

## **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. Furnish labor, materials, tools and other equipment, and services necessary to provide cast stone masonry assembly system to the full extent of the Drawings and Specifications, including all components and accessory items as required for a complete installation. Following are items of Work normally associated with this Section. Not all of these listed Work items may apply to this Project nor are they being represented as being all inclusive of every Work item specified herein.
  - 1. Cast Stone Trim:
    - a. Water tables
    - b. Column corner returns as noted on architectural canopy details
    - c. Corner returns on all window and door openings.
- B. Refer to Drawings, and Part 2 of this Section for specific details and requirements.

##### **1.3 RELATED SECTIONS**

- A. Following are related Sections that contain additional Contractor requirements. Not all of these listed Sections may apply to this Project nor are they being represented as being all inclusive of every related Section possibly associated with this Section.
  - 1. Division 01 Section "Project Management and Coordination" for preinstallation conference.
  - 2. Division 03 Section "Precast Architectural Concrete"
  - 3. Division 04 Section "Unit Masonry" for installing cast stone units in unit masonry
  - 4. Division 07 "Joint Sealants" for sealing control and expansion joints in cast stone masonry

##### **1.4 REFERENCE STANDARDS**

- A. Following are reference standards normally associated with this Section. All of these Standards may not apply to this Project nor are they being represented as being all inclusive of every reference standard associated with this Section. Refer to Division 00 Section "Supplementary Conditions" Article 1, concerning version of Standards referenced.

1. American Concrete Institute, Structural Engineering Institute of the American Society of Civil Engineers, and The Masonry Society
  - a. ACI 530/ASCE 5/TMS 402: Building Code Requirements for Masonry Structures
  - b. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures
2. American Society for Testing Materials (ASTM) International
  - a. ASTM A 36/A 36M: Specification for Carbon Structural Steel
  - b. ASTM A 123/A 123M: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - c. ASTM A 240/A 240M: Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - d. ASTM A 276: Specification for Stainless Steel Bars and Shapes
  - e. ASTM A 615/A 615M: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - f. ASTM A 666: Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
  - g. ASTM A 767/A 767M: Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement
  - h. ASTM A 775/A 775M: Specification for Epoxy-Coated Reinforcing Steel Bars
  - i. ASTM C 33: Specification for Concrete Aggregates
  - j. ASTM C 91: Specification for Masonry Cement ASTM
  - k. ASTM C97: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
  - l. ASTM C 114: Test Methods for Chemical Analysis of Hydraulic Cement
  - m. ASTM C 144: Specification for Aggregate for Masonry Mortar
  - n. ASTM C 150: Specification for Portland Cement
  - o. ASTM C170: Standard Test Method for Compressive Strength of Dimension Stone.
  - p. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes
  - q. ASTM C 260: Specification for Air-Entraining Admixtures for Concrete
  - r. ASTM C 270: Specification for Mortar for Unit Masonry
  - s. ASTM C 494/C 494M: Specification for Chemical Admixtures for Concrete
  - t. ASTM C 666/C 666M: Test Method for Resistance of Concrete to Rapid Freezing and Thawing
  - u. ASTM C 979: Specification for Pigments for Integrally Colored Concrete
  - v. ASTM C 1329: Specification for Mortar Cement
  - w. ASTM C 1364: Specification for Architectural Cast Stone
  - x. ASTM E 329: Specification for Agencies Engaged in Testing and/or Inspection of Materials Used in Construction
3. International Masonry Institute All-Weather Council
  - a. Recommended Practices and Guide Specifications for Cold Weather Masonry Construction
4. Masonry Advisory Council
  - a. Hot and Cold Weather Construction
5. The Brick Industry Association
  - a. BIA Technical Notes 20: Cleaning Brickwork
6. This specification shall be supplemented by any applicable federal, state and local building codes, guidelines, regulations, and standards adopted in the immediate geographic area of the Project; insurance rating organizations; including all other Authorities Having Jurisdiction.

## 1.5 ACTION SUBMITTALS

- A. Certification of Compliance: Submit all information necessary to indicate full compliance to all requirements specified herein, otherwise, submittal will be returned marked 'Rejected.'
- B. Action Submittals:
  - 1. Refer to Division 01 Section "Product Requirements" in its entirety with particular attention to "Submittals" Article 1.6.
  - 2. Product Schedule: For cast stone masonry. Descriptive list of all materials proposed for use as described in Division 01 Section "Submittal Procedures." Use same designations indicated on Drawings.
  - 3. Product Data: Manufacturer's technical product data and specifications for each type of product indicated.
    - a. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 4. Shop Drawings: Show fabrication and installation details for cast stone units and assembly system requirements. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
    - a. Include building elevations showing layout of units and locations of joints and anchors.
  - 5. Samples for Initial Selection: For colored mortar. Samples will be reviewed by the Architect for appearance only.
  - 6. Samples for Verification:
    - a. For each color and texture of cast stone required, 10-inches square in size.
    - b. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.
  - 7. Full-Size Samples: For each color, texture, and shape of cast stone unit required.
    - a. Make available for Architect's review at Project site or at manufacturing plant, if acceptable to Architect.
    - b. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.
    - c. Approved Samples may be installed in the Work.

## 1.6 INFORMATIONAL SUBMITTALS:

- A. Refer to Division 01 Section "Quality Requirements" in its entirety with particular attention to "Submittals" Article 1.9.
- B. Qualification Data: For manufacturer, installer, and testing agency.
  - 1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.
- C. 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.

## 1.7 QUALITY ASSURANCE

- A. Refer to Division 01 Section “Quality Requirements” in its entirety with particular attention to “Quality Assurance” Article 1.13 and “Quality Control” Article 1.14, and Division 01 Section “Product Requirements” in its entirety with particular attention to “Quality Assurance” Article 1.7.
- B. 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 and/or the Architectural Precast Association and/or the Precast/Prestressed Concrete Institute for Group A, Category AT.
- C. Additional Installer Qualifications: Comply with requirements in Division 04 Section “Unit Masonry” for additional installer qualifications requirements.
- D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- E. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.
- F. 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.
- G. Mockups: Comply with requirements in Division 04 Section “Unit Masonry” for mockup requirements.
- H. Preinstallation Conference: Comply with requirements in Division 04 Section “Unit Masonry” for preinstallation conference requirements. Review Shop Drawings, mockups and other Project / assembly system recommendations and requirements.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 01 Section “Product Requirements” in its entirety with particular attention to “Product Delivery, Storage, and Handling” Article 1.8.
- B. Comply with requirements in Division 04 Section “Unit Masonry” for delivery, storage, and handling requirements.
- C. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
- D. Pack, handle, and ship cast stone units wrapped in protective film, 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.
  - 3. Follow any more stringent manufacturer recommendations and requirements.

## 1.9 PROJECT CONDITIONS

- A. Comply with requirements in Division 04 Section “Unit Masonry” for Project condition requirements.
- B. Cold-Weather Requirements: Do not use frozen material or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602 and any more stringent manufacturer requirements.
  - 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 no fewer than seven days after completing cleaning.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602 and any more stringent manufacturer requirements.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

- A. In other Articles within Part 2 of this Section where titles such as ‘Product,’ ‘Products,’ ‘Available Products,’ ‘Manufacturer,’ ‘Manufacturers,’ ‘Available Manufacturers,’ ‘Product Options,’ ‘Basis-of-Design,’ etc. introduce lists, refer to Division 01 Section “Product Requirements” in its entirety with particular attention to “Product Selection Procedures” Article 2.1.

### 2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:
- B. Portland Cement: ASTM C 150, 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; gradation and colors as needed to produce required cast stone textures and colors. The aggregates to match the architects color sample #4 on color sample board issued to The City of Draper, Utah. Sample to be reviewed before bid time to ensure match is achieved.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and 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: Use only admixtures 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. Do not use dark mineral admixtures in surfaces intended to be exposed to view.
  3. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
  4. 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.
  5. Water-Reducing Admixture: ASTM C 494/C 494M, Type A
  6. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D
  7. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E
- G. 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
- 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. Source Limitations for Cast Stone: Obtain stone, from single source with resources to provide materials of consistent quality in appearance and physical properties. NOTE: STONE MUST MATCH EXISTING FACILITY.
- B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
1. Fabricate stone masonry units to sizes, profiles, and textures as described herein and/or indicated on Drawings. (3 5/8"D, 23 5/8"L, 11 5/8"H) Provide corner returns at all openings and at columns and building corners. Provide water table as dimensioned on drawings.
  2. Provide units that are 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.
  3. Compressive Strength (ASTM C170): Minimum 6,500 psi at 28 days
  4. Absorption (ASTM C97, Cold Water Method): Maximum 6.5 percent at 28 days
- 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 L/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 L/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 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.
  - b. No fewer than six days at mean daily temperature of 60 deg F or above.
  - c. No fewer than seven days at mean daily temperature of 50 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. Match previously submitted sample #4 from unlimited designs. Custom color sample to be submitted in a full unit and to be reviewed before bid time to ensure match is achieved.

## 2.4 MORTAR MATERIALS

- A. Comply with requirements in Division 04 Section "Unit Masonry" for mortar material requirements and any more stringent criteria as per manufacturer.

## 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, unless indicated otherwise on Drawings. Seismic anchors required.
- 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, unless indicated otherwise on Drawings.
- C. Cleaners: Comply with requirements in Division 04 Section "Unit Masonry" for mortar cleaner requirements.
- D. 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 cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

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

## 2.6 MORTAR MIXES

- A. Comply with requirements in Division 04 Section "Unit Masonry" for mortar mix requirements.
- B. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

## 2.7 FABRICATION TOLERANCES

- A. Cross Section Dimensions: Not deviating by more than plus or minus 1/8-inch from approved dimensions.
- B. Length of Units: Not deviating by more than L/360 or plus or minus 1/8-inch maximum, whichever is greater.
- C. Maximum Length of any Unit: Maximum 15 times the average thickness of the unit.
- D. Warp, Bow or Twist of Units: Maximum L/360 or plus or minus 1/8-inch, whichever is greater.
- E. Location of Dowel Holes, Anchor Slots, Flashing Grooves, False Joints: Maximum deviation as follows:
  1. On Formed Sides of Unit: 1/8-inch
  2. On Unformed Sides of Unit: 3/8-inch

## 2.8 FINISHES

- A. Exposed Surfaces: Fine-grained texture similar to natural stone, with the following:
  1. No air voids in excess of 1/32-inch in diameter.
  2. Less than 3 voids per 1 sq./in. and not obvious under direct daylight illumination when viewed at a distance of 5-feet.
  3. A permissible color variation between units to ASTM D2244.
    - a. Total color difference: Not greater than 6 units.
    - b. Total hue difference: Not greater than 2 units.
- B. Color: Match Architect's Samples, as selected by the Architect to match Unlimited Design sample #4.

## 2.9 SOURCE QUALITY CONTROL

- A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.
- B. Test cast units as specified in Division 01 Section “Quality Requirements.”
- C. Test compressive strength and absorption from specimens selected at random from plant production, to ASTM C170 and ASTM C97.
  - 1. Test samples taken from every 500 cubic feet of product produced.
- D. Test new and existing mix designs for strength and absorption compliance prior to producing units.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. With Installer present, examine substrates and conditions under which stone masonry will be installed, 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. Proceed with installation only after unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
    - a. Beginning of installation means Installer accepts existing surface and/or substrate conditions.

### 3.2 SETTING CAST STONE IN MORTAR

- A. Set cast stone units to comply with Division 04 Section “Unit Masonry” and 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.
  - 2. Coordinate installation of cast stone with installation of flashing specified in other Sections.
- B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- C. Set units in full bed of mortar with full head joints unless otherwise indicated.
  - 1. Set units with joints 1/4- to 3/8-inch wide unless otherwise indicated.
  - 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.
- D. 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.
  - E. 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.
  - F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
  - G. Provide sealant joints at 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.
    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 Division 07 Section "Joint Sealants."

### 3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. 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.
  2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- C. Fill anchor holes with sealant.
  1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

- E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
  - 1. Form open joint of width indicated, but not less than 3/8-inch.
- F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants."

### 3.4 INSTALLATION TOLERANCES

- A. Comply with requirements in Division 04 Section "Unit Masonry" for installation tolerance requirements.
- B. Variation from Plumb: Do not exceed 1/8-inch in 10 feet maximum.
- C. Variation from Level: Do not exceed 1/8-inch in 10 feet maximum.
- D. 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.
- E. 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.

### 3.5 ADJUSTING AND CLEANING

- A. Comply with requirements in Division 04 Section "Unit Masonry" for repairing, adjusting and cleaning requirements.
- B. 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.
- C. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- D. 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 splatter.
- E. 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 or clean cast stone with proprietary acidic cleaner if recommended by manufacturer when applied according to manufacturer's written instructions.

**END OF SECTION 047200**