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SUPERSEDING
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FEDERAL SPECIFICATION

ADHESIVE, EPOXY, SAND-FILLED (FOR REPAIRING, SEALING, AND GROUTING CONCRETE)

The General Services Administration has authorized the use of this federal specification for all federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers multiple component, sand-filled, epoxy resin-based adhesive systems used in repairing, sealing, and grouting either damp or dry concrete.

1.2 Classification. The adhesives shall be of the following types and classes as specified (see 6.2):

Type I - A three-part epoxy polymer concrete kit consisting of separate components: a low viscosity epoxy resin, curing agent, and aggregate filler. This type shall be of a screedable or trowelable consistency for horizontal or flat applications.

Type II - A three part epoxy polymer concrete kit consisting of separate epoxy resin, curing agent, and aggregate filler. This type shall be a non-sag consistency for vertical or overhead applications.

Type III - A low-viscosity epoxy primer.

Class 1 - For application temperatures of 60 to 120 deg. F (15 to 49 deg. C).

Class 2 - For application temperatures of 40 to 120 deg. F (4 to 49 deg. C).

Class 3 - For application temperatures of 0 to 120 deg. F (-18 to 49 deg. C).

Class 4 - For application temperatures of -40 to 10 deg. F (-40 to -12 deg. C).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Standards:

FED-STD-313 - Preparation and Submission of Material Safety Data Sheets (MSDS)
FED-STD-123 - Marking for Shipment (Civil Agencies)

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 - Military Standard for Shipment and Storage

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available from: General Services Administration, Federal Supply Service Bureau, Specification Section (3FBP-W), 470 East L'Enfant Plaza S.W., Suite 8100, Washington, DC 20407.)

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

Laws and Regulations:

49 CFR 170-179 - Hazardous Materials Regulations

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for its issuance.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

C 33 - Standard Specification for Concrete Aggregate
C 150 - Standard Specification for Portland Cement
C 672 - Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
C 882 - Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete
C 884 - Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
D 412 - Test Method for Rubber Properties in Tension

D 570 - Test Method for Water Absorption of Plastics
D 638 - Test Method for Tensile Properties of Plastics
D 695 - Compressive Properties of Rigid Plastics
D 1259 - Nonvolatile Content of Resin Solutions
D 2240 - Standard Test Method for Rubber Property - Durometer Hardness
D 2393 - Test Method for Viscosity of Epoxy Resins and Related Compounds
D 2566 - Test Method for Linear Shrinkage of Cured Thermosetting Casting Resins During Cure

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Associations, Inc., 2200 Mill Road, Alexandria, Virginia 22314.)

Uniform Classification Committee, Agent:

Uniform Freight Classification

(Application for copies should be addressed to the National Railroad Frieght Committee, Suite 1120, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 First Article/Bid Sample testing. The purchasing or contracting activity of the Government reserves the right to request bid samples or first articles for testing to determine compliance with this specification at the option of the contracting officer. The contractor shall, as a minimum, supply a test report with supporting data for all tests and a certificate of compliance underwriting the validity of the test results as a prerequisite for bid acceptance (see 6.2).

3.2 Portland cement standard. Concrete specimens used in the testing of adhesive products supplied under this specification shall conform to ASTM C 150, Type I.

3.3 Aggregate sand fillers. Aggregate fillers shall be bagged, dry, clean silica sand in the 18 - 100 mesh range with a maximum moisture content of 1.0 percent when tested as specified in 4.6.1. Not more than 4% shall pass the 100 mesh screen. The sand shall be a blend of angular and round suitable for making epoxy polymer concrete.

3.4 Sag resistance, Type II. When tested as specified in 4.6.2, the material shall not run or drip from the applied position before it has hardened.

3.5 Freeze-thaw cycles. When tested as specified in 4.6.3, the materials shall not show any evidence of separation from concrete.

3.6 Deicing chemical resistance. When tested as specified in 4.6.4, the materials shall not show any evidence of deicing salt damage.

3.7 Compression strength. All materials shall have a minimum compression of 8000 psi. (55.2 MPa) when tested as specified in 4.6.5.

3.8 Linear coefficient of shrinkage on cure. The linear coefficient of shrinkage on cure shall not exceed 0.005 when tested as specified in 4.6.6.

3.9 Tensile strength, Type I only. When tested as specified in 4.6.7, the cured product shall have a minimum tensile strength of 2000 psi. (13.8 MPa).

3.10 Elongation. When tested as specified in 4.6.8 the elongation at breaking shall be 1 percent, minimum.

3.11 Water absorption. The cured adhesive resin system shall not absorb more than 1.0 percent water when tested as specified in 4.6.9.

3.12 Nonvolatile content. The mixed but uncured adhesive shall be free from volatile solvents, and the average nonvolatile matter in the adhesive system shall be not less than 99.0 percent when tested as specified in 4.6.10.

3.13 Working life and cure time. The complete adhesive systems shall remain workable, spreadable, and of smooth consistency for the times listed in Table I shown below, when tested as specified in 4.6.11. Tack free and time to full cure requirements are also shown in Table I.

Table I. Pot Life, Tack-Free, and Full-Cure Times

Class	Potlife (min.)	Tack-Free (hrs.)	Full Cure (days)
1	35	3-4	5
2	30	2-3	3
3	30	1-8	3-7
4	20	1-12	5-21

3.14 Viscosity of mixed adhesive. The viscosity of the mixed adhesives shall be 5 to 10 Poise for Type I, gel consistency for Type II, and 5 to 7 Poise for Type III Primer when tested as specified in 4.6.12.

3.15 Bond strength between concrete and adhesive. The bond strength between the adhesive and concrete shall not be less than 1800 psi. (12.4 MPa) at full cure on dry concrete and not less than 90% of its dry strength if applied to damp concrete when tested as specified in 4.6.13.

3.16 Hardness. The hardness of the cured adhesive shall not be less than 78 on the Shore D hardness scale when tested as specified in 4.6.14.

3.17 Instructions for use. Complete instructions for use shall be furnished by the manufacturer to the purchaser. The instructions shall specify the ratio of the weights of each component to be mixed. Complete instructions shall be placed on the outside of all containers of each component by stencil, lithograph, or securely affixed label. Components shall be identified (A, B, Resin, Hardener, or Filler as appropriate) on the container, and not on the cap or lid. Instructions shall include statements

directing users to read the manufacturer's technical data sheets and the material safety data sheets. The manufacturer shall also have the volatile organic compound (VOC) content on the product label and the technical data sheet or material safety data sheet.

3.18 Shelf life. All products supplied under this specification shall have a shelf life minimum of one year.

3.19 Shelf life update. In order to update the shelf life of this material, the adhesive should be evaluated for conformance with 3.9, 3.13, 3.14, 3.15, and 3.16.

3.19 Material Safety Data Sheet. A Material Safety Data Sheet (MSDS) shall be prepared in accordance with FED-STD-313 and forwarded to the qualifying or contracting activity (see 6.2). The MSDS shall be included with each shipment of the material covered by this specification and submitted to pertinent government agencies as stated in Appendix B of FED-STD-313.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article or bid sample inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 First article/bid sample inspection. First article or bid sample inspection shall be performed on three complete kits when a first article or bid sample is required (see 3.1 and 6.2). This inspection shall include the quality conformance tests of 4.6.1 to 4.6.15.

4.4 Quality conformance inspection. Quality conformance inspection shall include the tests of 4.6.7, 4.6.11, 4.6.12, 4.6.13, and 4.6.14.

4.5 Sampling and inspections.

4.5.1 Lot. The kits of adhesive shall be assembled into lots as specified in MIL-STD-105.

4.5.2 Sampling for inspection. For purposes of sampling, the lot shall be expressed in kits. A random sample of kits offered for delivery shall be selected in accordance with MIL-STD-105, sampling plan S-1, no defectives.

4.5.3 Inspection of the end item. Each kit randomly selected from the lot offered for inspection shall be examined for defects of construction of the containers and closures, for evidence of leakage, and for unsatisfactory markings; each kit selected shall also be inspected to determine the number of components and the amount of contents in each component. Any kit in the sample having one or more defects or under required shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for sampling plan S-1 of MIL-STD-105, the lot represented by the sample shall be rejected.

4.5.4 Inspection of preparation for delivery. An inspection shall be made to determine whether the packaging, packing, and marking comply with the requirements of Section 5. The packaging and packing shall be examined as specified in Table II for the cited defects. The sample unit shall be one shipping container fully prepared for delivery and selected at random. Sampling shall be in accordance with MIL-STD-105. The AQL level shall be 0% defective, and the inspection level shall be S-1, no defectives. The lot size shall be the number of shipping containers in the end item inspection lot.

TABLE II. Classification of preparation for delivery defects

Examine	Defects
Markings and mixing instructions	Omitted; incorrect; illegible; improper size, location, sequence, or method of application.
Material	Any component missing or damaged or wrong type.
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling, or distortion of container.

4.5.5 Sampling of the end item for testing. For purposes of sampling, one unit shall consist of the resin component(s) and filler when appropriate, in proper proportion, to formulate 1 gallon (4 liters) of grout. The lot shall be expressed in such one gallon (4 liter) units. Samples from lots shall be taken in accordance with MIL-STD-105.

4.5.6 Lot acceptance tests. Acceptance testing of individual lots shall consist of tests specified in 3.7, 3.9, 3.13, and 3.15. The contractor shall supply a certificate of compliance with each manufacturing lot.

4.6 Test methods. All tests shall be conducted in accordance with the

methods specified. Unless otherwise specified, all tests shall be performed at standard testing conditions which are 23 ± 2°C. and a relative humidity of 50 ± 5 percent. All test reports shall contain the individual values utilized in obtaining the final results. Each final result shall be compared with the applicable requirement in Section 3 to determine compliance with this specification. Failure to pass any test or non-conformance with any requirement shall be cause for rejection of the sample and lot. Any sample that fails a test shall be retested. If a second failure occurs, the sample and lot shall be rejected.

4.6.1 Testing of aggregate sand filler.

4.6.1.1 Moisture content. The moisture content of the sand fillers shall be tested in accordance with ASTM D 1259, Method B.

4.6.1.2 Particle size. The particle size of the sand filler shall be in the 18 - 100 mesh range when tested in accordance with ASTM C 33; not more than 4% shall pass through the 100 mesh screen.

4.6.2 Sag resistance. Apply 25 grams of mixed material to a clean, glass plate so that the material is at least 1.25 cm thick. Raise the plate to a vertical position. Any running, sagging, or dripping of the grout from its position before it has hardened shall constitute failure of this test.

4.6.3 Freeze-thaw cycle test. Determine the resistance to separation from the concrete because of repeated freezing and thawing in accordance with ASTM C 884.

4.6.4 Deicing chemicals resistance. Determine the resistance to deicing chemicals in accordance with ASTM C 672.

4.6.5 Compressive flexible strength. Determine the compressive flexible strength in accordance with ASTM D 695 and the following procedures:

4.6.5.1 The molded sample shall have dimensions of 1/2 by 1/2 by 1 inch (1.27 by 1.27 by 2.54 cm).

4.6.5.2 The samples shall be conditioned at standard conditions for 7 days.

4.6.5.3 Five samples shall be tested, and the average value shall be used to determine compliance with 3.7.

4.6.6 Coefficient of linear shrinkage on cure. Determine the Coefficient of Linear Shrinkage on cure in accordance with ASTM D 2566.

4.6.7 Tensile strength. Determine the tensile strength in accordance with ASTM D 638. Use Die C size dumbbells as described in ASTM D 412. The crosshead speed shall be 0.20 in./min. (5 mm/min.).

4.6.8 Elongation. Determine the elongation at break in accordance with ASTM D 638. Use Die C size dumbbells as described in ASTM D 412.

4.6.9 Water absorption. Determine the water absorption of the cured resin system at room temperature for 24 hours in accordance with ASTM D 570.

4.6.10 Nonvolatile content. Determine the nonvolatile content in accordance with ASTM D 1259, Method B.

4.6.11 Working life and cure time. Mix the adhesive components in accordance with the manufacturer's instructions and transfer to a 400 ml beaker. Measure the initial Brookfield viscosity using a Brookfield RVF, speed 10 rpm., and spindle number 7 or equivalent. Measure the viscosity at 15 minute intervals. At the end of 60 minutes the viscosity of the mixed adhesive shall not be more than double the initial viscosity to pass the test.

4.6.12 Viscosity of mixed adhesives. Determine the viscosity of the mixed adhesive systems in accordance with ASTM D 2393.

4.6.13 Bond strength between concrete and adhesive. Determine the bond strength between concrete and the adhesive in accordance with ASTM C 882.

4.6.14 Hardness. Determine the Shore D Hardness of the cured adhesive in accordance with ASTM D 2240.

5. PREPARATION FOR DELIVERY

5.1 Packaging. The packaging shall be level A or commercial as specified (see 6.2). Packaging shall be in units of kits in 1-, 2-, 5-, and 10-liter and 1/2-, 1-, and 2-1/2 gallon total mixed volume sizes or as specified by the procuring activity.

5.1.1 Level A Kit Components, Type I. Each kit shall contain the base resin and hardener in separate compound-lined, double-seamed end cans with multiple friction closure, and the mineral filler in multiwall sacks as separate components. One of the resin component containers shall be 0.5 - 1.5 liters larger in volume capacity than the total kit volume to permit mixing of all the components therein. The kits shall be packed in a 200 lb. (1.379 MPa) minimum burst strength corrugated fiberboard box. The box shall also contain an instruction sheet and a suitable stirring paddle for mixing the adhesive components.

5.1.1 Level A Kit Components, Type II. Each kit shall contain the base resin and hardener with premixed aggregate filler in separate compound-lined, double seamed end cans with multiple friction closure. The container sizes shall be the same as for Type I in 5.1.1. The kits shall be packed in a 200 lb. (1.379 MPa) minimum burst strength box. The box shall also contain an instruction sheet and a suitable stirring paddle for mixing the adhesive components.

5.1.2 Commercial. Each component shall be packaged in tubes, cans, pails, or sacks, as specified, in accordance with normal commercial practice. The complete package shall be designed to protect the item against damage during shipment, handling, storage, and redistribution.

5.2 Packing. The packing shall be Level A or Commercial as specified (see 6.2).

5.2.1 Level A. Ten liter sizes or smaller types I and II components, as specified in 5.1, shall be packed together as a kit in fiberboard boxes made from weather-resistant fiberboard with a bursting test strength of not less than 275 lbs. (1.896 MPa) per square inch. The box flaps shall be secured

with water-resistant adhesive applied to not less than 75 percent of the surface area of contact between the flaps, or with 3 inch (7.62 cm) wide waterproof tape applied to the full length of the seams and extending over the ends not less than 3 inches (7.62 cm).

5.2.2 Commercial. The packaged components shall be packed in steel or plastic pails to insure safe delivery at destination, to provide for safe redistri-bution by the initial receiving activity, and shall be acceptable by common carrier under National Motor Freight Classification or Uniform Freight Classification.

5.3 Marking. All kits shall be marked with complete instructions for use and storage, the manufacturer's name and part number, the specification and type of material, the date of expiration or reinspection for shelf life, and markings if required for compliance with FED STD 123/MIL STD 129.

6. NOTES

6.1 Intended use. These adhesives are intended to be used to repair surface spalls and other defects in cured Portland concrete on buildings, sidewalks, paved streets, parking areas, aircraft runways, or as a grouting adhesive for decorative tiles on walls and floors.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

(a) Title, number, and date of this specification.
(b) Type and color, if other than cement gray, of material required.
(c) Level of packaging and level of packing required.
(d) Unitization, if applicable.
(e) Special marking if required.
(f) Size of kit.
(g) Whether first article/bid sample inspection is required.
(h) Aggregate size, if different from the stated requirements. Aggregate shape, size, and type may be changed to accomplish special applications.

MILITARY INTERESTS:

Navy - AS
Army - MR
Air Force - 99

PREPARING ACTIVITY:

GSA - FSS
Project 8040-0522