

POST-TENSIONING GROUT.

(REV 7-30-01) (7-02)

PAGE 875. The following new Section is added after Section 937.

SECTION 938 POST-TENSIONING GROUT

938-1 General Requirements.

Grouts shall be prepackaged in plastic lined or coated bags. Grout bags shall indicate date of manufacture, LOT number and mixing instructions. Any change of materials or material sources requires retesting 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 retested and recertified by the supplier before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Post-tensioning grout shall be a product listed on the QPL. 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 audited and independent Cement Concrete Research Laboratory (CCRL) which shows the material meets all the requirements specified herein. Compliance with the requirements stated in 938-5 and 938-6 may be by written manufacturers certification.

938-3 Mixing.

The material shall be mixed in accordance with the manufacturers recommendations.

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum powder or components, which produce hydrogen gas, carbon dioxide or oxygen.

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.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C1152
Fine Aggregate (if utilized)	Max Size # No. 50 Sieve (300 micron)	ASTM C33
Volume Change @ 24 hours and 28 days	0.0% to + 0.3%	ASTMC1090*
Expansion	# 2.0% for up to 3 hours	ASTM C940
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C953
Fluidity Test** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C939***
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C939
	or Max. 30 Sec.	ASTM C939***
Bleeding @ 3 hours	Max. 0.0 percent	ASTMC940****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C1202

*Modify ASTM C1090 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.

***Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.

****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 [18 to 24°C].

(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. For the test to be successful, the grout meeting the requirements of 938-4, 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 90°F [32.5°C] temperature for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (∇ 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with an inside diameter of 1 inch [25 mm] plus or minus 1/4 inch [6 mm].

(c) Mix the grout to the specified water content at and 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) At 10 minute intervals throughout the test period, record the pumping pressure at the inlet and test the grout and record the 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 neat grout.

A grout that shows a longer average time to corrosion in the ACTM than the control sample is considered satisfactory.

