

SECTION 042000

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. Clay face brick.
 - 2. Firebox brick.
 - 3. Clay flue lining units.
 - 4. Stone trim units.
 - 5. Mortar and grout.
 - 6. Masonry-joint reinforcement.
 - 7. Ties and anchors.
 - 8. Embedded flashing.
 - 9. Miscellaneous masonry accessories.
- B. Products Installed but not Furnished under This Section:
 - 1. Cast-stone trim in unit masonry.
 - 2. Steel shelf angles for supporting unit masonry.
 - 3. Cavity wall insulation.

1.3 ALLOWANCES

- A. Face brick is part of the Face Brick Allowance.

1.4 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection:
 - 1. Brick, in the form of straps of five or more bricks.
 - 2. Colored mortar.
 - 3. Weep holes/cavity vents.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.

- a. Include [data on material properties] [material test reports substantiating compliance with requirements].
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - d. For masonry units[used in structural masonry], include data and calculations establishing average net-area compressive strength of units.
2. Integral water repellent used in CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Joint reinforcement.
 8. Anchors, ties, and metal accessories.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for [each type of exposed unit masonry construction] [typical exterior wall] [typical interior wall] [typical exterior and interior walls] in sizes approximately [48 inches] [60 inches] <Insert dimension> long by [36 inches] [48 inches] <Insert dimension> high [by full thickness].
 2. Build sample panels facing south.
 3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
 4. Clean [one-half of] exposed faces of panels with masonry cleaner indicated.
 5. Protect approved sample panels from the elements with weather-resistant membrane.
 6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockup[of typical wall area] as shown on Drawings.
 2. Build mockups for [each type of exposed unit masonry construction] [typical exterior wall] [typical interior wall] [typical exterior and interior walls] in sizes approximately [48 inches] [60 inches] [72 inches] [96 inches] <Insert dimension> long by [36 inches] [48 inches] [60 inches] [72 inches] <Insert dimension> high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in [each] [exterior wall] mockup.
 - b. Include lower corner of window opening[, framed with stone trim,] at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

- d. Include [metal] [wood] studs, sheathing, [water-resistive barrier] [sheathing joint-and-penetration treatment] [air barrier], veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean[one-half of] exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. 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; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 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. Store preblended, dry mortar mix in delivery containers on elevated platforms 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.

1.10 FIELD 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 TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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, from single source from 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 single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 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. Clay Face Brick: [Facing brick complying with ASTM C 216] [or] [hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area)].
1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. <Insert, in separate subparagraphs, manufacturer's name; product name or designation for acceptable face brick>.
 2. Grade: [SW] [MW or SW].
 3. Type: [FBX] [FBS] [FBA] [or] [HBX] [HBS] [HBA].
 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
 5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet[or shall have a history of successful use in Project's area].
 7. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 8. Size (Actual Dimensions): .
 9. Application: Use where brick is exposed unless otherwise indicated.
 10. [Where shown to "match existing,"]provide face brick matching color range, texture, and size of existing adjacent brickwork.
 - a. <Insert information on existing brick if known>.
 11. Color and Texture: [Medium brown, wire cut] [Full-range red, sand molded] [Buff, velour] [Match Architect's samples] [As selected by Architect].

2.5 FIREPLACE AND CHIMNEY LINING UNITS

- A. Firebox Brick: ASTM C 1261, size required to produce lining thickness indicated.
- B. Clay Flue Lining Units: ASTM C 315.

2.6 STONE TRIM UNITS

- A. Varieties and Sources: Subject to compliance with requirements, provide[**one of**] the following:
1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.
- B. Finish: [Polished] [Honed] [Smooth] [Machine tooled, four bats per 1 inch] [Machine tooled, six bats per 1 inch] [Machine tooled, eight bats per 1 inch] [Chat sawed] [Split face] [Rock face (pitched face)] <Insert finish>.
1. Finish for [Tops of Sills] [Jamb Returns] [and] [Soffits of Lintels]: [Sand rubbed] [Split face] <Insert finish>.
- C. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.

2.7 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, 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.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- 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. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Essroc, Italcementi Group; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond Portland & Lime.
 - 4) Lehigh Cement Company.; Lehigh Custom Color Portland/Lime Cement.
 - 5) .
 - 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 3. Pigments shall not exceed 10 percent of portland cement by weight.
 - 4. Pigments shall not exceed 5 percent of [masonry cement] [or] [mortar cement] by weight.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Refractory Mortar Mix: Ground fireclay or nonwater-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
- H. 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.
 - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. BASF Construction Chemicals - Building Systems; Trimix-NCA.
 - b. Euclid Chemical Company (The); Accelguard 80.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - d. .
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. ACM Chemistries; RainBloc for Mortar.
 - b. BASF Corporation, Construction Chemicals; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

J. Water: Potable.

2.8 REINFORCEMENT

- A. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 1. Exterior Walls: [Hot-dip galvanized carbon] [Stainless] steel.
 2. Wire Size for Side Rods: [0.148-inch] [0.187-inch] diameter.
 3. Wire Size for Cross Rods: [0.148-inch] [0.187-inch] diameter.
 4. Wire Size for Veneer Ties: [0.148-inch] [0.187-inch] diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 6. Provide in lengths of not less than 10 feet[, with prefabricated corner and tee units].
- B. Masonry-Joint Reinforcement for Multiwythe Masonry:
 1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus [one side rod] [two side rods] at each wythe of masonry 4 inches wide or less.
 2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with 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. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.[Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.]

2.9 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, [Type 304] [Type 316].
 4. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, [Type 304] [Type 316].
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, [hot-dip galvanized steel] [stainless-steel] wire.[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

2. Tie Section: Triangular-shaped wire tie made from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized steel] [stainless-steel] wire.[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" Section 076200 "Sheet Metal Flashing and Trim" and as follows:
 1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch thick.
 2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 4. Fabricate through-wall metal flashing embedded in masonry from [stainless steel] [copper], with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 6. Fabricate through-wall flashing with drip edge [where] [unless otherwise] indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees[and hemmed].
 7. Fabricate through-wall flashing with sealant stop [where] [unless otherwise] indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 8. Fabricate metal [drip edges] [and] [sealant stops] for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
 9. Fabricate metal expansion-joint strips from [stainless steel] [copper] to shapes indicated.
 10. Solder metal items at corners.
- B. Application: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing [with a drip edge] [with a sealant stop] [or flexible flashing with a metal drip edge] [or elastomeric thermoplastic flashing with a drip edge] [or flexible flashing with a metal sealant stop].
 4. Where flashing is fully concealed, use [metal flashing] [or] [flexible flashing].
- C. Solder and Sealants for Sheet Metal Flashings:[As specified in Section 076200 "Sheet Metal Flashing and Trim."]
 1. Solder for Stainless Steel: ASTM B 32, [Grade Sn60] [Grade Sn96], with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Solder for Copper: ASTM B 32, [Grade Sn50] [with maximum lead content of 0.2 percent].
 3. Elastomeric Sealant: ASTM C 920, chemically curing [urethane] [polysulfide] [silicone] sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Termination Bars for Flexible Flashing: bars [0.075 inch by 1 inch] [1/8 inch by 1 inch].

2.11 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. Weep/Cavity 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 the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
 - 2) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 3) Hohmann & Barnard, Inc.; QV Quadro-Vent.
 - 4) Wire-Bond; Cell Vent.
 - 5) .
- C. 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 the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Advanced Building Products Inc.; Mortar Break Mortar Break II.
 - b. Mortar Net USA, Ltd.; Mortar Net.
 - c. Wire-Bond; Cavity Net Cavity Net II.
 - d. .
 - 2. Configuration: Provide one of the following:
 - a. Strips, not less than [3/4 inch] [1-1/2 inches] thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.12 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 mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.
 - 4. 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.
- 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] [Property] 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 or in contact with earth, use Type M.
 - 2. For reinforced masonry, use [Type M] [Type S] [Type N].
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

- D. Pigmented Mortar: Use colored cement product[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Mix to match Architect's sample.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Stone trim units.
 - c. Cast-stone trim units.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Stone trim units.
 - c. Cast-stone trim units.
- F. 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, [Table 1] [or] [paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi].
 - 3. Provide grout with a slump of [8 to 11 inches] [10 to 11 inches] as measured according to ASTM C 143/C 143M.

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 the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that substrates are free of substances that impair mortar bond.
- 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 cavity and composite walls and other masonry construction to full thickness shown. 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 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. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to 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] [stack bond] [one-third running bond] [Flemish bond] [English bond] [bond pattern indicated on Drawings]; 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 or bonded by lapping not less than [2 inches] [4 inches]. Bond and interlock 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. Stopping and Resuming Work: Stop work by stepping 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.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- 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 nonload-bearing interior partitions full height of story to underside of solid floor or roof 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 1/2-inch clearance between end of anchor rod and end of tube. Space anchors [48 inches] <Insert spacing> o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units[and hollow brick] 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.
- C. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.

- D. Install clay flue liners to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
- E. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
 - 4. Rake out mortar joints for pointing with sealant.
- F. Rake out mortar joints at [pre-faced CMUs] [glazed brick] [and] [glazed structural clay tile] to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.
- H. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- I. Cut joints flush where indicated to receive [waterproofing] [cavity wall insulation] [air barriers] unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together [using one of the following methods] [as follows]:
 - 1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] [tab-type reinforcement].
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement[with continuous horizontal wire in facing wythe attached to ties].
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement[with continuous horizontal wire in facing wythe attached to ties] to allow for differential movement regardless of whether bed joints align.
 - 2. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than [8 inches] [12 inches] clear horizontally and 16 inches clear vertically.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. 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.
- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to [wall framing] [and] [concrete and masonry backup] with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten anchors [through sheathing to wall framing] [and] [to concrete and masonry backup] with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
 - 5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each [2.67 sq. ft.] [3.5 sq. ft.] of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 - 6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than [2 inches] [1 inch] <Insert distance> of airspace between back of masonry veneer and face of [sheathing] [insulation].
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 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 12 inches beyond openings [in addition to continuous reinforcement].
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at [corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than [1/2 inch] [1 inch] [2 inches] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and 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] [1/2 inch] <Insert minimum width> for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than [3/8 inch] <Insert minimum width>.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 FLASHING, WEEP HOLES, AND CAVITY 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 cavity 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. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of [4 inches] [8 inches], and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 - 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of [4 inches] [8 inches], and 1-1/2 inches into the inner wythe.[Form 1/4-inch hook in edge of flashing embedded in inner wythe.]
 - 4. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under [water-resistive barrier] [air barrier], lapping at least 4 inches.[Fasten upper edge of flexible flashing to sheathing through termination bar.]
 - 5. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 7. Install metal [drip edges] [and] [sealant stops] with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use [specified weep/cavity vent products] [or] [open-head joints] to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
 - 3. Space weep holes formed from 16 inches o.c.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.
 - 1. Fill cavities full height by placing pea gravel in cavities as masonry is laid, so that at any point, masonry does not extend more than 24 inches above top of pea gravel.
- F. Place cavity drainage material in [cavities] [airspace behind veneers] to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use [specified weep/cavity vent products] [or] [open-head joints] to form cavity vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level [B] [C] in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for [mortar air content] [and] [compressive strength].
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at [7 days and at]28 days.

3.13 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. 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. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 7. Clean stone trim to comply with stone supplier's written instructions.

3.14 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.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

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SECTION 047200

CAST STONE 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. Cast-stone trim.
 - a. Window sills.
 - b. Coping.
 - c. Wall caps.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
- B. Samples for Initial Selection: For colored mortar.
- C. Samples for Verification:
 - 1. For each color and texture of cast stone required, 10 inches square in size.
 - 2. For each trim shape required, 10 inches in length.
 - 3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project.[Label Samples to indicate types and amounts of pigments used.]

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [manufacturer] [and] [testing agency].
 - 1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.
- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364[, including test for resistance to freezing and thawing].
 - 1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by [the Cast Stone Institute] [the Architectural Precast Association] [or] [the Precast/Prestressed Concrete Institute for Group A, Category AT].
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone[with unit masonry work] to avoid delaying the Work[and to minimize the need for on-site storage].
- B. 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, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST-STONE MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[free of carbon black,] nonfading, and resistant to lime and other alkalis.
- F. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.
 - 1. Epoxy Coating: ASTM A 775/A 775M.
 - 2. Galvanized Coating: ASTM A 767/A 767M.
- G. 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] [steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M].

2.3 CAST-STONE UNITS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. <Insert, in separate subparagraphs, manufacturers' names>.
- B. Cast-Stone Units: Comply with ASTM C 1364.
 - 1. Units shall be manufactured using the [vibrant dry tamp] [wet-cast] method.
 - 2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain 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 Units as Follows:
 - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
 - 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 deg F or above.
- F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- G. Colors and Textures: Match Architect's samples As selected by Architect from manufacturer's full range.

2.4 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 042000 "Unit Masonry."
- B. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- C. Water: Potable.

2.5 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

2.6 MORTAR MIXES

- A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

2.7 SOURCE QUALITY CONTROL

- A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.
 - 1. Include one test for resistance to freezing and thawing.

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

3.2 SETTING CAST STONE IN MORTAR

- A. 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.
- B. 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.
- C. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.
- D. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."
 - 1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- E. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
 - 1. Keep joints free of mortar and other rigid materials.
 - 2. Build in compressible foam-plastic joint fillers where indicated.
 - 3. Form joint of width indicated, but not less than [3/8 inch] [1/2 inch] <Insert dimension>.
 - 4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
 - 5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

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 are approved by Architect.
- 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. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. 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. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

END OF SECTION 047200

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