

EXPECTED IMPLEMENTATION JULY 2019

938 DUCT FILLER FOR POST-TENSIONED STRUCTURES (REV 12-13-18) (FA 12-31-18) (7-19)

SECTION 938 is deleted and the following substituted:

938-1 Description.

This Section covers filler materials used to fill voided areas within ducts to protect post-tensioning steel. Grout applications are differentiated into three applications: horizontal, vertical and repair. There is no differentiation for flexible fillers.

938-2 Approved Product List.

Only post-tensioning grouts and flexible filler material listed on the Department's Approved Product List (APL) shall be used. Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6 and include certified test reports from an independent AASHTO R-18 or ISO 9001 approved laboratory showing that the material meets all the requirements specified herein. A written certification from the manufacturer that the product meets the requirements of this Section must be submitted.

Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification.

Grout products will be qualified by application (horizontal, vertical or repair).

938-3 General Requirements.

938-3.1 Grout: Grouts shall exhibit thixotropic properties and shall be prepackaged in clearly labeled moisture proof containers. The containers shall indicate application type, date of manufacture, LOT number and mixing instructions. The Quality Control Data Sheet for each lot number and shipment sent to the job site shall be provided to the Contractor by the grout supplier and submitted to the Engineer.

938-3.2 Flexible Filler - Microcrystalline Wax: The flexible filler shall be a petroleum based microcrystalline wax delivered to the project site in clearly labeled prepackaged containers and stored in accordance with the manufacturer's recommendations as applicable for the particular project. A manufacturer's Quality Control Data Sheet indicating compliance with Table 938-2 for each shipment sent to the job site shall be submitted to the Contractor and furnished to the Engineer.

938-4 Grout.

938-4.1 Mixing: The material shall be mixed in accordance with the manufacturer's recommendations except when additional water is indicated for particular tests.

938-4.2 Grout Physical Properties:

938-4.2.1 Gas Generation: The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2.2 Laboratory Testing: The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM and FM test methods conducted at normal laboratory temperature (65°F-90°F) and conditions. Prepare all laboratory test specimens using 110 percent of

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the maximum water allowed by the manufacturer unless otherwise noted in Table 938-1. Tests A, B, N, and O will be conducted by the Department.

Table 938-1			
Test ID	Property	Test Value	Test Method
A	Total Chloride Ions	Max. 1.0 lbs/yd ³	FM 5-516 *
B	Total Sulfate Ions	Max. 30 ppm	FM 5-618 *
C	Gradation	99% passing the No. 50 95% passing the No. 100 90% passing the No. 170	ASTM C136**
D	Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C1090
E	Expansion	≤ 2.0% for up to 3 hours	ASTM C940
F	Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft ³	ASTM C138
G	Wet Density - Field	Report maximum and minimum obtained test value lb/ft ³	ASTM C138 or ASTM D4380
H	Compressive Strength 28 day (Average of 3 cubes)	≥7,000psi	ASTM C942
I	Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C953
J	Time of Efflux immediately after mixing	Max. 12 seconds	ASTM C939***
K	Bleeding @ 3 hours	0.0 percent	ASTM C940****
L	Pressure Induced Bleeding	0.0 percent	ASTM C1741
M	Surface Resistivity@ 28 days	≥16 KOhms-cm	AASHTO T358
N	Relative Viscosity, RV _f , determined from Dynamic Shear Rheometry	< 1.15	FM 5-605
O	Inclined Tube Test	< 0.3% (@3 hours)	EN 445
<p>*Obtain test sample from upper vent of inclined tube test specimen after 7 days curing. **Use ASTM C117 procedure to determine the percent passing after washing the sieve. ***The time of efflux is the time to fill a one liter container placed directly under the flow cone. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. Use the midrange of the water content indicated in the manufacturer's technical data sheet to produce the time of efflux. ****Use ASTM C940 to conform with the wick induced bleed test as modified by the Post-Tensioning Institute specification PTI M55.1-12.</p>			

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938-4.3 Accelerated Corrosion Test Method (ACTM): Perform the ACTM as outlined in Appendix B of the Specification for Grouting of Post-Tensioning Structures published by the Post-Tensioning Institute. Report the time to corrosion for both the grout being tested and the control sample using a 0.45 water-cement ratio neat grout.

A grout that shows a longer average time to corrosion in the ACTM than the control sample and the time to corrosion exceed 1,000 hours is considered satisfactory.

938-4.4 Variation in Testing for Specific Applications.

938-4.4.1 Horizontal Applications: Horizontal grout applications are defined as grouting of all superstructure tendons and transverse substructure tendons in caps, struts, etc. All physical requirements defined in 938-4.2 and 938-4.3 are applicable for grouts used in horizontal applications.

938-4.4.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4.2 and 938-4.3 are applicable for grouts used in vertical applications.

938-4.5 Repair Applications: Repair applications are used to augment grouting operations which did not completely fill the duct or anchorage. For new construction, repairs may be made with the same filler approved for use in the tendon as long as the volume of the void is less 0.5 gal. In all other cases, use a non-sanded grout meeting the requirements of 938-4.2 and 938-4.3.

938-5 Flexible Filler - Microcrystalline Wax.

938-5.1 Storage and Preparation: Store and prepare wax in accordance with Section 462. Reject wax that shows any sign of segregation or decomposition prior to application even though it conforms to these Specifications. Use equipment designed for pumping the wax in a fluid state to fill the tendon ducts. Manufacturers shall include the recommended pumping temperature in the material technical data sheet.

938-5.2 Laboratory Testing: The wax shall meet the specified physical properties stated herein as determined by the following standard and modified ASTM and FM test methods conducted at normal laboratory temperature (65°F-78°F) and conditions.

Table 938-2		
Property	Test Value	Test Method
Salt Fog – 168 hours@35°C	No corrosion	ASTM B117*
Chlorides	≤ 50 ppm (total)	ASTM D512**
Sulfate	≤ 100 ppm	ASTM D516**
Congealing Point	≥ 65°C	ASTM D938
Cone Penetration at 25°C	≤ 260 d-mm	ASTM D937
Bleeding at 40°C	≤ 0.5%	ASTM D6184
Resistance to Oxidation 100 hours at 100°C	≤ 0.03 MPa	ASTM D942
Kinematic Viscosity at 100°C	10 – 30mm ² /s	ASTM D445

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*Test sample consists of a 4 inch x 6 inch steel panel blast cleaned to a NACE surface preparation SP5 or equivalent, with a 2 to 2.5 mil surface profile. The plate is covered with a layer of wax equivalent to 0.5 grams wax per square inch of panel.

**Prepare sample in accordance with NF M07-023, sections 6a through 6c or equivalent. Other analytical methods are acceptable as long as equivalency to the above methods has been established by the Department.