

**SECTION 04 05 13
MASONRY MORTARING**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies mortar materials and mixes.

1.2 RELATED WORK:

- A. Mortar used in Section:
 - 1. Section 04 43 00, Natural Stone Veneer
- B. Mortar Color: As scheduled on Drawings.
- C. LEED Sustainable Construction Specification Section 018111.

1.3 QUALITY CONTROL

- A. Provide Mockup as specified in Section 01 33 23 Shop Drawings, Product Data and Samples.

1.4 TESTING LABORATORY-CONTRACTOR RETAINED

- A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.
- B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

1.5 TESTS

- A. Test mortar and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by Resident Engineer.
- E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.
- F. Testing:
 - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
 - 2. Mortar:
 - a. Test for compressive strength and water retention; ASTM C270.
 - b. Mortar compressive strengths 28 days as follows:
 - Type M: Minimum 17230 kPa (2500 psi) at 28 days.
 - Type S: Minimum 12400 kPa (1800 psi) at 28 days.
 - Type N: Minimum 5170 kPa (750 psi) at 28 days.
 - 3. 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.
- 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
 - 1. Testing laboratory's facilities and qualifications of its technical personnel.
 - 2. Indicating that following items meet specifications:
 - a. Portland cement.
 - b. Masonry cement.
 - c. Mortar cement.
 - d. Hydrated lime.
 - e. Fine aggregate (sand).
 - f. Color admixture.
- C. Laboratory Test Reports:
 - 1. Mortar, each type.
 - 2. Admixtures.
- D. Manufacturer's Literature and Data:
 - 1. Cement, each kind.
 - 2. Hydrated lime.
 - 3. Admixtures.
 - 4. Liquid acrylic resin.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C40-04.....Organic Impurities in Fine Aggregates for
Concrete
 - C91-05.....Masonry Cement
 - C109-08.....Compressive Strength of Hydraulic Cement Mortars
(Using 2-in. or 50-MM Cube Specimens)

C144-04.....	Aggregate for Masonry Mortar
C150-09.....	Portland Cement
C207-06.....	Hydrated Lime for Masonry Purposes
C270-10.....	Mortar for Unit Masonry
C307-03(R2008).....	Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing
C321-00(R2005).....	Bond Strength of Chemical-Resistant Mortars
C348-08.....	Flexural Strength of Hydraulic Cement Mortars
C595-10.....	Blended Hydraulic Cement
C780-10.....	Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C979-10.....	Pigments for Integrally Colored Concrete
C1329-05.....	Mortar Cement

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

See LEED Sustainable Construction Requirements Specification Section 018111 for additional product requirements for LEED certification.

2.2 HYDRATED LIME

ASTM C207, Type S.

2.3 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing.

B. Test sand for color value in accordance with ASTM C40. Sand producing color darker than specified standard is unacceptable.

2.4 BLENDED HYDRAULIC CEMENT

ASTM C595, Type IS, IP.

2.5 MASONRY CEMENT

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

B. Use white masonry cement whenever white mortar is specified.

2.6 MORTAR CEMENT

ASTM C1329, Type N, S or M.

2.7 PORTLAND CEMENT

A. ASTM C150, Type I.

B. Use white Portland cement wherever white mortar is specified.

2.8 LIQUID ACRYLIC RESIN

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

2.9 WATER

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

2.10 POINTING MORTAR

- A. For Cast Stone or Precast Concrete: Proportion by volume; One part white Portland cement, two parts white sand, and 1/5 part hydrated lime.

2.11 MASONRY MORTAR

- A. Conform to ASTM C270.
- B. Admixtures:
 - 1. Do not use mortar admixtures, unless approved by Resident Engineer.
 - 2. Submit laboratory test report showing effect of proposed admixture on strength, water retention, and water repellency of mortar.
 - 3. Do not use antifreeze compounds.
- C. Colored Mortar:
 - 1. Maintain uniform mortar color for exposed work throughout.
 - 2. Match mortar color in approved sample or mock-up.
- D. Color Admixtures:
 - 1. Proportion as specified by manufacturer.
 - 2. At Limestone; Rainbow Mortamix-Oyster White; or equal.
 - 3. At Ground Faced Architectural Masonry Unit; Rainbow Mortamix Champagne; or equal.
- E. Do not use calcium chloride products.

2.12 COLOR ADMIXTURE

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

- A. Mix in a mechanically operated mortar mixer.
 - 1. Mix mortar for at least three minutes but not more than five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.
- C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
- D. Mortar that has stiffened because of loss of water through evaporations:
 - 1. Re-tempered by adding water to restore to proper consistency and workability.
 - 2. Discard mortar that has reached its initial set or has not been used within two hours.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce a damp mixture of workable consistency which will retain its shape when formed into a ball.
2. Allow mortar to stand in dampened condition for one to 1-1/2 hours.
3. Add water to bring mortar to a workable consistency prior to application.

3.2 MORTAR USE LOCATION

- A. Use Type M mortar for below grade locations.
- B. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered) and setting stone
- C. Use Type N mortar for tuck pointing work.

3.3 CLEANING

- A. The use of acid cleaners is not acceptable.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of masonry unit walls.

1.2 RELATED WORK

- A. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- B. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
- C. LEED Sustainable Construction Specification Section 01 81 11.

1.3 QUALITY CONTROL

- A. Provide Mockup as specified in Section 01 33 23 Shop Drawings, Product Data and Samples.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Special masonry shapes.
 - 2. Drawings, showing reinforcement.
 - 3. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315.
- B. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Solid and load-bearing concrete masonry units.
 - 3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.
- C. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.
 - 2. Reinforcing bars.

1.5 WARRANTY

- A. Warranty exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

- A615/A615M-09.....Deformed and Plain Billet-Steel Bars for
Concrete Reinforcement.
- A675/A675M-09.....Standard Specification for Steel Bars, Carbon,
Hot-Wrought, Special Quality, Mechanical
Properties
- A951-06.....Steel Wire for Masonry Joint Reinforcement.
- C90-08.....Load-Bearing Concrete Masonry Units
- C476-08.....Standard Specification for Grout for Masonry
- C744-08.....Prefaced Concrete and Calcium Silicate Masonry
Units.
- D1056-07.....Flexible Cellular Materials - Sponge or Expanded
Rubber
- D3574-08.....Flexible Cellular Materials-Slab, Bonded, and
Molded Urethane Foams
- F1667-05.....Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:
Hot and Cold Weather Masonry Construction Manual,1999.
- D. American Welding Society (AWS):
D1.4-05.....Structural Welding Code - Reinforcing Steel.
- F. Masonry Standards Joint Committee; Specifications for Masonry Structures
(ACI 530.1-08/ASCE 6-05/TMS 602-05) (MSJC).
- G. American Concrete Institute (ACI)
ACI 315-99.....Details and Detailing of Concrete Reinforcement

PART 2 - PRODUCTS

2.1 MATERIALS

- A. See LEED Sustainable Construction Requirements Specification Section 01
81 11 for additional product requirements for LEED certification.

2.2 CONCRETE MASONRY UNITS

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
1. Unit Weight: Normal weight.
 2. Sizes: Modular, as indicated on the drawings.
- Basis of Design: ST2A: Cemex, Ground Face Architectural Masonry,
16Lx4Wx8H, Color: "Sand Dune" with Shell Aggregate.
- ST2B: [Base of Maintenance Facility] Ground Face Architectural
Masonry, 24Lx4Wx12H, Color:"Brown Stone" with shell aggregate.

2.2 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60).
- B. Joint Reinforcement:
1. Form from wire complying with ASTM A951.

2. Galvanized after fabrication.
3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
4. Cross wires welded to longitudinal wires.
5. Joint reinforcing at least 3000 mm (10 feet) in length.
6. Joint reinforcing in rolls is not acceptable.
7. Joint reinforcing that is crimped to form drip is not acceptable.
8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
9. Ladder Design:
 - a. Longitudinal wires deformed 5 mm (0.20 inch) diameter.
 - b. Cross wires 4 mm (0.16 inch) diameter.

2.3 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

2.4 ACCESSORIES

- A. Masonry Cleaner:
 1. Detergent type cleaner selected for each type masonry used.
 2. Acid cleaners are not acceptable.
 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Protection:
 1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
 2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:
 1. Masonry may be laid in freezing weather when methods of protection are utilized.
 2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

3.2 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:

1. In 3,000 mm (10 feet) - 6 mm (1/4 inch).
 2. In 6,000 mm (20 feet) - 10 mm (3/8 inch).
- C. Maximum variation from level:
1. In any bay or up to 6,000 mm (20 feet) - 6 mm (1/4 inch).
 2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
1. In any bay or up to 6,000 mm (20 feet) - 13 mm (1/2 inch).
 2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
1. Minus 6 mm (1/4 inch).
 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
1. Accurate to minus 0 mm (0 inch).
 2. Plus 6 mm (1/4 inch).

3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Wall Openings:
1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
 2. If items are not available when walls are built, prepare openings for subsequent installation.
- C. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
 4. Tool Exposed interior joints in finish work concave unless specified otherwise.
- D. Lintels:
1. Provide lintels as indicated on the drawings.
- E. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean.
- F. Wetting and Wetting Test:
1. Do not wet concrete masonry units before laying.

3.4 REINFORCEMENT

A. Joint Reinforcement:

1. Use as joint reinforcement in single wythe concrete masonry unit walls or partitions.

B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.

3.5 BUILDING EXPANSION JOINTS

A. Keep joint free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Where joints are on exposed faces, provide depth for backer rod and sealant as specified in Section 07 92 00, JOINT SEALANTS, unless shown otherwise.

3.6 CONCRETE MASONRY UNITS

A. Kind and Users:

1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
8. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar.
9. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.

10. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
11. Grout cells of concrete masonry units containing the reinforcing bars solid.

3.7 GROUTING

- A. Preparation:
 1. Clean grout space of mortar droppings before placing grout.
 2. Close cleanouts.
- B. Placing:
 1. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
 2. Interruptions:
 - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.

3.8 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Resident Engineer. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- E. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- F. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T"

sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

- G. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.

3.9 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

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**SECTION 04 43 00
NATURAL STONE VENEER**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for construction of natural stone veneer.

1.2 RELATED WORK

- A. Mortars Section 04 05 13, MASONRY MORTARING.
- B. Color and texture of masonry units: Refer to Finish Schedules on Drawings.
- C. LEED Sustainable Construction Specification Section 018111

1.3 QUALITY CONTROL

- A. Provide Mockup as specified in Section 01 33 23 Shop Drawings, Product Data and Samples.

1.4 PERFORMANCE REQUIREMENTS

- A. Design system to meet wind-loading requirements of the FBC. Refer to structural drawings for wind and design pressures.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Certificates:
 - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
 - 2. Indicating that the following items meet specification requirements:
 - a. Stone veneer.
- C. Manufacturer's Literature and Data:
 - 1. Anchors, ties, and reinforcement.
 - 2. Reinforcing bars.
- D. Shop Drawings:
 - 1. Details showing anchorage system, signed and sealed by a professional engineer responsible for their preparation.

1.6 SAMPLE PANEL

- A. Before starting masonry, lay up a sample panel as specified
 - 1. Use stone units from random pallets of units delivered on site.
 - 2. Include reinforcing, ties, and anchors.
 - 3. Provide a 1.2m x 1.8m (4 feet x 5 feet) panel
- B. Use sample panels approved by Resident Engineer for standard of workmanship of new masonry work.
- C. Use sample panel to test cleaning methods.

1.7 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Indiana Limestone Institute of America (ILI): All limestone to be installed and protected according to the best practices recommendation of the ILI.
- C. American Society for Testing and Materials (ASTM):
- A82/A82M-07.....Standard Specification for Steel Wire, for
Concrete Reinforcement
 - A153/A153M-09.....Standard Specification for Zinc Coating (Hot-Dip)
on Iron and Steel Hardware
 - A951-06.....Steel Wire for Masonry Joint Reinforcement
 - C119-08.....Standard Terminology Relating to Dimension Stone
 - C568-08a.....Standard Specifications for Limestone Dimension
Stone
 - C615-03.....Standard Specification for Granite Dimension
Stone
 - C616-08Standard Specification for Quartz-Based Dimension
Stone
 - C1242-05..... Standard Guide for Selection, Design, and
Installation of Dimension Stone Anchoring Systems
 - C1353-09..... Standard Test Method for Abrasion Resistance of
Dimension Stone Subjected to Foot Traffic Using a
Rotary Platform, Double-Head Abraser
 - C1515-01.....Standard Guide to Cleaning of Exterior Dimension
Stone, Vertical and Horizontal Surfaces, New or
Existing
 - D1056-07.....Standard Specification for Flexible Cellular
Materials - Sponge Expanded Rubber
 - D7089-06.....Standard Practice for Determination of the
Effectiveness of Anti-Graffiti Coating for Use on
Concrete, Masonry, and Natural Stone Surfaces by
Pressure Washing
- D. Masonry Industry Council:
- All Weather Masonry Construction Manual, 2000.

E. Federal Specifications (FS):

FF-S-107C-00.....Screws, Tapping and Drive

F. International Masonry Industry All Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

- A. See LEED Sustainable Construction Requirements Specification Section 018111 for additional product requirements for LEED certification.

2.2 ACCEPTABLE STONE PRODUCTS

- A. Limestone Veneer: Meet ASTM C568, Classification: II Medium-Density.

1. Face Size: Panel 150 or as indicated on drawings.

2. Color Range, finish, manufacturer/producer, Refer to Finish Schedule on Drawings.

ST1 Basis of Design: American Limestone Company, ALC Solution Anchor System. Color: Texas Cream, Honed Chat Finish. See Material Code List Sheet A-115.

ST3 Basis of Design: Coral Stone, Split-Face finish and smooth face finish as indicated on drawings. Sizes vary.

2.3 REINFORCEMENT AND ANCHORAGES

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply paragraphs below, unless otherwise indicated.

B. Aluminum 6061-T6.

C. Manufacturer's standard extruded anchor shapes designed to support panel weight on substrate indicated, and meeting windloading requirements for the FBC, ASCE 7-10

2.4 ACCESSORIES

- A. Joint Sealant: Refer to Section 07 92 00.

B. Nailing Strips: Western softwood, preservative treated, sized to masonry joints.

C. Weep Holes: Leave-out of full head mortar joints.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. (For site walls, see details.)

1. Strips, full-depth of cavity and 250 mm (10 inches) wide, with dovetail shaped notches 175 mm (7 inches) deep that prevent mesh from being clogged with mortar droppings.

E. Mortar: Refer to Section 04 05 13.

F. Expansion Joint Fillers: ASTM D1056 Class RE-11.

G. Dampproofing: Cementitious waterproof stone backing (applied per manufacturer's recommendations). Color to be approved by A/E.

1. Manufacturers:

- a. ThoroSystems or approved equal.
- b. Tamms Industries or approved equal.

H. Flashing: 40 mil EPDM flashing membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other Sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A. Verify items provided by other Sections of work are properly sized and located.
- B. Establish lines, levels, and coursing. Protect from disturbance.
- C. Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Scaffolding: Provide, erect, maintain, move, and finally remove scaffolding and staging required for masonry installation. Construct and maintain scaffolding in compliance with applicable ordinances, laws, rules and regulations. Scaffolding shall be sufficiently substantial to support workmen, and necessary materials and equipment. Provide adequate guard rails for protection of property, workmen, and passerby.

3.3 COURSING

- A. Place masonry to lines and level indicated.
- B. Arrange and trim stones for adequate fit in a range ashlar Pattern with course heights as indicated, random lengths, uniform joint widths with offset between vertical joints as indicated.

3.4 PLACING AND BONDING

- A. Lay masonry in full bed of mortar (horizontal, vertical, and collar joints), properly jointed with other work. Buttering corners of joints and deep or excessive furrowing of mortar joints is not permitted.
- B. Fully bond intersections, and external and internal corners.
- C. Do not shift, or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- D. Remove excess mortar on surface and in cavities.

- E. Perform job site saw cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.

3.5 TOLERANCES

- A. Alignment of Columns: Maximum of 6 mm (1/4 inch) from true line.
- B. Variation from Unit to Adjacent Unit: 0.8 mm (1/32 inch) maximum.
- C. Variation from Plane of Wall: 6 mm (1/4 inch) in 3 m (10 feet) and 12 mm (1/2 inch) in 6 m (20 feet) or more.
- D. Variation from Plumb: 6 mm (1/4 inch) per story non-cumulative, 12 mm (1/2 inch) in two stories or more.
- E. Variation from Level Coursing: 3 mm (1/8 inch) in 1 m (3 feet); 6 mm (1/4 inch) in 3 m (10 feet); 6 mm (1/4 inch) maximum.
- F. Variation of Joint Thickness: 3 mm (1/8 inch) in 1 m (3 feet).
- G. Maximum variation from Cross Sectional Thickness of Walls: Plus or minus 6 mm (1/4 inch).

3.6 REINFORCEMENT AND ANCHORAGES

- A. Anchor stone veneer to unit masonry with embedded (or attached) anchors/clips as shown on final Shop Drawings and meeting Performance Requirements.

3.7 MASONRY FLASHINGS

- A. Extend flashings to exterior face of veneer, turn up a minimum of 200 mm (8 inches) and seal onto face of sheathing over stud framed back-up.
- B. Lap end joints minimum 150 mm (6 inches) and seal watertight per manufacturer's recommendation.
- C. Use flashing manufacturer's recommended adhesive and termination sealant.
- D. Create end dams at end of window heads, and other vertical elements to channel water to nearest weep hole away from windows and other items which might allow water to travel vertically.
- E. Install concealed flashing at continuous shelf angles, lintels, ledges and similar obstructions to the downward flow of water so as to divert such water to the exterior.
- F. Keep cavities open where unfilled space is indicated between back of stone veneer and backup wall; do not fill cavities with mortar or grout.

3.8 LINTELS

- A. Install loose steel lintels as scheduled or shown. Leave space at end of lintels to expand.

3.9 WEEPS AND VENTS

- A. Install weep holes in veneer at 600 mm (24 inches) on center horizontally for clay masonry and 800 mm (32 inches) on center for 400 mm (16 inch) long concrete masonry, above through-wall flashing, above shelf angles,

and at bottom of walls. (For site walls, install weep holes with felt wick).

3.10 CONTROL/EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcing across control joints.
- B. Size control joints in accordance with Section 07 92 00 for sealant performance, but in no case larger than adjacent mortar joints in exposed face brick.
- C. Provide expansion joints as indicated.

3.11 DAMPPROOFING FOR STAIN PREVENTION (FOR SITE WALLS)

- A. Where indicated on drawings, coatings of cementitious waterproof stone backing shall be applied on backs, beds, and joints of all stones used at grade. Dampproof all adjacent concrete surfaces on which limestone will rest, including concrete or cmu haunches and ledges, as well as support angles.
- B. Dampproof unexposed surfaces of stone to at least 1'-0" above grade.
- C. Dampproof joints only to within 1" of finished surfaces when using bituminous or asphaltic solutions.
- D. Stone extending below grade shall be dampproofed as above, and in addition shall be dampproofed to the level of grade on their face surfaces which are covered.
- E. Cementitious coatings must be allowed to cure before treated stone is set. Due care must be exercised in handling all dampproofed stone to avoid chipping or off-setting.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other Sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.13 CLEANING

- A. Remove excess mortar and smears.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with non-acidic solution which will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners. Leave surfaces thoroughly clean and free of all mortar and other soiling.
- D. Use non-metallic tools in cleaning operations.
- E. ASTM C1515 and D7089.

3.14 PROTECTION

- A. Maintain protective boards at exposed external corners which may be damaged by construction activities.

- B. Provide protection without damaging completed work.
- C. Keep expansion joint voids clear of mortar.
- D. Protect from weather and cleaning until all joints are secure including cap joints. Cover at end of each working day and during rainy weather.

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SECTION 04 73 00
COLUMBARIUM NICHE COVERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

1. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.2 DESCRIPTION

- A. Work Included: Provide labor and materials necessary to complete the work of this Section, including but not limited to the following:
 1. The Department of Veterans Affairs (VA) shall furnish niche covers for all of the new Columbarium Niches being installed by the Contractor. This specification section is for all work necessary for the Contractor to accept, handle, store, move and install one, government approved and provided, blank columbarium niche cover for each of the new precast niches created in the new columbarium walls. The government shall also provide, as part of the niche cover products manufactured for this project, a predetermined minimum number of approved blank niche covers to act as spares. The spare niche covers are to be used to replace niche covers should any damage occur, or for re-inscription necessitated by additional interment at a specific niche location.
 2. The number of approved government provided spare columbarium niche covers for this project to be accepted, offloaded and stored at the designated location is 700.

1.3 QUALITY CONTROL

- A. Provide mockup of finished installation as specified in Section 01 33 23 Shop Drawings, Product Data and Samples.

1.4 INSTALLER QUALIFICATIONS

- A. Installation of columbarium niche covers will be performed by those companies who, through an approved certification process, have demonstrated previous experience in installation of similar design as indicated in the drawings and specified herein.

1.5 RELATED WORK

- A. The following items are not included in this Section and will be performed under the designated Sections:
 1. Section 03 48 24: PRECAST CONCRETE COLUMBARIUM UNITS, the precast concrete niche units with: niche cover mounting hardware assemblies

(installed); and niche cover attachment hardware assemblies (provided for use to attach the Government provided niche covers). Four each of the niche cover mounting hardware assemblies shall be furnished and installed for each precast concrete niche opening. Four each of the niche cover attachment hardware assemblies shall be provided for each precast niche opening, to be used to mount the approved government niche covers as indicated and on the drawings.

1.6 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, LEED CONSTRUCTION REQUIREMENTS, for project low-emitting materials requirements.
- B. Biobased Material: For products designated by the USDA's BioPreferred® program, provide products that meet or exceed USDA recommendations for biobased content, subject to the products compliance with performance requirements in this Section. For more information regarding the product categories covered by the BioPreferred® program, please visit <http://www.biopreferred.gov/>.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NICHE COVERS (GOVERNMENT PROVIDED) - CONTRACTOR ACCEPTANCE

- A. Niche covers that have been inspected and accepted as being in compliance with manufacturing tolerances for size, hole size and placement, perpendicularity, finish, and product stone quality shall be furnished by the Government and delivered to the site on pallets. They shall be of size, type, manufacturing, finish and quantities required for this project. The covers shall be delivered to the site Freight on Board (FOB) and the Contractor shall be responsible to offload and secure them at the job site. The general quantity and condition shall be observed and an adequate count to cover all the installed columbarium units, plus required spares shall be verified by the Contractor prior to accepting the units and performing the offloading operations. Note any shipping damage and reject any damaged covers before the delivery truck leaves the site. Once satisfied, take ownership of the acceptable covers, as all being approved as meeting the government specifications and being suitable for installation at this project. Once the niche covers are accepted at the site, they shall become the Contractors responsibility until installed and the installation is accepted by the Resident Engineer.

3.2 INSPECTION

- A. All materials shall be inspected prior to installation to insure compliance with the contract documents and to insure there is no damage. Should conditions be different from those indicated on the contract documents, contractor should immediately notify the Resident Engineer.

3.3 NICHE COVER ATTACHMENT HARDWARE

- A. Each of the four niche cover attachment hardware assemblies provided, for each new precast concrete niche opening, as part of Section 03 48 24, PRECAST CONCRETE COLUMBARIUM UNITS, consists of: the stainless steel rosette, stainless steel tamperproof screw and the white or clear washer beneath the rosette, that is to bear against the niche cover when rosette is snugged up causing the cover to stay in place against the face of the niche opening due to friction. All of the niche cover hardware (mounting and attachment assemblies) shall be as submitted and approved as part of the work in Section 03 48 24, PRECAST CONCRETE COLUMBARIUM UNITS.
- B. The Contractor performing the installation of the niche covers shall maintain control of the niche cover attachment hardware assemblies from delivery to the site through acceptance of the installation of the government provided niche covers.

3.4 INSTALLATION

- A. Installation of the government provided niche covers shall include all materials, manpower, tools and equipment required to receive the approved government provided niche covers from the manufacturer, and handle them as necessary and perform whatever work is needed to result in the successful installation of one niche cover for every precast concrete niche space created for this project.
- B. The niche covers shall be installed so as to create a visual straight line along the top of the row of covers agreed to by the Resident Engineer as the primary visual vertical reference line in the installation. The covers shall be spaced achieve, as close as possible, the intended design spacing, taking into consideration the allowable fluctuations in the manufacturing tolerances for the government provided niche covers.
- C. The niche cover attachment assemblies shall be installed so that the threaded end of the tamperproof screw is inserted into the threads of the spring clip on the mounted angle bracket behind each of the mounting holes in the niche covers. This should result in the head of the screw being parallel with the face of the niche cover. The threaded hole in

the spring clip shall be fully visible when looking through the mounting hole in the niche cover to the respective spring clip behind the hole. The position of the spring clip shall be adjusted so the threaded tamperproof screw will enter the threaded hole in the spring clip and that the attachment assembly can be tightened to secure the cover in the intended position. To achieve this installation, the angle brackets shall be adjusted to be the correct height from the niche wall so the hole in the spring clip can have the respective tamper proof screw inserted and tightened. To achieve the proper positioning of the spring clips, the angle brackets shall be adjusted in their position, or the hole in the angle bracket through which the tamper proof screw passes when tightened into the spring clip, shall be enlarged as necessary to allow the adjustment of the spring clip to align with the hole in the niche cover so the tamper proof screws through the individual rosettes can each be inserted and tightened using the threaded spring clip. Only correct installations of the tamperproof screws, inserted into the threads of the spring clip and being tightened are acceptable. The head of the tamperproof screw shall be snugged up tight against the rosette, and shall be seated against the rosette, which occurs when the tamperproof screw is approximately perpendicular to the face of the niche cover.

3.5 CLEANING AND PROTECTION

- A. Columbarium niche covers shall be shop cleaned at the time of fabrication. After installation, carefully clean the markers, removing all dirt stains, and all other incident defacements.
 - 1. Stiff bristle fiber brushes may be used, but the use of wire brushes or acid-type cleaning agents and other solutions which may cause discoloration is expressly prohibited. Fabricator should be contacted regarding the use of any cleaners and must approve of them before use.
 - 2. Protection of Finished Work: All covers that are installed as part of the work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.
- B. Clean up area of excess material and debris. Clean visible portions of all covers.

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SECTION 04 73 11
MEMORIAL MARKER-MARBLE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.2 DESCRIPTION

- A. Work Included: Provide labor and materials necessary to complete the work of this Section, including but not limited to the following:
1. The Department of Veterans Affairs (VA), National Cemetery Administration (NCA) will furnish markers to memorialize veterans. This specification provides for blank memorial markers made from white marble.
 2. This work includes all labor and materials to furnish 720 accepted white marble memorial marker covers (one for each marker location created in the memorial wall(s) for this project. In addition, furnish a quantity of spare accepted white marble markers in the quantity of 180. All accepted markers shall meet or exceed the manufacturing tolerances as specified.

1.3 DELIVERY

Contractor shall coordinate the submittal review, ordering, and delivery of the memorial markers to arrive sufficiently in advance to allow the inspection for compliance with the allowable tolerances and obtain additional approved units to replace any not deemed acceptable and complete the full installation within the allowable project work schedule. The complete installation shall be before the date of the final inspection. Contractor shall have the covers delivered F.O.B. to the Contractor selected location within the:

Cape Canaveral National Cemetery
5525 Highway 1
Mims, FL 32754

1.4 RELATED WORK

- A. LEED Sustainable Construction Specification Section 01 81 11.
- B. The following items are not included in this Section and will be performed under the designated Sections:
1. Section 03 48 24: PRECAST CONCRETE COLUMBARIUM UNITS

1.5 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:

1. Submit at contractor expense, two blank white marble memorial marker samples (285.75mm) 11-1/4" wide x (196.85mm) 7-3/4" high x (19.05mm) 3/4" deep, representative of the stone to be used, the finish to be attained, the chamfering of the corners, the drilling of mounting holes, and testing results. One sample and the testing results shall be provided to the Resident Engineer and the other shall be sent to the Memorial Programs Service, Program Support Unit. The sample and testing results shall be submitted. The sample shall be marked clearly on the back with indelible marker, showing contractor name, project number, quarry source of stone and name of stone. The testing results shall be submitted with this sample. Any sample which arrives damaged will not be acceptable.
2. Once an acceptable sample is provided and accepted, the sample will become the basis for comparison of all blank memorial markers furnished under this contract.

1.6 REFERENCE STANDARDS

- A. The publications listed below form a part of this specification and the work shall comply with pertinent standards of the latest editions as specified below or by industry standards unless designated otherwise herein. The publications are referenced in the text by basic designation only.
 1. Munsell Neutral Value Scale, Matte (31 - step scale)
617 Little Britain Road, New Windsor, NY 12553 - 6148
 2. American Society for Testing Materials (ASTM) Standards:
C97/C97M-09 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
C99/C99M-09.....Standard Test Method for Modulus of Rupture of Dimension Stone
C119-08Standard Terminology Relating to Dimension Stone
C170/C170M-09Standard Test Method for Compressive Strength of Dimension Stone
C241/C241M-09Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
C880/C880M-09Standard Test Method for Flexural Strength of Dimension Stone
 3. Dimension Stones of the World, Volume II
Marble Institute of America, Inc.
28901 Clemens Road, Suite 100, Cleveland, OH 44145
 4. Drawings, Memorial Marker Layout (Marble/Granite) following the end of this section.

1.7 QUALITY ASSURANCE

A. Marble Testing

1. The marble supplied under this contract shall conform to the following specifications and physical requirements. Stone shall be tested, for the tests listed below, by an approved testing laboratory and test results shall be submitted to the Memorial Programs Service, Program Support Unit for approval prior to the production of the sample memorial markers. Testing is required only once and shall be from a representative sample of the quarry.
2. Abrasion Resistance, Hardness:
Marble shall have an abrasive hardness value (Ha) of 10.0 minimum, when tested as specified in ASTM C241.
3. Absorption:
Marble absorption shall be 0.15 of moisture by weight when tested for a 48 hour period as specified in ASTM C97.
4. Compressive strength:
Marble shall have a minimum compressive strength of 5.27 kg/mm² (7,500 psi), when tested as specified in ASTM C170.
5. Modulus of rupture:
Marble shall have a minimum modulus of rupture of 0.70kg/mm² (1000 psi) when tested as specified in ASTM C99.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. See LEED Sustainable Construction Requirements Specification Section 01 81 11 for additional product requirements for LEED certification.
- B. Source of supply:
 1. All stone shall be obtained from quarries within the United States of America, having adequate capacity and facilities to meet the specified requirements. Cutting and finishing shall be done by a manufacturer equipped to process the material promptly, in order and in strict accordance with these specifications. Evidence to this effect shall be provided by the contractor to Memorial Programs Service, Program Support Unit (41A1B) if requested and shall be provided to the Resident Engineer as part of the submittal of the samples and testing results.
 2. Marble Material
Marble shall be white American monumental marble which shall be sound and compact, free from cracks, spalls, chips, holes, calcite lines more than two inches in length, open seams, pits, or other defects that would impair its strength, durability or appearance.
 3. Marble Color

The overall whiteness of the marble exclusive of allowable coloration shall be no less than standard number N8 of the Munsell Neutral Value Scale, 31 Step Scale (desirable value is N8.5 or higher). Variations in coloration shall blend gradually with the white background. Blotches of color, or clouding and veining which is in sharp contrast with the background whiteness, which would inhibit ease of legibility of the inscription, or which presents an objectionable appearance shall be cause for rejection.

2.2 MANUFACTURE

- A. The following requirements are to establish the performance standards for the memorial markers as being manufactured, delivered and installed as part of the work by the Contractor for the project. Memorial markers shall be cut from the larger blocks in such a way that any evident and allowable veining is predominantly parallel to the short dimension of the marker.

1. Incising - No incising is required as part of this contract.

2. Dimension Tolerances

Memorial Markers shall conform to the dimensions shown on the Memorial Marker Layout Marble drawing.

3. Each surface shall be parallel to its counterpart and perpendicular within 0.25 degree to its contiguous surfaces. Dimension tolerances are:

- a. width -- plus or minus 1/16 inch
- b. height -- plus or minus 1/16 inch
- c. thickness -- plus or minus 1/16 inch
- d. surface deviation from a true plane -- plus or minus 1/32 inch

4. Finish

The face of each memorial markers shall be machine 80 grit honed with a finishing stone to produce a smooth satin finish, free of scratches, saw marks, rust spots and skips. The back face of the memorial markers can be sawn finished or better. All edges, of the front, back and corners shall be smooth sawn and finished with a clean 1/16 inch aris (eased edge). Provide a 1/4" 45 degree chamfer on all 4 corners.

5. Workmanship

Each memorial marker shall be free from defects in workmanship. Spalls, chips, cracks, open seams, or abraded edges, will not be permitted and the repair or patching of any such defects is prohibited and will be cause for rejection. The markers shall be free of ink, oil, crayon marks, dirt, coatings, sealers and stone dust. Workmanship quality shall be in accordance with industry standards and practices.

2.3 MEMORIAL MARKER ATTACHMENT HARDWARE

- A. Hardware for attachment shall be specifically designed for attaching engraved markers. The hardware shall be designed to be hidden, except for the rosettes at the corners of the plaques. The hardware shall allow for the removal of an individual plaque for engraving, without having to remove multiple plaques. The material for the attachment hardware shall be compatible with stainless steel rosettes and rosette attachment screws, without adverse reactions. The hardware shall not cause staining on the plaques. The attachment hardware should only be visible when looking in the crack between the plaques, and shall be recessed from the face of the plaques. The hardware shall be suitable for installation in concrete masonry unit memorial wall installations and shall be coordinated with the wall design and shall be submitted for review and approval as part of the submittal for the entire memorial wall assembly. The attachment hardware shall be suitable for a permanent installation, out of doors, suitable for the indicated loads, and shall produce the finish installation as indicated on the contract drawings.

PART 3 - EXECUTION

3.1 INSPECTION

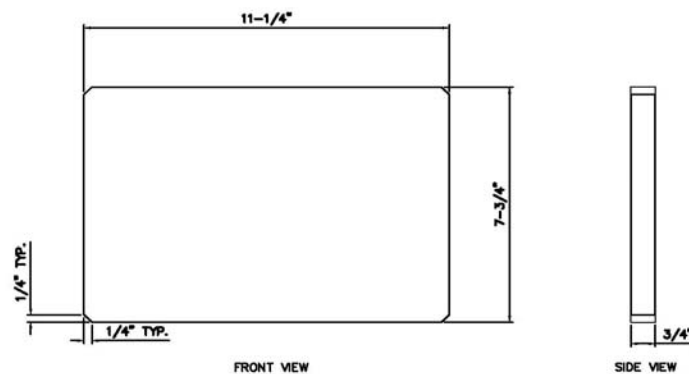
- A. All materials shall be inspected prior to installation to insure compliance with the contract documents and to insure there is no damage. Should conditions be different from those indicated on the contract documents, contractor should immediately notify the Resident Engineer/COTR.

3.2 INSTALLATION

- A. See Section 03 48 24: PRECAST CONCRETE COLUMBARIUM UNITS

3.3 CLEAN UP

- A. Clean up area of excess material and debris. Clean visible portions of all markers.



MEMORIAL MARKER LAYOUT

- END -