

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:

1. Face brick.
2. Mortar and grout.
3. Masonry joint reinforcement.
4. Ties and anchors.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

- B. Related Sections:

1. Section 042200 "Concrete Unit Masonry" for concrete block.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Samples for Initial Selection:

1. Face brick.

- C. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Accessories embedded in masonry.

- D. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Joint reinforcement.
5. Anchors, ties, and metal accessories.

- E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.

- F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- C. Mockups: Build mockups as indicated on Drawings to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - 2. Protect accepted mockups from the elements with weather-resistant membrane.
 - 3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; integration of other architectural components into wall assembly and aesthetic qualities of workmanship.
 - 4. Demolish and remove mockups when directed unless otherwise indicated.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: ASTM C 216, Grade SW, Type FBS.
 - 1. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
 - 2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 3. Size (Utility): 3-5/8 inches wide by 3-5/8 inches high by 11-5/8 inches long.
 - 4. Basis of Design Products: The design for brick masonry is based on the following products:
 - a. Typical Brick: Campus standard "Forterra Columbia 4 #605 Waverly Mills" by Meridian Brick.
 - b. Accent Brick: Black #1303-T-324 by Taylor Clay Products, Inc., Salisbury, NC.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- B. Mortar Cement: ASTM C 1329.

- C. Aggregate for Mortar: ASTM C 144.
- D. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate custom blend as selected by Architect to match existing.
 - 2. Acceptable Manufacturers:
 - a. Holcim.
 - b. Argos.
 - c. Lafarge.
- E. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Exterior Walls: Hot-dip galvanized, carbon steel.
- C. Adjustable Joint Reinforcement for Multiwythe Masonry: As specified in Section 042200 – Concrete Unit Masonry.

2.5 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.
- D. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- E. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.6 EMBEDDED FLASHING MATERIALS

- A. Through-Wall Flashing: For concealed flashing, use one of the following:
 - 1. Non-Asphaltic Laminated Stainless Steel: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive.
 - a. Products:
 - 1) York Manufacturing, Inc.; Multi-Flash SS.
 - 2) Hohmann & Barnard, Inc.; Mighty-Flash.
 - 3) STS Coatings: Gorilla Flash Stainless.

- B. Flashing Sealant: Polyether based, moisture curing, elastomeric, sealant; non-shrinking, 100% solids, moisture-cure polymer, solvent-free.
 - 1. Products:
 - a. York Manufacturing, Inc.; UniverSeal US-100.
 - b. ChemLink; M-1 Structural Adhesive/Sealant.
 - c. STS Coatings: Great Seal LT-100.
- C. Flashing Termination Bars: Stainless steel, 22 ga., with mounting holes spaced 16 inches o.c. and with a 3/8 inch sealant flange at top.
- D. Pre-Formed Corners and End Dams: Prefabricated stainless steel or fabricated from non-asphaltic, laminated stainless steel flashing material sealed with polyether sealant.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use one of the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 2) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 3) Hohmann & Barnard, Inc.; Quadro-Vent.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Mortar Break DT.
 - b. MasonPro, Inc.; Mason ProNet.
 - c. Mortar Net USA, Ltd.; Mortar Net.
 - 2. Provide the following configuration:
 - a. Sheets or strips with trapezoidal-shaped top edge, full depth of cavity and installed to height indicated on Drawings.

2.8 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Masonry cleaners **must be used only**

when other methods have not been effective and must be approved in writing by both the brick and mortar manufacturers prior to cleaning.

1. Manufacturers: Subject to compliance with requirements, provide appropriate products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. ProSoCo., Inc.
 - c. EaCo Chem, Inc.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 4. Color: Custom color as selected by Architect to match existing.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 1. For masonry below grade, masonry veneer, and for other applications where another type is not indicated, use Type S.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
- 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
- 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes, including epoxy paint.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
 1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 1. Provide rigid metal anchors not more than 16 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

- D. Installing Cavity-Wall Insulation: Coordinate installation of insulation with placement of masonry veneer anchors. Fit courses of insulation with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.7 EXPANSION JOINTS

- A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
 - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 - 3. Build in compressible joint fillers where indicated.
 - 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.

3.9 FIELD QUALITY CONTROL

- A. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- B. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.10 REPAIRING AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. **Only if other methods have not been effective and if use of proprietary cleaner has been approved in writing by Architect**, a proprietary acidic cleaner may be used according to manufacturer's written instructions.

END OF SECTION 042113

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Mortar
 - 4. Grout.
 - 5. Steel reinforcing bars.
 - 6. Masonry joint reinforcement.
 - 7. Ties and anchors.
 - 8. Miscellaneous masonry accessories.

1.3 RELATED SECTIONS

- A. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Single Wythe Masonry Joint reinforcement
 - 2. Multiwythe Cavity Wall Masonry Joint Reinforcement.
 - 3. Rigid Anchors
 - 4. Masonry cleaners
- B. Contractor's Statement of Responsibility Per Division 01 Section "Quality Requirements"
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - a. Dowels shall match typical wall reinforcing unless noted otherwise.
 - b. Dowels shall extend a lap distance above finished floor, unless top of footing is more than typical bar lift below finished floor. In such an instance dowel shall extend a lap distance out of footing.

- c. Coordinate bar lift detailing with sequencing requirements of part 3 of this specification section.
 - d. Layout cmu control joints per contract documents and show associated typical reinforcing.
 - e. General Contractor shall coordinate all necessary openings in masonry walls with all subcontractors and shall provide information to reinforcing steel detailer for preparation of shop drawings.
- D. Material Certificates: For each of the following indicating compliance with the required standards and signed by manufacturers:
- 1. Concrete Masonry units.
 - a. Submit material certificate for each type of mix to be use in production of block for the project.
 - b. Submit material certificate not more than 180 days old demonstrating compliance with the specified ASTM standards and project requirements.
 - c. Include material test reports substantiating compliance with requirements.
 - d. Include data and calculations establishing average net-area compressive strength of each size and profile of block to be used on the project.
 - e. Include a statement confirming that cmu produced for the project will use materials identical to those used in producing the block for which test reports are submitted.
 - 2. Grout Cementitious materials.
 - a. Submit material certificates not more than 90 days old demonstrating compliance with the specified ASTM standards.
 - 3. Mortar Cementitious materials.
 - a. Submit material certificates not more than 90 days old demonstrating compliance with the specified ASTM standards.
 - 4. Grout Coarse Aggregates
 - a. Submit material certificates not more than 90 days old demonstrating compliance with the specified ASTM standards.
 - 5. Grout Fine Aggregates.
 - a. Submit material certificates not more than 90 days old demonstrating compliance with the specified ASTM standards.
 - 6. Mortar Fine Aggregates
 - a. Submit material certificates not more than 90 days old demonstrating compliance with the specified ASTM standards.
 - 7. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 8. Preblended Grout mixes. Include description of type and proportions of ingredients.
- E. Design Mixtures:
- 1. Grout: For each type of grout
 - a. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - b. Mix design submittals shall include test results and/or trial batch data that meet or exceed the required average compressive strengths required by ACI 301. In accordance with ASTM C476 all testing shall be completed per ASTM C10119.
 - c. Trial batches shall consist of identical cementitious materials, fine and course aggregates, and admixtures to be used for mix design.
 - d. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 2. Mortar: For each type of mortar
 - a. Indicate materials to be used
 - b. Indicate proportioning of ingredients.
 - c. Indicate repeatable means of measuring ingredient proportions.
 - d. When using the ASTM C270 property specification include test reports. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

- F. Samples for Verification: For each type and color of the following:
 - 1. Decorative CMUs.
- G. Hot and Cold Weather Program: Describe in detail procedure for working in Hot and Cold Weather. Include detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate
- D. Limitations on Aggregates: For concrete masonry units containing recycled material or post-industrial waste, provide units free of impurities that will cause rusting, staining or popouts and with a record of successful in-service performance in conditions similar to those expected at Project site.
 - 1. Ferrous material shall be removed by magnetic separation.
 - 2. Aggregates shall contain no combustible materials.
 - 3. Aggregates shall be graded and supplied in consist graduations from batch to batch.
 - 4. Material shall be tested according to the following:
 - a. ASTM C 40: Organic Impurities in Fine Aggregates for Concrete.
 - b. ASTM C 136: Sieve Analysis of Fine and Coarse Aggregate.
 - c. ASTM C 641: Staining Materials in Lightweight Concrete Aggregates.
 - d. ASTM C 151: Autoclave Expansion of Hydraulic Cement (for popouts).
- E. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- F. Grout Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design grout mixtures.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Review construction sequencing and required time allotted for inspections prior to grouting.
 - 2. Review ACI 530 tolerance for placement of reinforcing steel.
 - 3. Review hot and cold weather procedures.
 - 4. Review typical details for reinforcement requirements
 - 5. Review requirements for horizontal joint reinforcement
 - 6. Review reinforcement placement tolerance
 - 7. Review reinforcement anchorage requirements
 - 8. Review reinforcement lap requirements
 - 9. Review reinforced masonry construction sequence
 - 10. Review limits on embedded items in grouted masonry
 - 11. Review grouting procedures and requirement for mechanical vibration.

12. Review requirements for masonry protection

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, bond beams and other special conditions.
 - 2. Provide square edge units for outside corners unless otherwise indicated
- B. Cell Layout:
 - 1. All block shall be of standard two cell or open end configuration.
 - 2. All block shall be configured such that it allows for both of the following:
 - 3. Placement of reinforcing as indicated with not less than 1/2" clear grout cover between the bar and the block.
 - 4. For the required bonding pattern the block will provide a minimum 3 inch by 3 inch continuous vertical column to receive grout.
- C. Integral Water Repellent: Provide units made with integral water repellent for exterior wall units.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
- D. Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Density Classification: Lightweight, unless otherwise indicated.
 - a. Provide lightweight units free of organic impurities that will cause rusting, staining and pop outs, and free of combustible matter. The use of coal cinder aggregate/bottom ash, or similar waste products will not be allowed. Fly ash contained within the cement paste may be used at the manufacturer's discretion.
 - b. For lightweight units, use expanded slate aggregate conforming to ASTM C 331 and ASTM C 330 or ESCI SMartWall System; graded to ensure constant texture.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Exposed Faces: Provide color and texture to match existing adjacent construction.

- E. Decorative Concrete Masonry Units: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Normal weight.
 - 3. Size (Width): As indicated on Drawings.
 - 4. Patterns and Textures: Provide the following, as indicated on Drawings:
 - a. Standard pattern, smooth finish.
 - b. Standard pattern, split-face finish.
 - 5. Basis-of-Design Product: 931 Antique Gray Split-Face Block by CEMEX.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Unless indicated otherwise provide built-in-place masonry lintels made from lintel or channel concrete masonry units for the bottom course, and bond beam units for additional courses indicated with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: Not Permitted
- E. Mortar Cement: ASTM C 1329.
- F. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate custom blend as selected by Architect to match existing.
 - 2. Acceptable Manufacturers:
 - a. Holcim.
 - b. Argos.
 - c. Lafarge.
- G. Aggregate for Mortar: ASTM C 144.
- H. Aggregate for Grout: ASTM C 404.

- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
- K. Water: Potable.

2.5 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Finish: Hot Dip Galvanized
 - 2. Wire Size for Side Rods: 3/16" or 0.188-inch diameter.
 - 3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
- D. Masonry-Joint Reinforcement for Multiwythe Cavity Wall Masonry:
 - 1. Adjustable (two-piece) type, either ladder design.
 - 2. One side rod at each face shell of backing wythe.
 - 3. Separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches.
 - 4. Tie Section:
 - a. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
 - b. Provide rectangular units with closed ends and not less than 4 inches wide.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Vertical Reinforcing Bar Positioners: Custom fabricated wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding vertical reinforcing bars in proper location of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.
 - 1. Provide units with two loops for masonry walls indicated to have a single vertical reinforcing bar at each grout spacing.
 - 2. Loop layout shall allow for placement of vertical reinforcing in center of cmu wall thickness unless noted otherwise

3. Provide units with four loops or a pair of units with two loops for masonry walls indicated to have two vertical reinforcing bars at each grout spacing.
 4. Provide custom fabricated positioners with loop layout to allow for placement of vertical reinforcing as indicated in the contract documents.
- D. Horizontal Reinforcing Bar Positioners: Custom fabricated wire units designed to fit into mortar bed joints spanning masonry unit cells and bent down for holding horizontal reinforcing bars at proper height in lintels and bond beam. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.
1. Provide custom fabricated positioners to allow for placement of horizontal reinforcing in lintels as indicated in the contract documents.
 2. Positioners for continuous bond beams shall center reinforcing in the depth of the bond beam unit unless noted otherwise.

2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M. Hot-dip galvanized to comply with ASTM A 153/A 153M
- B. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- C. Rigid Anchors: Fabricate from ASTM A36 steel bars 1-1/2 inches wide by 1/4 inch thick by length required, with ends turned up 2 inches in alternate directions. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M

2.8 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

4. Color: Custom color as selected by Architect to match existing.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 - C. Preblended, Dry Grout Mix: Furnish dry grout ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 - D. Mortar for Unit Masonry: Provide "Type S" mortar complying with ASTM C 270, Proportion or Property Specification unless indicated otherwise.
 - E. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 as follows:
 - a. 28-day compressive strength of 3000 psi unless noted otherwise.
 - b. Provide grout with a slump of 8 - 11 inches as measured according to ASTM C 143/C 143M.
 3. Ready-Mixed Grout: Measure, batch, mix, and deliver grout according to ASTM C 476, and furnish batch ticket information.
 - a. Slump shall be adjusted on site as necessary, and grout shall be re-mixed at mixing speed for at least one minute before discharging to achieve the desired consistency.
 4. Project-Site Mixed Grout: Mix preblended, dry grout mix according to ASTM C 476.
 - a. Mix in a mechanical mixer for a minimum of 5 minutes with sufficient water to achieve the desired consistency.
 - b. Hand mixing of grout is not permitted
 - c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that foundations are "broom" clean and free of debris or other laitance that may compromise mortar bond.
 4. Verify that reinforcing dowels are properly placed and extend to the proper elevation.
- B. Before installation, examine rough-in and built-in construction for electrical, mechanical, piping and other systems to identify locations of built in construction..

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build composite walls and other masonry construction to full thickness shown. Build singlewythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.3 TOLERANCES

- A. Comply with the construction tolerances in ACI 530.1-11 unless modified herein.
- B. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- C. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- D. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
3. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
4. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond. Bond each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Reinforced Masonry: Keep vertical cells aligned to maintain continuous unobstructed cells not less than 3 inches by 3 inches to receive reinforcing steel and grout.
- E. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- F. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, leaving a minimum 1/2" clearance between masonry and structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1 inch clearance between end of anchor rod and end of tube. Space anchors 32 inches o.c. unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. General: Prepare mortar in accordance with current Portland Cement Association publications.

- B. Prepare fresh mortar at the rate it will be used, in order to maintain consistent color and workability. Do not use mortar that has stiffened because of hydration. Discard when not used within the time recommended by mortar manufacturer or PCA publications, whichever is shorter. Retemper mortar carefully to avoid color changes, no more than twice per batch.
- C. Measure mortar materials using cubic foot measuring box or other approved container of known volume, of size appropriate for operation. Use a consistent ratio of water to mortar materials, within the range recommended by the mortar manufacturer's written instructions.
- D. Lay hollow CMUs as follows:
 - 1. Only lay CMU on foundations after they have achieved a "broom" clean condition and are free of debris or other laitance that may compromise mortar bond.
 - 2. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 3. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 4. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 5. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
 - 6. With head joints filled to a minimum thickness equal to the face shell of the unit on both faces of the unit.
- E. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- G. Immediately after placing a course of masonry clean mortar drippings and fins from cells to receive reinforcing. Care shall be taken to collect the loose material and remove it from the cell and not allowing it to collect at the bottom of the cell.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 24 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.

3.8 LINTELS

A. Built in Place Lintels:

1. Provide lintels where shown and where openings of more than 12 inches for block-size units are shown without structural steel or other supporting lintels.
2. Construct from closed bottom lintel or channel concrete masonry units for the bottom course with reinforcing steel placed as indicated, supported on positioners and anchored in place. Bond beam units are not permitted for bottom course.
3. Provide bond beam units for additional courses indicated with reinforcing steel placed as indicated supported on positioners and anchored in place.
4. Fill the entire depth and length of the lintel grout in one grout pour. Grout joints are not permitted in lintels.
5. Temporarily support built-in-place lintels until cured.
6. Provide minimum bearing of 16 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 and as follows:

1. Center all vertical reinforcing steel on the thickness of the concrete masonry unit unless noted otherwise.
2. Bar positioners must be anchored in place with mortar.
3. Sequencing:
 - a. Reinforcing steel from previous grout lift extends a lap distance out of hardened grout.
 - b. No additional reinforcing is placed, and additional masonry is laid up, but not exceeded the grout pour height limit.
 - c. Reinforcing bar positioner is placed in the bed joint of the second course of additional masonry, and below the last bed joint of additional masonry with additional bar positioners installed such that spacing does not exceed 48 inches on center
 - d. The cells of additional masonry are cleaned of mortar droppings and mortar fins.
 - e. A lift of reinforcing steel is dropped into the previously laid masonry using the bar positioners to ensure proper location. The reinforcing steel shall extend above the proposed grout pour height by a minimum of one splice distance.
 - f. The grout lift is placed and consolidate.
 - g. The sequence is repeated.
4. Where a reinforced cell is noted to have the vertical reinforcing offset from the center of the concrete masonry unit then provide special two loop bar positioners to locate each vertical bar and the associated splice bar per the contract documents.
 - a. Alternately a two loop bar positioner may be installed rotated parallel to the face shells to locate the vertical bar and the associated splice bar per the contract documents.
5. Where a reinforced cell is noted to have two vertical bars provide special four loop bar positioners to locate each vertical bar and the associated splice bar per the contract documents.

- a. Alternately a pair of two loop bar positioners may be installed rotated parallel to the face shells to locate each vertical bar and the associate splice bar per the contract documents.
6. A minimum of 1" clear shall be maintained between pairs of parallel bars occurring in the same vertical cell, lintel or bond beam.
7. A minimum of 1" clear shall be maintained between vertical bars or pairs of vertical bars and , piping or other embeds occurring in the same vertical cell.
8. A minimum of ½" shall be maintained between any reinforcing bar and the adjacent masonry unit.
9. Wet setting of reinforcing steel into previously placed grout is not permitted.

C. Conduits, Piping, Panels, Boxes and other Embedded Equipment

1. The maximum outside diameter of any vertical conduit or piping located in a grouted cell shall be as follows:
 - a. 1.5 inches for 12 inch cmu
 - b. 1.125 inches for 8 inch cmu
 - c. 1 inch for 6 inch cmu
 - d. Where vertically reinforced and grouted cells are not specifically located in the contract documents it is acceptable to relocate the vertically reinforced and grouted cell to the next adjacent cell to avoid a conduit or pipe of larger dimension than permitted. The typical center to center spacing of vertically reinforced and grouted cells shall be maintained.
 - e. Where vertically reinforced and grouted cells are specifically located in the contract documents, conduit or pipes of dimensions larger than permitted shall be routed to avoid the vertically reinforced and grouted cells. In the case that the conduit or piping cannot be routed to avoid the vertically reinforced and grouted cell the Engineer shall be contacted for resolution.
2. Horizontal runs of conduit or pipe are not permitted in within lintels or bond beams
3. Horizontal runs of conduit or pipe passing through vertically reinforced and grouted cells are not permitted.
4. Piping containing either of the following shall not be located in grouted masonry:
 - a. Liquid, gas or vapors at temperatures higher than 150 degrees Fahrenheit
 - b. Under pressures in excess of 55 psi
 - c. Containing water or other liquids when they are subject to freezing
5. Inset panels, boxes, fire extinguisher cabinets and other embedded items are not permitted in grouted cells.
 - a. Where vertically reinforced and grouted cells are not specifically located in the contract documents it is acceptable to relocate the vertically reinforced and grouted cell to the next adjacent cell to avoid conflict with embedded equipment. The typical center to center spacing of vertically reinforced and grouted cells shall be maintained.
6. Where vertically reinforced and grouted cells are specifically located in the contract documents and conflict with embedded equipment, the embedded equipment shall be surface mounted or relocated as allowed by the contract documents. Where contract documents do not allow for surface mounting or relocating the equipment the Engineer shall be contacted for resolution.

D. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Prior to grouting all grouted cells shall be inspected to ensure cells are free of loose mortar droppings or debris.

- a. All debris and mortar droppings shall be removed.
 - b. All hardened mortar or mortar fins protruding more than 1/2 inch into cell shall be removed.
2. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for grout properties and minimum grout space.
 3. Limit height of vertical grout lifts and grout pours to not more than 60 inches.
 4. Grout all courses of lintels and beams in one continuous operation for the full height of the lintel or beam. Do not allow cold joints in lintels and beams.
 5. Grout lifts shall be terminated at top of walls shall be carefully consolidated to ensure grout is cured flush to top of masonry, and provides solid bearing beneath all bearing plates.
 6. Grout lifts terminating at bond beams, except at top of wall shall stopped 1/2" down from top of bond beam
 7. Typical grout lifts, not terminating at bond beam or top of wall shall be terminated a minimum of 1 1/2", but not more than 3" below a bed joint.
 8. All grout lift terminations shall be coordinate with reinforcing steel layout to ensure proper lap distance of reinforcing steel. Grout pours shall not be terminated anywhere along the length of the splice.
 9. All grout shall consolidated using internal vibration with a pencil type vibrator.
 - a. Consolidate grout in each cell or bond beam immediately after placement. Top of bond beam or cell to desired height after initial consolidation.
 - b. Reconsolidate grout in each cell or bond beam after initial water loss and settlement has occurred approximately 10 minutes after initial consolidation. Top of bond beam or cell to desired height after reconsolidation.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042200

SECTION 047200 - CAST STONE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Cast stone units.

1.3 PERFORMANCE REQUIREMENTS

- A. Professional Design Services by Contractor: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cast stone, including attachment to brick or precast concrete building construction.

1.4 DEFINITIONS

- A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.
 - 1. Dry Cast Concrete Products – manufactured from zero slump concrete.
 - a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
 - b. Machine casting method: manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.
 - 2. Wet Cast Concrete Products – manufactured from measurable slump concrete.
 - a. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.5 SUBMITTALS

- A. Product Data: Include construction details, casting method, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.
- B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions; details of reinforcement and anchorages; and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
 - 2. Indicate locations and details of anchorage devices to be embedded in other construction.

3. Comprehensive engineering analysis for anchorage system signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Samples for Verification: Sample to be included in Mockup as indicated on Drawings.
 - D. Quality-Control Plan: Manufacturer's written quality-control plan that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."
 1. Provide copies of documentation showing compliance with quality-control plan as requested by Architect.
 - E. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364.
 - F. Protection Plan: Submit statement to Architect describing materials and techniques for protection of installed cast stone.
 - G. Professional Design Submittal by Contractor: For installed cast stone indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.
 1. Manufacturer is a producing member of the Cast Stone Institute or has on file and follows a written quality-control plan approved by Architect that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."
- B. Manufacturing Standards: Cast Stone Institute, Technical Manual, 4th edition (or current edition).
- C. Mockups: As indicated on Drawings.
- D. Professional Engineer Qualifications: For design of anchorages and reinforcing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship cast stone units in suitable packs or pallets.
 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- B. Store installation materials on elevated platforms, under cover, and in a dry location.

1.8 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ACCI - Tannerstone.
 - 2. Architectural Cast Stone, Inc.
 - 3. Continental Cast Stone Manufacturing.
 - 4. Cast Stone Systems, Inc.
 - 5. Reading Rock, Inc.; Rockcast.

2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:
- B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required cast stone colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required cast stone colors.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Do not use admixtures unless specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - 4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.

- 6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.
- H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.3 CAST STONE UNITS

- A. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
 - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.
 - 2. Compressive Strength (ASTM C 1194): 6,500 minimum.
 - 3. Absorption (ASTM C 1195): 6% maximum by cold water method or 10% maximum by boiling method.
 - 4. Freeze-Thaw (ASTM C 1364): CPWL less than 5% after 300 cycles of freeze-thaw.
 - 5. Linear Shrinkage (ASTM C 426): Not exceeding 0.065%.
- B. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of material.
 - 1. Minimum reinforcing shall be 0.25 percent of the cross section area.
 - 2. Panels, soffits and similar stones greater than 24 inches in both length and width dimension shall be reinforced in that direction. Units less than 24 inches in both their length and width dimension shall be non-reinforced, unless otherwise indicated.
 - 3. Welded wire fabric reinforcing shall not be used in dry cast products.
- C. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements, unless otherwise indicated.
- D. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- E. Cure and finish units as follows:
 - 1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
 - 2. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.

3. Acid etch units to remove cement film from wet cast surfaces indicated to be finished.

F. Colors and Textures: As selected by Architect from manufacturer's full range.

1. Ensure that no identification markings or writing are visible on exposed faces of cast stone units.

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042113 "Brick Masonry."

B. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to match color of cast stone units.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, and 1/2-inch diameter.

C. Job-Mixed Detergent Solution: Solution of 1/2 cup of dry-measure tetrasodium polyphosphate and 1/2 cup of dry-measure laundry detergent dissolved in 1 gal. of water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in the "Cast Stone Institute Technical Manual."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints, unless otherwise indicated. For conventional masonry units, all head joints at coping stones and joints at column covers, cornices, platforms, soffits, window sills and in general, all stone sections with projecting profiles, exposed top joints or rigid suspension

connections to the supporting structure should be “soft” sealant joints. When piece sizes are larger than conventional masonry units, a professional designer or engineer should be consulted for proper joint design and function.

1. If not indicated, set units with joints 1/4 to 3/8 inch wide.
 2. Build anchors and ties into mortar joints as units are set.
 3. Fill dowel holes and anchor slots with mortar.
 4. Fill collar joints solid as units are set.
 5. Build concealed flashing into mortar joints as units are set.
 6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
 7. Keep joints at shelf angles open to receive sealant.
- E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- H. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.
1. Form open joint of width indicated, but not less than 3/8 inch.
- I. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants."
1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant, unless otherwise indicated.

3.3 INSTALLATION TOLERANCES

- A. Comply with Cast Stone Institute Technical Manual.
- B. Variation from Plumb: Do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
- C. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results match Architect approved mockup.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
 3. Consult with manufacturer on appropriate cleaners.
 4. Units damaged by cleaning process shall be replaced at no cost to Owner.
- D. Protect cast stone from splashing, stains, mortar, and other damage during brick installation.

END OF SECTION 047200