1. SCOPE

1.1 This test method covers acceptance tests for NY Standard Specification Item 701-10 Duct Grouting Material (Structures). The method includes tests for setting time, expansion/contraction, compressive strength, bleed water, fluidity, chloride content and sulfate content.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards

T105 Chemical Analysis of Hydraulic Cement
T106 Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
T131 Time of Setting of Hydraulic Cement by Vicat Needle
T162 Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
T260 Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials by Procedure B (Acid-Soluble Chloride Ion by Atomic Absorption)
T277 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

2.2 ASTM Standards

C939 Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
C940 Rev A (Modified) Wick Induced Bleed Test
C1090 Measuring Changes in Height of Cylindrical Specimens from Hydraulic Cement Grout
C1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
C1202 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

3. APPARATUS

3.1 Apparatus is as specified in Referenced Documents with the following exceptions:
3.1.1 The 50-mm (2") cube mold assembly is fabricated of high density polyethylene with the approximate dimensions of that specified in AASHTO T106.

3.1.2 Mortar mixing apparatus is as specified in AASHTO T162 except the bowl positioner is adjusted to allow for the largest size aggregate in the mixture being tested.

3.1.3 Testing apparatus for Modified ASTM C940 Rev, Wick Induced Bleed Test.
   3.1.3.1 Thermometer, accurate to within ±1°F (±0.5°C).
   3.1.3.2 Clear graduated cylinder, 1000 ml, reading to 10 ml, 2.5 to 3.5 in. diameter.
   3.1.3.3 Clear graduated cylinder, 25 ml, reading to 0.5 ml.
   3.1.3.4 Plastic bucket large enough to hold 1500 ml sample.
   3.1.3.5 Wick, made of 20 in. length of seven-wire ½-in. diameter cable strand, meeting the requirements of §709-06.
   3.1.3.6 Duct tape or electrical tape, 2 in. wide.
   3.1.3.7 Degreasing solvent, acetone, or hexane solvent.
   3.1.3.8 Wire brush
   3.1.3.9 Plastic wrap
   3.1.3.10 Plastic pipette or medicine dropper

4. PROCEDURE

4.1 Mixing of Duct Grouting Material - Premix dry components to ensure uniformity. Mix the duct grouting material in accordance with the manufacturer's recommendations using water/grout ratio specified in the testing memo. If no mixing instructions are specified, add water to 5 qt. bowl then add grouting material and mix on slow speed for 3 minutes. Briefly stop mixer (not over 15 s) during first minute of mixing to scrape into batch any grout that may have collected on the side of the bowl.

4.2 Setting Time - Determine the setting time according to AASHTO T131 except place the material in the mold immediately after mixing and store the specimen at ambient conditions instead of in the moist cabinet. Begin taking Vicat readings immediately. Take additional readings at 2 minute intervals for materials whose initial set is expected to be 15 minutes or less. Take readings at 5 minute intervals if the initial set is expected to be greater than 15 minutes.

4.3 Expansion/Contraction - Determine expansion or contraction according to ASTM C1090 using moist cabinet storage conditions. Take measurements at 1, 3, and 7 days.
4.4 Compressive Strength - The compressive strength at a specified curing time is the average compressive strength of three 50mm (2") compression cubes. Cast the cubes in polyethylene cube molds following the procedures of ASTM C1107 for compressive strength except omit the use of a cover plate. Remove from the molds after 24 hours and cure in lime water in the moist cabinet until they are to be broken. Break the cubes in compression as described in AASHTO T106.

4.5 Wick Induced Bleed Test – The Wick Induced Bleed Test is a modified version of ASTM C940 Rev A. This test determines the amount of water that bleeds from freshly mixed grout which can be conducted in the lab or the field. Grout is placed in a graduated cylinder, and changes in grout volume or accumulation of bleed water on the surface of the grout are recorded over time. Conduct all testing at an air temperature of 50 to 90°F. Test samples at lab or field conditions.

4.5.1 Measure out 20 in. of seven-wire ½-in. diameter cable strand, meeting the requirements of §709-06.

4.5.2 Wrap the strand with 2-in. wide duct tape or electrical tape at each end before cutting to avoid splaying of the wires when cut.

4.5.3 Cut wire to 20 in. length.

4.5.4 Remove tape from strand.

4.5.5 Degrease with acetone or hexane

4.5.6 Use a wire brush to remove any surface rust on the strand.

4.5.7 Sample approximately 1500 ml of grout from the mixer for field test, with bucket.

4.5.8 Place 800 ml ± 10 ml of the mixed grout into the 1000 ml graduated cylinder.

4.5.9 Immediately record the temperature of the grout and ambient temperature of the test area.

4.5.10 Center and fasten the strand so that it remains parallel to the vertical axis of the cylinder.

4.5.11 Wrap plastic wrap around the interface between the strand and
the top of the graduated cylinder.

4.5.12 Measure the level of grout and bleed water every 15 minutes for the first hour and hourly for two successive readings thereafter.

4.5.13 Draw the water off with a pipette or large medicine dropper into a 25 ml graduated cylinder after the 3 hour testing duration.

4.5.14 Record the final volume of bleed water to the nearest 0.5 ml.

4.5.15 Calculate the bleed water, expansion of grout, expansion of grout and bleed water. Note if:
- The bleed water remains above or below the top of the original grout height and
- Any bleed water is absorbed into the specimen during the test.

4.6 Fluidity

4.6.1 If not thixotropic determine the time of efflux according to ASTM C939.

4.6.2 If thixotropic use ASTM C939 with the following modifications:

4.6.2.1 The flow cone is filled to the top, i.e. above the standard level, and the time to fill a 1 liter container is measured.

4.6.2.2 After the initial mixing allow the grout to stand for 30 minutes. Then mix
a second time for 30 seconds. Within 30 seconds of halting the mixing fill the
flow cone to the top, i.e. above the standard level, and the time to fill a 1 liter
container is measured.

4.7 Chlorides – Determine Chloride content according to AASHTO T260
Procedure B.

4.8 Sulfates – Determine Sulfate content according to AASHTO T105 section
15.1.

4.9 Permeability – Determine coulomb value according to AASHTO T277.

5. REPORT

5.1 Batch weights with water amount (w/g ratio)

5.2 Initial Setting Time (minutes)

5.3 Expansion or Contraction (%)

5.4 Compressive Strengths (MPa and/or psi)

5.5 Bleed Water (%)

5.6 Time of Efflux (seconds)

5.6 Chloride Content (%)

5.7 Sulfates (%)

5.8 Permeability (coulombs)