Florida Department of Transportation

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Tallahassee, FL 32399-0450

STEPHANIE KOPELOUSOS
SECRETARY

May 1, 2009

Monica Gourdine
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 938
Proposed Specification: 9380000 - Post-Tensioning Grout

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

This change is proposed by the Specifications Office to merge Section 938 from the Spec Book and a Supplemental Specification together, to be added to the Workbook for January 2010.

Please review and transmit your comments, if any, within four weeks. Comments should be sent via Email to ST986RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4110.

Sincerely,

Signature on file

Rudy Powell, Jr., P.E.
State Specifications Engineer

RP/sh
Attachment
cc: Gregory Jones, Chief Civil Litigation
Florida Transportation Builders' Assoc.
State Construction Engineer

~~938~~ ~~POST-TENSIONING GROUT.~~
~~(REV 6-13-08~~*~~5-1--09~~*~~) (FA 8-12-08) (1-09)~~

SECTION 938 (Pages 832–835) is deleted and the following substituted:

938-1 General Requirements.

This Section covers grouts to be used to protect post-tensioning steel. Grout applications are differentiated into three applications: horizontal, vertical and repair.

Grouts shall be prepackaged in moisture proof containers. Grout bags shall indicate application, date of manufacture, LOT number and mixing instructions. Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification. A copy of 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 furnished to the Engineer. Materials with a total time from manufacture to usage in excess of six months shall be tested and certified by the supplier that the product meets the QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) shall be used. Manufacturers of post-tensioning grout seeking evaluation of their product shall submit an application in accordance with Section 6 and include certified test reports from an independent laboratory, audited by the Cement Concrete Reference Laboratory (CCRL) which shows 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 provided. Grout products will be qualified by application (horizontal, vertical or repair).

938-3 Mixing.

The material shall be mixed in accordance with the manufacturer's recommendations.

938-4 Grout Physical Properties.

938-4.1 Gas Generation: The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test: The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F) and conditions. Conduct all grout tests with grout mixed to produce the minimum time of efflux. Establish the water content to produce the minimum and maximum time of efflux.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152

Property	Test Value	Test Method
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Time of Efflux***		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2,500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C 117 procedure modified to use a #50 sieve. Determine the percent passing the #50 sieve after washing the sieve.
**Modify ASTM C 1090 to include verification at both 24 hours and 28 days.
***Adjustments to flow rates will be achieved by strict compliance with the manufacturer's recommendations. The time of efflux is the time to fill a one liter container placed directly under the flow cone.
****Modify the ASTM C 939 test by filling the cone to the top instead of to the standard level.
*****Modify ASTM C 940 to conform with the wick induced bleed test as follows:
(a) Use a wick made of a 20 inch length of ASTM A 416 seven wire 0.5 inch diameter strand. Wrap the strand with 2 inch wide duct or electrical tape at each end prior to cutting to avoid splaying of the wires when it is cut. Degrease (with acetone

or hexane solvent) and wire brush to remove any surface rust on the strand before temperature conditioning.

(b) Condition the dry ingredients, mixing water, prestressing strand and test apparatus overnight at 65 to 75°F.

(c) Mix the conditioned dry ingredients with the conditioned mixing water and place 800 ml of the resulting grout into the 1,000 ml graduate cylinder. Measure and record the level of the top of the grout.

(d) Completely insert the strand into the graduated cylinder. Center and fasten the strand so it remains essentially parallel to the vertical axis of the cylinder. Measure and record the level of the top of the grout.

(e) Store the mixed grout at the temperature range listed above in (b).

(f) Measure the level of the bleed water every 15 minutes for the first hour and hourly for two successive readings thereafter.

(g) Calculate the bleed water, if any, at the end of the three hour test period and the resulting expansion per the procedures outlined in ASTM C940, with the quantity of bleed water expressed as a percent of the initial grout volume. Note if the bleed water remains above or below the top of the original grout height. Note if any bleed water is absorbed into the specimen during the test.

~~**938-5 Simulated Field High Temperature Fluidity Test.**~~

~~Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.~~

~~(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F for a minimum of 12 hours prior to the test.~~

~~(b) Use 400 feet (±10 feet) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch.~~

~~(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.~~

~~(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.~~

~~(e) Pump and recirculate the grout for a minimum of one hour.~~

~~(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.~~

~~**938-6 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.~~

~~**938-7 Variation in Testing for Specific Applications.**~~

~~**938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.~~

~~**938-7.2 Vertical Applications:** Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 are applicable for grouts used in vertical applications. In addition, perform the Schupack Pressure Bleed Test Procedure for Cement Grouts for Post-Tensioned Structures as outlined in Appendix C of the "Specification for Grouting of Post-Tensioned Structures" published by the Post-Tensioning Institute. Report the percent bleed for the grout tested. Test grout at the specified pressure of 100 psi. An acceptable test will result in no bleed water (0.0 percent).~~

~~**938-7.3 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 grout 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 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 at 30 volts). Non-sanded grouts shall have 95% passing on the #100 sieve and 90% passing the #170 sieve as determined by ASTM C33. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.~~

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