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**Test Procedure for****TESTING SINGLE-COMPONENT POLYURETHANE  
WATERPROOFING****TxDOT Designation: Tex-615-J****Effective Date: August 1999**

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**1. SCOPE**

- 1.1 Use this method to test a single-component polyurethane coal-tar-modified waterproofing.
  - 1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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**2. PREPARING TEST SAMPLES**

- 2.1 This material is sensitive to moisture in the air, so a light skin may have formed on the surface of samples. Remove any skin that has formed prior to testing.
  - 2.2 Prepare test specimens as soon as possible after opening a sample; minimize the amount of atmosphere exposure.
  - 2.3 Maintain a temperature of  $25 \pm 1^\circ\text{C}$  ( $77 \pm 2^\circ\text{F}$ ).
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**3. CONSISTENCY TEST**

- 3.1 *Apparatus:*
    - 3.1.1 *Brookfield Synchro-Lectric viscometer*, of suitable range.
    - 3.1.2 *Cans*, 480 mL (1 pt.), friction top.
    - 3.1.3 *Thermometer*, range  $10\text{--}30^\circ\text{C}$  ( $50\text{--}86^\circ\text{F}$ ),  $0.1^\circ$  div. (ASTM E 77).
  - 3.2 *Procedure:*
    - 3.2.1 Place the sample in a container with at least 25 mm (1 in.) of clearance between the bottom and sides of the spindle when immersed to the proper depth.
    - 3.2.2 Maintain the sample at  $25 \pm 1^\circ\text{C}$  ( $77 \pm 2^\circ\text{F}$ ).
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- 3.2.3 Select the proper spindle and attach it to the lower end of the motor shaft.  
**Note 1**—When using a disc-type spindle, immerse the spindle at an angle to eliminate air bubbles. Then screw onto the shaft.
- 3.2.4 Adjust the height to bring the liquid level to the indentation on the spindle.
- 3.2.5 Level the instrument, set the speed control at 2 rad/s., and start the motor.
- 3.2.6 Allow the spindle to rotate for approximately 2 minutes before taking a reading.
- 3.2.7 Convert the scale reading to viscosity in poises by multiplying by the factor supplied by Brookfield for the combination of spindle and speed used.  
**Note 2**—Spindle types: No. 5, 6, or 7; scale reading between 20 and 80.
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#### 4. PEEL STRENGTH TEST

- 4.1 *Apparatus:*
- 4.1.1 *Aluminum strips*, 25 × 305 × 0.2–0.25 mm (1 × 12 × 0.008–0.10 in.), cut from lithograph sheet stock.
- 4.1.2 *Mortar blocks*, 51 × 76 × 25 mm (2 × 3 × 1 in.), as described in ASTM D 1191.
- 4.1.3 *Spatula*, with 102 × 16-mm (4 × 0.625-in.) blade.
- 4.1.4 *Weight*, 200 ± 20 g, approximately 76 × 19 mm (3 × 0.75 in.)
- 4.1.5 *Forced draft oven*, capable of maintaining 60 ± 2°C (140 ± 5°F).
- 4.1.6 *Lap wheel*, flat, solid cast iron wheel 457 mm (18 in.) in diameter, mechanically driven at approximately 21 rad/s. (200 rpm), water, and silicone carbide grit size No. 150.
- 4.1.7 *Special grip*, to hold mortar block during testing.
- 4.1.8 *Tensile machine*, as described in ASTM D 903, except that autographic capability is not required.
- 4.2 *Procedure:*
- 4.2.1 Prepare rigid members according to ASTM D 1191.
- 4.2.2 Using the lap wheel and grit size No. 150, grind the surface of the blocks to remove laitance.
- 4.2.3 Wash the blocks thoroughly with water, wipe dry with a clean towel, and dry in the 60°C (140°F) oven for 2 hours.
- 4.2.4 Remove the blocks from the oven and cool to 25 ± 1°C (77 ± 2°F).  
**Note 3**—The flexible member should be aluminum.

- 4.2.5 Degrease the bonding surface of the aluminum.
  - 4.2.6 Etch it with a 6–8% phosphoric acid solution prior to bonding.
  - 4.2.7 Bond the aluminum strip to the 76-mm (3-in.) dimension of the mortar block.
  - 4.2.8 Apply 5–10 mils coating to both bonding surfaces.
  - 4.2.9 Place the surfaces together and hold with a  $200 \pm 20$  g weight resting on top of the aluminum strip during initial cure.
  - 4.2.10 Cure for 1 day at  $25 \pm 1^\circ\text{C}$  ( $77 \pm 2^\circ\text{F}$ ), then for 2 days at  $60 \pm 2^\circ\text{C}$  ( $140 \pm 5^\circ\text{F}$ ).
  - 4.2.11 After curing, insert the mortar blocks in the special grip.
  - 4.2.12 Attach the special grip to the moving member of the tensile machine.
  - 4.2.13 Insert the free end of the aluminum in the grip attached to the fixed member.
  - 4.2.14 Use a rate of 152 mm (6 in.) per minute until the strip peels off the mortar block.
  - 4.2.15 Record the maximum initial reading.
  - 4.2.16 Take additional readings at 5-second intervals.
  - 4.2.17 Report the average of the readings as the peel strength in pounds per inch.
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## 5. WET STRENGTH TEST

### 5.1 *Apparatus:*

- 5.1.1 *Mortar blocks*,  $51 \times 76 \times 25$  mm ( $2 \times 3 \times 1$  in.), as described in Section 3.2.1.
- 5.1.2 *Spatula*, with  $102 \times 16$ -mm ( $4 \times 0.630$ -in.) blade.
- 5.1.3 *Forced draft oven*, capable of maintaining  $60 \pm 2^\circ\text{C}$  ( $140 \pm 5^\circ\text{F}$ ).
- 5.1.4 *Tensile machine*, screw type, with a load range between 0–4,450 N (0–1,000 lb.) and 0–17,800 N (0–4,000 lb.), capable of a testing speed of 1.3 mm/min. (0.05 in./min.), conforming to the requirements of ASTM E 4.
- 5.1.5 *Special jigs*, to hold mortar blocks during testing.

### 5.2 *Procedure:*

- 5.2.1 Bond 2 mortar blocks together with the waterproofing material.

**Note 4**—Make sure that the 76-mm (3-in.) dimensions are perpendicular to produce a bonded area of 102 mm (4 in.)

- 5.2.2 Apply 5–10 mils of the coating to the bonding surface of both blocks.
- 5.2.3 Place them together.
- 5.2.4 Cure them for 1 day at  $25 \pm 1^\circ\text{C}$  ( $77 \pm 2^\circ\text{F}$ ), then for 2 days at  $60 \pm 2^\circ\text{C}$  ( $140 \pm 5^\circ\text{F}$ ).
- 5.2.5 Immerse the cured materials in tap water maintained at  $20\text{--}30^\circ\text{C}$  ( $70\text{--}80^\circ\text{F}$ ) for 7 days.
- 5.2.6 Remove the cured material from the bath.
- 5.2.7 Use appropriate jig to hold mortar blocks for tensile loading.
- 5.2.8 Use a tensile loading rate of 1.3 mm/min. (0.05 in./min.) until failure occurs.
- 5.3 *Calculation:*
- 5.3.1 Calculate wet strength:

$$\text{Wet Strength, } N / \text{mm}^2 (\text{psi}) = \frac{\text{Maximum tensile load in Newton (lb.)}}{2.6 \text{ mm}^2 (4 \text{ in.}^2)}$$

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## 6. RESISTANCE TO FLOW ON VERTICAL SURFACES

- 6.1 *Apparatus:*
- 6.1.1 *Metal plate*,  $76 \times 152.4 \times 2.5$  mm ( $3 \times 6 \times 0.10$  in.)
- 6.1.2 *Metal form*,  $51 \times 102 \times 0.8$  mm ( $2 \times 4 \times 0.030$  in.)
- 6.1.3 *Spatula*, with  $102 \times 16$ -mm ( $4 \times 0.630$ -in.) blade.
- 6.2 *Procedure:*
- 6.2.1 Place the form on the metal plate and pour the waterproofing material inside the form.
- 6.2.2 Spread the materials with spatula by turning the spatula on edge and using short back and forth strokes, until the surface of the waterproofing material is even with the top of the form.
- 6.2.3 Remove the form by lifting both ends simultaneously, leaving a  $51 \times 102 \times 0.8$ -mm ( $2 \times 4 \times 0.030$ -in.) panel of waterproofing on the metal plate.
- 6.2.4 Immediately place it in a vertical position.
- 6.2.5 After curing the material, examine it for any evidence of flow or sag.

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## 7. ADHESION BETWEEN COATS

### 7.1 Apparatus:

7.1.1 *Water bath*, at a temperature of 24°C (75°F).

7.1.2 *Hobart mixer*.

7.1.3 *Flow table*, (13-mm [1/2-in.] drop).

7.1.4 *Balance*.

7.1.5 *Hardwood mortar screed*.

7.1.6 *Brushes*.

7.1.7 *Metal form*, 51 × 102 × 0.8 mm (2 × 4 × 0.030 in.)

7.1.8 *Spatula*, with 102 × 16-mm (4 × 0.630-in.) blade.

### 7.2 Materials:

7.2.1 *Alamo Type II Portland cement*, high early strength, meeting ASTM C 150.

7.2.2 *Graded Ottawa sand*, (ASTM C 109).

7.2.3 *Grease*, for specimen release from molds.

### 7.3 Procedures:

#### 7.3.1 *Proportion and Mix the Mortar:*

7.3.1.1 Weigh an amount of cement and transfer into bowl of the mixer.

**Note 5**—The proportion of cement and sand to use is determined by adding dry Ottawa sand to a cement paste having a water-cement ration of 0.40 by weight to produce a flow of  $100 \pm 5$ . Determine the flow for each new shipment of cement.

7.3.1.2 Weigh an amount of water sufficient to make the water-cement ratio 0.40, and pour into the cement.

7.3.1.3 Start the time and the mixer.

7.3.1.4 Mix at the lowest speed until the water and cement form a smooth paste with no visible lumps.

7.3.1.5 Increase the mixing speed to the second position and continue mixing for 1 minute.

7.3.1.6 Stop the mixer.

- 7.3.1.7 Weigh enough sand to cause the flow of  $100 \pm 5$ .
- 7.3.1.8 Start the mixer.
- 7.3.1.9 Mix at the slowest speed until the sand mixes completely into the water-cement paste.
- 7.3.1.10 Speed up the mixer to the fastest speed and mix for approximately 15 seconds.
- 7.3.1.11 Drop the speed to the medium range and mix for approximately 15 seconds.
- 7.3.1.12 Set the mixer to mix at the slowest speed and continue mixing until the materials mix completely into a smooth mortar.
- Note 6**—The total mixing time from start should be between 2 and 2-1/2 minutes.
- 7.3.1.13 Determine the flow as described in ASTM C 87.
- 7.3.1.14 Use ten 1/2-drops in 6 seconds of a 254 mm (10 in.) flow table.
- 7.3.2 *Preparing Mortar Blocks:*
- 7.3.2.1 Cover the inside of the metal molds with a very light coating of grease.
- 7.3.2.2 Weigh the molds and record the weights.
- 7.3.2.3 Place a sufficient amount of mortar into a  $152 \times 152 \times 25$ -mm ( $6 \times 6 \times 1$ -in.) mold. Make sure the mortar is evenly distributed.
- 7.3.2.4 Place the mold with contents on the flow table and drop 13 mm (1/2 in.) five times at the rate of approximately one drop per second.
- 7.3.2.5 Slowly turn the table top between drops
- Note 7**—The flow table used for this portion of the procedure is a much larger flow table than the 10-inch table used to check the flow of the mortar.
- 7.3.2.6 Use a hardwood screed and screed off the excess mortar and then level and smooth the mortar.
- 7.3.2.7 Remove the entrapped air from the surface with smooth, even strokes of the screed.
- 7.3.2.8 Brush the surface of the specimen lightly with a soft-bristled brush.
- 7.3.2.9 Clean the outside of the mold and weigh immediately to the nearest estimated 0.5 g and record the weight.
- 7.3.2.10 Cure the molded specimen at a temperature of  $24^\circ$  ( $75^\circ\text{F}$ ) with a humidity of 65% for 3 hours.
- 7.3.2.11 Leave the specimen undisturbed for an additional 2 hours.
- 7.3.2.12 Remove the forms when the mortar is firm enough to handle.

7.3.2.13 Place the specimens in a water bath at a temperature of approximately 24°C (75°F).  
**Note 8**—If desired, make a number of specimens at once in a series of forms, and keep in the water bath until needed.

7.3.3 *Adhesion between Coats:*

7.3.3.1 Apply a 30-mil coat to a dry mortar block, as described in Section 6.2.2.

7.3.3.2 Cure for 24 hours at  $25 \pm 1^\circ\text{C}$  ( $77 \pm 2^\circ\text{F}$ ) and 10% humidity.

7.3.3.3 Apply a second 30-mil coat over the original coat.

7.3.3.4 Cure for 48 hours at the above conditions.

7.3.3.5 Attempt to separate the coats with a knife.