DMS-4655

Concrete Repair Materials

Effective Date: December 2023

1. DESCRIPTION

This Specification governs the pre-qualification procedure, quality assurance, material requirements, and packaging requirements of inorganic cementing material for concrete repair. DMS-6170 covers polymeric materials and Item 431, "Pneumatically Placed Concrete," covers pneumatically placed materials.

The Concrete Repair Manual provides repair recommendations for different distress and structure types.

2. UNITS OF MEASUREMENTS

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.

3. MATERIAL PRODUCER LIST

The Materials and Tests Division (MTD) maintains the Material Producer List (MPL) of all materials conforming to the requirements of this Specification. Materials appearing on the MPL, entitled "Concrete Repair Materials," require no further sampling and testing before use, unless deemed necessary by the Project Engineer or MTD. Materials listed on the MPL have been tested as received and do not include optional additives.

4. BIDDERS' AND SUPPLIERS' REQUIREMENTS

The Department will only purchase or allow on projects those products listed by producer and product code or designation shown on the MPL.

Use of pre-qualified product does not relieve the Contractor of the responsibility to provide product that meets this Specification. The Department may inspect or test material at any time and reject any material that does not meet the specifications.

5. PRE-QUALIFICATION PROCEDURE

5.1. **Pre-Qualification Request.** Submit a written request on company letter head for evaluation under DMS-4655 to DMS_Prequal@txdot.gov.

Include the following information in the request:

- company name;
- physical and mailing addresses;
- contact person, phone numbers, and email address;
- repair material classification (Neat/Extended, Type A/B/C/D) listed under Article 7., "Repair Material Classifications"; and
- independent laboratory test report from a laboratory audited and inspected by the Cement and Concrete Reference Laboratory containing test results and certifying compliance of the repair material with this

Specification. Test reports older than 1 yr. must be accompanied by a notarized certification stating that there has been no alteration of the product since originally tested by the independent laboratory;

- technical data sheets typically accompanying product with printed instructions for mixing and application and shelf life; and
- list of all possible package types and available sizes.

5.2. **Pre-Qualification Sample.** After reviewing the pre-qualification request, MTD will request a sample of adequate size to complete testing for the classifications being sought. Ship samples with packaging representative of that supplied to the field to the Materials and Tests Division MTD, Laboratory Building, 6230 E. Stassney Ln., Austin, TX 78744.

Include the following with the sample:

- current safety data sheet (SDS) that complies with OSHA Hazard Communication Standard 29 CFR 1910.1200;
- producer certification and lot number for submitted sample;
- producer certification that repair material contains no added chlorides;
- technical data sheets typically accompanying product with printed instructions for mixing, application, shelf life and acceptable water dosage (products will always be evaluated at the maximum acceptable water dosage listed on the product label or technical data sheet, whichever is greater);
- statement regarding whether material is used neat or extended—if extended, state the recommended aggregate content, nominal maximum aggregate size and submit all additional material needed, with sourcing information, except water;
- curing protocol (recommended or required) for field application; and
- statement regarding whether bonding agent is required for application. If required, submit bonding agent and a current SDS for the bonding agent. The Department's standard practice is to require installation of repair material over saturated-surface dry (SSD) substrates rather than utilizing bonding agents.

Submit all materials for pre-qualification at no cost to the Department.

5.3. **Evaluation.** MTD will notify prospective bidders and suppliers after completion of material evaluation.

5.3.1. **Qualification.** If approved for Department use, MTD will add the repair material to the MPL.

Report changes in the composition or in the manufacturing process of any material to MTD. Significant changes reported by the producer, as determined by MTD, may require a re-evaluation of performance. The Department reserves the right to conduct any tests deemed necessary to identify a pre-qualified material and determine if there is a change in the composition, manufacturing process, or quality that may affect its durability or performance; inclusive of tests not listed in this Specification. In case of variance, the Department's tests will govern.

5.3.2. **Failure.** Products not qualified under this Specification may not furnish materials for use on Department projects.

Producers failing to qualify may submit a request for re-evaluation after 12 mo. have elapsed from the date of the original request. MTD may modify this time limit at its discretion. In the request for re-evaluation, document the cause for failing to meet the requirements of this Specification and corrective action taken. Include an independent laboratory test report from a laboratory audited and inspected by the Cement and Concrete Reference Laboratory (CCRL) containing test results and certifying compliance of the corrected material with this Specification.

The Department normally bears the costs of sampling and testing; however, the producer will bear the costs associated with materials failing to conform to the requirements of this Specification and any re-evaluation testing. MTD will assess this cost at the time of testing and amounts due will be billed to the producer.

6. QUALITY ASSURANCE

The Department reserves the right to conduct random sampling and testing of pre-qualified materials to verify performance and specification compliance and to perform random audits of documentation. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse. The Department may also request samples for evaluation at any time from the producer.

6.1. **Periodic Evaluation.** The Department will conduct a periodic evaluation on approved products every three years. Approved products must meet the requirements of Article 8, "Material Requirements", as applicable, to maintain approved status. The Department reserves the right to conduct any or all of the tests listed in Article 8., "Material Requirements," for the approved type during a periodic evaluation.

6.2. **Failure**. Failure of materials to comply with the requirements of this Specification as a result of periodic evaluation may be cause for removal of those materials from the MPL. In case of variance, the Department's tests will govern.

6.3. **Disqualification.** Causes for disqualification and removal from the MPL may include, but are not limited to:

- falsification of documentation,
- producer fails to report any change in material composition or manufacturing process to MTD,
- material fails to meet the requirements of this Specification as a result of periodic evaluation,
- producer does not provide the department with samples for periodic evaluations when requested
- producer has unpaid charges for failing samples.

MTD will remove disqualified producers from the MPL and will not allow submission of material for re-qualification for 12 mo. from the date of notification, at the Department's discretion.

6.4. **Re-Qualification.** Once the disqualification period established by MTD has elapsed, producers disqualified and removed from the MPL may begin the re-qualification process by submitting a request in accordance with Section 5.1., "Pre-Qualification Request," including additional documentation identifying the cause for disqualification and corrective action taken. The re-qualification process will then follow all subsequent sections of Article 5., "Pre-Qualification Procedure."

The Department normally bears the costs of sampling and testing; however, the disqualified producer will bear the costs associated with re-qualification. MTD will assess this cost at the time of re-qualification and amounts due will be billed to the producer.

7. REPAIR MATERIAL CLASSIFICATIONS

A concrete repair material may be pre-qualified for multiple repair material classifications if desired. The target compressive strengths listed in this article are intended only to distinguish between the different classifications. See Article 8., "Material Requirements," for the full material requirements for each classification.

7.1. **Definitions.**

7.1.1. **Neat.** Material with 100% of the final mixed product passing the No.8 sieve (2.36 mm) sieve.

7.1.2. **Extended.** Material with aggregate of the final mixed product retained on the 3/8-in. (9.53 mm) sieve. Aggregates must be pre-mixed with the dry product by the producer, or the producer must list the recommended aggregate content in the product technical data sheet.

7.2. **Classifications.** Products may only be classified as a single type.

7.2.1. **Type A—Rapid Repair Materials.** These materials must attain 3,000 psi compressive strength in 6 hr., 4,000 psi compressive strength in 3 days, and may be either neat or extended.

Note 1—Type A products are appropriate for horizontal repairs of pavement and bridge decks as well as form-and-pour applications.

7.2.2. **Type B—Ultra-Rapid Repair Materials.** These materials must attain 2,000 psi compressive strength in 2 hr., 3,000 psi compressive strength in 4 hr., and may be either neat or extended. Type B products are generally only allowed when shown on the plans or approved by the Engineer.

Note 2—Type B products are appropriate for horizontal repairs of pavement and bridge decks as well as form-and-pour applications.

7.2.3. **Type C—Vertical or Overhead Repair Materials**. These materials, while not necessarily rapidly setting, are typically used for vertical or overhead repairs and must be trowel-applied or pneumatically-placed, neat materials.

7.2.4. **Type D—Standard (Non-Rapid) Repair Materials.** These non-rapid materials may be either neat or extended. Rapid or ultra-rapid materials that use admixtures or material additions to extend the working time are not considered standard (non-rapid) repair materials.

Note 3—Type D products are appropriate for horizontal repairs of pavement and bridge decks as well as form-and-pour applications.

8. MATERIAL REQUIREMENTS

8.1. **General Requirements.** Addition of chlorides is not allowed. The product must perform satisfactory during mixing and molding. Unsatisfactory performance includes, but is not limited to, excessive bleeding, presence of deleterious material in the dry mix, inability to mix at recommended mixture proportions, or segregation.

8.2. **Manifestly Faulty Specimens.** Each test specimen will be inspected after demolding, before testing, and after testing for voids, cold joints, segregation, and cracking not related to physical testing. Test specimens determined to be manifestly faulty will be discarded and not tested. When more than one test specimen for a given test at a given age is discarded, the entire test will be discarded and repeated.

8.3. **Type A—Rapid Repair Materials.**

Table 1
Rapid Repair Material Requirements

Property	Requirement	Test Method[1]
Min Compressive Strength, psi	3,000 at 6 hr. 4,000 at 3 days	ASTM C39[2]
Max Shrinkage, %	0.07 at 28 days	ASTM C157[3]
Min Splitting Tensile Strength, psi	400 at 3 days	ASTM C496
Coefficient of Thermal Expansion, microstrain /°F,	Informational[4]	Tex-428-A
Modulus of Elasticity, ksi	Informational[4]	ASTM C469
Min Bond Strength, psi	1,750 at 3 days	ASTM C882[5]

1. Unless otherwise specified by the producer on the technical data sheet, cure all test specimens in covered molds in the laboratory.
2. Specimen dimensions are as follows: 3 × 6" cylinders for neat materials; 4 × 8" cylinders for extended materials.
3. Modified as follows:
   - Specimen dimensions are as follows: 1 × 1 × 11.25" prisms for neat materials; 3 × 3 × 11.25" prisms for extended materials.
   - Demold and determine initial length reading at 6 ± 1/4 hr.
   - Store specimens in a drying room; at no point should specimens be placed in water after they are demolded.
   - Take readings at 1, 4, 7, 14, and 28 days.
4. There are no property requirements for this test. MTD will test for this property and report it on the MPL for material selection purposes.
5. Standard substrate concrete used in test procedure must have the following properties:
   - Max Water-Cementitious Material Ratio: 0.45
   - Max Nominal Aggregate Size: 3/4"
   - Compressive Strength at 28 days: 5,000–6,000 psi

   Modified as follows:
   - Preparation of slant face surface of substrate concrete includes the following: sand blast the surface to expose aggregate surface to a uniform depth and maintain at saturated surface dry (SSD) condition before casting repair material.
   - Use one of the following methods when casting repair material onto the substrate surface.
     - If required by the manufacturer, apply the bonding system as directed.
     - If a bonding system is not required, maintain the substrate at SSD and apply a scrub coat of repair material to the substrate surface.
     - If directed by the manufacturer, cast the repair material directly onto the prepared surface.
   - Specimen ends may be ground plane within 0.002 in before testing.

8.4. **Type B—Ultra-Rapid Repair Materials.**

Table 2
Ultra-Rapid Repair Material Requirements

Property	Requirement	Test Method[1]
Min Compressive Strength, psi	2,000 at 2 hr. 3,000 at 4 hr.	ASTM C39[2]
Max Shrinkage, %	0.07 at 28 days	ASTM C157[3]
Min Splitting Tensile Strength, psi	300 at 4 hr.	ASTM C496
Coefficient of Thermal Expansion, micro strain /°F	Informational[4]	Tex-428-A
Modulus of Elasticity, ksi	Informational[4]	ASTM C469
Min Bond Strength, psi	1,750 at 24 hr.	ASTM C882[5]

1. Unless otherwise specified by the producer on the technical data sheet, cure all test specimens in covered molds in the laboratory.
2. Specimen dimensions are as follows: 3 × 6" cylinders for neat materials; 4 × 8" cylinders for extended materials.
3. Modified as follows:
   - Specimen dimensions are as follows: 1 × 1 × 11.25" prisms for neat materials; 3 × 3 × 11.25" prisms for extended materials.
   - Demold and determine initial length reading at 2 ± 1/4 hr.
   - Store specimens in a drying room; at no point should specimens be placed in water after they are demolded.
   - Take readings at 1, 4, 7, 14, and 28 days.
4. There are no property requirements for this test. MTD will test for this property and report it on the MPL for material selection purposes.
5. Standard substrate concrete used in test procedure has the following properties:
   - Max Water/Cementitious Ratio: 0.45
   - Max Nominal Aggregate Size: 3/4"
   - Compressive Strength at 28 days: 5,000–6,000 psi

   Modified as follows:
   - Preparation of slant face surface of substrate concrete includes the following: sand blast the surface to expose aggregate surface to a uniform depth and maintain at saturated surface dry (SSD) condition before casting repair material.
   - Use one of the following methods when casting repair material onto the substrate surface.
     - If required by the manufacturer, apply the bonding system as directed.
     - If a bonding system is not required, maintain the substrate at SSD and apply a scrub coat of repair material to the substrate surface.
     - If directed by the manufacturer, cast the repair material directly onto the prepared surface.
   - Specimen ends may be ground plane within 0.002 in before testing.

8.5. **Type C—Vertical or Overhead Repair Material.**

Table 3
Vertical or Overhead Repair Material Requirements

Property	Requirement	Test Method[1,2]
Min Compressive Strength, psi.	3,600 at 28 days	ASTM C39[3]
Max Length Change, %	0.07 at 28 days	ASTM C157[4]
Min Splitting Tensile Strength, psi	350 at 28 days	ASTM C496
Coefficient of Thermal Expansion, micro strain /°F	Informational[5]	Tex-428-A
Modulus of Elasticity, ksi	Informational[5]	ASTM C469
Min Bond Strength, psi	1,750 at 28 days	ASTM C882[6]

1. Unless otherwise specified by the producer on the technical data sheet, cure all test specimens in covered molds in the laboratory.
2. Test specimens may be vibrated, rodded, and tapped on a solid surface to achieve satisfactory consolidation of the material within the molds.
3. Specimen dimensions are 3 × 6" cylinders.
4. Modified as follows:
   - Specimen dimensions are 1 × 1 × 11.25" prisms.
   - Demold and determine initial length reading at 24 ± 1/4 hr.
   - Store specimens in a drying room; at no point should specimens be placed in water after they are demolded.
   - Take readings at 4, 7, 14, and 28 days.
5. There are no property requirements for this test. MTD will test for this property and report it on the MPL for material selection purposes.
6. Standard substrate concrete used in test procedure musthave the following properties:
   - Max Water-Cementitious Material Ratio: 0.45
   - Max Nominal Aggregate Size: 3/4"
   - Compressive Strength at 28 days: 5,000–6,000 psi

   Modified as follows:
   - Preparation of slant face surface of substrate concrete includes the following: sand blast the surface to expose aggregate surface to a uniform depth and maintain at saturated surface dry (SSD) condition before casting repair material.
   - Use one of the following methods when casting repair material onto the substrate surface:
     - If required by the manufacturer, apply the bonding system as directed.
     - If a bonding system is not required, maintain the substrate at SSD and apply a scrub coat of repair material to the substrate surface.
     - If directed by the manufacturer, cast the repair material directly onto the prepared surface.
   - Specimen ends may be ground plane within 0.002 in before testing.

8.6. **Type D—Standard (Non-Rapid) Repair Materials.**

Table 4
Standard Repair Material (Non-Rapid) Requirements

Property	Requirement	Test Method[1]
Min Setting Time, minutes	60 initial 180 final	ASTM C403
Min Compressive Strength, psi	4,000 at 28 days[3]	ASTM C39[2]
Max Shrinkage, %	0.07 at 28 days	ASTM C157[3]
Min Splitting Tensile Strength, psi	500 at 28 days	ASTM C496
Coefficient of Thermal Expansion, micro strain /°F	Informational[4]	Tex-428-A
Modulus of Elasticity, ksi	Informational[4]	ASTM C469
Min Slant Shear, psi	2,500 at 28 days	ASTM C882[5]
Min Resistivity, kΩ-cm	10.4 at 28 days	ASTM C1876[6]

1. Unless otherwise specified by the producer on the technical data sheet, standard cure all specimens.
2. Specimen dimensions are as follows: 3 × 6" cylinders for neat materials; 4 × 8" cylinders for extended materials.
3. Modified as follows:
   - Specimen dimensions are 1 × 1 × 11.25" prisms for neat materials; 3 × 3 × 11.25" prisms for extended materials.
   - Demold and determine initial length reading at 24 ± 1/2 hr.
   - Store specimens in a drying room; at no point should specimens be placed in water after they are demolded.
   - Take readings at 4, 7, 14, and 28 days.
4. There are no property requirements for this test. MTD will test for this property and report it on the MPL for material selection purposes.
5. Standard substrate concrete used in test procedure has the following properties:
   - Max Water/Cementitious Ratio: 0.45
   - Max Nominal Aggregate Size: 3/4"
   - Compressive Strength at 28 days: 5,000–6,000 psi

   Modified as follows:
   - Preparation of slant face surface of substrate concrete includes the following: sand blast the surface to expose aggregate surface to a uniform depth and maintain at saturated surface dry (SSD) condition before casting repair material.
   - Use one of the following methods when casting repair material onto the substrate surface:
     - If required by the manufacturer, apply the bonding system as directed.
     - If a bonding system is not required, maintain the substrate at SSD and apply a scrub coat of repair material to the substrate surface.
     - If directed by the manufacturer, cast the repair material directly onto the prepared surface.
   - Specimen ends may be ground plane within 0.002 in before testing.
6. Alternatively, use AASHTO T259 to determine the resistivity to chloride ion penetration when the product contains additives that may inhibit electrical resistance testing. The limit shall be 0.09% by mass in the top 1".

9. PACKAGING AND LABELING

Prepackage material in plastic lined or coated bags or other suitable moisture-resistant container. Repair material packaging must include the following:

- producer name,
- product name,
- date of manufacturer,
- lot number, and

- mixing, placing, and curing instructions.

10. ARCHIVED VERSIONS

Archived versions are available.