557.97030003 - REGROUTING POST-TENSIONING SYSTEM

DESCRIPTION
This work shall consist of preparing and re-grouting voids in existing post-tensioning tendon ducts and anchorages. All work is to be in accordance with the details shown on the Contract Drawings and as directed by the Engineer.

References
The following is a listing of the publications from the Post-Tensioning Institute (PTI) referenced in this Section:

- PTI M50.3-12 Guide Specification for Grouted Post Tensioning
- PTI M55.1.12 Specification for Grouting of Post-Tensioned Structures

MATERIALS

1.01 GROUT FOR TENDONS

A. General:
Grout used to fill voids in tendons shall consist of a commercially available, pre-packaged, cement-based grout mixture meeting the requirements of §701-10 DUCT GROUTING MATERIAL (STRUCTURES) and this Specification. Pre-packaged grout mix shall be stored, mixed, and pressure injected in accordance with PTI M50.3-12, PTI M55-1.12, and manufacturer’s written recommendations.

B. Grout Testing and Approval:
The manufacturer shall submit the grout for evaluation and approval by the NYSDOT Materials Bureau in accordance with Test Method 701-18 P, C. Prior to construction, the Contractor shall furnish the Engineer with results of tests, performed by a CCRL-approved laboratory, demonstrating that the grout production material meets the requirement of this Specification.

C. Required Properties:
Grout shall have the properties required by Table 701-10 of §701-10. Water for mixing shall be potable, clean and free of injurious quantities or substances known to be harmful to cement or steel. Water shall have chloride, sulfide, sulfate, and nitrate contents no greater than 500, 100, 650 and 13 parts per million, respectively.

CONSTRUCTION DETAILS

2.01 QUALIFICATIONS

A. All work described in this Section under the direct, full-time supervision of a person who is a Certified Grouting Technician as certified by the American Segmental Bridge Institute (ASBI) or has a Level 2 Bonded PT – Field Specialist Certification issued by the Post-Tensioning Institute (PTI). Submit written proof of certification before starting work and following any personnel changes.
3.01 SUBMITTALS
B. Test data for proposed grout and mix water including properties required by 1.01C shall be submitted to the Engineer. Manufacturer’s handling, storage, and mixing requirements for grout shall be provided.
C. Erection Procedure and Work Plan - Detailed re-grouting procedure specific to this project include proposed equipment, tendon preparation procedures, venting, materials, appurtenances, suppliers, and schedule. Installation Drawings shall be submitted to the Deputy Chief Engineer (Structures) as required by the NYSDOT Prestressed Concrete Construction Manual. Work shall not begin until Installation Drawings are approved, etc.
D. Qualifications of personnel responsible for grouting operations in the field
E. Mill certifications for caps, bolts, or other fabricated components

4.01 PREPARATION
F. Contractor shall take care to not damage existing wire ends, anchor plates or other components of prestressing system to remain in place.
G. Cleaning and Preparing: All soft and unsound grout, debris and loose corrosion byproduct on wire or strand within anchorages and ducts shall be removed prior to re-grouting.
H. Inspecting: All transverse tendon anchorages shall be investigated for voids. Investigation shall include careful drilling into the anchorage through the existing vent hole at the center of the anchor plate. Borescope equipment with digital camera shall be used to determine the presence and extent of any void discovered. Ground penetrating radar equipment will be employed to verify position and concrete cover of tendon ducts. For each location, a written report will be provided identifying tendon location, presence of voids, void volume and depth or length and photos of tendon interior.
I. Grout Port Drilling: An additional grout or vent port may be required to be drilled through the wedge plate into the anchorage zone to enable preparing and grouting operations. The contractor shall determine locations and number of anchorages requiring grout port drilling. The Contractor shall take care to not damage existing tendon ends, anchor plates, or other components of prestressing system to remain in place. Drills equipped with the capability to interrupt drilling upon contact with embedded steel shall be used. The location, size and cutting/drilling procedures of any proposed holes shall be clearly described in the Re-Grouting procedure prepared by Contractor.

5.01 GROUTING
J. Equipment:
   1. Equipment for mixing grout shall be capable of continuous mechanical mixing of the grout to produce a grout which is free of lumps and in which the ingredients are thoroughly dispersed.
   2. The grouting equipment shall contain a screen having clear openings of 1/8 inch maximum size to screen the grout prior to its introduction into the
grout pump. This screen shall be easily accessible for inspection and cleaning.

3. Grout pumps shall be capable of pumping grout in a manner which complies with the provisions of this Specification. Pumps shall be a positive displacement type capable of producing an outlet pressure of not less than 150 psi with seals adequate to prevent introduction of oil, air or other foreign substance into the grout and to prevent loss of grout or water. A pressure gauge having a full scale reading of no greater than 300 psi shall be placed at some point in the grout line between the pumping outlet and the duct inlet.
   a. For vacuum grouting operations provide a vacuum pump, volume-measuring device, grout flow meter, filter system, valves and fittings as necessary. Provide hand held power tools as necessary for drilling anchor holes and cleaning surfaces of existing anchors and concrete.

4. The grouting equipment shall utilize gravity feed to the pump inlet from a hopper attached to and directly over it. The hopper must be kept at least partially full of grout at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

K. Mixing Grout:
   1. Grout shall be mixed in accordance with the written recommendations of the grout manufacturer.
   2. The grout shall be mixed until a uniformly blended mixture is obtained and shall be continuously agitated until it is introduced into the grout pump. Batches of grout shall be placed within 30 minutes of completion of mixing. Water shall not be added to the grout to modify its consistency after the initial mixing operation is completed.

L. Placing Grout:
   1. Perform re-grouting operations in accordance with PTI M55.1-12 except for the following.
      a. Use vacuum assisted grouting where necessary to ensure that voids are completely filled as determined by the Engineer.
      b. If low pressure grouting is performed on caps and small voids, do not exceed a pressure of 10 psi unless a higher pressure is needed and approved.
      c. Notify the Engineer before starting grouting operations at a given location and complete all grouting operations at a given location (vertical face or top surface) in a single day.
      d. Inspect the grout caps, in the presence of the Engineer, 24 hours after grouting to verify that the ducts and caps were adequately grouted. If voids or soft grout are detected, remove the soft grout and re-grout as needed using vacuum assisted grouting methods at the Contractor’s expense.
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2. When it is anticipated that the air temperature will fall below 32° F, ducts shall be kept free of water so as to avoid freeze damage to ducts. Grouting shall not be done when the temperature of the grout is below 45° F. The temperature of the concrete or air surrounding the tendon shall be maintained at 35° F or above from the time grout is placed until the compressive strength of the grout, as determined from tests on two-inch cubes cured under the same conditions as the in-place grout, exceeds 800 psi.

3. Grouting shall not be done when the temperature of the grout exceeds 90° F. It may be necessary to chill mixing water or take special measures to lower the grout temperature.

4. After the grout has set, pipes used as injection or vent ports shall be cut off and vent ports sealed to be watertight. Duct tape will not be permitted.

5. Remove any grout spilled after all grouting operations have been completed. Do not leave any hardware, trash, tools or other similar loose material on or around the abutment.

6. The Contractor shall provide records of grouting for review by the Engineer within 72 hours of each grouting operation. Each report shall include:
   - Project name & contract number
   - Location of grouting operations
   - Identification of tendon
   - Date, start time, & end time of grouting operation
   - Type of grout used
   - Air pressure of vacuum pump
   - Injection end and applied grouting pressure
   - Theoretical and actual grout quantities
   - Weather conditions
   - Names of technical personnel supervising/carrying out operation
   - Results of QC tests conducted
   - Summary of any problems encountered and corrective action taken.

6.01 GROUT TESTING
M. Testing of production grout shall be in accordance with PTI M55-1.12 with the following minimum number of tests:
   (a) One pressure bleed test (ASTM C 1741) per day. The sample is to be taken at the mixer; results to be evaluated based on PTI M55.1-12, Table 4.1b.
   (b) Two mud balance tests per day or when there is a visual or apparent change in the characteristics of the grout at the mixer and one at the duct outlet, as per PTI M55.1-12, Section 4.4.8;
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(c) Minimum of one compressive strength test per day during grouting operations, results evaluated per NYSDOT Test Method 701-18 P,C.;
(d) Minimum of two fluidity tests (flow cone)-one at the mixer and one at the duct outlet per requirements of ASTM C939 (Modified per PTI M55.1-12, Section 4.4.5), repeating testing every 2 hours of grouting operations. The efflux time shall be within 5 seconds of the values established during laboratory testing per NYSDOT Test Method 701-18 P, C.

7.01 POST GROUTING INSPECTION

N. The Contractor shall inspect the re-grouted tendons and anchorages of each day’s production in the presence of the Engineer 24 hours after grouting. Drill into existing grout ports at all high points along tendon as well as inlets or outlets located at anchorages for inspection. Use drilling equipment that automatically shuts off when steel is encountered. Perform all inspections using bore scopes and in presence of the Engineer. Where voids or soft grout are detected, remove unsound grout and fill voids using volumetric measuring vacuum grouting process within 48 hours. Seal and repair all anchorage and inlet/outlet voids that are produced by drilling for inspection purposes as specified within four hours of completion of inspections if no additional voids are detected in tendon ducts or anchorages.

METHOD OF MEASUREMENT

The re-grouting of the post tensioning ducts and tendon anchorages will be measured as the number of cubic feet of satisfactorily placed grout.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.