

# Chapter 7

## Tex-525-C, Tests for Asphalt and Concrete Joint Sealers

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## **Section 1**

### **Overview**

Effective dates: August 1999 – January 2005.

This method covers the various procedures for all types of asphalt and concrete pavement joint sealers. The tests performed will depend upon the requirements set forth for each particular material.

#### **Units of Measurement**

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.

## Section 2

### Class 1 and 2 Two-component Synthetic Polymers

#### Apparatus

The following apparatus is required:

- ◆ For penetration, resilience and flow, see apparatus listed under ASTM D 3407
- ◆ Mortar blocks, 76 x 51 x 25 mm (3 x 2 x 1 in.) constructed according to ASTM D 5329
- ◆ Mold spacers as shown in 'Mold Spacers'
- ◆ Paraffin
- ◆ Rubber bands
- ◆ Spatula with 100 mm (4 in.) blade
- ◆ Forced draft oven capable of maintaining  $70 \pm 1$  °C ( $158 \pm 2$  °F)
- ◆ One quart can, with friction rim removed or an 800 mL (27 oz.) beaker.

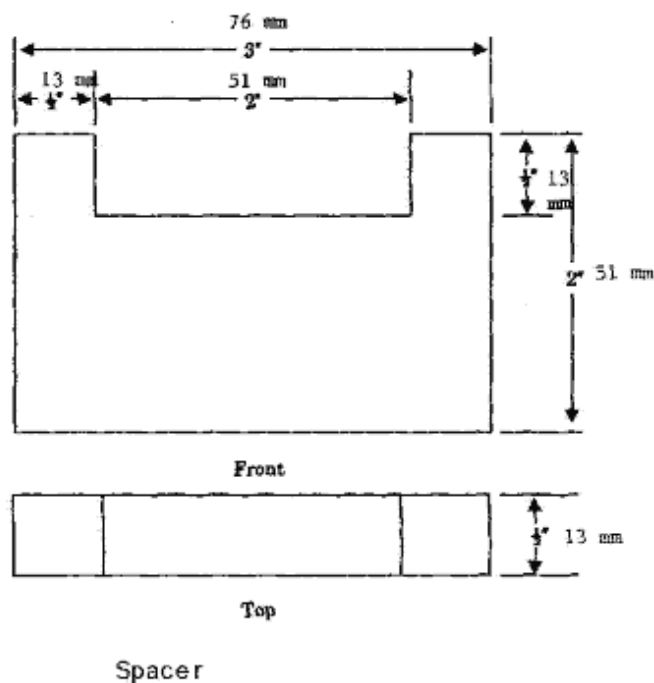
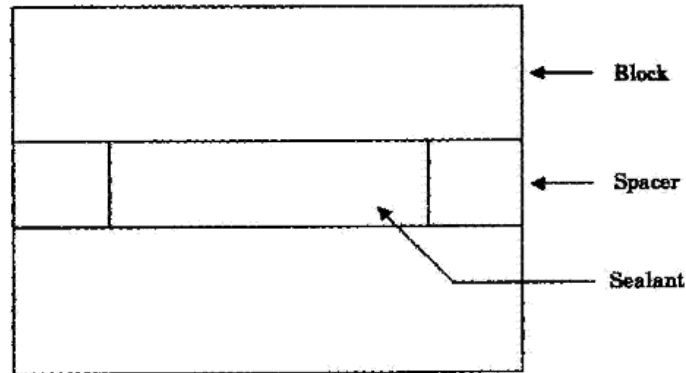


Figure 7-1. Mold Spacers.

**Procedure**

This table details the steps for performing the required test for Class 1 and Class 2, Two Component Synthetic Polymers.

<b>Testing Class 1 and Class 2, Two Component Synthetic Polymers</b>	
<b>Step</b>	<b>Action</b>
1	Blend the two components according to manufacturer's recommendations.
2	Assemble the mold for the bond specimen by placing a spacer between two mortar blocks, as shown in 'Mold Assembly,' and secure with rubber bands.
3	Each spacer should be coated with paraffin before assembling the mold.
4	Overfill the 51 x 13 x 13 mm (2 x 0.5 x 0.5 in.) mold void with sealant.
5	With the spatula, strike off the excess sealant level with the block face.
6	Pour the penetration, resilience and flow following the procedure in ASTM D 3407.
7	With the spatula, strike off the excess sealant even with the face of the flow mold immediately after pouring the specimen.
8	Cure penetration, resilience and bond specimen for 48 hours.
9	Perform tests on penetration, resilience and bond specimen following the procedure in ASTM D 3407.
10	After determining resilience, place the specimen in the forced draft oven maintained at $70 \pm 1 \text{ }^\circ\text{C}$ ( $158 \pm 2 \text{ }^\circ\text{F}$ ) for 5 hours.
11	Remove the specimen from the oven and allow it to cool at room temperature for 1 hour.
12	Determine the resilience.
13	Cure the flow specimen for 24 hours.
14	Determine flow following the procedure in ASTM D 3407.



Mold assembly

Figure 7-2. Mold Assembly.

### **Section 3**

## **Class 3 Hot-poured Rubber**

#### **Apparatus**

The following apparatus is required:

- ◆ Apparatus as described in ASTM D 3407.

#### **Procedure**

Follow procedure in Test Method ASTM D 3407 except that mortar blocks are constructed according to ASTM D 5329.

## Section 4

### Classes 4, 5, 7 & 8 Low-modulus Silicone Sealant and Classes 5 & 8 Single Component Polyurethane Sealant

#### Apparatus for Flow Test – Class 4 Only

The following apparatus is required to perform the flow test for Class 4 Low-Modulus Silicone Sealant.

- ◆ Flow jig as shown in 'Flow-Test Jig'
- ◆ Spatula with 4 inch blade
- ◆ Timer – accurate to 1 second.

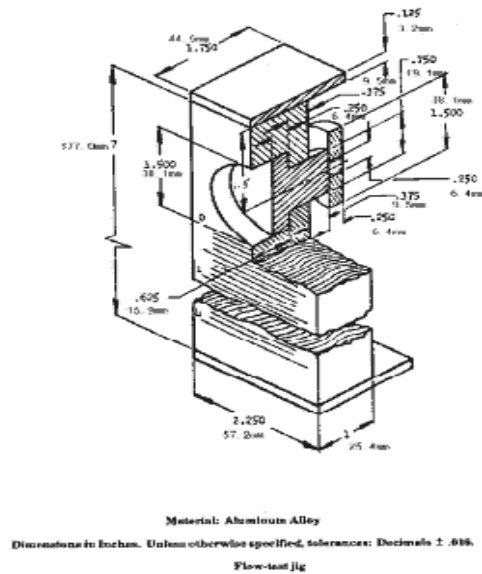


Figure 7-3. Flow-Test Jig.

#### Procedure

This table details the steps for performing the Flow test on Class 4 Low-Modulus Silicone Sealant.

<b>Flow Test – Class 4 Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Place flow jig on table with face upward and plunger fully depressed.
2	Fill the cavity with seal compound to overflowing.
3	With a spatula, level off sealant even with the face of the jig.
4	Within 10 seconds after leveling, place the jig on end and extend the plunger.
5	The measurement for flow shall be taken exactly 30 minutes after leveling.

### Apparatus for Extrusion Rate – Class 4 Only

The following apparatus is required to determine the extrusion rate of Class 4, Low-Modulus Silicone Sealant.

- ◆ Extrusion gun – Semco Model 250, 152 mm (6 in.)
- ◆ Cartridge – Semco, to fit gun
- ◆ Gauge and Air Regulator to control  $620 \pm 35$  kPa ( $90 \pm 5$  psi)
- ◆ Suitable air supply
- ◆ Nozzle – Semco, Model 440,  $3.175 \pm 0.127$  mm ( $0.125 \pm 0.0005$  in.)
- ◆ Balance – accurate to  $\pm 0.01$  g
- ◆ Container large enough to hold 20 g of sealant.

### Procedure

This table details the steps for determining the extrusion rate of Class 4, Low-Modulus Silicone Sealant.

<b>Extrusion Rate – Class 4 Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Fill the Semco gun cartridge with the sealing compound.
2	Assemble gun and cartridge, nozzle shall be $3.175 \pm 0.127$ mm ( $0.125 \pm 0.005$ in.)
3	Attach air supply controlled at $620 \pm 35$ kPa ( $90 \pm 5$ psi).
4	Extrude a small amount to clear any trapped air.
5	Extrude material into a tared container for a minimum of 15 seconds or until 20 g are collected.
6	Reweigh the container and calculate the extrusion rate in grams per minute.
7	Extrusion rate, $g / \text{min} = \frac{(\text{sample} + \text{tare}) - \text{tare}}{\text{time, min.}}$

### Apparatus for Tack Free Time

This is the apparatus required to perform the Tack Free test on Class 4, 5, 7 and 8 Low-Modulus Silicone and Polyurethane Sealants.

- ◆ Metal panel – approximate dimensions 203 x 76 x 1.6 mm (8 x 3.0 x 1/16 in.)
- ◆ Mold – inside dimensions, 152 x 51 x 3.175 mm (6 x 2 x 0.125 in.)
- ◆ Weight – 28.3 ± 0.1 g with base 25 x 51 mm (1 x 2 in.)
- ◆ Polyethylene sheeting -0.08 ± 0.02 mm (0.003 ± 0.001 in.)
- ◆ Spatula with 100 mm (4 in.) blade
- ◆ Scissors
- ◆ Timer, accurate to one minute.

### Procedure

This table details the steps for performing the tack free test on Class 4, 5, 7 and 8 Low-Modulus Silicone and Polyurethane Sealants.

<b>Tack-Free Time – Class 4, 5, 7 and 8 Silicone and Polyurethane Sealants</b>	
<b>Step</b>	<b>Action</b>
1	Using the panel and mold, form a specimen 152 x 51 x 3.175 mm (6 x 2 x 1/8 in.).
2	Maintain test environment at 25 ± 1 °C (77 ± 2 °F) and 50 ± 5% relative humidity.
3	At 5 minute intervals, place a clean polyethylene strip, 25 x 101 mm (1 x 4 in.), on a fresh surface.
4	Set a 28.3 g weight on the strip for 5 ± 1 seconds.
5	After removing weight, gently pull strip off the specimen.
6	Do not remove the strip if it will not separate from the sealant.
7	When the strip pulls clean from the sealant, record the time.



## Section 5

### Non-volatile Content, Classes 5, 7, & 8

#### Apparatus

This is the apparatus required to determine the Non-Volatile Content of Class 5, 7 and 8 Low-Modulus Silicone and Polyurethane Sealants.

- ◆ Metal or other suitable flat bottom dish, diameter  $70 \pm 2$  mm ( $2.75 \pm 0.08$  in.) and height  $17 \pm 2$  mm ( $0.69 \pm 0.08$  in.)
- ◆ Forced draft oven maintained at  $70 \pm 1$  °C ( $158 \pm 2$  °F)
- ◆ Desiccator
- ◆ Balance, accurate to 0.001 g
- ◆ Spatula with 100 mm (4 in.) blade.

#### Procedure

This table details the steps for determining the Non-Volatile Content of Class 5, 7 and 8 Low-Modulus Silicone and Polyurethane Sealants.

Non-Volatile Content – Class 5, 7 and 8 Low-Modulus Silicone and Polyurethane Sealants	
Step	Action
1	Place $10 \pm 0.5$ g of the sealant in the tared metal or other suitable flat bottom dish.
2	Immediately weigh to the nearest 0.001 g.
3	Place in the forced draft oven maintained at $70 \pm 1.0$ °C ( $158 \pm 2$ °F) for $168 \pm 2$ hours.
4	Remove dish from oven.
5	Place in desiccator for 30 minutes.
6	Remove from desiccator.
7	Weigh to nearest 0.001 g.
8	Calculate the percent non-volatile content as shown under 'Calculations.'

#### Calculations

Use the following to calculate the percent non-volatile content.

$$\% \text{ non-volatile content} = 100 - \frac{(\text{Initial sample weight} - \text{Final sample weight}) \cdot 100}{\text{Initial sample weight}}$$

## Section 6

### Tensile Strength and 24-hour Extension Test

#### Apparatus for Preparing Test Specimen

This is the apparatus required to prepare test specimen for the bond, tensile strength, and 24 hour extension tests.

- ◆ Mortar blocks, 76 x 51 x 25 mm (3 x 2 x 1 in.), constructed according to ASTM D 1191
- ◆ Steel blocks, 76 x 51 x 6 mm (3 x 2 x 0.25 in.)
- ◆ 'Mold spacers'
- ◆ Paraffin
- ◆ Rubber bands
- ◆ Spatula with 100 mm (4 in.) blade.

#### Preparing Test Specimen

This table details the steps for preparing bond, tensile strength and 24 hour extension tests specimen.

<b>Preparing Test Specimen</b>	
<b>Step</b>	<b>Action</b>
1	Prepare five (5) specimens for testing.
2	Mold each specimen by placing a spacer between two mortar blocks to form a mold assembly, as shown in the 'Mold Assembly.'
3	If sealant is to be used with armor joints, use steel blocks and use a primer if so recommended by the manufacturer.
4	The spacer may be made from any suitable material. Each spacer should be coated with paraffin before assembling the mold.
5	Assemble the mold and secure with rubber bands.
6	Overfill the 51 x 13 x 13 mm (2 x 0.5 x 0.5 in.) mold void with sealant.
7	With a spatula strike off the excess sealant even with the block face.
8	Cure, condition and test specimen as described under 'Curing, Conditioning and Testing.'

## Section 7

### Curing, Conditioning and Testing

#### Apparatus

The following apparatus is required for curing, conditioning and testing specimen for bond, tensile strength and 24 hour extension.

- ◆ Water bath capable of being maintained at  $25 \pm 0.5$  °C ( $77 \pm 1$  °F)
- ◆ Forced draft oven capable of maintaining  $70 \pm 1$  °C ( $158 \pm 2$  °F)
- ◆ Extension machine capable of expanding specimen at a uniform rate of approximately 3.2 mm (0.125 in.) per hour
- ◆ Tensile machine capable of head movement at a uniform rate of approximately 13 mm (0.5 in.) per minute
- ◆ Environmental cabinet, capable of maintaining  $-29 \pm 1$  °C ( $-20 \pm 2$  °F) and chamber capacity to accommodate specimen extension portion of the extension machine
- ◆ Spacer blocks, 63 x 32 x 13 mm (2.5 x 1.25 x 0.5 in.).

#### Procedures for Class 4, Low-Modulus Silicone Sealant

- ◆ Specimen No. 1: Water Immersed

This table details the steps for performing the water immersion, tensile strength and 24-hour extension on Class 4, Low-Modulus Silicone Sealant.

<b>Water Immersed – Class 4, Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $72 \pm 2$ hours at $24 \pm 3$ °C ( $75 \pm 5$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Place in $25 \pm 0.5$ °C ( $77 \pm 1$ °F) water bath for $96 \pm 2$ hours.
4	Remove from water bath.
5	Condition at room temperature for 2 to 24 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 2: Oven Aged

This table details the steps for performing oven aging, tensile strength and 24-hour extension on Class 4, Low-Modulus Silicone Sealant.

<b>Oven Aged – Class 4, Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 72 ± 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Place in forced draft oven maintained at 70 ± 1 °C (158 ± 2 °F) for 96 ± 2 hours.
4	Remove from oven.
5	Condition at room temperature for 2 to 24 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen Nos. 3 and 4: Bond

This table details steps for performing the bond, tensile strength and 24-hour extension on Class 4, Low-Modulus Silicone Sealant.

<b>Bond – Class 4, Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 168 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Condition and perform bond tests according to ASTM D 3407.
4	Condition at room temperature for 2 to 24 hours.
5	Perform tensile strength to 150 percent extension and record results.
6	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 5: Initial Air Cured

This table details the steps for performing the tensile strength and 24-hour extension on Class 4, Low-Modulus Silicone Sealant.

<b>Initial Air Cured – Class 4, Low-Modulus Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 168 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Perform tensile strength to 150 percent extension and record results.
4	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

**Procedures for Classes 5 & 8, Low-modulus Silicone and Single Component Polyurethane Sealants**

◆ Specimen No. 1: Water Immersed

This table details the steps for performing the water immersion, tensile strength and 24-hour extension on Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants.

<b>Water Immersed – Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 144 ± 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Place in 25 ± 0.5 °C (77 ± 1 °F) water bath for 96 ± 2 hours.
4	Remove from water bath.
5	Condition at room temperature for 2 to 24 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 2: Oven Aged

This table details the steps for performing the oven aging, tensile strength and 24-hour extension on Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants.

<b>Oven Aged – Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 144 ± 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Place in forced draft oven maintained at 70 ± 1 °C (158 ± 2 °F) for 96 ± 2 hours.
4	Remove from oven.
5	Condition at room temperature for 2 to 24 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen Nos. 3 and 4: Bond

This table details the steps for performing the bond, tensile strength and 24-hour extension on Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants.

<b>Bond – Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants</b>	
<b>Step</b>	<b>Action</b>
1	Cure for 240 ± 2 hours at 24 ± 3 °C (75 ± 5 °F) and 55 ± 5% relative humidity.
2	Remove spacer.
3	Condition and perform bond tests according to ASTM D 3407.
4	Condition at room temperature for 2 to 24 hours.
5	Perform tensile strength to 150 percent extension and record results.
6	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 5: Initial Air Cured

This table details the steps for performing the tensile strength and 24-hour extension on Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants.

<b>Initial Air Cured – Classes 5 and 8, Low-Modulus Silicone and Single Component Polyurethane Sealants</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $240 \pm 2$ hours at $24 \pm 3$ °C ( $75 \pm 5$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Perform tensile strength to 150 percent extension and record results.
4	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

**Procedures for Class 7, Rapid Curing Silicone Sealant**

◆ Specimen No. 1: Water Immersed

This table details the steps for performing the water immersion, tensile strength and 24-hour extension on Class 7, Rapid Curing Silicone Sealant.

<b>Water Immersed – Class 7, Rapid Curing Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $48 \pm 2$ hours at $25 \pm 1$ °C ( $77 \pm 2$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Place in $25 \pm 0.5$ °C ( $77 \pm 1$ °F) water bath for $96 \pm 2$ hours.
4	Remove from water bath.
5	Condition at room temperature for 2 to 4 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 2: Oven Aged

This table details the steps for performing oven aging, tensile strength and 24-hour extension on Class 7, Rapid Curing Silicone Sealant.

<b>Oven Aged – Class 7, Rapid Curing Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $48 \pm 2$ hours at $25 \pm 1$ °C ( $77 \pm 2$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Place in forced draft oven maintained at $70 \pm 1$ °C ( $158 \pm 2$ °F) for $96 \pm 2$ hours.
4	Remove from oven.
5	Condition at room temperature for 2 to 4 hours.
6	Perform tensile strength to 150 percent extension and record results.
7	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen Nos. 3 and 4: Bond

This table details steps for performing the bond, tensile strength and 24-hour extension on Class 7, Rapid Curing Silicone Sealant.

<b>Bond – Class 7, Rapid Curing Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $140 \pm 2$ hours at $25 \pm 1$ °C ( $77 \pm 2$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Condition and perform bond tests according to ASTM D 3407.
4	Condition at room temperature for 2 to 4 hours.
5	Perform tensile strength to 150 percent extension and record results.
6	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

◆ Specimen No. 5: Initial Air Cured

This table details the steps for performing the tensile strength and 24-hour extension on Class 7, Rapid Curing Silicone Sealant.

<b>Initial Air Cured – Class 7, Rapid Curing Silicone Sealant</b>	
<b>Step</b>	<b>Action</b>
1	Cure for $140 \pm 2$ hours at $25 \pm 1$ °C ( $77 \pm 2$ °F) and $55 \pm 5\%$ relative humidity.
2	Remove spacer.
3	Perform tensile strength to 150 percent extension and record results.
4	Using the spacer blocks, hold at 150 percent extension for 24 hours and record results.

## Section 8

### Tensile Strength and Extension Tests

#### Procedure

This table details the steps for performing the tensile strength and 150% extension tests.

<b>Determining Tensile Strength and Extension Tests</b>	
<b>Step</b>	<b>Action</b>
1	Subject each specimen to tensile loading at an extension rate of $13 \pm 2.5$ mm ( $0.5 \pm 0.1$ in.) per minute until the joint has been extended 150% - joint spacing to 31.8 mm (1.25 in.).
2	Record the load at 150% extension.
3	Maintain the 150% extension for 24 hours using spacer blocks.
4	After 24 hours, examine specimen for adhesive or cohesive failure of the extended material.

NOTE: Specimens which fail during bond test (specimen nos. 3 and 4) shall be so noted and tensile testing shall not be performed.