



## PRODUCT SPECIFICATION

### Specification for High Performance Modified Urethane applied to PCC and Aged Asphalt without Sealer or Primer

#### 1. SCOPE

1.1. This specification describes HPS<sup>®</sup>-4, a reflectorized modified urethane, plural component, durable liquid pavement marking material designed for long term delineation on Portland Cement Concrete (PCC) and asphalt surfaces. HPS -4 is a 100% solid two-part system that is applied as a 2 to 1 mixture by volume. HPS -4 is available in retro-reflective white and yellow.

#### 2. MATERIALS

2.1. **Composition:** HPS -4 shall consist of a homogeneous blend of modified urethane resins, pigments and a top application of retro-reflective media. Two parts of Part A shall be mixed with one part of Part B by volume.

##### 2.2. Part A

| <u>Pigments</u>         | <u>White</u> | <u>Organic Yellow</u> |
|-------------------------|--------------|-----------------------|
| Titanium Dioxide Rutile | 21 - 27%     | 12 – 15%              |
| Organic Yellow          |              | 5 - 9%                |
| <br><u>Resin</u>        |              |                       |
| Modified Urethane       | 73 – 79%     | 76 – 83%              |

**US PATENT 6,437,059 AND 6,485,787**

#### 3. PHYSICAL PROPERTIES AND TEST METHODS

3.1. **Color:** The modified urethane material, without drop-on beads, shall visually match the color chips that visually correspond to the Federal Standard Number 595B for the following colors:

|        |             |
|--------|-------------|
| White  | Color 17925 |
| Yellow | Color 13538 |

The modified urethane white and yellow must be applied to 3" x 6" steel plates at  $20 \pm 1$  mil thickness without glass beads. Expose the prepared samples as per ASTM G-53. The test shall be conducted for 72 hours at 122°F, 4 hours humidity, and 4 hours UV using QUV A-340 bulbs in alternating cycles. The color of the coatings shall be within 5 units of the Federal Standards shown above.

**3.2. Yellowness Index (ASTM D-1925):**

- Cure 72 hours after sample preparation
- Take yellow index reading, XYZ C/2°, following 72 hour cure and preceding QUV (ASTM G-53)
- Maximum before QUV 6.0
- Place sample in QUV for 72 hours
- Maximum after QUV 20.0

3.3. **Toxicity:** Upon heating to application temperature, the material shall not exude fumes, which are toxic or injurious to persons or property when handled according to manufacturer specifications. HPS -4 compositions shall not contain free isocyanate functionality.

3.4. **No Tracking Time:** When mixed in the proper ratio and applied at  $15 \pm 1$  mils wet film thickness with 8 pounds per gallon Type 4 gradation beads and 10 pounds per gallon AASHTO M247 Type I beads, HPS -4 shall have a no track time of less than 5 minutes when tested according to ASTM D-711 at  $75^\circ\text{F} \pm 2^\circ\text{F}$ . When saturated with a double drop of 12 pounds per gallon Type 4 gradation beads and 12 pounds per gallon AASHTO M247 Type I beads and tested under the same conditions as above, HPS -4 shall have a no track time of 3 minutes or less.

3.5. **Hardness:** The modified urethane marking material, when tested according to ASTM D-2240, shall have a Shore D Hardness greater than 75. Samples shall be allowed to cure at  $75^\circ\text{F} \pm 2^\circ\text{F}$  for a minimum of 72 hours prior to performing the tests indicated.

3.6. **Flexibility:** The modified urethane marking material, when tested in accordance with ASTM D-522, shall pass the test at  $\frac{3}{4}$ ". Panels are prepared by casting 5 mil films on 4" x 12" aluminum panels. The test is run after panels are cured for a minimum of 72 hours at  $75^\circ\text{F} \pm 2^\circ\text{F}$ .

3.7. **Adhesion to Concrete:** The modified urethane marking material, when tested according to ASTM D 4541, shall have a high degree of adhesion to the specified concrete surface such that there shall be a 100% concrete failure in the performance of this test. The prepared specimens shall be conditioned at  $75 \pm 2^\circ\text{F}$  for a minimum of 72 hours prior to the performance of the test indicated.

3.8. **Abrasion Resistance:** The abrasion resistance shall be evaluated on a Taber Abrader with a 1,000 gram load and CS-17 wheels. The duration of test shall be 1,000 cycles. The wear index shall be calculated based on ASTM test method D-4060 and the wear index for the catalyzed material shall not be more than 80. The tests shall be run on

cured samples of material which have been applied at a film thickness of  $15 \pm 0.5$  mil to code S-16 steel plates (to be run without glass spheres). The samples shall be allowed to cure at  $75^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for a minimum of 72 hours prior to performing the indicated tests or as instructed by the manufacturer.

- 3.9. **Tensile Strength:** When tested according to ASTM D-638, the modified urethane marking material shall have an average tensile strength of not less than 6,000 pounds per square inch. The Type IV Specimens shall be pulled at a rate of  $\frac{1}{4}$ " per minute by a suitable dynamic testing machine. The samples shall be allowed to cure at  $75^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for a minimum of 72 hours prior to performing the indicated tests.
- 3.10. **Compressive Strength:** When tested according to ASTM D-695, the catalyzed modified urethane marking material shall have a compressive strength of not less than 12,000 pounds per square inch. The cast sample shall be conditioned at  $75^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for a minimum of 72 hours before performing the indicated tests. The rate of compression of these samples shall be no more than  $\frac{1}{4}$ " per minute.

#### 4. **INSTALLATION AND SURFACE PREPARATION**

- 4.1. **Placement** – HPS -4 and retro-reflective media shall be placed according to Ennis' requirements. All technical data regarding material type and application rate will be provided to the project engineer prior to starting work. HPS -4 shall be applied at a rate of 240 feet per gallon based on a minimum of 20 mils applied at a four (4) inch width.
- 4.2. **Surface Preparation** – To assure maximum possible adhesion, all pavements upon which HPS -4 is to be applied shall be properly prepared. The surface shall be clean and dry. The surface preparation shall include, but not be limited to, cleaning and removal of sealing and curing compound. All pavements and temporary paint markings shall be cleaned free of grease, oil, mud, dust, dirt, grass, loose gravel, loose, or flaking paint and other deleterious material prior to the application of HPS-4.

The pavement surface area to be prepared shall be wider than the HPS -4 to be applied, such that a prepared area is on all sides of the HPS -4 after application. New asphalt, concrete and seal coated surfaces shall be in place a minimum of two weeks prior to marking application.

Any existing marking which may interfere with the performance of the material shall be physically removed by any Agency approved method except for the use of chemicals. All new PCC surfaces shall have all curing compound removed. All existing markings shall be at least 90% removed. HPS -4 can be applied over temporary paint markings which are well adhered to the substrate and are 8 mils dry or less when prepared according to paragraph 1 in this section.

- 4.3. **Final Surface Preparation** - Upon completion of section 2, the pavement surface shall first be power broomed and vacuumed. An additional compressed air operation, separate from the compressed air guns on the striping applicator, shall be used to remove residue and debris resulting from the cleaning work. Compressed air shall also be used during striping application.

- 4.4. **Weather Conditions** - Ambient and surface temperature shall be 35°F and rising. The pavement surface temperature and ambient temperature shall be determined and documented before the start of each day of marking operation and at any other time deemed necessary by the manufacturer or the agency.

5. **Equipment**

- 5.1. HPS -4 shall be applied with equipment approved by Ennis Traffic Safety Solutions. The equipment shall be designed to control the viscosity of the material accurately at the spray gun. This equipment shall have pressure gauges for each proportioning pump. The equipment shall have a metering device to register the accumulated footage for each spray gun or a gallon meter to determine actual gallons used. Each piece of equipment shall be operated by a technician who is an expert in that particular equipment's operation and plural component application techniques.

6. **Shelf Life** – Stored in dry cool conditions and in sealed containers, the shelf life of HPS-4 is two years.