

**9380000 DUCT FILLER FOR POST-TENSIONED STRUCTURES**  
**COMMENTS FROM INTERNAL/INDUSTRY REVIEW**

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Joe Salvadori  
(878) 313-3146  
Joe.salvador@dsiamerica.com

Comments: (Industry, 12-4-18)

The Specification section 938-3.1 Grout states "...thixotropic properties and shall be prepackaged in clearly labeled moisture proof containers. Grout bags and containers shall..." The distinction between bags and containers implies a difference between the two but I don't think that is the intent. A bag satisfies the definition of a container...'an object that can be used to transport something'. Consider better use of terminology.

Response: Agree. The term "bags" is eliminated. The manufacturer will have the option of selecting the type of container.

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Alex Blythe (on behalf of Five Star Products, Inc.)  
(203) 336-7978  
blythea@fivestarproducts.com

Comments: (Industry, 12-4-18)

Regarding Specification revisions on 9380000: Per 938-4.2.2 Laboratory Testing: "Five Star Products strongly recommends that preparing test specimens using more water than the material manufacturer's recommended maximum quantity is a bad practice, and any requirement to do otherwise should not be part of the test protocol. As a material manufacturer we develop and test our products following the water addition requirements and mixing procedures published on our Technical Data Sheet. Failure to follow the published procedures will affect the material properties and the way the material performs. It is not practical to expect a material manufacturer to test and publish results for formulations that do not follow their published mixing instructions." Regarding proposed Test ID "B" from Table 938-1: "we don't have any history of testing the product to the noted standards, so we don't have a clear basis for selection of maximum value here. We have minimal related testing of water soluble sulfate(as SO<sub>4</sub>) based on a sanded grout that had values range from 0.0015-0.01%(15-100 ppm) when tested per ASTM D 516 with extraction based on ASTM C 1218. We might expect a cable grout to possibly have results that are higher than the top end of what were observed based on this history, and because of this, would suggest an initial maximum of 0.05%(500 ppm) until further data can be confirmed." Thank you for your time and consideration. Sincerely, Alex Blythe Product Specialist Five Star Products, Inc

Response: Response: This approach is necessary due to the type of application. Research has indicated that some grouts are more susceptible to additional water than others. Because it is near impossible to identify any water or moisture inside the duct system, the intent is to have a buffer on which this situation could be addressed. We have already tested some grouts that pass the tests under these conditions. In addition, this will also be a PTI requirement for all Type C grouts.

Within the last three years the Department researched the cause of corrosion of several corroded

tendons and high sulfates in the grout was identified as the root cause. Based on this, a decision is made to limit the amount of sulfates in grouts. More research on this is being done but at this time the decision is made to limit the amount of sulfates in the grouts. We agree to increase the amount of sulfates proposed to 50 ppm to accommodate more grouts but at this time this will be the limit.

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Samanbar Permeh  
(305) 348-6124  
Samanbar.permeh@fiu.edu

Comments: (Industry, 12-6-18)

Review of FDOT Specification 9380000 Duct Filler for Post-Tensioned Structures Samanbar Permeh and Kingsley Lau, Florida International University -938-1 Description. Description should also include flexible filler material. "This Section covers [grout and flexible filler] materials to fill voided area..." or remove second sentence where only grout material has additional qualification in material application. -938-4-1 Mixing. The language states to mix the grout following the manufacturer's recommendation but Section 938-4.2.2 but then inconsistently states to mix additional water. We believe that there should be clarification for which tests require the additional mix water. If all tests require additional mix water, we recommend a note next the each reference test method in Table 938-1. Particularly, in Table 938-1, Test ID B has a caption to obtain grout samples from the top vent of the inclined-tube test (Test ID O) following EN 445 that does not specify additional mix water. Either Test ID O should be made following a modified inclined-tube test or Test ID B should specify testing differentiated from Test ID O. -Table 938-1. Test ID B. We believe the property should be "Water-Soluble Sulfate Ions." Test ID B Test Method \*caption. (See comment above). We agree that sampling should be made at the upper elevation of the modified inclined tube test. This criteria would minimize the level of allowable sulfate accumulation due to grout segregation. Test ID O Inclined Tube Test. Recommend "Modified Inclined Tube Test." Test ID B Test Value. Our testing with hardened Sika300PT and Euco PTX grout supports this criteria. The test results indicated that the upper bound of sulfate limits where corrosion developed was >100ppm. We agree with testing of free sulfates in grout mixed excess 10% water in the modified inclined tube test, sampled from the upper tube elevation. We believe that the units for the FM 5-618 should be normalized by the sample dry mass. -FM 5-618 Step 3.1.2. It's redundant to measure 4 ±1 g in step 3.1.1 and then reweigh 1±0.1g in step 3.1.2. The text should refer to sample size of hardened grout to be oven dried. Text on bulk sample proportioning should be moved prior to the drying step. After testing in step 4, calculate final sulfate concentration. Final Concentration in gSulfate/gDryGrout can be calculated by formula below:  $M = (C \cdot V) / m$  M= SO<sub>4</sub><sup>2-</sup> concentration in (gSulfate/gDryGrout) C= SO<sub>4</sub><sup>2-</sup> concentration by testing in (mg/L) V= 0.1 L Volume of solution m= dry mass of grout in (mg) If this concentration is adopted, 30 ppm would be equivalent 0.003gSulfate/gDryGrout.

Response: Agree that the specification covers both filler. A sentence is added to clarify that there is no differentiation for the flexible fillers.

Expanded the sentence in 938-4.1 to indicate the additional water if required particular tests as indicated.

Last sentence of 938-4.2.2 indicates to use the 110% additional water in ALL test samples. This will include the EN 445, which will be run by SMO.

Agree. "water soluble" added.

Following communication with Dr. Iau, we agree to set the upper limit at 50 ppm as supported by research. Also added, "Modified Inclined Tube Test" to the table as suggested.

Will address in the test method review.

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ASBI  
Gregg Freeby

Comments: (12-7-2018)

Florida Department of Transportation  
Mail Station 75  
605 Suwannee Street  
Tallahassee, Florida 32399-0450

December 6, 2018

RE: Industry review of 938000 Duct Filler for Post-Tensioned Structures

Greetings,

The American Segmental Bridge Institute thanks you for the opportunity to comment on revisions to Specification 9380000 Duct Filler for Post-Tensioned Structures. We appreciate that the Florida Department of Transportation recognizes the importance of well written, technically correct and enforceable specifications for post-tension duct filler. To that end we offer the following comments:

General Comment - We agree with the requirement to use only "prepackaged" grout. However, the acceptance of these grouts should be based on industry standards. Specifically the Post-Tensioning Institute "Specification for Grouting of Post-Tensioned Structures", PTI M55.1-12(13). This is the current industry standard which manufacturers of prepacked materials are familiar with and capable of consistently meeting. Agency specific "tweaks" or requirements outside the PTI specifications creates an undue burden on manufacturers that supply material on a national level. Imagine if structural bolts had their own specifications in every state. Even something as simple as bolts would be difficult to obtain at a reasonable price with assurances that local requirements were being met. Prepackaged grouts should be viewed in the same way.

Specific Comments –

938-3.1 Grout.

Suggest requiring PTI M55.1-12(13) Class C grout. As previously mentioned, this Specification is the current industry standard for grouting post-tensioned structures. In the event you decide not to adopt this specification we would ask you to consider how a contractor or manufacturer will demonstrate that the supplied grouts "exhibit thixotropic properties" as currently written in the specification.

Table 938-1

Test ID B, Total Sulfate Ions - This is not currently supported by industry. Again, this can become onerous for manufacturers of prepackaged materials.

Test ID H Compressive Strength – The Test Value is set at a minimum of 7,000 psi. The current industry standard is a minimum of 5,000 psi. Is the higher compressive strength really needed? Also, requiring the grout to achieve 7000 psi with the proposed addition of 110% of the maximum water content may not be possible.

Test ID K, Bleeding @ 3 hours – The footnote prescribes the modifications to ASTM C940 necessary to accomplish the test. However, the wording requires “a wick made of a 20 inch length” of strand. We believe this to be incorrect as the industry standard test per PTI M55.1-12(13) calls for a 40 inch length of strand.

Section 938-4.3 PT Grouts are typically designed with a w/c ratio less than 0.3. The requirement to perform the ACTM at 0.45 provides results that are not representative of in-place grouts.

Again, we thank you for the opportunity to comment on these specifications and look forward to continuing to work with you on this very important item.

**Response:** We are indeed considering the use of PTI Class C but at this time PTI specification does not require testing the grouts for sulfates or with the additional water (although added water is proposed for next PTI specification revision). We will be monitoring the development of PTI specification for grouts and are looking to adopt your suggestion in the future. However, most of the requirements here are based on those of PTI M55 already.

Test ID B: Based on FDOT experience, high sulfates are considered an item of consideration with possible detrimental results on the tendons. Issue that we cannot ignore. Our research has tested various grouts that meet the proposed sulfates requirement and gave history of satisfactory performance.

Test ID H: This is not a change in the specification. Our already approved grouts all meet or exceed the 7000 psi requirement.

Test ID K: Agree that this test can be updated. Language is changed to use PTI M55 1.12. modified procedure.

938-4.3: This is not a change in the specification. Our already approved grouts all meet or exceed the requirement using this w/c for the control. However, the 0.45 w/c is the less stringent value for the control (neat) grout given in PTI M55 1.12, so this should not be a concern for manufacturers of new grouts since already required by PTI.

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Michael Sandow  
D2- Construction

Comments: (Industry, 12-7-18)

“Although this industry review is not proposing any changes to Section 938-4.5 Repair Applications: Recommend deleting Section 938-4.5 or rewording to clarify its intent. This entire paragraph may lead to confusion and its intent is not understood. Voids discovered in tendons (regardless of size) are filled with the same type grouting material as initially utilized. This repair procedure is done with vacuum assist as discussed in Section 462. Resistivity

requirements of repair material are repeated unnecessarily as all material properties, including resistivity are reflected in Table 938-1”

Response: This section is mostly to address repairs for other than new construction since as you indicate, new construction is covered in 462. The language differentiates types of grouts to be used in new and existing (all other) structure. The reference to new construction is just to point out the difference.

Regarding the resistivity value, we agree that it is repeated and is being deleted (good catch).

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