

GDT 15

A. Scope

For a complete list of GDTs, see the Table of Contents.

Use this test method to determine compliance with the specifications of the Elastomeric Polymer Type concrete and steel joint sealing compound.

B. Apparatus

The apparatus consists of the following:

1. Containers: Use 3 oz (89 ml) ointment boxes (0C-10).
2. Curing Cabinet: Use a cabinet for curing the specimens at laboratory-controlled atmospheric conditions, a temperature of 77 °, ± 7 °F (25 °, ± 4 °C), and a relative humidity of 57 percent, ± 7 percent.
3. Penetrometer Cone: Use a cone constructed of stainless steel or brass with a detachable hardened steel or stainless steel tip, conforming to the dimensions shown in [Figure 15-1](#).
Ensure the outside surface of the cone and tip have a very smooth finish. The total moving weight of the cone and attachments is 35 lb (150 g).
4. Penetrometer: Use a standard penetrometer except with the penetration tool shown in [Figure 15-2](#).
5. Oven: Use a mechanical convection oven capable of maintaining 158 °, ± 2 °F (70 °, ± 1 °C) for 24 hours.
6. Molds and Metal Plates: Use metal molds and plates as specified in 6.1 Method 223.11, Federal Specification SS-R-406.
7. Water Bath: Use a water bath with a 2 gal (7.57 L) capacity.
8. Extension Machine: Use an extension machine consisting of one or more screws rotated by an electric motor through suitable gear reductions. Provide self-aligning plates or grips, one of each pair fixed and the other carried by the rotating screw or screws, for holding the test specimen in position during the test.
9. Concrete Test Block Molds: Use a metal mold with a metal base plate with means provided for securing the base plate to the mold in a watertight condition. The inside measurement of the mold must be 10 in (254 mm) wide and 2 in (50.8 mm) deep by any convenient length.
10. Forced Draft Oven: Use an oven capable of maintaining a temperature of 200 °F (93.3 °C).

C. Sample Size and Preparation

1. Concrete Test Blocks
 - a. Concrete Characteristics
 - 1) Use AASHTO T 85 to ensure the coarse aggregate includes crushed limestone with a water absorption of not more than 1.5 percent.
 - 2) Ensure that the fine aggregate is made from the same crushed limestone used for the coarse aggregate.
 - 3) The table below shows the gradation of the aggregate.

Aggregate for Bond Test Blocks		
Type Aggregate	Sieve Size	Passing Percent
Coarse	3/4 in (19 mm)	97 to 100
	1/2 in (12.5 mm)	63 to 69
	3/8 in (9.5 mm)	30 to 36
	No. 4 (4.75 mm)	0 to 3
Fine	No. 4 (4.75 mm)	100
	No. 8 (2.36 mm)	82 to 88

	No. 16 (1.18 mm)	60 to 70
	No. 30 (600 µm)	40 to 50
	No. 50 (300 µm)	16 to 26
	No. 100 (150 µm)	5 to 9

- 1) Ensure the Portland cement conforms to Federal Specification SS-C-192, Type II or ASTM C-150, Type II. (Granite aggregate may be substituted for limestone.)
- 2) The concrete has:
 - Water-cement ratio: 5.5 gal (20.8 L) per bag of cement
 - Cement factor: 6, ± 0.5 bags per cubic meteryard of concrete
 - Slump: 2-1/2, ± 1/2 in (63.5, ± 12.7 mm)
- 3) The ratio of fine aggregate to total aggregate must be approximately 40 percent by solid volume.
- 4) Ensure the air content is 5 percent, ± 0.5 percent and is obtained by adding an approved air-entraining admixture to the batch.
- 5) Prepare the concrete according to ASTM C 192.
- b. Preparing the Concrete Blocks
 - 1) Fill the mold to overflowing with concrete.
 - 2) Vibrate the mold externally at approximately 4,600 vibrations per minute for 30 seconds.
 - 3) Screed (level) the concrete to a smooth surface with a wooden float.
 - 4) Level off the concrete with a metal straightedge drawn across the top surface with a sawing motion.
 - 5) Cure in accordance with ASTM C 192 for not less than 28 days.
 - 6) Cut the concrete blocks into 2 x 3 x 1 in (50.8 x 76.2 x 25.4 mm) test blocks using a concrete saw with a diamond cutting edge.
 - 7) While the blocks are still wet from the sawing operation, hold the blocks under a stream of running water and lightly scrub all the surfaces with a stiff-bristle brush.
 - 8) Store the blocks under laboratory-controlled atmospheric conditions.
2. Steel Test Blocks

Prepare the steel test blocks as follows:

 - a. Make the steel test blocks 2 x 3 x 1/2 in (50.8 x 76.2 x 12.7 mm) from structural grade steel.
 - b. Wash the blocks thoroughly in carbon tetrachloride (CCl₄) or other suitable solvent to remove all traces of oil.
 - c. Immerse the blocks in muriatic acid at 77 °, ± 5 °F (25 °, ± 3 °C) for 2 minutes.
 - d. Thoroughly rinse the blocks with water and dry them immediately to prevent rusting.
 - e. Immediately use the blocks for testing purposes or store them in an oven at approximately 140 °F (60 °C) until needed.
3. Test Specimens

Mix the components of the compound in accordance with the manufacturer's recommendations.

 - a. Cone Penetration, Solubility, and Resilience Test

Fill three ointment boxes level with the mixed materials, one for each test.
 - b. Flow Test

Prepare the specimen as described in the Federal Specification: SS-R-406.
 - c. Bond Test

Prepare three specimens with concrete blocks and three with metal blocks. Each specimen consists of two blocks assembled as follows:

 - 1) Place four metal spacer strips, approximately 14 in (355.6 mm) thick, on an amalgamated metal plate base to form an open space approximately 1 in (25.4 mm) wide and 2 in (50.8 mm) long.

- 2) Place the blocks on the metal strips spaced 1 in (25.4 mm) apart by means of amalgamated metal blocks 1/2-in (12.7 mm) thick. Place the metal blocks so that an opening 1 x 2 x 2 in (25.4 x 50.8 x 50.8 mm) is formed between the blocks with a 1/4 in (6.35 mm) opening below the blocks.
- 3) Hold the blocks in position with rubber bands, clamps, or similar suitable means.
- 4) Place spacer strips at least 1/4 in (6.35 mm) thick on top of the blocks.
- 5) Pour or trowel material into the space between the blocks in sufficient quantity to bring it at least flush with the top of the spacer strips.
- 6) After the specimen has set, cut the excess material protruding beyond the top and bottom of the blocks with a sharp metal knife.

D. Procedures

1. Cone Penetration
 - a. Cure the test specimen for 7 days under laboratory atmospheric conditions.
 - b. Perform the test in accordance with AASHTO T 49, except use a penetration cone ([Figure 15-1](#)) instead of the standard penetration needle.
2. Solubility
 - a. Cure the test specimen for 7 days at laboratory atmospheric conditions.
 - b. Weigh the sample to the nearest 0.01 g.
 - c. Immerse the sample for 24 hours in clean, 30 weight, high detergent motor oil at room temperature.
 - d. Immediately after the 24 hour immersion period, wipe the specimen clean and weigh it.
 - e. Calculate the solubility as follows:

$$\text{Solubility (\%)} = \frac{(\text{Final Weight} - \text{Initial Weight})}{\text{Initial Weight}} \times 100$$

3. Resilience
 - a. Air Cured
 - 1) Cure the specimen for 7 days under laboratory atmospheric conditions.
 - 2) Test the specimen with a standard penetrometer, using the ball penetration tool shown in [Figure 15-2](#) instead of the needle.
 - 3) Place the ball in contact with the surface of the specimen and set the indicating dial to zero.
 - 4) Apply a uniform load so the ball penetrates the specimen to a depth of 10 mm in 10 seconds.
 - 5) Lock the ball in position for 5 seconds and reset the indication pointer to zero.
 - 6) Release the clutch for 20 seconds to allow the specimen to lift the ball and penetrometer shaft, a total weight of 75, ± 0.1 g.
 - 7) Measure the recovery. Report the difference between the indicated reading and 10 mm as the percentage of recovery.
 - b. Oven Aged
 - 1) Cure the specimen for 7 days under laboratory atmospheric conditions, then condition it further in the oven at 158 °, ± 2 °F (70 °, ± 1 °C) for 72 hours.
 - 2) Cool the specimen under laboratory atmospheric conditions for 1 hour.
 - 3) Follow the test procedures in [C.3.a.2.](#)) through [C.3.a.7.](#)).
4. Flow
 - a. Determine flow as specified in 6.1 Method 223.11, Federal Specification: SS-R-406, except as modified herein.
 - b. Trim the specimens immediately after filling the mold and before the compound cures.
 - c. Condition the specimens under laboratory atmospheric conditions (77 °, ± 7 °F (25 °, 4 °C) and a relative humidity of 57 percent, ± 7 percent) for 7 days before removing the mold.

- d. Run the flow test in duplicate at $200^{\circ} \pm 2^{\circ}\text{F}$ ($93.3^{\circ} \pm 1^{\circ}\text{C}$) in a forced-draft oven.
5. Bond
 - a. Make bond tests on all three specimens in the steel blocks and all three specimens in the concrete blocks.
 - b. Cure the specimens at laboratory atmospheric conditions ($77^{\circ} \pm 7^{\circ}\text{F}$ ($25^{\circ}, 4^{\circ}\text{C}$) and a relative humidity of 57 percent, ± 7 percent) for 7 days.
 - c. After the laboratory conditioning period, remove the side spacers and the base plates from the six specimens.
 - d. Insert thinner spacers so that the spacing is maintained at $1/2$ in (12.5 mm) between spacers and the sealer so that water can contact all four exposed faces.
 - e. Immerse each specimen for 4 days in 1 pint (500 ml) of distilled water maintained at $77^{\circ} \pm 2^{\circ}\text{F}$ ($25^{\circ} \pm 1^{\circ}\text{C}$). Place the 6 specimens in 1 container, provided you maintain the water-specimen ratio.
 - f. At the end of the 4-day period, remove the specimens from the water.
 - g. Drain them of all excess water and wipe them with a dry, absorbent material.
 - h. Place the specimens in an atmosphere maintained at $0^{\circ} \pm 2^{\circ}\text{F}$ ($-32^{\circ} \pm 1^{\circ}\text{C}$) for at least 4 hours.
 - i. Remove the metal spacer blocks and mount the specimens immediately in the self-aligning clamps of the extension machine.
 - j. Maintain the atmosphere surrounding the test specimens at a temperature of $0^{\circ} \pm 2^{\circ}\text{F}$ ($-32^{\circ} \pm 1^{\circ}\text{C}$).
 - k. Extend the specimens 0.5 in (12.7 mm) at a uniform rate of approximately $1/8$ in (3.175 mm) per hour.
 - l. Remove the specimens from the extension machine and return them to storage at room temperature.
 - m. Place the 1 in (25.4 mm) metal spacer blocks between the blocks again.
 - n. Place each specimen to rest on one block so the weight of the top block recompresses the sealing material.
 - o. Leave the specimens in storage for 2 hours.
 - p. If the specimen has not recompressed to its original thickness, place it in a testing machine and recompress it at the approximate rate of 0.1 in (2.54 mm) per minute.
 - q. The block fails if a crack, separation, or other opening that measures over $1/4$ in (6.35 mm) deep at any point, develops in the sealing compound or between the sealing compound and the block. Measure the depth of the crack, separation, or opening perpendicularly to the side of the sealer showing the defect.
 - r. If two of three specimens, representing a given sample of sealing compound, fail, reject the sample.
 - s. One complete bond test consists of five cycles of extension and compression.
 6. Retesting

Retest any sample that fails to meet all of the requirements of these tests. Retest as follows:

 - a. Have the manufacturer submit two additional samples.
 - b. Prepare and test two series of specimens.
 - c. Both series must meet all of the specifications. If either or both series fail, reject the material.

E. Calculations

No calculations are needed for this test.

F. Report

1. Report the results of the tests on Form 168.
2. Send the completed original form to the Office of Materials and Research in Forest Park.
3. Notify the department head of any material that fails.

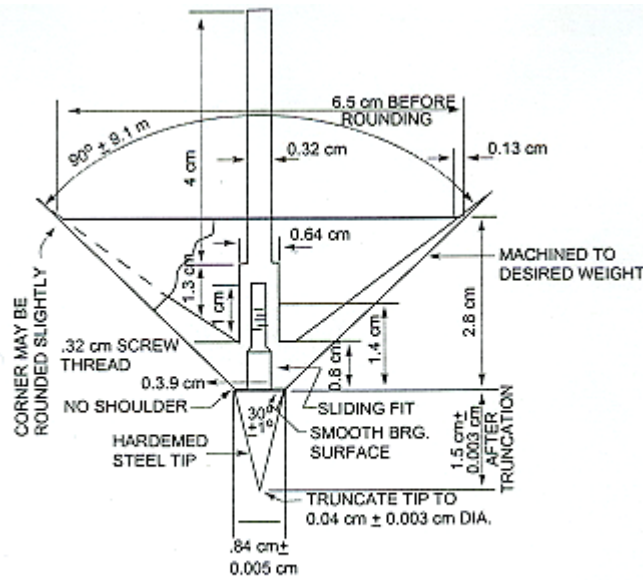
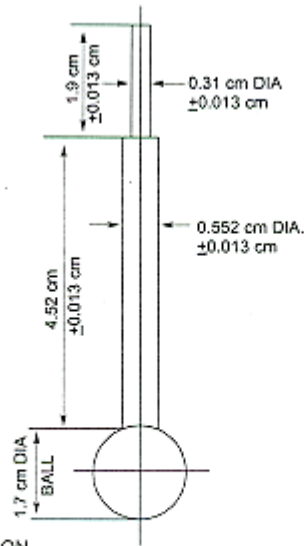


FIGURE 1 - PENETROMETER CONE



SPECIFICATION
 DIAMETER OF BALL: 1.7 cm, PLUS/MINUS 0.013 cm
 WEIGHT OF BALL: 27.5 GRAMS PLUS/MINUS 0.1 GRAM.

FIGURE 2 - BALL PENETRATION