Document Summary

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Commodity	Paint, Rapid Dry Waterborne Traffic Line, White, Yellow, and Black
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Revision History

Bid Spec	Rev Level	Revision Date	Author	Summary of Changes
PTWB-01R2	2	November 2016		Bid development

[1] This Specification cancels and supersedes; #PTWB-01R2 (March 2010), #PTWB-01R1 (October 2009), #PTWB-01 (February, 2006), #PTWB-01(Dec, 2003), #PTWB-01 (September, 2002), #PTWB-01 (September, 2001), #8010-20B (January, 2000), #8010-20A (February, 1997), #8010-20 (March, 1996) and #8010-03QPL (October, 1994).

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1.0 SCOPE

This specification covers a ready-mixed, one–component, waterborne acrylic traffic line paint which can be applied to either asphalt concrete or Portland cement concrete pavements.

2.0 APPLICABLE LAWS and INDUSTRY STANDARDS

The following specifications, test methods, and standards in effect on the opening of the invitation for bid, form a part of this specification where referenced.

1.1 LAWS and REGULATIONS

1.1.1 Federal Specification 595b, Color #33538 and #37038
1.1.2 U.S. Environmental Protection Agency (EPA) Method 24
1.1.3 Code of Federal Regulations, Title 49
1.1.4 California Code of Regulations, Title 22, Division 4
1.1.5 California Department of Transportation, Test Method No. 660
1.1.6 California Department of Transportation, Standard Specifications, latest revision

1.2 INDUSTRY STANDARDS

1.2.1 American Society for Testing and Materials (ASTM) Designations: D93, D476, D522, D562, D711, D869, D1210, D1475, D1640, D2369, D2486, D3168, D3335, D3718, D3723, D3960, D4563, D5380, D6628, D7585, E70, E313, E1710, G151 and G154

3.0 TECHNICAL REQUIREMENTS

1.3 GENERAL

This specification is intended to specify traffic paint that will meet pavement delineation requirements for highway construction and maintenance. This traffic paint is to be used in conjunction with glass spheres to produce pavement delineation that is visible during both day and night conditions.

1.4 COMPOSITION

1.4.1 Acrylic Polymer Emulsion

The paint binder shall consist of one of the commercial acrylic or styrene/acrylic polymer emulsions described below;

- Dow Chemical, Fastrack HD-21A
- Dow Chemical, Fastrack 3427
- Arkema Coating Resins, Encor DT-400
- Arkema Coating Resins, Encor DT-250

1.4.2 Prime Pigments

White paint:

The white paint shall contain a minimum of one pound per gallon of titanium dioxide pigment meeting ASTM D476 Type II (Rutile). The titanium dioxide content will be determined using ASTM D4563 and D5380.

Yellow paint:

The yellow paint shall be pigmented with Pigment Yellow C.I. #65 and/or pigment yellow C.I. #75. Other pigments may be added to meet the yellow color and opacity requirements in sections 3.3.19 and 3.3.16, respectively. However, the paint shall not contain lead or chromium at levels above the limits set in sections 3.3.23 and 3.3.24.

1.5 CHARACTERISTICS OF THE FINISHED PAINT

1.5.1 Condition in the Container

The paint, as received, shall show no evidence of; biological growth, corrosion of the container, livering or hard settling. The paint shall be returned to a smooth and homogeneous consistency, which is free from; gel structures, persistent foam or air bubbles - using only hand mixing.

1.5.2 Minimum Degree of Settling

White: 7
Yellow: 7
Black: 7
ASTM D869

A one-pint paint can is filled with a well-mixed sample. The can is capped and allowed to set undisturbed at standard conditions[2] for 14 days. The settling is then determined as specified in ASTM D869. The one-quart laboratory samples of each batch, as received, shall also pass this test.

1.5.3 Nonvolatile Content, weight %

White: 77 ±2.0
Yellow: 76 ±2.0
Black: 76 ±2.0
ASTM D2369

1.5.4 Pigment Content, weight %

White: 60 ±2.0
Yellow: 58 ±2.0
Black: 58 ±2.0
ASTM D3723

[2] Standard conditions are defined here as: 23±2°C and 50±5% relative humidity.

1.5.5 Nonvolatile in Vehicle minimum weight % (%NVV)
Calculated as:

$$\%NVV = \left(\frac{\%NonVolatile\ Content - \%Pigment}{100 - \%Pigment}\right)(100)$$

White: 42
Yellow: 42
Black: 42

1.5.6 Density, g/ml at 25°C
White: 1.68 ±0.04
Yellow: 1.63 ±0.04
Black: 1.62 ±0.04
ASTM D1475

1.5.7 Consistency, K.U. at 25 +1°C
White: 78 to 92
Yellow: 78 to 92
Black: 78 to 90
ASTM D562

1.5.8 Minimum Fineness of Dispersion, Hegman
White: 3.0
Yellow: 3.0
Black: 3.0
ASTM D1210

1.5.9 Dry to No Pick-Up Time, without beads, minutes, maximum
White: 10
Yellow: 10
Black: 10
ASTM D711

1.5.10 Dry Through, minutes, maximum
White: 20
Yellow: 20
Black: 20

This test may be performed on the same draw down sample as in section 3.3.9. The test is the same as outlined in ASTM D1640 except that the lightest thumb pressure possible should be used. The thumb is rotated through an angle of 90° while lightly in contact with the film. The drying time at which this rotation does not break the film is recorded.

1.5.11 Dry Through, at 90% relative humidity, minutes, maximum
White: 180
Yellow: 180
Black: -

Draw down the paint on a glass panel to a wet film thickness of 13 mil. Immediately place the panel in a humidity chamber maintained at 23+2°C and 90+5% relative humidity. Test in accordance with ASTM D1640 except that the pressure exerted shall be the minimum needed to maintain contact between the thumb and the paint film. Check the film for a dry through condition at 15-minute intervals. The thumb is rotated through an angle of 90 degrees while lightly in contact with the film. The drying time at which this rotation does not break the film is recorded. Quickly return the glass panel to the humidity chamber after each check.

1.5.12 Volatile Organic Compounds (VOC)
Maximum grams per liter of paint, excluding water
White: 38
Yellow: 38
Black: 38

Use U.S. EPA Method 24 or other approved method in effect at the time of paint manufacture to determine the VOC level and water content of the paint.

1.5.13 Flashpoint, minimum °C
White: 38
Yellow: 38
Black: 38
ASTM D93 Method A

1.5.14 Flexibility
White: Pass
Yellow: Pass
Black: Pass
ASTM D522 Method B

Use 4x6 inch tin-plated steel panels 10 mils thick. Prepare the panel by lightly buffing one side with Grade 0 (medium-fine) steel wool, followed by cleaning with toluene and drying. Draw down the paint on the buffed side of the panel to a wet film thickness of five mils. Air dry the panel for 24 hours at standard conditions, then bake for five hours at 105+2°C and finally condition the panel for 30 minutes at standard conditions. Bend the panel 180° over a ½ inch mandrel in 1 second, then examine under a magnification of 10 times. The paint film shall not; crack, chip or flake when the panel is bent around the mandrel.

1.5.15 Appearance

White: Pass
Yellow: Pass
Black: Pass

Draw down a 13 mil thick wet film of the paint on a glass plate and allow to dry for 24 hours at standard conditions. The paint shall produce a film which is smooth, uniform, and free from; grit, undispersed particles, craters, pinholes and cracking.

1.5.16 Dry Opacity, minimum

White: 0.93
Yellow: 0.89
Black: 1.0

On a black-white Leneta chart, Form 2C-Opacity, draw down a uniform 5 mil thick wet film of paint covering both the black and white portions of the chart. Measure the wet film thickness with an appropriate gauge. Dry for 24 hours at standard conditions. Use a BYK-Gardner “Color-Guide” Spectrophotometer to measure the opacity according to the manufacturer’s instructions. Calibrate the spectrophotometer according to the manufacturer’s instructions using; 2° Observer/Illuminant “C” measurement conditions, and the (Y, x, y) color system.

1.5.17 Yellowness Index, maximum

White: 8
Yellow: -
Black: -

Draw down a 13 mil thick wet film of the white paint on two 3x6 inch chromate treated aluminum panels (i.e.: Q Panel Co., type AL). Dry for 24 hours at standard conditions. Save one panel for the Accelerated Weathering test (section 3.3.21). Using a BYK-Gardner “Color-Guide” Spectrophotometer, follow the manufacturer’s instructions (see section 3.3.16), and measure the Yellowness Index of the white paint film using the ASTM E313 mode.

1.5.18 Daytime Luminance Factor

White: 87
Yellow: 47 to 60
Black: 4

Using the draw down panels prepared in sections 3.3.17 or 3.3.19, measure the reflectance of the white and yellow paint films using the BYK-Gardner “Color-Guide” Spectrophotometer. Follow the manufacturer’s instructions to obtain the Reflectance or “Y” value (see section 3.3.19).

1.5.19 Yellow Color

Draw down the yellow paint on two chromate treated aluminum panels as described in section 3.3.17. One panel should be used for the Accelerated Weathering test (section 3.3.21). Retain the other yellow panel as a control and for the reflectance test (section 3.3.18). The yellow color shall match Federal Standard 595b, color #33538 and shall lie within the “box” formed by the chromaticity coordinate limits as defined below, when tested according to California Test 660 and plotted on a C.I.E. (1931) Chromaticity Diagram. A BYK-Gardner “Color-Guide” spectrophotometer, that has been set up as described below, can also be used to measure the chromaticity coordinates. The measured yellow color shall lie within the “box” formed by the chromaticity coordinate limits - both before and after the Accelerated Weathering test (see section 3.3.21). A graph for plotting the chromaticity coordinates is available from the Transportation Laboratory.

Color System: C.I.E. (1931) Chromaticity Diagram, (Y, x, y)
Measurement conditions: 2º Observer/Illuminant “C”
Hue: 580 to 583.5 nm
Minimum color saturation: x=0.7000-0.5000y
Brightness: Y=47 to 60

The yellow color coordinates shall lie within a “box” defined by plotting the following four (x, y) pairs on the C.I.E. Chromaticity Diagram (1931).

(x1,y1) = (0.5125, 0.4866)
(x2,y2) = (0.4733, 0.4533)
(x3,y3) = (0.4848, 0.4305)
(x4,y4) = (0.5348, 0.4646)

1.5.20 Black Color

Draw down the black paint on a chromate treated aluminum panel as described in section 3.3.17. After drying for 24 hours at standard conditions the color shall closely match Federal Standard 595b, color #37038. The black paint must also meet the Daytime Luminance Factor requirement in section 3.3.18.

1.5.21 Accelerated Weathering Test

Ultraviolet Light and Condensate Exposure, 300 hours total, ASTM G154 and G151.

Prepare samples of the white and yellow paints as described in sections 3.3.17 and 3.3.19. Alternately expose the samples to; eight hours of UV exposure at 60°C, followed by four hours condensate exposure at 50°C in a QUV Accelerated Weathering Tester. Type UVA-340 bulbs are used at an irradiance level of 0.77 watts per square meter per nanometer at 340 nanometers, as measured at the sample surface during the UV cycle. After 300 hours total exposure the paint samples shall meet the requirements below.

White: Yellowness Index after weathering, maximum, 12 (see section 3.3.17)
Yellow: Must pass Yellow Color test after weathering (see section 3.3.19)

1.5.22 Scrub Resistance
Minimum cycles
White: 800
Yellow: 800
Black: -

Follow the procedure in ASTM D2486. Prepare a panel using an appropriate bird doctor blade that will produce a uniform dry film thickness of paint between three and four mils. Dry the panel for seven days at standard conditions. The panel shall require more than 800 cycles to remove the paint film in one continuous line across the width of the shimmed area.

1.5.23 Lead
Maximum mg/kg in dried paint
White: 20
Yellow: 20
Black: 20
ASTM D3335

1.5.24 Chromium
Maximum mg/kg in dried paint
White: 5
Yellow: 5
Black: 5
ASTM D3718

1.5.25 Thick Application Cracking Resistance
White: Pass
Yellow: Pass
Black: Pass

On a black-white Leneta chart, Form 2C-Opacity, draw down a stripe of the paint three inches wide and at least six inches long and having a 60±5 mil wet film thickness. Allow the paint to dry for 48 hours at standard conditions on a horizontal surface. After 48 hours the paint film shall not exhibit any cracks.

1.5.26 Accelerated Package Stability
White: Pass
Yellow: Pass
Black: Pass

Fill a clean one-pint, resin-lined, friction-top paint can with a well-stirred sample. Measure the initial Consistency as in section 3.3.7. Close the can tightly. Store this can in an oven at a temperature of 52ºC for 14 days. After 14

days remove the can from the oven and allow the can to cool overnight. Determine the Consistency of the paint as in section 3.3.7, except allow hand stirring of the sample for five minutes to ensure uniform redistribution of any settlement before testing. The Consistency of the paint shall not change more than seven K.U. after this heated storage period, when compared to the initial Consistency. Draw down a 13 mil thick wet film of this sample on a glass plate and examine for Appearance as in 3.3.15.

1.5.27 Infrared Spectra of Nonvolatile Vehicle
Allowable variation from laboratory reference spectra
White: None
Yellow: None
Black: None
ASTM D3168

1.5.28 pH
White: 10±1.0
Yellow: 10±1.0
Black: 10±1.0
ASTM E70

1.5.29 Initial Retroreflectivity of Applied Paint (with beads)
Minimum mcd•m-2•lx-1
White: 250
Yellow: 175
Black: -

The paint shall produce delineation that has the minimum required level of retroreflectivity when applied to pavement (with drop-on beads) according to the manufacturer's recommendations. Drop-on glass beads shall be uniformly applied at a minimum rate of 5 pound per gallon of paint. The retroreflectivity shall be measured as specified in ASTM D7585 using a retroreflectometer meeting ASTM E1710.

1.5.30 Color after Application
The color of the applied white and yellow stripes and markings (with beads) shall conform to the daytime and nighttime color requirements in ASTM D6628.

1.6 WORKMANSHIP, SETTLING AND SHELF-LIFE

1.6.1 The paint shall be free from dried paint skins and foreign materials such as; dirt, sand, fibers, or other materials capable of clogging; screens, valves, pumps, or other equipment used in paint striping apparatus.

1.6.2 The paint pigment shall be well ground and properly dispersed in the vehicle. The pigment shall not cake or thicken in the container and shall not become granular or curdled. Any settlement of the pigment in the paint shall result in a

thoroughly wetted soft mass that permits the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with a minimum of resistance to the sidewise manual motion of the paddle across the bottom of the container. This stirring shall return the paint to a smooth uniform product of the proper consistency. If the paint cannot be easily redispersed, due to excessive pigment settlement or any other cause, then the paint shall be considered unfit for use.

1.6.3 The paint shall retain all specified properties under normal storage conditions for eight months after acceptance and delivery. Ordered paint shall be no more than 90 days old (based on date of manufacture) upon delivery to a Department of Transportation Maintenance facility. The date of manufacture shall be clearly marked on each container. The vendor shall be responsible for all costs and transportation charges incurred in replacing paint that is unfit for use. The characteristics of any replacement paint, as specified in ection 3.3, shall remain satisfactory for eight months from the date of acceptance and delivery.

4.0 QUALITY ASSURANCE PROVISIONS

1.7 SAMPLING and TESTING

A one-quart representative sample of each batch of traffic paint intended for use by the Department of Transportation must be sent to the Transportation Laboratory for testing and approval before the batch is shipped. The address of the Transportation Laboratory is listed in section 6.4. A batch shall be that amount of paint which was manufactured and packaged in a single operation. The Department of Transportation reserves the right to take random samples of batches of paint destined for use by the Department, at the manufacturer's facility. If requested by the Inspector, batch tickets must also be provided for batches of paint produced for the Department.

A manufacturer's test report shall be included with the one-quart sample of each batch sent to the Transportation Laboratory. The following information shall be included in the manufacturer's test report:

- State Specification number (#PTWB-01R2 (November, 2016))
- Batch number, batch volume, color, date of manufacture
- Dry to No Pick-Up time (section 3.3.9)
- Dry Opacity (section 3.3.16)
- Yellowness Index (of white only, see section 3.3.17)
- Reflectance (section 3.3.18)
- Yellow Color (of yellow only, see section 3.3.19)
- Consistency (section 3.3.7)
- Nonvolatile Content, Weight Percent (section 3.3.3)
- Pigment, Weight Percent (section 3.3.4)
- Density (section 3.3.6)

Once the Transportation Laboratory approves a batch of paint, the manufacturer will be notified that the batch is approved for shipment. Upon shipment of the approved batch of paint, the manufacturer shall fax the following information to the Transportation Laboratory within 48 hours.

- A list of each delivery location
- Name and phone number of contact person(s) at the delivery location(s)
- State Specification number (#PTWB-01R2 (November, 2016))
- Colors, batch numbers and quantity of each batch of paint delivered

This information shall be faxed to: Transportation Laboratory, Chemical Testing Section, 5900 Folsom Boulevard, Sacramento, CA 95819-0128, attn.: Lisa Dobeck, Fax (916) 227-7168.

The Department of Transportation reserves the right to retest any batch of traffic paint after delivery. Data from such retesting shall prevail over all other tests and will be the basis of rejection. Material not meeting the specification shall be removed and replaced by the supplier at their expense, including all costs for handling, retesting and shipping.

5.0 PREPARATION FOR DELIVERY

1.8 PACKAGING

All manufactured paint shall be prepared at the factory ready for application. The finished paint shall be furnished in the container size specified in the purchase order or contract.

- When 19-liter (5-gallon) containers are specified, they shall be round and have standard full open head and bail.
- If 208-liter (55-gallon) steel drums are specified, they must have removable lids and airtight band fasteners.
- When 946-liter (250-gallon) bulk containers are specified, they shall be an industry standard type bulk paint container.
- When 1325-liter (350-gallon) bulk containers are required by the purchase order or contract, the paint shall be delivered in a container (tote) meeting the following requirements.
  1. Tank volumes are estimated and so specified in each of three Bulk Container drawings dated 09-04-91. Vendor shall allow a 19-liter headspace for expansion of the paint.
  2. Maximum size in regards to width, depth and height shall be in accordance with one of the three drawings dated 09-04-91.
  3. Top openings: 46 centimeter diameter manhole and 15 centimeter diameter fill cap/viewport.
  4. Bottom outlet: five centimeter I.D. full-flow, non-restrictive valve with outlet guard.
  5. Outlet to have 'Ever-Tite' or compatible quick coupler.
  6. Fabricated from 304 stainless steel.
  7. Capable of being stacked two-high when full.
  8. Capable of being lifted by crane (lifting eye) and forklift when full.
  9. Top of tank shall be equipped with one vacuum relief valve and one pressure relief valve.
  10. Top opening and outlet shall provide for easy installation of liner.
  11. Proper certification by the California Highway Patrol that the container complies with all applicable laws, rules, and regulations.

All shipping containers must comply with Code of Federal Regulations, Title 49 and all other applicable Federal and State Regulations governing their use. The containers and lids must be lined with a suitable coating so as to prevent attack by the paint or by agents in the airspace above the paint. The lining must not come off the container or lid as skins. Lids with bungholes shall not be used.

Containers shall be colored white, including lids, and have an identifying band of the appropriate color around and within the top one-third of the container. Stainless steel containers (totes) do not need to be painted white.

All containers shall be properly sealed with suitable gaskets and shall show no evidence of leakage and shall remain in satisfactory condition for a period of 12

months after delivery. The vendor shall be held responsible for replacing containers unfit for use and will be responsible for all costs and transportation charges incurred in replacing paint and containers.

All containers shall be palletized and banded for shipment.

1.9 MARKING

All containers of paint shall be labeled showing the State Specification number (PTWB-01R2), manufacturer's name, date of manufacture, color and manufacturers batch number. Containers shall be clearly labeled "Waterborne Traffic Paint".

All containers of the paint shall be labeled to indicate that the contents fully comply with all rules and regulations concerning air pollution control in the State of California.

The manufacturer of the paint shall be responsible for proper shipping labels with reference to whether the contents are; toxic, corrosive, flammable, etc., as outlined in the Code of Federal Regulations, Title 49.

The Contractor shall list on the Demountable Weight Tags the kilograms per liter and pounds per gallon each for the white, yellow and black paints.

6.0 NOTES

1.10 CERTIFICATION of COMPLIANCE

The manufacturer shall furnish a Certificate of Compliance with each batch of paint, in accordance with the provisions of Section 6-2.03C of the Department of Transportation Standard Specifications, 2015. This Certificate must state that the particular batch of paint complies with State Specification #PTWB-01R2 (November, 2016).

1.11 MATERIAL SAFETY DATA SHEETS

The manufacturer shall furnish MSDS product information sheets whenever paint is delivered to a Department of Transportation facility.

1.12 AIR POLLUTION COMPLIANCE

The paint shall comply with all air pollution control rules and regulations within the State of California in effect at the time the paint is manufactured.

1.13 CONTACT INFORMATION

Please send batch samples to the Transportation Laboratory for testing at the address below.

California Department of Transportation
Transportation Laboratory, Chemistry Section
5900 Folsom Blvd.
Sacramento, CA 95819
Attention: Lisa Dobeck, phone: (916) 227-7291

California Department of Transportation
Specification #PTWB-01R2 (November, 2016)
File: SpecPTWB-01R2(Nov 2016).doc
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