



SECTION 1039

EPOXY RESIN MATERIAL

SECTION 1039.10 TYPE II EPOXY.

1039.10.1 Scope. This specification covers epoxy resin to be used to bond plastic concrete or mortar to hardened concrete or mortar.

1039.10.2 General Requirements. The epoxy shall be furnished as a system in accordance with the requirements of ASTM C 881, Type II, Grade 2, Class B or C.

1039.10.3 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report showing specific test results from an independent laboratory in accordance with all requirements of these specifications. The certified test report shall contain the manufacturer's name, brand name of material, lot tested, date of manufacture and ratio of components. In addition, the manufacturer shall submit a one-quart sample of each component, A and B, for laboratory testing accompanied by a technical data sheet and an MSDS. With approval from the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of concrete bonding compounds. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

1039.10.4 Acceptance. To obtain final acceptance of this material, the manufacturer shall furnish certification to the engineer at the destination that the material supplied is in accordance with all requirements specified and stating that the material is the same system and is identically formulated to the material tested for manufacturer and brand name approval.

SECTION 1039.20 TYPE III EPOXY.

1039.20.1 Scope. This specification covers epoxy to be used in the grouting of dry cracks, in epoxy mortar for patching concrete and in epoxy mortar surface leveling.

1039.20.2 General Requirements. The epoxy shall be furnished as a system in accordance with the requirements of ASTM C 881, Type III, Grade 1, Class B or C.

1039.20.3 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report showing specific test results from an independent laboratory in accordance with all requirements of these specifications. The certified test report shall contain the manufacturer's name, brand name of material, lot tested, date of manufacture and ratio of components. In addition, the manufacturer shall submit a one-quart sample of each component, A and B, for laboratory testing accompanied by a technical data sheet and an MSDS. With approval from the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of concrete bonding compounds. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

1039.20.4 Acceptance. To obtain final acceptance of this material, the manufacturer shall furnish a certification to the engineer at destination certifying that the material supplied is in accordance with all requirements specified and stating that the material is the same system and is identically formulated to the material tested for manufacturer and brand name approval.

SECTION 1039.30 EPOXY OR POLYESTER BONDING AGENTS FOR DOWELS.

1039.30.1 Scope. This specification covers a multi-component epoxy or polyester bonding agent to be used in anchoring epoxy coated dowel bars in concrete for pavement repair.

1039.30.2 General Requirements. Epoxy or polyester bonding agents for anchoring epoxy coated dowel bars shall be furnished as a multi-component system. The system shall include automatic mixing, whether in cartridge or bulk form. The component ratios shall be shown on the label of each cartridge or bulk container.

1039.30.3 Properties. The epoxy or polyester bonding agent shall exhibit good bonding properties between the epoxy coated dowel bar and the existing concrete and shall cure in accordance with the manufacturer's recommendation. Bonding agents, when initially mixed, shall have a viscosity, which prevents flow from a horizontal hole. When tested in accordance with MoDOT Test Method TM 49, the minimum pull-out load shall be 8,100 pounds.

1039.30.4 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report from an independent laboratory showing specific test results in accordance with all requirements of this specification. The certified test report shall contain the manufacturer's name, brand name of material, lot tested, date of manufacture, ratio of components by volume and system tested. In addition, the manufacturer shall submit to Construction and Materials a sample representing the system for laboratory testing accompanied by a technical data sheet, an MSDS and any special installation instructions relative to the system being submitted, including recommended curing time. With approval from the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of bonding agents for dowels. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

1039.30.5 Acceptance. To obtain final acceptance of this material, the manufacturer shall furnish certification to the engineer at the destination that the material supplied is in accordance with all requirements specified and stating that the material supplied is the same system and is identically formulated to the material tested for manufacturer and brand name approval.

SECTION 1039.40 EPOXY BONDING AGENTS FOR RESIN ANCHOR SYSTEMS.

1039.40.1 Scope. This specification covers a multi-component epoxy bonding agents to be used in anchoring steel components in concrete for structures.

1039.40.2 General Requirements. The epoxy shall be furnished as a system in accordance with the requirements of ASTM C 881, Type IV, and Grade 3 and as described herein. When a cartridge dispensing system is used the epoxy shall have a gel time as stated in ASTM C 881 paragraph 5.2.

1039.40.3 Pull Test. The epoxy bonding agent shall exhibit good bonding properties between the anchored product and the existing concrete and shall cure in less than 24 hours or manufacturer's recommendation. For acceptance on the qualified list, Resin Anchor Systems shall be tested in accordance with MoDOT Test Method TM 74. The ultimate minimum pull-

out load shall be in accordance with the following table. When tested in accordance with ASTM E 488 the minimum embedment for each size anchor shall be determined and the minimum ultimate pullout loads shall be in accordance with the following table:

Pull-Out Specification Requirements	
Diameter of Threaded Rod or Reinforcing Bar	Minimum Ultimate Pullout Strength
1/2"	9,800 lbs
5/8"	15,500 lbs
3/4"	20,400 lbs
7/8"	27,500 lbs
1"	33,600 lbs

1039.40.4 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report from an independent laboratory showing specific test results in accordance with all requirements of this specification. The certified test report shall contain the manufacturer's name, brand name of material, lot tested, date of manufacture, bar or rod size tested, embedment depth and ratio of components. In addition, the manufacturer shall submit a one-quart sample of each component, A and B, for laboratory testing accompanied by a technical data sheet and a material safety data sheet. With approval from the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of Epoxy Bonding Agents for Resin Anchor Systems. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

1039.40.5 Acceptance. To obtain final acceptance of this material, the manufacturer shall furnish certification to the engineer at the destination that the material supplied is in accordance with all requirements specified and stating that the material is the same system and is identically formulated to the material tested for manufacturer and brand name approval.

SECTION 1039.50 SAND FOR EPOXY MORTAR.

1039.50.1 Scope. This specification covers sand for use in epoxy mortar for the repairing of concrete surfaces. The epoxy material used in epoxy mortar shall be Type III epoxy in accordance with [Sec 1039.20](#).

1039.50.2 Properties. Sand for mortar shall be a quartzite sand, Ottawa sand or equal. The sand shall be clean and dust free. The maximum moisture content shall be 2 percent. The gradation shall be in accordance with the following requirements:

Gradation Requirements	
Sieve Size	Percent Passing by Weight
No. 16	100
No. 30	97-100
No. 50	5-35
No. 100	0-2
No. 200	0-0.4

1039.50.3 Acceptance. The manufacturer shall furnish certification to the engineer at the destination that the material supplied is in accordance with all requirements of this specification. Acceptance will be based on certification and testing.

SECTION 1039.60 EPOXY POLYMER CONCRETE OVERLAY.

1039.60.1 Scope. This specification covers an epoxy concrete overlay system consisting of an epoxy resin material and aggregate for use on bridge deck surfaces.

1039.60.2 Epoxy Resin Material. The infrared spectrum for each component of the epoxy-resin material shall essentially match that of the standard infrared spectrum for the particular component as specified in AASHTO T 237, Sections 4 and 5. The epoxide equivalent for Component A shall not exceed 270. The mixed epoxy shall meet the following requirements:

Epoxy Resin Requirements	
Property	Specific Value
Pot life, 75 F, minutes	10 - 55
Tensile strength, 75 F, 7 Days, psi, min.	1500
Tensile elongation, 75 F, percent, min.	20
Water absorption, percent, max.	0.8
Compressive strength, 4 hr., psi, min.	1000
Compressive strength, 48 hr. wet, psi, min.	4000
Ash content, percent, max	0.5
Rotational Viscosity, 75 F, Spindle 3, 60 rpm, Poise	7 - 25
Volatile Content, percent, max.	3.0
Thermal Shear	No shearing, shrinkage, expansion or scaling.

1039.60.2.1 Classes. Epoxy resin shall be formulated for use at specific temperatures as specified in ASTM C 881. The controlling temperature shall be that of the hardened concrete surface to which the overlay is applied. Where unusual curing rates are desired and upon the approval from the engineer, a class of epoxy may be used at a temperature other than that for which the epoxy is normally intended.

1039.60.2.2 Packaging. Containers shall be identified as "Component A--Contains Epoxy Resin" and "Component B--Contains Hardener" and shall show the type, class and mixing directions. Each container shall be marked with the name of the manufacturer, class, batch, or lot number, date of packaging, date of shelf life expiration, pigmentation, if any, manufacturer, and the quantity contained in pounds and gallons.

1039.60.3 Aggregate for Epoxy Polymer Concrete Overlay. Aggregate shall be bauxite, crushed porphyry, aluminum oxide, flint chat or other similarly hard, durable, dry aggregates with less than 0.2 percent moisture. Aggregate shall be in accordance with the following gradation:

Aggregate Requirements	
Sieve Size	% Passing By Weight
# 4	100
# 20	0-5
# 200	0-1.0

1039.60.3.1 Lead Content. Aggregate produced as a by-product from lead or zinc mining operations shall not have a total lead content greater than 4,500 ppm, as determined by EPA Method 3050A, "Acid Digestion of Sediments, Sludges and Soils. Suppliers of this aggregate shall provide certification to the engineer for each shipment that the total lead content of the aggregate does not exceed this value, and attach a typical test report from the same source no older than 12 months prior to the shipment.

1039.60.3.2 Aggregate Recommendation. For each contract, the epoxy supplier shall supply a letter to the engineer specifically recommending the use of a designated aggregate and source, which has been previously approved by Construction and Materials.

1039.60.4 Overlay System. The overlay system shall not exhibit shearing, shrinkage, expansion or scaling.

1039.60.5 Test Methods. Tests will be performed in accordance with the following methods:

Test Methods	
Rotational Viscosity	ASTM D 2393 Model LVT Brookfield viscometer
Epoxy equivalent	MoDOT Test Method TM 73
Volatile content ^a	ASTM D 1259, Method B, for mixed system
Filler content	MoDOT Test Method TM 73
Ash content	ASTM D 482
Pot life	AASHTO T 237
Tensile strength	ASTM D 638
Compressive strength	ASTM C 881
Water absorption	ASTM D 570
Thermal Shear	MoDOT Test Method TM 72

^aSample cured 4 days at room temperature and weighed on a previously weighed metal foil.

1039.60.6 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report showing specific test results in accordance with all requirements of this specification. The certified test report shall include the manufacturer's name, brand name of material, lot tested, date of manufacture, ratio of components by volume and system tested. In addition, the manufacturer shall submit to Construction and Materials a sample representing the system for laboratory testing accompanied by a technical data sheet, an MSDS and any special installation instructions relative to the system being submitted. Upon approval of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of epoxy resin material for polymer concrete overlay. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates non-conformity with any of the requirements herein specified.

1039.60.7 Product History. The overlay system shall have a proven record of a minimum of two years on similar bridge decks within the United States. A list including the location, the name of the agency involved with the project, and a name and phone number of a contact person with that agency, shall be provided for each location used as evidence of satisfactory use.

1039.60.8 Acceptance. The manufacturer shall furnish certification to the engineer at the destination that the material supplied is in accordance with all requirements specified and stating that the material supplied is the same system and is identically formulated to the material tested for manufacturer and brand name approval. Acceptance will be based on certification and testing.

SECTION 1039.70 POLYMER CONCRETE.

1039.70.1 Scope. This specification covers polymer concrete consisting of a fast setting epoxy based solid that may contain aggregate for use at bridge expansion joints.

1039.70.2 General Requirements. The polymer concrete shall be resilient, self-adhering, water tight and shall withstand and remain bonded to the surrounding material under repeated impact and thermal cycling. The polymer concrete shall not flow or become tacky at temperatures up to 130 F, shall be resistant to ultraviolet radiation, petroleum products and abrasion, and shall be capable of curing at all temperatures above 50 F. Mixing and placement shall be in accordance with the manufacturer's recommendations.

1039.70.2.1 The combined liquid components with no aggregate added shall be in accordance with the following requirements:

Epoxy Requirements	
Property	Specific Value
Mixing Ratio, by Volume	1:1
Viscosity (ASTM D 2393), Poises, Spindle 2, 30 rpm, 25 C ± 2 C	9-20
Color	Black
Gel Time (AASHTO M-200-73), minutes	25-50
Elongation (ASTM D 638 ^a), percent	45-55
Tensile Strength (ASTM D 638 ^a), psi, min.	900
Shore D Hardness (ASTM D 2240), 77 F	45-75

^aTest Method Type 1, Molded Specimens, 0.25 inches thickness

1039.70.2.2 The cured polymer concrete including aggregate, which shall be supplied by the manufacturer, shall be in accordance with the following requirements:

Polymer Concrete Requirements	
Property	Specific Value
Compression strength (ASTM C 579), psi min. at 24 hours	2,500
Bond Shear Strength (ASTM C 882), psi	700
Abrasion Resistance (ASTM C 501), Wear Index (Taber H-22), max.	1.0
Compressive Stress (OK/OHD L-6), psi	350
Resilience (OK/OHD L-6), percent	70

1039.70.3 Manufacturer and Brand Name Approval. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report from an independent laboratory showing specific test results in accordance with all requirements of this specification. The certified test report shall contain the manufacturer's name, brand name of material, lot tested, date of manufacture and ratio of components. In addition, the manufacturer shall submit a one-quart sample of each component, A and B, for laboratory testing accompanied by a technical data sheet and a material safety data sheet. With approval from the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on a qualified list of polymer concretes. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

1039.70.4 Acceptance. To obtain final acceptance of this material, the manufacturer shall furnish certification to the engineer at destination certifying that the material supplied is in accordance with all requirements specified and stating that the material is identically formulated to the material tested for manufacturer and brand name approval.