

SECTION 03600

GROUT

PART 1 GENERAL:

1.01 SECTION INCLUDES

This section includes work necessary to provide all submittals, provide training, and furnish and install, complete, grout as specified herein. This section includes non-shrink grout and other grouts used on the project.

1.02 SUBMITTALS:

A. Quality Control Submittals. Furnish the following.

1. ASTM C1107-89a, Grade B certified testing laboratory reports, showing the grout tested at a fluid consistency for temperatures of 45 degrees F and 90 degrees F with a pot life of 30 minutes at fluid consistency. The expansion at 3 or 14 days shall not exceed the 28-day expansion and non-shrink property is not based on gas expansion.
2. Twenty-four-hour evaluation of non-shrink grout. Test and report with independent test laboratory letterhead and signature, dated within the last 18 months. Test requirements and forms are specified hereinafter on attached form. Required only for non-specified grouts.
3. Test results and service report from the demonstration and training session and from the field tests.
4. Certification based on test results proving that all grout used on the project contains no chlorides or other chemicals causing corrosion.

B. Warranty. Submit written warranty with no disclaimers as specified hereinafter.

C. Name and telephone number of grout manufacturer's representative living close enough to give regular job service at no extra cost. The representative shall have at least 1 year of experience with these grouts.

D. Contract Closeout Submittals. Manufacturer's certification of installation, including manufacturer's job service report, certifying grouts are used in accordance with manufacturer's recommendations.

1.03 WARRANTY:

- A. Provide 1-year warranty for work provided under this section.
- B. Manufacturer's warranty shall not contain a disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products or materials furnished or their responsibility to anything less than this specified warranty.
- C. Manufacturer's warranty shall not be more limited than the warranty required under this Contract.
- D. Manufacturer shall warrant participation with Contract in replacing or repairing grout found to be defective due to faulty materials, as determined by industry standard test methods.

1.04 QUALITY ASSURANCE:

- A. Preinstallation Demonstrations and Training.
 - 1. Establish a location on project site and schedule a time for the grout manufacturer's demonstration and training session of the proposed non-shrink grouts to be used on the project. The non-shrink grouts shall be mixed to specified consistency, tested, placed, and curing initiated on actual project placements such as baseplates and tie holes to provide actual on-the-job training for CONTRACTOR and OWNER.
 - 2. Conduct the training session using a minimum of five bags for each of Category II and Category III grout, mix the 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, 3, and 28 days, and then use the final work for the project. The CONTRACTOR shall have the employees who will be doing this work present and have them actually participating in this training and demonstration work. The training shall include the methods for curing of the grout.
 - 3. The grout manufacturer shall also mix sufficient Category I grout for a minimum of 15 tie holes and shall train the CONTRACTOR's employees how to perform the work and cure the grout with the employees assisting in the mixing and actual sealing of the tie holes.
 - 4. If the project includes patching, throughbolt holes, and blockouts such as for gate guides, the manufacturer shall also mix and train the

CONTRACTOR's employees how to install and cure each of these applications.

5. Transport the test cubes to an independent test laboratory, obtain the test reports, pay for these tests, and submit a report of these demonstration and training test cube strengths to the OWNER.

PART 2 PRODUCTS:

2.01 NONSHRINK GROUTS:

- A. Provide grouts free of chlorides and other chemicals that cause corrosion.
- B. Non-shrink Grout. Provide non-shrink grout for applications in the grout category as specified in Table 1.

Table 1 Applications for Grout

Application	Temperature Range	Maximum Placing Time	
	40 to 100°F	20 min	Greater than 20 min
Filling tie holes	I	I	I
Blockouts for gate guides	I or II	I	II
Precast joints	I or II	I	II
Column baseplates single-story	I or II	I	II
Machine bases 25 hp or less	II	II	II
Bases for precast wall sections	II	II	II
Baseplates for columns over one story	II	II	II
Precast base joints higher than one story	II	II	II
Through-bolt openings	II	II	II
Patching concrete walls	II	II	II
Machine bases 26 hp and up	III	III	III
Baseplates and/or soleplates with vibration, thermal movement, etc.	III	III	III

- C. Nons-shrink Grout, Category I. Nonmetallic, nongas-liberating flowable grouts meeting the specified test requirements and applications.
 1. A prepackaged natural aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.
 2. Meet ASTM C1107-89a requirements when tested at:
 - a. Flowable consistency (140 percent flow on ASTM C230, five drops in 30 seconds).
 - b. Flowable for 15 minutes.

- c. Fluid working time of at least 30 minutes.
- 3. The grout when tested shall not bleed at maximum allowed water.
- 4. The non-shrink property of the grout shall not be based on gas or gypsum expansion.
- 5. Grout shall have a minimum strength of 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
- D. Non-shrink Grout, Category II. Nonmetallic, nongas-liberating, natural aggregate fluid grouts meeting the specified test requirements and applications.
 - 1. A prepackaged natural aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.
 - 2. Meet the requirements of CRD-C621-89 and ASTM C1107-89a, Grade B when tested at:
 - a. Fluid consistency (20 to 30 seconds) per CRD-C611-89.
 - b. At temperatures of 45, 70, and 90°F.
 - 3. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas or gypsum expansion.
 - 4. The fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.
 - 5. Grout shall have a minimum strength of 2,500 psi at 1 day, 4,500 psi at 3 days, and 7,000 psi at 28 days.
 - 6. Grout shall be pretested within the last 18 months per the hereinafter specified 24-hour grout test requirements.
- E. Non-shrink Grout, Category III. Metallic, nongas-liberating fluid grouts meeting the specified test requirements and applications.
 - 1. A prepackaged metallic aggregate grout, requiring only the addition of water. Mix, place, and cure demonstrated by the manufacturer during the demonstration and training session.

2. Meet the requirements of CRD-C621-89 and ASTM C1107-89a, Grade B when tested at:
 - a. Fluid consistency (20 to 30 seconds) per CRD-C611-89.
 - b. At temperatures of 45, 70, and 90°F.
 - c. Fluid working time of at least 30 minutes.
 3. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas or gypsum expansion.
 4. The fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.
 5. Grout shall have a minimum strength of 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
 6. Test per the hereinafter specified 24-hour grout test requirements.
- F. Non-shrink Grout Manufacturers:
1. Master Builders Co., Cleveland, OH.
 2. Euclid Chemical Co., Cleveland, OH.
 3. Dayton Superior Corp., Miamisburg, OH.
- G. Grout for Horizontal Construction Joints in Walls. Flowable, consisting of sand, water, and minimum 12 sacks of cement per cubic yard.

PART 3 EXECUTION:

3.01 PLACING GROUT:

- A. Place and cure non-shrink grout as demonstrated by the manufacturer during the demonstration and training session.
- B. Non-shrink Grout, Category I and II. For formwork tie holes or through-bolt holes, fill space with dry pack dense grout hammered in with steel tool and steel hammer. For through-bolt holes, coordinate the dry pack dense grout application with the vinyl plug.

- C. Location for Use of Various Types of Nonshrink Grout. As shown and specified herein before.
- D. Horizontal Construction Joints in Reinforced Concrete Walls.
 - 1. Use positive measuring device such as a bucket or other device that will contain only enough sand-cement grout, specified herein before, for depositing in one place in the wall to ensure that portion of the form does not receive too much grout. Limit grout placement to 2-inch maximum thickness.
 - 2. Do not deposit grout from pump hoses or large concrete buckets unless inspection windows close to the joint are available to allow visual measurement of grout thickness and means for grout removal are available for removal of excess grout.

3.02 GROUTING MACHINERY FOUNDATIONS:

- A. Block out original concrete or finish off a sufficient distance below bottom of machinery base to provide for thickness of grout as shown. Prepare the concrete surface by sandblasting or chipping or by other mechanical means to remove any soft material.
- B. Set machinery in position and wedge to proper elevation by steel wedges or use cast-in leveling bolts.
- C. Form with watertight forms at least 2 inches higher than the bottom of the plate.
- D. Fill space between bottom of machinery base and original concrete pour with fluid non-shrinking type grout as specified and in accordance with manufacturer's demonstration instructions.

3.03 FIELD TESTS:

- A. Evaluation and Acceptance of Non-shrink Grout. Provide a flow cure and cube molds with restraining plates onsite. Continue tests during this project as demonstrated by grout manufacturer before grouting began, as follows:
 - 1. Perform flow cone test and bleed tests and make three (2-inch by 2-inch) cubes for each 25 cubic feet of each type of non-shrink grout used. Cube molds shall have restraining caps specified per COE CRD-C-621.

2. On large grouting placements, make three more cubes, one more flow cone test, and more bleed test for each additional 25 cubic feet of non-shrink grout placed.
 3. Flow. As specified herein before.
 4. Grout with flows outside the specified range shall be rejected.
 5. Non-shrink grout cubes shall test equal to or greater than minimum strength as specified.
 6. Strength Test Failures. Reject non-shrink grout work and required removal and replacement of grout with material meeting these Specifications with no additional compensation.
 7. Perform bleeding test to show that grout does not bleed. Test fails if grout bleeds.
 8. Store cubes at 70°F.
 9. An independent testing laboratory shall prepare, store, cure, and test cubes per CRD-C621-89.
 10. OWNER will pay costs for the independent test laboratory work to prepare, transport, store, cure, and test the strength samples. The contractor shall assist the independent test laboratory staff during this work, with costs included in the lump sum bid.
- B. Evaluation and Acceptance of Other Grout. The OWNER will test and evaluate other grout with samples furnished by the CONTRACTOR.

3.04 MANUFACTURER'S SERVICES:

- A. Furnish non-shrink grout manufacturer's representative as follows:
1. Qualifications. An authorized and trained representative of the grout manufacturer.
 2. Responsibilities.
 - a. Coordinate demonstrations, training sessions, and other site visits with the CONTRACTOR.
 - b. Provide and conduct onsite demonstration and training sessions for bleed tests, proper mixing, flow cone measurement, cube testing, placement, and curing for each

category or type of non-shrink grout used and for each use as specified.

- c. Coordinate to ensure necessary equipment and materials are available for demonstration.
- d. Check non-shrink grouting during the job with enough frequency to write job service report to describe grout application and workmanship in relation to manufacturer's recommendations.

END OF SECTION

(Test Lab Name)

(Address)

(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

DESCRIPTION: 24-hour evaluation and analysis of nonshrink grout in accordance with requirements listed herein.

* This evaluation does not supersede any standard ASTM, CRD, or other tests required by specifier to qualify as an approved grout for the project at hand.

OBJECTIVE: To define a standard set of tests that any local certified independent laboratory can perform and complete within a 24-hour period. Costs to run tests will be borne by the manufacturer of the grout to be tested or by whoever requests a substitute for the specified grouts.

SCOPE: Utilize test procedures providing 24-hour results which attempt to duplicate field grouting demands. This evaluation is intended to prove a manufacturer's quality and viability to perform to standards described by specifier.

PRIOR TO TEST: Secure five bags of each grout to be tested:

1. From local dealer/jobber, preferably from ultimate supplier of grout to the job for which grout is specified.
2. All five bags should be of the same lot number.
3. Obtain data/literature pertaining to grout being tested.

ANSWER THE FOLLOWING QUESTIONS CONCERNING GROUT TO BE TESTED FROM LITERATURE/DATA/PRINTING ON BAG:

- A. Is all product data and warranty information contained in company literature/data? Yes ___ No ___
- B. Is It Pertinent? Do literature and bag information agree? Yes ___ No ___
- C. Does the manufacturer warranty the grout in accordance with project specifications? Yes ___ No ___

- D. Does warranty extend beyond grout replacement value and allows participation with contractor in replacing and repairing defective areas?
Yes ___ No ___
- E. Are water demands and limits printed on the bag? Yes ___ No ___
- F. Is mixing information printed on the bag? Yes ___ No ___
- G. Are temperature restrictions printed on the bag? Yes ___ No ___

* Disqualification of a grout if one or more NO answers are noted.

GROUT TESTING REQUIREMENTS

A. Bagged Material:

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

Disqualify grout if bag weights have misstated measure ± 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in the mixing since this affects all other properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in a 10-gallon pail.
2. Use an electric drill with a paddle device to mix the grout (a jiffy or jiffler type paddle.)
3. Use maximum water allowed per the water requirements listed in the bag instructions.
4. Mix grout maximum time listed on bag instructions.
5. Using CRD-C611 (flow cone) determine time of mixed grout through the flow cone. _____ seconds.
6. Add water needed to attain 20- to 30-second flow per CRD-C611.
7. Record time of grout through cone at new water demand.
_____ seconds.

8. Record total water needed to get 20- to 30-second flow.
_____ pounds
 9. Record percent of water manufacturer's recommendations.
_____ percent
- C. When fluid grout is specified and additional water is required above manufacturer's listed maximum water, CRD-C621 must run at the new water/grout ratio to determine whether this grout passes using the actual water requirements to be fluid. Use this new water/grout ratio on all remaining tests.
- D. Bleed Test:
1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures required for each category and at consistency specified for each.
 2. Place one can of grout in tub of ice water; leave one can at ambient temperature.
 3. Cover top of both cans with a glass or plastic plate to prevent evaporation.
 4. Maintain 38 to 42°F temperature with grout placed in ice, maintain ambient temperature for second container, for 1 hour.
 5. Visually check for bleed water at 15-minute intervals for 2 hours.
 6. Make final observation at 24 hours.
- Disqualify grout if it bleeds even a small amount at the temperatures specified for the category intended for use.
- E. Extended Time Flow Test (for Category II and III):
1. Leave the grout in the mix can and mix it with the drillmixer every 5 minutes for 20 seconds. Maintain this process for 1 hour at ambient temperatures of 40, 80, and 100°F.
 2. Take a CRD-C611 flow cone test of the grout at 20, 40, and 60 minutes and record the flow time.
 - a. 20 min _____, sec. @ 40°F
 - b. 40 min _____, sec. @ 40°F
 - c. 60 min _____, sec. @ 40°F
 - d. 20 min _____, sec. @ 80°F

- e. 40 min _____, sec. @ 80°F
- f. 60 min _____, sec. @ 80°F
- g. 20 min _____, sec. @ 100°F
- h. 40 min _____, sec. @ 100°F
- i. 60 min _____, sec. @ 100°F

Disqualify any category grout that will not go through the flow cone with continuous flow after 60 minutes. Disqualify any category grout for high temperature grouting environments that will not go through the flow cone with a continuous flow after 60 minutes at temperature 40, 80, and 100°F.

Qualified

Disqualified

F. 24-Hour Strength Test:

1. Using the grout left in the mixing cans per CRD-C621-89 as specified hereinbefore for the mixing and consistency determination test and for the extended time flow test, make a minimum of nine cube samples.
2. Store cubes at 70°F for 24 hours.
3. Record average compressive strength of nine cubes at 24 hours.

Disqualify grout if 24-hour compressive strengths are under 1,000 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are OK for use on the project for the application shown in the specified table.

Signature of Independent Test Lab
Personnel Supervising and Certifying
these Test and Test Results

Date Test Conducted