

SECTION 04 05 16

MASONRY GROUTING

PART 1 GENERAL

1.1 DESCRIPTION

Section specifies grout materials and mixes.

1.2 RELATED WORK

Grout used in Section 04 20 00, UNIT MASONRY.

1.3 TESTS

1.3.1 Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days. Submit test results.

1.3.2 Certified test reports.

1.3.3 Identify materials by type, brand name and manufacturer or by origin.

1.3.4 Do not use materials until laboratory test reports are approved by Contracting Officer Representative.

1.3.5 After tests have been made and materials approved, do not change without additional test and approval of Contracting Officer Representative.

1.3.6 Testing

Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:

1.3.6.1 Grout

- a. Test for compressive strength; ASTM C1019.
- b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.

1.3.6.2 Cement

- a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
- b. Nonstaining cement shall contain not more than 0.03 percent water soluble alkali.

3. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.4 SUBMITTALS

1.4.1 Certificates. Indicating that following items meet specifications:

VAMC COATESVILLE, PA
INSTALL BACKFLOW PREVENTER SOUTH PUMP BLDG 25
PROJECT NUMBER: 542-15-121

- a. Portland cement.
- b. Masonry cement.
- c. Grout.
- d. Hydrated lime.
- e. Fine aggregate (sand).
- f. Coarse aggregate for grout.
- g. Color admixture.

1.4.2 Laboratory Test Reports

- a. Grout, each type.
- b. Admixtures.

1.4.3 Manufacturer's Literature and Data

- a. Cement, each kind.
- b. Hydrated lime.
- c. Admixtures.
- d. Liquid acrylic resin.

1.4.4 Color Sample

- a. Color to match existing.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.

Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.5 APPLICABLE PUBLICATIONS

Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C40-04	Organic Impurities in Fine Aggregates for Concrete
ASTM C91-05	Masonry Cement
ASTM 150-09	Portland Cement
ASTM C207-06	Hydrated Lime for Masonry Grout
ASTM C476-10	Grout for Masonry
ASTM C595-10	Blended Hydraulic Cement
ASTM C979-10	Pigments for Integrally Colored Concrete
ASTM C1019-11	Sampling and Testing Grout

PART 2 PRODUCTS

2.1 HYDRATED LIME

ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY GROUT

ASTM C404, Size 8.

2.3 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.4 MASONRY CEMENT

2.4.1 ASTM C91. Type N, S, or M.

2.4.2 Use white masonry cement whenever white mortar is specified.

2.5 PORTLAND CEMENT

2.5.1 ASTM C150, Type I.

2.5.2 Use white Portland cement wherever white mortar is specified.

2.6 LIQUID ACRYLIC RESIN

Formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

2.7 WATER

Potable, free of substances that are detrimental to grout, masonry, and metal.

2.8 GROUT

2.8.1 Conform to ASTM C476 except as specified.

2.8.2 Grout type proportioned by volume as follows:

2.8.2.1 Fine Grout

- a. Portland cement or blended hydraulic cement: one part.
- b. Hydrated lime: 0 to 1/10 part.
- c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.

2.8.2.2 Coarse Grout

- a. Portland cement or blended hydraulic cement: one part.
- b. Hydrated lime: 0 to 1/10 part.
- c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
- d. Coarse aggregate: one to two times sum of volumes of cement and lime used.

- 2.8.2.3 Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

2.9 COLOR ADMIXTURE

- 2.9.1 Pigments: ASTM C979.
- 2.9.2 Use mineral pigments only. Organic pigments are not acceptable.
- 2.9.3 Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.
- 2.9.4 Color shall match existing or adjacent finish.

PART 3 EXECUTION

3.1 MIXING

- 3.1.1 Mix in a mechanically operated grout mixer.
 - 3.1.1.1 Mix grout for at least five minutes.
- 3.1.2 Measure ingredients by volume. Measure by the use of a container of known capacity.
- 3.1.3 Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

3.2 GROUT USE LOCATIONS

- 3.2.1 Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 50 mm (2 inches) or less.
- 3.2.2 Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).

3.3 GROUT PLACEMENT

Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units.

3.3.1 Vertical Grout Barriers for Fully Grouted Walls

Provide grout barriers not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.3.2 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout.

3.3.3 Grout Holes and Cleanouts

3.3.3.1 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.3.4 Grouting Equipment

3.3.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.3.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

3.3.5 Grout Placement

Lay masonry to the top of a pour before placing grout. Do not place grout in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.3.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and

reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.3.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS				
			Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells in mm inches (1,2)	
Maximum Grout Pour Height in feet (4)	Grout Type	Grouting Procedure	Multiwythe Masonry (3)	Hollow-unit Masonry
0.31	Fine	Low Lift	203/4	40 x 50 1-1/2 x 2
1.55	Fine	Low Lift	502	50 x 75 2 x 3
2.48	Fine	High Lift	502	50 x 75 2 x 3
3.612	Fine	High Lift	652-1/2	65 x 75 2-1/2 x 3
7.324	Fine	High Lift	753	75 x 75 3 x 3

VAMC COATESVILLE, PA
 INSTALL BACKFLOW PREVENTER SOUTH PUMP BLDG 25
 PROJECT NUMBER: 542-15-121

0.31	Coarse	Low Lift	401-1/2	40 x 75 1-1/2 x 3
1.55	Coarse	Low Lift	502	65 x 75 2-1/2 x 3
2.48	Coarse	High Lift	502	75 x 75 3 x 3
3.612	Coarse	High Lift	652-1/2	75 x 75 3 x 3
7.324	Coarse	High Lift	753	75 x 100 3 x 4

Notes:

- (1) The actual grout space or cell dimension shall be larger than the sum of the following items:
 - (a) The required minimum dimensions of total clear areas given in the table above;
 - (b) The width of any mortar projections within the space;
 - (c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

-- End of Section --

VAMC COATESVILLE, PA
INSTALL BACKFLOW PREVENTER SOUTH PUMP BLDG 25
PROJECT NUMBER: 542-15-121

THIS PAGE INTENTIONALLY LEFT BLANK