

SECTION 03 62 16

GROUT
03/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1107	(2005) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 230	Standard Specification for Flow Table for Use in Tests of Hydraulic Cement
ASTM C 939	(2002) Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 611	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
COE CRD-C 621	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Nonshrink grout manufacturer's representative qualifications; A/E

Surface preparation method for keeping existing concrete surfaces wet prior to placing grout; A/E

Forming method for fluid grout placements; A/E

Curing method for grout; A/E

SD-03 Product Data

Data sheets of grouts; A/E

SD-06 Test Reports

Test report for 24-hour evaluation of nonshrink grout; A/E

Test results and service report from demonstration and training session

Field test reports and laboratory test results for field-drawn Samples; A/E

SD-07 Certificates

Manufacturer's Certificate of Compliance - Properties; A/E
 Manufacturer's Certificate of Compliance - Corrosion; A/E

SD-08 Manufacturer's Instructions

Manufacturer's Instructions; A/E for mixing of grout

Manufacturer's proposed training schedule for grout work; A/E

1.3 QUALIFICATIONS

Nonshrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1-year experience that has resulted in successful installation of grouts similar to those for this Project.

For grout not meeting requirements listed herein, provide completed 24-Hour Evaluation of Nonshrink Grout Test Form, attached at the end of this section. Independent testing laboratory to certify that testing was conducted within last 18 months.

1.4 GUARANTEE

Manufacturer's guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.

Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective as a result of faulty materials, as determined by industry standard test methods.

PART 2 PRODUCTS

2.1 NONSHRINK GROUT SCHEDULE

Furnish nonshrink grout for applications in grout category in the following schedule:

<u>Application</u>	<u>Maximum Placing Time</u>		
	<u>Temperature Range</u> 40 to 100 deg F	<u>20 Min.</u>	<u>Greater than</u> <u>20 Min.</u>
Filling tie holes	I	I	I
Blockouts for gate guides	I or II		II
Precast joints	I or II		II

<u>Application</u>	<u>Maximum Placing Time</u>		
	<u>Temperature Range</u> <u>40 to 100 deg F</u>	<u>20 Min.</u>	<u>Greater than</u> <u>20 Min.</u>
Column baseplates single-story	I or II		II
Machine bases 25 hp or less	II	II	II
Bases for precast wall sections	II	II	II
Baseplates - columns over one story	II	II	II
Precast base joints higher than one story	II	II	II
Through-bolt openings	II	II	II
Machine bases 26 hp and up	III	III	III
Baseplates and/or soleplates with vibration, thermal movement, etc.	III	III	III

Provide [data sheets](#) for each type of grout.

2.2 NONSHRINK GROUT

2.2.1 Category I

- a. Nonmetallic and nongas-liberating.
- b. Prepackaged natural aggregate grout requiring only the addition of water.
- c. Test in accordance with [ASTM C 1107](#).
 - 1. Flowable consistency 140 percent, five drops in 30 seconds, in accordance with [ASTM C 230](#).
 - 2. Flowable for 15 minutes.
- d. Grout shall not bleed at maximum allowed water.
- e. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.

2.2.2 Category II

- a. Nonmetallic, nongas-liberating.
- b. Prepackaged natural aggregate grout requiring only the addition of water.
- c. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
- d. Test in accordance with [COE CRD-C 621 ASTM C 1107](#), Grade B.
 - 1. Fluid consistency 20 to 30 seconds in accordance with [COE CRD-C 611](#).

2. Temperatures of 40, 80, and 100 degrees F.
 - e. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
 - f. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
 - g. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.
- 2.2.3 Category III
- a. Metallic and nongas-liberating.
 - b. Prepackaged aggregate grout requiring only the addition of water.
 - c. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
 - d. Test in accordance with [COE CRD-C 621 ASTM C 1107](#), Grade A.
 1. Fluid consistency 20 to 30 seconds in accordance with [COE CRD-C 611](#).
 2. Temperatures of 40 and 100 degrees F.
 - e. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
 - f. Minimum strength of fluid grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
 - g. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.

PART 3 EXECUTION

3.1 NONSHRINK GROUT

3.1.1 General

Mix, place, and cure nonshrink grout in accordance with grout [manufacturer's instructions](#).

3.1.2 Form Tie or Through-Bolt Holes

Provide nonshrink grout, Category I and Category II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes, coordinate dry pack dense grout application with vinyl plug in [Section 03 11 13.00 10](#), STRUCTURAL CONCRETE FORMWORK, and bonding agent.

3.1.3 Grouting Machinery Foundations

- a. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.
- b. Set machinery in position and wedge to elevation with steel wedges, or

use cast-in leveling bolts.

- c. Form with watertight forms at least 2 inches higher than bottom of plate.
- d. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions

3.2 FIELD QUALITY CONTROL

3.2.1 Evaluation and Acceptance of Nonshrink Grout

- a. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
- b. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with [ASTM C 1107](#)
- c. For large grout applications make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
- d. Consistency: As specified in Article NONSHRINK GROUT. Grout with consistencies outside range requirements shall be rejected.
- e. Segregation: As specified in Article NONSHRINK GROUT. Grout when aggregate separates shall be rejected.
- f. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
- g. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
- h. Perform bleeding test to demonstrate grout will not bleed.
- i. Store cubes at 70 degrees F.
- j. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with [ASTM C 1107](#).
- k. Provide [field test reports](#) and laboratory test reports for field-drawn samples.

3.3 MANUFACTURER'S SERVICES

3.3.1 General

- a. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative.
- b. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of nonshrink grout.
- c. Necessary equipment and materials shall be available for demonstration.

3.3.2 Training

- a. Training is required for all Type II and Type III grout installations.
- b. Grout manufacturer's representative shall train Contractor to perform grout work.
- c. Establish location at Site and [proposed training schedule](#) for grout manufacturer's demonstration and training session of proposed nonshrink grouts. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and tie holes to provide actual on-the-job training.
- d. Use minimum of five bags for each grout Category II and Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.
- e. Training shall include recommended grout [surface](#) preparation method, [forming method](#), and [curing method](#).
- f. Mix and demonstrate patching through-bolt holes and blockouts for gate guides, and similar items.
- g. Transport test cubes to independent test laboratory and obtain test reports.

3.3.3 Certificates of Compliance

[Certificate of Compliance - Corrosion](#) for grout free from chlorides and other corrosion-causing chemicals.

[Certificate of Compliance - Properties](#): Provide certificate for nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28 day expansion and nonshrink properties are not based on gas or gypsum expansion.

3.4 SUPPLEMENTS

The supplement listed below, following "End of Section," is part of this Specification

- a. 24 hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.
- End of Section --

SUPPLEMENT I

(Test Lab Name)

(Address)

(Phone No.)

24 HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24 hour results to duplicate field grouting demands. Intent of evaluation is establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain five bags of each type of grout.

1. From intended grout supplier for Project.
2. Five bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

- A. Product data and warranty information contained in company literature and data? Yes_____ No_____
- B. Literature and bag information meet specified requirements? Yes_____ No_____
- C. Manufacturer guarantees grout as specified in Article Guarantee? Yes_____ No_____
- D. Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas? Yes_____ No_____
- E. Water demands and limits printed on bag? Yes_____ No_____
- F. Mixing information printed on the bag? Yes_____ No_____
- G. Temperature restrictions printed on bag? Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.

GROUT TESTING PROCEDURES

A. Bagged Material:

- 1. List lot numbers. _____
- 2. List expiration date. _____
- 3. Weigh bags and record weight. _____

Engineer will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

- 1. Mix full bag of grout in 10 gallon pail.
- 2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
- 3. Use maximum water allowed per water requirements listed in bag instructions.
- 4. Mix grout to maximum time listed on bag instructions.
- 5. In accordance with ASTM C939 (flow cone) determine time of mixed grout through the flow cone _____ seconds.
- 6. Add water to attain 20 to 30 second flow in accordance with **ASTM C 939**.
- 7. Record time of grout through cone at new water demand _____ seconds.
- 8. Record total water needed to attain 20 to 30 second flow _____ pounds.
- 9. Record percent of water. _____ percent.

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, ASTM C 1107 will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

- 1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
- 2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
- 3. Cover top of both cans with glass or plastic plate preventing evaporation.

4. Maintain 38 degrees F to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15 minute intervals for 2 hours.
6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and III):

1. Divide the remaining grout into two 3 gallon cans. Place the cans into the 40 degree F and 100 degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4 inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.
2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take a ASTM C939 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 degrees F and 100 degrees F.
 - a) 20 min _____, sec. @ 40 degrees F.
 - b) 40 min _____, sec. @ 40 degrees F.
 - c) 60 min _____, sec. @ 40 degrees F.
 - d) 20 min _____, sec. @ 100 degrees F.
 - e) 40 min _____, sec. @ 100 degrees F.
 - f) 60 min _____, sec. @ 100 degrees F.

All Category II and Category III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

Qualified Disqualified

F. 24 hour Strength Test:

1. Using grout left in mixing cans in accordance with ASTM C 1107 for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.
2. Store cubes at 70 degrees F for 24 hours.
3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24 hour compressive strengths are under 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for

use on the Project for the application indicated in Nonshrink Grout Schedule.

Signature of Independent Testing Laboratory

Date Test Conducted

-- End of Section --