

SECTION 926 EPOXY COMPOUNDS

926-1 Types of Compounds.

Epoxy resin compounds for application to portland cement concrete, bituminous cement concrete, metals and other type surfaces shall be two-component systems of the applicable of the following types as designated.

Type	Description
A	An epoxy resin, for bonding fresh concrete to hardened concrete.
B	An epoxy resin adhesive, for bonding hardened concrete to hardened concrete and constructing doweled splices in precast prestressed concrete piles.
E	A fluid epoxy for crack injection in the repair of old structures.
F	An epoxy for repairing spalled areas on concrete bridge structures with these subtypes:
F-1	A non sagging gel type for vertical surfaces.
F-2	A pourable type for repairs where forms are to be used.
G	An epoxy for rebuilding expansion joints and associated wearing surfaces.
H	An epoxy for structural bonding where asphalt overlays are to be in contact with the hardened compound.
I	An epoxy for filling small holes in concrete such as lifting bolt cut-outs on beams, etc.
J	An epoxy for installing rebar and anchor bolts into hardened concrete.
K	An epoxy for underwater sealing of the bottom of the jacket of an integral pile jacket system.
L	An epoxy for coating the interior of sewage disposal tanks.
M	A coal tar epoxy coating for steel sheet piles and H piles (water immersion).
N	An epoxy for preparing mortars and concrete for patching portland cement concrete pavement.
P	An epoxy for bonding metals.
Q	An epoxy for use in post tensioning anchorage protection systems.
T	Hot applied coal tar epoxy tape.

926-2 Epoxy Design Requirements.

926-2.1 General: All types of compounds except L, and M shall contain no volatile solvent.

All types of compounds except F, J, L, M, and N shall be basically pure reactive material with a maximum ash content of 2%.

All types shall have simple mix ratios of one to one or two to one or shall be supplied in pre-measured containers in which all of the contents of both packages are to be mixed.

Certain terms used in this specification shall have these meanings:

low modulus - the stress-strain property for which ultimate tensile strength is attained at over 10% elongation.

high modulus - the stress-strain property for which ultimate tensile strength is attained at under 6% elongation.

non-sagging gel - grades of mixed compounds which will not perceptibly flow under their own weight on a vertical surface in the unhardened state.

pourable - grades of mixed compound sufficiently fluid that they (either neat or filled) can be cast into and will take the shape of a mold.

926-2.2 Qualified Products List: All epoxy materials shall be one of the products listed on the Department's Qualified Products List. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

Products may only be used for applications recommended by the manufacturer.

926-2.3 Certification: The Contractor shall provide the Engineer with certification from the manufacturer of the epoxy, confirming that the requirements of this Section are met. The certification shall conform to the requirements of Section 6. Each certification shall cover only one batch of epoxy materials.

926-3 Specific Requirements for Types A and B Compounds.

926-3.1 Mixing and Application: Types A and B epoxy compounds (for bonding fresh concrete to hardened concrete or bonding precast concrete parts) shall be mixed, applied, and cured in accordance with the manufacturer's directions, or as might be directed otherwise by the Engineer.

Epoxy compounds shall be used only under conditions which are compatible with the material being applied in accordance with the specific directions of the manufacturer.

926-3.2 Performance Tests:

(a) Epoxy Bonding Compounds: Epoxy Bonding Compounds shall be prepared and tested in accordance with FM 3-C882. The ratio of the compressive strength of the composite cylinder to the compressive strength of the weaker concrete shall not be less than 0.90.

(b) Epoxy Mortars: Epoxy mortar shall be prepared and tested in accordance with FM 3 C-882. The average compressive strength of the three test specimens shall be at least 5,000 psi.

926-4 Specific Requirements for Type E Compounds.

Epoxies for crack injection shall meet the Specification for Type B compound with these additional requirements:

Viscosity five minutes after mixing	300 to 600 cps at 77°F by ASTM D-2393
Wet bond strength to concrete, minimum	250 psi at seven days by Florida Method FM 5-518

926-5 Specific Requirements for Type F Compounds.

Epoxies for repairing spalled areas shall meet these requirements:

Subtype F-1 for repairing vertical and other surfaces shall be a trowelable low modulus, non-sagging gel epoxy compound capable of bonding to wet surfaces with these properties:

Color	Shall match gray color No. 36622 of Federal Standard No. 595a
Viscosity	Gel
Maximum sand loading	2.25 parts sand to one part mixed epoxy by volume
Elongation in tension minimum	10% by ASTM D-638, seven day cure
Wet bond to Steel and Concrete minimum	250 psi by Florida Test Method FM 5-518

Subtype F-2 for filling larger spalls where a form is required to build back to the original surface shall be a pourable low modulus type compound capable of bonding to wet surfaces with these properties:

Color	Shall match gray color No. 36622 of Federal Standard No. 595a
Maximum sand loading	2.25 parts sand to one part mixed epoxy by volume
Elongation in tension, minimum	10% by ASTM D-638, seven day cure
Exotherm	110°F by ASTM D-2471, 1 pint sample
Wet bond strength	250 psi at seven days by Florida Method FM 5-518

926-6 Specific Requirements for Type G Compounds.

Epoxies for rebuilding expansion joints shall be pourable types which may be mixed with sand and with these requirements for the mix:

Compressive strength	
at 24 hours, minimum	4,500 psi
at seven days, minimum by the method of 926-3.2(b)	7,500 psi
Bond to wet concrete at seven days by Florida Method FM 5-518	250 psi
Maximum sand loading	2.25 parts to one part mixed epoxy by volume
Elongation in tension at seven days, ASTM D-638, minimum	2%
Color	Natural
Exotherm, maximum by test method ASTM D-2471, 1 pint sample size	110°F

926-7 Specific Requirements for Type H Compounds.

Epoxies for structural bonding where bituminous pavement overlays will come in contact with the hardened compound shall meet the requirements for Types A and B compounds above and the manufacturer shall provide test data showing that cutback and emulsified asphalts, asphalt cement, and bituminous mixes shall bond to but not soften or otherwise damage the epoxy after a curing period of four days.

926-8 Specific Requirements for Type I Compounds.

Epoxies for cosmetic patching of small areas on new concrete structures and components shall be of any non-sagging grade which has a gray color matching that of Shade 36622 of the Federal Standards and which has been demonstrated to the Engineer to bond satisfactorily to the concrete.

926-9 Specific Requirements for Type J Compounds.

Epoxies for installing rebar and anchor bolts into the hardened concrete shall meet the requirements of Section 937 and be installed in accordance with Section 416. When the Contract Documents call for the use of Type J, Class I, II, III, IV, epoxy or a Class IV Adhesive Anchor System, use materials meeting the requirements of Section 937, constructed in accordance with Section 416.

926-10 Specific Requirements for Type K Compounds.

Epoxies for sealing the bottom of integral pile jackets in the repair of concrete piles shall be a type which will harden underwater with these requirements for the sand-epoxy mix:

Compressive strength at seven days, minimum by the method described in 926-3.2(b)	4,500 psi
Bond	
to wet concrete, minimum	250 psi
to wet pile jacket, minimum (by Florida Method FM 5-518)	150 psi
Maximum sand loading	2.25 parts to one part mixed epoxy by volume
Viscosity of mixed epoxy component at 77°F, five minutes by ASTM D-2393	1,000-2,000 cps

The epoxy sand mix shall be capable of flowing through water in the void area of the jacket so as to provide a water tight seal of the depth indicated on the plans or approved shop drawings and to maintain this seal during subsequent construction steps.

926-11 Specific Requirements for Type L Compounds.

Epoxies for coating the interior of sewage disposal system tanks shall be of an approved type. Manufacturers shall submit data and a record of previous usage showing satisfactory performance in the protection of concrete from the aggressive effect of sewage for a five year minimum to the State Materials Office.

926-12 Specific Requirements for Type M Compounds.

Epoxy coatings for steel sheet and H piles used in bridges, fender systems and other structures subject to immersion in water shall comply with the requirements of Corps of Engineers Specification C-200. Products not meeting these requirements may be approved by the State Materials Office on the basis of data furnished by the manufacturer documenting equal or superior performance.

Application of the epoxy coating shall meet the requirements of Section 560 for a coal tar epoxy coating.

926-13 Specific Requirements for Type N Compounds.

Epoxy adhesives for making epoxy mortar or concrete for patching portland cement concrete pavement shall be any of approved products listed at the time of the work. Mix designs for mortar and concrete shall be submitted to the Engineer at the time of the preconstruction conference. Approval shall be by a field demonstration made by the Contractor using the criteria of bond to the pavement, matching color, durability, and absence of excessive surface slicking under traffic flow for acceptance.

The basic approval of new adhesives shall be made by the State Materials Office using a six months road test with mortar-concrete mix designs recommended by the epoxy manufacturer.

926-14 Specific Requirements for Type Q Compounds.

These epoxy materials are to be used to protect the anchorages of post-tensioning tendons or bars and other uses indicated in the plans. The material shall produce a low exothermic reaction and have flow and fill characteristics suitable for machine base plate applications. The material will be extended with the aggregate supplied by the manufacturer. Mix with the full aggregate loading unless the use of less aggregate is approved by the Engineer.

The material shall be factory pre-proportioned including factory supplied aggregate. Deliver products in original containers with manufacturer's name, date of manufacture, product identification label and batch numbers. Materials must be within the manufacturer's recommended shelf life. Store and condition the product in full compliance with manufacturer's recommendations.

The epoxy grout plus aggregate mix shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.

Property	Test Value	Test Method
Compressive Strength Cubes 7 day Cure at 77°F	> 10,000 psi	ASTM C-579B
Tensile Strength at 7 days	> 2,100 psi	ASTM C-307
Flexural Strength at 7day Cure at 77°F	> 3,600 psi	ASTM C-580
Modulus of Elasticity 7 day Cure at 77°F	< 2,100,000 psi	ASTM C-580
Coefficient of Thermal Expansion at 74 to 210°F	< 20 x 10 ⁻⁶ in/in/°F	ASTM C-531

Peak Exotherm, Specimen 12 x 12 x 3 in.	< 150°F	ASTM D-2471
Slant Shear at 7 days (Bond Strength to Concrete)	> 3000 psi	ASTM C-882
Thermal Compatibility	5 Cycles Passed	ASTM C-884

Linear Shrinkage at 7 days	0.025%	ASTM C-531
Flowability and Bearing Area	90% Contact area	ASTM C-1339
Gel Time, Specimen 12 x 12 x 3 in.	< 4:00 (hr.)	ASTM D-2471

926-15 Specific Requirements for Type T Tape Compounds.

Hot Applied Coal Tar Epoxy Tape used to protect tie back rods on sheet pile walls and bulkheads shall comply with the requirements of American Water Works Association standard C203. Application shall be according to the manufacturers published recommendations.

926-16 Packaging, Labeling, and Safety.

All containers shall be identified as Component A - contains epoxy resin or Component B - contains hardener, and shall show the type, mixing directions, batch numbers, manufacturer's name, date of packaging, shelf life expiration date and quantity in pounds or gallons. Mix ratios shall be prominently shown on labels. Potential hazards shall be stated on each package in accordance with the Federal Hazardous Products Labeling Act.

926-17 Storage.

Epoxy materials, which have been in storage for more than 12 months, will not be accepted for use.

926-18 Fillers.

Fillers for mixing mortars and grouts may be as recommended by the manufacturer of the particular epoxy compound and may be supplied as packages accompanying the epoxy or premixed in accordance with approved properties.

If a manufacturer recommends only the gradation of filler, it must be a silica sand commercially available in Florida and shall be a gradation listed in Table I or a specified blend of these gradations.

The silica sands specified in Table I shall be clean, kiln dried, packaged in strong moisture proof bags, contain no more than 0.2% organic trash, and be chloride free.

Fillers shall not be used with these compounds: Types E, J, L, and M.

When the fillers specified in Table I are used, the maximum amount shall be 2.25 volumes to one volume of mixed compound.

TABLE I GRADATION REQUIREMENTS FOR FILLERS FOR USE WITH EPOXY COMPOUNDS				
GRADE				
	A	B	C*	D**
Sieve Opening Size	Required % Passing			
No. 4			95-100	95-100
No. 6		90-100		
No. 8			0-15	85-100
No. 16				65-97
No. 20	80-100	0-20		

TABLE I GRADATION REQUIREMENTS FOR FILLERS FOR USE WITH EPOXY COMPOUNDS				
GRADE				
	A	B	C*	D**
Sieve Opening Size	Required % Passing			
No. 30	0-40			25-70
No. 50	0-10			5-35
No. 100				0-7
*For use only in sections 1 1/2 inches or greater in thickness.				
**Same as quartz sand fine aggregate for cement concrete (902-1.3.1).				