

SECTION 02276

GROUTING STONE PROTECTION

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 in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	Portland Cement
ASTM C 260	Air Entraining Admixture for Concrete
ASTM C 494	Chemical Admixture for Concrete

US ARMY CORPS OF ENGINEERS, HANDBOOK FOR CONCRETE AND CEMENT (CRD)

CRD C 300	Membrane-forming Compounds for Curing Concrete
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-08 Statements

Proportions of Mix; GA.

The results of trial mix along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete shall be provided to the Government, at least 30 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Sampling and Testing; FIO

Certified copies of laboratory test reports, including all test data, for

aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

SD-13 Certificates

Cementitious Materials; FIO

Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan. No cement or pozzolan shall be used until notice of acceptance has been given.

Cement and pozzolan may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

PART 2 PRODUCTS

2.1 AGGREGATE

Aggregate for grouting shall consist of clean, hard, unweathered and uncoated particles obtained from a source approved by the Contracting Officer.

2.1.1 Gradation

All points on individual grading curves obtained from representative samples shall be between the boundary limits as defined by smooth curves drawn through the tabulated grading limits, plotted on a mechanical analysis diagram. The individual grading curves shall not exhibit abrupt changes in slope denoting skip grading or scalping of certain sizes. All materials shall be made to the required grading at the source, and individual loads as delivered to the project shall meet the required grading. Aggregate for grouting shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing
3/8	100
No. 4	95-100
No. 16	45-80
No. 50	10-30
No.100	2-10

2.2 CEMENT

Cement shall conform to ASTM C 150, Type II. Only one brand of cement shall be used. No shrinking compensating admixtures shall be used.

2.2.1 Air Entraining Admixture

Air entraining admixture shall conform to ASTM C 260.

2.2.2 Water Reducer

Water reducer shall conform to ASTM 494, type A, F, or G.

PART 3 EXECUTION

3.1 MIXING

The Contractor shall submit a grout mix design to the Contracting Officer for approval. The grout shall be composed of cement, coarse aggregate, air-entraining admixture, water reducing admixture, and water mixed in proportions of the approved mix design. The grout shall have a 28-day compressive strength of 2000 psi. The water cement ratio shall not exceed 0.50. In calculating total water content of the mix, the amount of moisture carried on the surfaces of aggregate particles shall be included. Slump of grout mixed shall be between 9 and 10 inches for the first course and between 7 and 8 inches for the second course or where one course is placed. The grout shall be mixed in a concrete mixer in the manner specified for concrete, except that time of mixing shall be as long as is required to produce a satisfactory mixture, and the grout shall be used in the work within a period of 30 minutes after mixing. Retempering of grout will not be permitted. The consistency of the grout shall be such as to permit gravity flow into the interstices of the stones with the helping of spading, rodding, and brooming. Grout batches in the same course shall be uniform in mix, size and consistency. Sufficient admixture shall be added to produce an entrained air content of between 6 and 8 percent by volume at the mixer.

3.2 PLACING

Stone protection shall not be grouted when the ambient temperature is below 35 degrees F., or above 85 degrees F., nor when the grout, without special protection, is likely to be subjected to freezing temperatures before final set has occurred. Prior to grouting, the stone shall be thoroughly washed with water to wash down the fines and to prevent absorption of water from the grout. The stone shall be kept wet just ahead of the actual placing of grout. The grout shall be placed in one course on inverts and in 2 courses on side slopes. Each course shall be placed full width or in successive lateral strips approximately 10 feet in width, as applicable, extending from toe of slope to top of side slopes. The grout shall be brought to the place of final deposit by tubes, buckets, chutes, pumps or other approved means and discharged directly between the stones, using a trunk or tube to prevent covering the surface of the stones. In no case will grout be permitted to flow on the protected surface. The flow of grout shall be immediately worked into place between stones with suitable spades, trowels, or vibrating equipment, to assure that all crevices are filled. Sufficient barring shall be done to loosen tight pockets of stone and otherwise aid the penetration of grout. The first course shall fully penetrate the stone blanket. The second course shall be placed as soon as the first course has sufficiently stiffened so that it will not flow when additional grout is added. On side slopes, all brooming shall be uphill. Placement and brooming of the grouted surface shall be such that the outer layer of rock projects 1/3 to 1/4 their diameter above the grouted surface. After the top course has stiffened the entire surface shall be rebroomed to eliminate runs in the top course and to fill voids caused by sloughing of layers of grout. After completion of any strip or panel, no workmen or other load shall be permitted on the grouted surface for a period of 24 hours. The grouted surface shall be protected from injurious action of the sun; shall be protected from rain, flowing water, and mechanical injury; and shall be moist cured or membrane cured at the Contractor's option.

3.3 CURING AND PROTECTION

3.3.1 Water Curing

The surface of all grouted stone protection shall be cured by keeping the surface continuously wet using fog spray nozzles or other approved methods for a period not less than 7 days. Curing shall be started as soon as the grout has obtained sufficient strength as to not be damaged by the water cure.

3.3.2 Membrane Curing

The surface of all grouted stone protection shall be cured by use of pigmented curing compound, conforming to Corps of Engineers publication CRD-C-300. The curing compound shall be applied as soon after placing the grout as free water has disappeared. Application shall be with approved power-spraying equipment, by a two-coat continuous operation at a uniform coverage of not more than 400 square feet per gallon for each coat. The second coat shall be applied to overlap the first application. Surfaces which are subjected to rainfall within 3 hours after curing compound has been applied, shall be resprayed by the method and coverage above specified. Curing time shall be a minimum of 7 days and no travel on the grouted surface will be allowed during that period which will disrupt the continuity of the curing membrane.

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