant D65 with the 10 degree standard observer. Evaluate for conformance with 3.2.7.

4.3.9.4 Yellow color match. Determine the color match for yellow paint before and after weathering in accordance with ASTM D 1729 with the daylight illumination represented by CIE Illuminant D75 or D65. Evaluate for conformance with 3.2.7.3.

4.3.10 Accelerated weathering.

4.3.10.1 Sample preparation. Apply the paint at a wet film thickness of 0.33 mm (0.013 in) to four 8 by 15 cm solvent-cleaned aluminum panels. Air-dry the sample for 48 hours under standard conditions.

4.3.10.2 Testing conditions. Test in accordance with ASTM G 154 using both ultraviolet light (UV-B PS-40) and condensate exposure, 300 hours total, alternating 4 hours of UV exposure at 60°C and 4 hours of condensate exposure at 40°C.

4.3.10.3 Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in 4.3.9.2 and 4.3.9.3. Evaluate for conformance with the color requirements in 3.2.7. Using the procedure described in 4.3.12, run the scrub resistance test. Evaluate for conformance with 3.2.13.

4.3.11 Dry opacity. Use the procedure of ASTM 2805, calculate the contrast ratio of the paint applied at a wet film thickness of 0.13 mm (0.005 in). Evaluate for conformance with Table 1.

4.3.12 Scrub resistance. Using the procedure of ASTM D 2486 modified to use the 8 by 15 cm test panels from the accelerated weathering test (4.3.10), evaluate for conformance with 3.2.13.

4.3.13 Heat-shear stability. One pint of the paint is sheared in a kitchen blender at high speed to 65°C. The blender should have a tight-fitting lid and taped to minimize volatile loss. When the paint reaches 65°C, stop the blender, immediately can and apply a cover. Let cool a

minimum of 12 hours and examine for gelling or other signs of instability. Evaluate for compliance with 3.2.8.

4.3.14 Skinning. Place 188 mL of the paint in a 250 mL container and seal. Invert the container momentarily and then place upright in a dark environment at 22.2– 26.7°C (70-80°F) for 48 hours. Examine for compliance with 3.2.9.

4.3.15 Dry-through (early washout) (For Type II only). Draw down the paint on a glass panel to a wet film thickness of 0.33 mm (0.013 in). Immediately place in a humidity chamber maintained at 23°C ± 2°C and 90% ± 3% relative humidity. Test in accordance with ASTM D 1640, except that the pressure exerted will be the minimum needed to maintain contact with the thumb and film. Check for compliance with 3.2.10.

4.3.16 Titanium dioxide content. Determine the titanium dioxide content using the aluminum reduction method of ASTM D 1394. Evaluate for conformance with 3.2.14.