

Method of Test for
TENSILE BOND STRENGTH OF EPOXY RESIN SYSTEMS
METHOD B – MOIST CURED METHOD (72 HOURS)

DOTD Designation: TR 706 (B)

I. Scope

- A. This method of test is intended to indicate the moisture sensitivity characteristics of an epoxy by measuring the moist-cured tensile bond strength of hardened cement mortar bonded with epoxy to plastic cement mortar.
- B. Reference Documents
 - 1. AASHTO M 235 – Epoxy Resin Adhesives
 - 2. AASHTO T 132 – Tensile Strength of Hydraulic Mortars
 - 3. AASHTO M 201 – Moist Cabinets Used in the Testing of Hydraulic Cements and Concretes
 - 4. AASHTO M 231 – Balances Used in the Testing of Materials
 - 5. ASTM C305 – Standard Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
 - 6. ASTM C778 – Standard Specification for Standard Sand

II. Apparatus

- A. Balance – A balance conforming to AASHTO M 231 (Class G2 minimum).
- B. Beaker – A 200 mL (minimum) graduated disposable plastic beaker.
- C. Mixing Tools – Stainless steel spatulas.
- D. Molds – Briquette molds conforming to AASHTO T 132.
- E. Cement Mortar Mixing Apparatus – Apparatus for mixing Portland cement mortar specimens, conforming to AASHTO T 132.
- F. Saw – A concrete sawing device that will produce clean and smooth cut faces on briquette halves.
- G. Testing Machine – A tensile testing machine with gripping device that conform to the requirements of AASHTO T 132.
- H. Thermometer – A thermometer conforming generally to the requirements for ASTM 1°F thermometers.
- I. Timer – A clock or stop watch capable of measuring minutes and seconds.
- J. Roughening or Texturing Equipment – A wire brush or sandblasting equipment capable of producing a lightly rough finish on hardened briquette halves.
- K. Moist Cabinet – A moist cabinet conforming to AASHTO M 201

III. Sample

A minimum of 1-gallon of each component of epoxy delivered in a sealed 1-gallon friction top metal can or two samples of injection cartridges with proper dispensing mechanism.

IV. Health Precautions

The following precautions shall be observed when handling epoxy components and cleaning fluids:

- A. Use appropriate protective clothing, including rubber or plastic gloves, and appropriate eye

protection such as safety glasses.

- B. If any epoxy or cleaning material should contact the skin, the material should be removed immediately with a dry cloth or paper towel, and the affected area should be washed thoroughly with soap and water.
- C. If any material should come in contact with the eyes, flush immediately with water and contact a physician.
- D. Adequate ventilation is necessary to prevent inhalation of vapors. Perform testing in a well-ventilated area under a vent hood.
- E. Observe all precautions as specified by the manufacturer before handling each material.

V. Sample Preparation

Note 1: Laboratory temperature, all equipment and samples during sample preparation shall be $73 \pm 2^{\circ}\text{F}$.

- A. Prepare three cement mortar briquette specimens according to AASHTO T 132.
- B. After a curing period of no less than seven (7) days, saw cut the three briquettes at the centerline perpendicular to the longitudinal axis.
- C. Lightly sandblast or wire brush the saw cut surfaces of the briquettes and use a dry brush to remove the loose surface material.
- D. Place the three (3) half-sections of the cured briquette specimens inside three (3) molds so that the remaining halves of the molds can be filled with fresh Portland cement mortar.
- E. Prior to mixing, condition the individual epoxy components and any equipment to be used to the conditioned test temperature.
- F. Thoroughly stir each individual epoxy components for at least one minute immediately before measuring the sample.
- G. Use separate sampling tools when obtaining and mixing the desired quantities of each component to avoid contamination. Combine and mix sufficient quantities of components "A" and "B" in accordance with the manufacturer's recommendations, such that a minimum sample quantity of 50 mL is obtained. Unless the manufacturer recommends a mixing time, mix the components together in the disposable beaker for at least three (3) minutes.
- H. Apply the mixed adhesive to the saw cut end of each hardened briquette half section and allow the adhesive to set until a tacky state is attained.

Note 2: In no case shall the setting period exceed the specified gel time, as determined by AASHTO M 235.

- I. Fill the remaining halves of the molds with fresh Portland cement mortar prepared in accordance with AASHTO T 132
- J. Allow the specimens to cure for 24 hours in the moist cabinet at a relative humidity of not less than 95% and at a temperature of $73.4 \pm 3^{\circ}\text{F}$. Remove the specimens from the molds and return the bonded specimens to the moist cabinet for an additional two (2) days of moist curing.

VI. Procedure

- A. After the elapsed cure period, carefully center each briquette in the gripping devices of the testing machine and apply a continuous load at a rate of 600 ± 25 lbf/min.
- B. Record the maximum load indicated by the testing machine (L) to the nearest pound (lbf).

VII. Calculations

A. Calculate the tensile bond strength of each specimen using the following formula:

$$S = \frac{L}{1in.^2}$$

Where:

S = Tensile Bond Strength, (psi)

L = Maximum Load Indicated by Testing Machine, (lbf)

Example:

L = 365 lbs

$$S = \frac{365 \text{ lbs}}{1 \text{ in}^2} = 365 \text{ psi}$$

VIII. Report

A. Complete Identification of the Material Tested, including:

1. Manufacturer's Code
2. Product Name
3. Source
4. Mixing Ratio
5. Batch/Lot Numbers
6. Type
7. Grade
8. Class

B. Conditioning Procedure

C. Conditions in Test Room

D. Number of Specimens Tested

E. Load Rate

F. Maximum Load Indicated by Testing Machine

G. Individual Tensile Strength (S) of Each Specimen to the Nearest 5 psi

H. Average Tensile Bond Strength of a Set of Specimens to the Nearest 5 psi

I. Note the Mode of Failure:

1. In the Mortar
2. In the Adhesive
3. In the Mortar/Adhesive Interface

J. Defects in Specimens

K. Date and Time of the Mix

Date and Time of the Break

Note 3: *Should any of the bonded test specimens fail in the mortar at a strength less than the required, a retest shall be conducted for that specimen.*

Note 4: *Normal Testing Time is eight (8) Days.*