ORIGINATION FORM
Proposed Revisions to the Specifications
(Please provide all information - incomplete forms will be returned)

Date: 5/8/2019

Office: *State Materials*

Originator: Richard DeLorenzo

Specification Section: 926

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Article/Subarticle: all

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Will the proposed revision require changes to:

Publication	Yes	No	Office Staff Contacted
Standard Plans Index	○	◉	
Traffic Engineering Manual	○	◉	
FDOT Design Manual	○	◉	
Construction Project Administration Manual	○	◉	
Basis of Estimate/Pay Items	○	◉	
Structures Design Guidelines	○	◉	
Approved Product List	◉	○	Karen Byram
Materials Manual	○	◉	

Will this revision necessitate any of the following:

Design Bulletin ☐ **Construction Bulletin** ☐ **Estimates Bulletin** ☐ **Materials Bulletin** ☐

Are all references to external publications current? **Yes** ◉ **No** ○

If not, what references need to be updated? (Please include changes in the redline document.)

Why does the existing language need to be changed?

Correct errors and clarify the document

Summary of the changes:

926-2 clarify requirements; allow NTPEP as an option not requirement, corrected FTIR language; 926-3 corrected Type AB requirements; 926-4, 926-5, 926-7, 926-10 corrected requirements, removed redundant throughout.

Are these changes applicable to all Department jobs? **Yes** ◉ **No** ○

If not, what are the restrictions?

Contact the State Specifications Office for assistance in completing this form.
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M E M O R A N D U M

DATE: May 23, 2019

TO: Specification Review Distribution List

FROM: Dan Hurtado, P.E., State Specifications Engineer

SUBJECT: Proposed Specification: **9260100 Epoxy Compounds.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

This change was proposed by Richard DeLorenzo in the State Materials Office to correct errors and clarify the specification.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at http://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx . Comments received after **June 20, 2019**, may not be considered. Your input is encouraged.

DH/rf
Attachment

EPOXY COMPOUNDS
(REV 5-13-19)

SECTION 926 is deleted and the following substituted:

926-1 Types of Compounds.

Epoxy resin based compounds for application to portland cement concrete, bituminous cement concrete, metals and other type surfaces shall be applicable for the following types as designated. Products may only be used for applications recommended by the manufacturer.

Type	Description
AB*	An epoxy resin, for bonding fresh or 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 F-1* F-2**	An epoxy for repairing spalled areas on concrete bridge structures with these subtypes: A non-sagging gel type for vertical surfaces. A pourable type for repairs where forms are to be used.
H**	An epoxy for structural bonding where asphalt overlays are to be in contact with the hardened compound.
K*	An epoxy for underwater sealing of the bottom of the jacket of an integral pile jacket system.
M***	A coal tar epoxy coating for steel sheet piles and H piles (water immersion) and hot applied coal tar epoxy tape.
PSE*	A two-part epoxy system to match the cast faces of joints between precast segmental concrete superstructure and/or substructure segments.
Q*	An epoxy for use in post tensioning anchorage protection systems.
*Accepted by APL **Accepted by certified test report ***Accepted by certification	

926-2 Epoxy Design Requirements.

926-2.1 General: All types of compounds, except for Type M, shall be thermosetting containing no volatile solvent.

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

~~When product materials are required to be mixed,~~ Aall types of compounds except for Type M shall have simple mix ratios of one to one, ~~or~~ two to one, or shall be supplied in pre-~~measured~~proportioned containers in which all ~~of~~ the contents ~~of all packages~~ are to be mixed.

All types of compounds shall be labeled with the manufacturer's name, brand name, component type (resin, hardener or filler), mix ratio, mixing directions, date manufactured, shelf life, and the manufacturer's lot number. Potential hazards shall be stated on each package in accordance with the Federal Hazardous Products Labeling Act.

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.

Fillers for mixing mortars and grouts shall be recommended by the manufacturer of the epoxy compound and supplied as packages accompanying the epoxy or premixed.

926-2.2 Approved Product List (APL): All epoxy materials shall be one of the products listed on the Department's Approved Product List (APL) unless an alternative acceptance is identified in this Specification. ~~All manufacturers shall submit a product data sheet.~~ Manufacturers seeking evaluation of their product~~s for inclusion on the APL~~ shall submit an application in accordance with Section 6~~.~~ and identify the epoxy type. Include with the submittal product data sheets, safety data sheets (SDS), and certified test reports from an independent laboratory showing the product meets the requirements of this Section. Manufacturers may submit performance test reports from the National Transportation Product Evaluation Program (NTPEP) as acceptable independent laboratory data.

Upon request, submit product samples to the Department for confirmatory testing and Infrared (IR) analysis.

~~Information on the APL application must identify the epoxy type.~~

~~Manufacturers seeking evaluation of Type AB and Type PSE epoxies shall submit performance test reports from the National Transportation Product Evaluation Program (NTPEP) showing that the product meets the requirements of this Section.~~

~~Manufacturers of all other types shall submit test data from an independent laboratory showing that the product meets the requirements of this Section and an infrared identification curve (2.5 to 15 µm).~~

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

~~**926-2.3 Certification:** The Contractor shall submit to the Engineer 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 Type AB Epoxy Compounds.

926-3.1 Mixing and Application: Type AB epoxy compounds are used ~~(~~for bonding fresh ~~concrete~~ or~~to~~ hardened concrete to harden concrete and constructing doweled splices in precast prestressed concrete piles ~~or bonding precast concrete parts) shall be listed on the APL and be mixed, applied, and cured in accordance with the manufacturer's directions, or as 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: Meet the requirements of ASTM C881 Type IV and V, Class C, when tested at 73° ± 2° F~~Grade 3~~.

926-4 Specific Requirements for Type E Compounds.

Epoxies for crack injection shall meet the requirements of ASTM C881 Type IV ~~Specification for Type AB~~ compound with these additional requirements:

Viscosity five minutes after mixing	300 to 600 cps at 77°F by ASTM D 2556393
Wet bond strength to concrete, minimum	250 psi at seven days by FM 5-518

926-5 Specific Requirements for Type F Compounds.

926-5.1: Repairing Spalled Areas: Epoxies for repairing spalled areas shall meet the requirements in this Section.

926-5.2: Subtype F-1: Subtype F-1 epoxy is used for repairing vertical and other surfaces and 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 FED-STD-595
ViscositConsistency	Gel
Maximum sand loading	Recommended by the manufacturer2.25 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-1 shall be listed on the APL.

926-5.3: Subtype F-2: Subtype F-2 epoxy is used for filling larger spalls where a form is required to build back to the original surface. Materials 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 FED-STD-595-
Maximum sand loading	Recommended by the manufacturer2.25 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 FM 5-518

Type F-2 epoxy compoundsproducts will be accepted by certified test reporton the job. Submit to the Engineer testing from the manufacturer of the product for each LOT of material to be incorporated in the project. The test results will indicate that the material is in conformance with the Specifications, and will include actual values from the required tests. Obtain approval from the Engineer before incorporating material into the project.

926-6 Specific Requirements for Type H Compounds.

Type H eEpoxies 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. Submit from the manufacturer 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.

Type H epoxy compoundsproducts will be accepted by certified test reporton the job. Submit to the Engineer testing from the manufacturer of the product for each LOT of material to be incorporated in the project. The test results will indicate that the material is in conformance with the Specifications and will include actual values from the required tests. Obtain approval from the Engineer before incorporating material into the project.

926-7 Specific Requirements for Type K Compounds.

Type K eEpoxies are used for sealing the bottom of integral pile jackets in the repair of concrete piles shall be listed on the APL. These epoxies will be extended with the aggregate supplied by the manufacturer. The epoxy shall be factory pre-proportioned including factory supplied aggregate and meet the following requirements:

Compressive strength at seven days, minimum by ASTM C 579Bthe method described in 926-3.2(b)	4,500 psi
Bond Strength by FM 5-518	
to wet concrete, minimum	250 psi
to wet pile jacket, minimum	150 psi
Viscosity of mixed epoxy component at 77°F, five minutes by ASTM D 2556393	1,000-2,000 cps

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

926-8 Specific Requirements for Type M Compounds.

Type M Coal Tar 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 SSPC Paint 16 with Type 1 pitch. Application of the epoxy coating shall meet the requirements of Section 560 for a coal tar epoxy coating.

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.

Submit to the Engineer a manufacturer certification, confirming that the coal tar epoxypenetrant sealer meets the requirements of this Section. The certification shall conform to the requirements of Section 6. Do not incorporate these materials into the project until the Engineer has accepted and approved the certification for the material. Submit such certification for each LOT of material delivered to the project. In each certification, identify the serial or LOT numbers of the containers certified.

926-9 Specific Requirements for Type PSE Epoxy Compounds.

Precast Ssegmental Eepoxyies (PSE) compounds are used for match-cast joints between precast concrete segmentsshall be listed on the APL. The epoxy shall be factory pre-proportioned in two parts and labeled with the manufacturer's name, brand name, component type (resin or hardener), the range of substrate (surface of concrete) temperature over which the application is

~~suitable, material classification, the date of formulation, the shelf life of the material, and the manufacturer's lot number.~~

~~_____~~ Normal set PSE shall remain workable for a short open time (about one hour) and meet the requirements of ASTM C881, Type VI Grade 3. Slow set PSE shall remain workable over an extended open time (about eight hours), meet the requirements of ASTM C881, Type VII Grade 3, and have a compressive yield strength of 6,000 psi at 14 days.

~~_____ Epoxy bonding agents for match-cast joints between precast segments must be thermosetting, 100% solid compositions, and shall not contain solvent or any non-reactive organic ingredient except for colorant.~~

~~_____~~ PSE compounds~~Epoxy bonding agents~~ shall be factory pre-proportioned and formulated to provide application temperature ranges which are suitable for the erection of match cast segments with substrate temperatures between 40°F and 105°F with a minimum of at least two, but preferably three, formulations dividing the range into approximately equal subranges which overlap by at least 5ºF.

926-10 Specific Requirements for Type Q Compounds.

Type Q~~hese~~ epoxy compounds~~materials shall be listed on the APL and~~ 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 shall be factory pre-proportioned including factory supplied ~~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 at~~Cubes~~ 7 day Cure at 77°F	> 10,000 psi	ASTM C 579B
Tensile Strength at 7 days, Cure at 77ºF	> 2,100 psi	ASTM C 307
Flexural Strength at 7days Cure at 77ºF	> 3,600 psi	ASTM C 580
Modulus of Elasticity 7 days Cure at 77ºF	< 2,100,000 psi	ASTM C 580
Coefficient of Thermal Expansion at 74° to 210°F	< 20 x 10^{-6} in/in/ºF	ASTM C 531

Peak Exotherm, Specimen 12 x 12 x 3 in.	< 150ºF	ASTM D 2471

Slant Shear at 7 days (Bond Strength to Concrete)	> 3000 psi	FM 5-587
Thermal Compatibility	90% of control~~5 Cycles Passed~~	FM 5-609~~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

~~**926-11 Packaging, Labeling, and Safety.**~~

~~**All containers shall show the type, mixing directions, batch numbers, manufacturer's name, date of packaging, shelf life expiration date and quantity in pounds or gallons. Containers with components shall clearly be identified with Component A-epoxy resin or Component B-hardener. 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.~~

~~**926-12 Storage.**~~
~~Epoxy materials, which have been in storage for more than twelve months, will not be accepted for use.~~

~~**926-13 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 1 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 and M.~~
~~When the fillers specified in Table 1 are used, the maximum amount shall be 2.25 volumes to one volume of mixed compound.~~

~~Table 1~~
~~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~~		
~~No. 30~~	~~0-40~~			~~25-70~~
~~No. 50~~	~~0-10~~			~~5-35~~

Table 1 Gradation Requirements for Fillers for use with Epoxy Compounds				
Grade				
	A	B	C*	D**
Sieve Opening Size	Required % Passing			
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).