NOTE: This Document is "Inactive"

OHD L-21
METHOD OF TEST FOR
COLD APPLIED, TWO COMPONENT, POLYMER TYPE
JOINT SEALING COMPOUNDS

I. **SCOPE.** These methods cover tests for machine extruded or pourable, cold applied, two component, polymer type joint sealing compounds. The base component, containing the polymer, shall be referred to as component B and the component containing the catalyst or accelerator shall be referred to as component A. The following tests are covered:

II. **MIXING.** This procedure describes the laboratory mixing of the two components of a Polymer Joint Sealer. Incomplete mixing or improper proportioning of the components will not give valid test results.

A. **Machine Extruded Material.**

1. Apparatus. An approved laboratory mixing and dispensing machine (Note) shall be used for the preparation of all test specimens. The machine shall contain separate reservoirs clearly labeled "A" and "B", for two components. It shall be equipped with pumps for feeding the components at accurate rates to a mixing nozzle. The nozzle shall be capable of immediately mixing the two components and ejecting the mixture through a tube.

   NOTE: Similar to that available from: Allied Products Corporation, 5101 North Pennsylvania Avenue, Oklahoma City, Oklahoma.

2. Mixing.

   a. It is important that each individual component be uniformly mixed by boxing and vigorous stirring before any tests are performed. This is especially important with Component A, if in liquid form. In this case, extreme care must be taken to insure that all settled material is uniformly reincorporated.

   b. Be sure that each component is placed in its proper reservoir. If a component should be placed in the wrong reservoir, it will react with material from a previous test and solidify, spoiling the sample to be tested and plugging the dispensing machine. The machine will have to be dismantled and the affected reservoir and lines cleaned out or replaced before the dispenser can be used.

   c. Fill reservoirs with components. Turn on air to 10 psi (69 Kpa), open the by-pass valves and close line valves, and measure the metering of the components. The gauge for one component should read approximately the same as the gauge for the other components. Open the line valves and close the by-pass valves; allow approximately one pint of the mixed components to be wasted before filling specimens.

B. **Pourable Material.**

1. Apparatus. Laboratory mixer with propeller-type paddle, 2 ½ inches (63.5 mm) in diameter, operating at 800 ± 100 revolutions per minute (RPM).

2. Mixing.

a. It is important that each individual component be uniformly mixed by boxing and vigorous stirring before any tests are performed. This is especially important with component A, if in liquid form. In this case, extreme care must be taken to insure that all settled material is uniformly reincorporated.

b. Weigh a sufficient amount of the two components in the ratio given by the manufacturer to give a volume of about one (1) pint (450 ml) to one (1) quart (1 Liter). Mix the materials for five (5) minutes in a can of approximately twice the volume of the sample, using mixer described in II, B, 1.

III. **PENETRATION.**

A. **Apparatus.**

1. Penetrometer and Penetration Cone conforming to ASTM D 217.

2. 6 ounce (177 ml) metal seamless ointment containers with a diameter of 3.75 inches (9.5 cm) and a height of 1.25 inches (3.2 cm).

3. An air circulated oven capable of maintaining a temperature of 158° ± 2°F (70°C ± 1°C).

B. **Procedure.**

1. At 77° F (25°C), 150 grams total load, 5 seconds: Fill 6 ounce containers with compound, strike off and smooth the surface. Allow the specimens to cure twenty-four (24) hours at room temperature. Condition sample and cone at 77° ± 2° F (25° ± 1°C) for one (1) hour. Using the penetration cone attachment with the cone set at its highest position and the dial set at zero, lower the indicator assembly until the tip of the cone is in contact with the surface of the specimen. Lock in place. Release locking mechanism for 5 seconds to permit the cone to penetrate the surface being tested. Lock the shaft, push dial needle shaft down to meet the cone shaft and read the indicator dial. Make three (3) tests for penetration on each sample at points on the surface not less than ¾ inch (19 mm) apart and ¾ inch (19 mm) from the edge of the container.

2. At 158°F (70°C), 150 grams total load, 5 seconds: Prepare samples and allow to cure as in Section III, B, 1. Condition sample and cone in oven at 158° ± 2°F (70°C ± 1°C) for 1 ½ hours. Use the same procedure as in III, B, 1 to determine penetration with the exception that the test must be completed within twenty (20) seconds after removing sample from oven. Return cone and sample to oven for five (5) minutes and repeat determination. Obtain three (3) penetration values in this manner.

3. The penetration shall be reported as the average of three (3) determinations giving the temperature, total load and time.

IV. **FLOW (200° F).** The flow at 200° F (93.3°C) will be conducted in accordance with ASTM D 1851, Section 5, with the exception that the test shall be conducted in an air circulated oven capable of maintaining a temperature of 200° ± 3° F (93.3° ± 1.7°C).

V. **FLOW (ROOM TEMPERATURE).**

A. **Apparatus.** 2 channels, 1inch (2.54 cm) wide, 1 ½ inches (3.81 cm) deep and 24" (60.96 cm) long, formed of 24 gauge black iron, galvanized iron or aluminum sheet. Amalgamated metal plates, 1 ½ x 1 x ½ inches (3.81cm x 2.54cm x 1.27cm), are inserted near each end of the channels. The metal plates shall be 20 inches (50.8 cm) apart and held in place with "C" clamps. In order to support the channels in a vertical position on a nail or hook, ¼ inch (6.35mm) diameter holes are cut in the bottom of the channels ½inch (12.7mm) from the end.

B. **Procedure.** Fill the channels with the sealing compound from the bottom to the top without the entrapment of air. Strike off the excess compound. Remove the amalgamated plates from one channel at 3 minutes after filling. Suspend the specimen vertically with the end last filled down. Remove the amalgamated plates from the second channel forty (40) minutes after filling. Suspend the specimen vertically with the end last filled down. The total movement of the bottom of the specimens in inches at the end of 24 hours will be recorded as cold flow.

VI. **RESILIENCE (77° F).**

A. **Apparatus.**

1. Use apparatus for penetration specified in ASTM D 217, except that the Ball Penetration tool attachment described below is used in place of the cone. Diameter of ball 0.670 ± 0.005 inch (17.0 ± 0.1mm) total length of shaft approximately 2.7 inches (69mm), diameter of shaft 0.22 ± 0.01 inch (5.6 ± 0.2mm) except that the diameter of the top 0.7 inch (18mm) length of the shaft shall be 0.12 ± 0.01 inch (3.0 ± 0.2mm). The weight of the ball and shaft shall be 27.5 ± 0.1 gram. Total load on sample, including Ball Penetration tool and penetrometer shaft, shall be 75 ± 0.1 gram.

2. Oven specified in Section III, A, 3.

B. **Procedure.**

1. Prepare samples and condition in the same manner as for the penetration test at 77° F (25°C). (Section III, B).

2. Using the Ball Penetration tool attachment with the ball set at its highest position and dial set at zero, lower the indicator assembly until the ball is in contact with the surface of the specimen. Lock in place.

3. Release locking mechanism, then apply uniform pressure to the ball by manual loading so that the ball penetrates the specimen to a dial reading of 100 at a uniform rate in 10 seconds.

4. Lock the ball shaft locking mechanism for 5 seconds. During these 5 seconds, raise the dial shaft to its zero position. The needle should read zero.

5. Release the ball shaft locking mechanism for 20 seconds at the end of the above prescribed 5 seconds. Lock the shaft, push dial needle shaft down to meet the ball and read the indicator dial.

6. Observing the same spacing between tests as for penetration, make two (2) additional tests. The average of 3 resilience values, each calculated as 100 minus the dial reading 20 seconds after release, shall be recorded as the resilience value at 77° F (25°C).

VII. **RESILIENCE (158° F).**

A. **Apparatus.** The apparatus shall be the same as described in Section VI, A.

B. **Procedure.**

1. Prepare and cure specimens as described in Section III, B.

2. Condition samples and ball penetration tool for 1 ½ hours in oven at 158° ± 2° F (70° ± 1°C). Determine the resilience reading (Section VI, B) within 55 seconds after removing from oven. Return the sample and tool to the oven for 10 minutes before making another reading.

3. Obtain 3 readings in the above manner. The average of three resilience values, each calculated as 100 minus the dial reading 20 seconds after release, shall be recorded as the resilience value at 158° F (70°C).

VIII. **RESILIENCE (OVEN-AGED).**

A. **Apparatus.** The apparatus shall be the same as described in Section VI, A.

B. **Procedure.**

1. Place the specimen from the resilience test at 77° F (25°C) (Section VI), in an air circulated oven maintained at 158° ± 2° F (70° ± 1°C) and age for seven (7) days. Remove from oven and condition in air for two (2) hours at 77° ± 2° F (25° ±1°C) .

2. Make three (3) tests for resilience as provided in Section VI, B. The average of 3 resilience values, calculated as 100 minus the dial reading 20 seconds after release, shall be the resilience value of the oven-aged sample.

IX. **BOND.**

A. **Apparatus.**

1. Bond Extension Machine - An apparatus capable of extending the bond specimens described below from a spacing of ½ inch (12.7mm) between blocks to 1 inch (25.4mm) at a uniform rate of ⅛ inch (3.175mm) per hour at -20°F (-28.9°C). AASHTO T 187 shows a machine which meets the requirements; however, machines of other design also may be satisfactory.

2. Cooling Chamber - A refrigerated enclosure, capable of maintaining the

temperature of the specimens, mounted in the Bond Extension Machine, at -20° ± 2° F (-28.9° ± 1°C).

3. Spacers for mold of amalgamated brass ½ x ½ x 2 inch (12.7 x 12.7 x 50.8 mm).

4. Amalgamated 3 x 5 inch (76.2 x 127 mm) tin panels.

5. Mold for concrete blocks. The mold shall be of metal and shall be provided with a detachable metal base plate. Means shall be provided for securing the base plate to the mold. The assembled mold and base plate shall be watertight and shall be oiled with mineral oil before use. The inside measurement of the mold shall be 10 inches (254mm) wide, 18 ½ inches (469.9mm) long, and 3 inch (76.2mm) deep.

6. Concrete saw having a diamond or silicon carbide cutting edge. Blades to be of such size that the kerf cut by them does not exceed ⅜ inch (9.5mm) in width.

B. **Materials Used in Concrete Blocks.**

1. Aggregate. The aggregate shall conform to the following requirements: The coarse aggregate shall consist of crushed limestone, shall have an absorption of not more than 1.5 percent, and shall conform to the following grading:

Sieve Size	Percent Passing
¾ inch (19mm)	97 to 100
½ inch (12.5mm)	66 ± 3
⅜ inch (9.5mm)	33 ± 3
No. 4	0 to 3

The fine aggregate shall consist of natural silicious sand and shall conform to the following grading:

Sieve Size	Percent Passing
No. 4	100
No. 8	85 ± 3
No. 16	65 ± 5
No. 30	45 ± 5
No. 50	21 ± 5
No. 100	7 ± 2

2. Portland Cement. The portland cement shall conform to Section 701 of the "Oklahoma Standard Specifications for Highway Construction." Unless otherwise specified, Type I cement shall be used.

C. **Design of Concrete Mix.**

1. The concrete shall have a water-cement ratio of 5.5 gallons (20.8 Liters)/bag of cement and a slump of 2 ½ ± ½ inch (6.35 ± 1.27cm).

2. The ratio of fine aggregate to total aggregate shall be approximately 40 percent by solid volume.

3. The cement factor shall be 6 ± 0.5 bags per Cubic Yard of concrete.

4. The air content shall be 5.0 ± 0.5 percent and shall be obtained by the addition to the batch as mixed, a sufficient quantity of an air-entraining admixture such as neutralized vinsol resin.

D. **Fabrication of Test Blocks.**

1. Mix the concrete, fill the mold and moist cure the block in accordance with ASTM Method C-192. After moist curing for not less than 28 days, saw the concrete block into 1 x 2 x 3 inches (25 x 51 x 76 mm) test blocks in the following manner:

   a. First cut the 10 x 17 ½ x 3 inch (25.40 x 44.45 x 7.62 cm) block in half by making a cut down the long axis through the center. This yields two (2) slabs.

   b. Cut each into two 2 x 17½ x 3 inch (5.08 x 44.45 x 7.62 cm) slabs by making cuts at a distance of 2 inches from the sawed faces.

   c. Then saw each of the four 2 x 17½ x 3 inch (5.08 x 44.45 x 7.62 cm) slabs obtained as described above, into twelve (12) 1 x 2 x 3 inch (2.54 x 5.08 x 7.62 cm) blocks in the following manner.

      (1) Cut a ½ inch (1.27cm) selvage from the 2 x 3 inch (5.08 x 7.62 cm) face which was in contact with the mold face; then cut twelve (12) 1 x 2 x 3 inch (2.54 x 5.08 x 7.62cm) blocks from the slab.

      (2) Each 10 x 17½ x 3 inch (25.40 x 44.45 x 7.62 cm) slab yields forty-eight (48) 1 x 2 x 3 inch (2.54 x 5.08 x 7.62 cm) test blocks. These dimensions permit sawing by blades cutting a kerf up to ⅜ inch (0.95cm) wide.

2. After sawing and while still wet from the sawing operations, lightly scrub the surfaces of the blocks with a stiff bristled brush while holding under a stream of running water. Store the blocks in the laboratory air in such a manner as to preclude dust accumulation on the surfaces.

E. **Preparation of Test Specimens.**

1. Prepare six (6) test specimens; three (3) for the dry bond and three (3) for the wet bond test. Two (2) blocks are required for each specimen.

2. Dry six (6) blocks for the dry bond test to a constant weight in an oven maintained at 220° ± 2° F (104.4° ± 1°C), then brush the blocks with a stiff bristled brush and place the blocks in a desiccator until used.

3. Soak six (6) blocks in water for 24 hours. Remove from water and drain off excess moisture before assembling for test as described below.

4. Prepare each of the three (3) dry bond specimens by placing two (2) dry concrete blocks on an amalgamated base plate with the 1 x 3 inches (2.54 x 7.62 cm) faces in contact with the base plate. Space the concrete blocks ½ inch (1.27cm) apart by means of amalgamated blocks ½ x ½ x 2 inch (1.27 x 1.27 x 5.08 cm) , standing on their ½ x ½ inch (1.27 x 1.27cm) ends and forming an opening between them ½ inch (1.27cm) wide by 2 inches (5.08cm) long. Use clamps, tape or other suitable means to hold the blocks in position.
5. Prepare the six (6) wet bond blocks using the same procedure as with the dry bond blocks. Put the wet bond blocks into water until immediately before filling

the spaces between them.

6. Fill the spaces between the dry bond blocks with the freshly mixed compound to be tested from the bottom to the top to exclude air pockets. Strike off excess overfill with a spatula.

7. Immediately before filling each wet bond specimen, remove from water and drain. Wipe off excess moisture from all surfaces of the hole to be filled, using a dry, absorbent swab. Fill in the same manner as for the dry bond specimens.

F. **Testing the Specimens.**

1. After conditioning the specimen blocks for 24 hours at room temperature, place them in the holders of the bond extension machine for further conditioning at -20° ± 2° F, for one hour.

2. Place a slight tension on the specimens. Start the bond extension machine and allow to run for the time required to obtain specified extension. (2 hours for 50% or 4 hours for 100% extension.)

3. Remove the specimens from the machine, expose them to room temperature for 30 minutes, then examine them immediately for defects described in Section IX, G (below).

4. Repeat the above procedure twice which comprises three (3) cycles or one complete test.

G. **Interpretation of Test Results.** A bond block shall be considered a failure if a separation in the sealing compound or a separation between the sealing compound and concrete block occurs, which when measured perpendicularly to the face of the sealant, is in excess of the following amounts:

1. Dry bond blocks: ⅛ inch (3.2mm)

2. Wet bond blocks: ¼ inch (6.4mm)

X. NON-VOLATILE CONTENT.

A. **Procedure.**

1. Transfer 3 to 5 grams of freshly mixed material to a tared dish approximately 2½ inches (6.35cm) diameter. Weigh to the nearest milligram and place in an air circulated oven at a temperature of 158° ± 2° F (70° ± 1°C) for 24 hours. Cool the sample to room temperature and weigh to nearest milligram.

2. Calculate the percentage of total non-volatile as follows:

$$\%\ Non\text{-}volatile = \frac{Final\ Weight\ of\ Sample}{Initial\ Weight\ of\ Sample}\ x\ 100$$

XI. VISCOSITY OF COMPONENTS (MACHINE EXTRUDED SEALANTS).

A. **Apparatus.** Brookfield Viscometer, capable of operating at 5 rpm and equipped with a Number 5 spindle.

B. **Procedure.**

1. Mix each component until it is uniform. Fill a one (1) pint (450ml) or a one (1) quart (1 Liter) can, ¾ full of the component to be tested. Adjust the temperature of the sample to 77° F (25°C).

2. Determine the viscosity using the Number 5 spindle on the Brookfield Viscometer set at 5 rpm.

XII. **VISCOSITY AND APPLICATION TIME (POURABLE JOINT SEALANTS).**

A. **Apparatus.** In addition to the apparatus described in Section XI, A, use a Number 6 spindle for the viscometer.

B. **Procedure.**

1. Adjust the temperature of the two components to 77° F (25°C).

2. Mix the sample as described in Section II, B, 2. Fill a one pint or one quart can ¾ full, let set for 5 minutes, then determine the viscosity using the Number 5 spindle at 5 rpm.

3. Allow the sample to stand for two (2) hours after the end of the mixing period. Determine the viscosity using the Number 6 spindle at 5 rpm.

4. Report a material having a viscosity of 2,000 poise (200 Pa-sec) or less, 2 hours after mixing, as having an application time of "2 hours". Report application time as "less than 2 hours" if the viscosity exceeds 2,000 poise (200 Pa-sec). Record viscosity (5 minutes after mixing) and application time.