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SECTION 044300

STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Granite masonry
2. Limestone masonry
3. Masonry anchored to the following:
 - a. Concrete backup.
 - b. Unit masonry backup.
 - c. Wood framing and sheathing.

d. Cold-formed metal framing and sheathing.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for dovetail slots in concrete for anchoring stone.
2. Division 04 Section "<insert>" for cavity-wall insulation.
3. Division 05 Section "<insert>" for steel lintels and shelf angles for stone masonry.

1.2 REFERENCES

- A. ASTM A 123-02: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM C 97-02: Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
- C. ASTM C 119-04: Terminology Relating to Dimension Stone
- D. ASTM C 170-90 (1999): Test Method for Compressive Strength of Dimension Stone
- E. ASTM C 270-03: Specification for Mortar for Unit Masonry
- F. ASTM C 615-03: Specification for Granite Dimension Stone
- G. ASTM C 568-03: Specification for Limestone Dimension Stone
- H. ASTM C 1242-03: Guide for the Selection, Design, and Installation of Exterior Dimension Stone Anchors and Anchoring Systems
- I. ASTM C 1354-96: Test Method for Strength of Individual Stone Anchorages in Dimension Stone

1.3 DEFINITIONS

- A. Definitions contained in ASTM C 119 apply to this Section.

1.4 SUBMITTALS

- A. Product Data: For each stone type and each manufactured product shown on Drawings or specified.
 1. For each stone variety used on Project, include physical property data.
- B. Shop Drawings: Show fabrication and installation details for stone cladding:
 1. Include dimensions and profiles of stone units.
 2. Show locations and details of joints.
 3. Show locations and details of anchors.
- C. Samples: Submit samples for each stone type required, exhibiting the full range of color characteristics expected.
 1. Submit a minimum of 2 each, 12 inches x 12 inches in size, in each color and finish specified.

2. In the case of more variegated stones, color photos shall be submitted in addition to the number of samples to show the full range of color and markings to be expected.
3. Mortar Samples: Full range of exposed color and texture.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Stone: Obtain each stone variety from a single quarry.
- B. Visual Mockup: Provide full sized mock-up of the approved stone or stones in the approved finishes, erected at a site agreed to by the Architect, Contractor, and the Fabricator. The approved mock-up shall become the standard for the project.
 1. Build mockup of **[typical exterior stone]** **[areas as shown on Drawings]**.
 2. Size: **[insert size of visual mockup]**
 3. Color consistency: demonstrate color consistency with mockup; color range shall not exceed range of color established by samples.
 4. Included typical components and anchors.
 5. Mockup may become part of the completed Work if approved at time of Substantial Completion.
 6. Demolish mockup and remove from site after completion of stone cladding work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials to prevent deterioration or damage.
 1. Stone shall be carefully packed and loaded for shipment using reasonable care and customary precautions against damage in transit. Material, which may cause staining or discoloration shall not be used for blocking or packing.
- B. Properly store cementitious materials. Do not use damp cementitious materials.
- C. Store masonry accessories, including metal items, to prevent corrosion and contamination.

1.7 PROJECT CONDITIONS

- A. Protect stone as follows:
 1. At the end of each day's work, cover tops of walls with nonstaining, waterproof covering. Protect partially finished work when not being worked on.
 2. Prevent staining of stone from **[mortar]**, grout, **[sealants]**, and other sources. Immediately remove such materials without damaging stone.
 3. Protect base of walls using coverings spread on ground and over wall surface.
 4. Protect sills, ledges, and other projections from **[mortar]**.
- B. Cold-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.
- C. Hot-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 STONE SOURCE

- A. Varieties and Source: Subject to compliance with requirements, provide stone from the following source:
 - 1. Granite Source: Coldspring
 - 2. Dolomitic Limestone Source: Kasota Valley Limestone by Coldspring.
- B. Each color of granite shall come from a single quarry, with sufficient reserves to satisfy the requirements of the project. The granite supplier shall have the capabilities to cut and finish the stone without delaying the project.
- C. Stone Source Examination: Make quarried blocks available for examination by Architect.

2.2 STONE MATERIAL

- A. Granite: ASTM C 615.
- B. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- C. Match Architect's samples.
- D. Granite Type **[Insert Drawing Designation Type ST-1]**:
 - 1. Stone Variety: **[Insert stone variety]** by Coldspring.
 - 2. Location: Exterior Masonry.
 - 3. Finish:
 - a. [Polish]
 - b. [Velvet]
 - c. [Diamond 8 (Honed)]
 - d. [Rub & Sand]
 - e. [Textured]
 - f. [Thermal]
 - g. [Diamond 10]
 - h. [Bush hammer]
 - i. [Rock Pitch]
 - j. [Rock Face]
 - k. [Splitface]
 - l. [Diamond 100]
 - m. [Diamond 200]
 - n. [Thermal Brush]
 - 4. Nominal Thickness: Not less than the following nominal thickness:
 - a. [3 1/8 inches (+1/8" -1/16")] [79 mm]
 - b. [3 7/8 inches (+1/8" -1/16")] [98 mm]
 - c. [6 1/8 inches +/-1/8"] [156 mm]

- d. [8 inches +/-1/8"] [203 mm]

2.3 LIMESTONE MATERIALS

A. Dolomitic Limestone: ASTM C 568, classification as follows:

1. Medium Density Limestone: ASTM C 568 Class II.

- a. Density: [135 - 160 lb/cu. ft.]
- b. Absorption by weight: 5 percent maximum
- c. Modulus of rupture: 800 psi minimum

B. Dolomitic Limestone Type [**insert type designation**]:

1. Location: [**Exterior Cladding**].

2. Finish:

- a. [Polish]
- b. [Honed]
- c. [Diamond Smooth]
- d. [Textured]
- e. [Splitface]
- f. [Rockface]
- g. [Rockpitch]

3. Color: Cream

4. Surface: Unfilled.

5. Nominal Thickness: Not less than the following nominal thickness:

- a. [3-1/8 inches plus 1/8 inch or minus 1/16 inch (79 mm)]
- b. [3-7/8 inches plus 1/8 inch or minus 1/16 inch (98 mm)]

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction.

1. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207.

C. Portland Cement-Lime Mix: ASTM C 150, Type I or Type III and lime.

1. Low-Alkali Cement: ASTM C 114.

D. Colored Portland Cement-Lime Mix: ASTM C 150, Type I or Type II, lime, and mortar pigments.

E. Aggregate: ASTM C 144

F. Mortar Pigments: Natural and synthetic iron oxides. Use only pigments with a record of satisfactory performance in mortar and containing no carbon black.

G. Water: Potable.

2.5 ANCHORS AND FASTENERS

- A. Hot-Dip Galvanized-Steel Wire: ASTM A 82, with ASTM A 153/A 153M, Class B-2.
- B. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
- C. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Stone Anchors: Anchors designed to engage kerfs or holes in stone trim and holes for anchor bolts for fastening to substrates or framing.
 - 1. Anchor Material: Stainless steel, ASTM A 666, Type 304
 - 2. Dowels and Pins Material: Stainless steel, ASTM A 276, Type 304
- F. Post installed Anchor Bolts: Provide the following for installation into concrete and masonry:
 - 1. Expansion anchors
 - 2. Stainless Steel Bolts: ASTM F 593, Alloy Group 1 or 2.
 - 3. Stainless Steel Nuts: ASTM F 594, Alloy Group 1 or 2.
 - 4. Anchor Material: ASTM A 666 or ASTM A 276, Type 304 or 316.
 - 5. Capacity:
 - a. Concrete: Sustain load equal to 4 times the required loads
 - b. Masonry: Sustain load equal to 6 times the required loads
 - c. Test: ASTM E 488.

2.6 VENEER ANCHORS

- A. Products: [insert manufacturer and product].
- B. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch-, [**hot-dip galvanized**] [**stainless**]-steel wire.
- C. Two Part Veneer Anchors: Wire tie section and a metal anchor section.
 - 1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
- D. Coated, Steel Drill Screws for Steel Studs: ASTM C 954 with hex washer head and neoprene washer, No. 10, with organic polymer coating.
- E. Stainless-Steel Drill Screws for Steel Studs: 300 Series stainless-steel, complying with ASTM C 954 with hex washer head and neoprene washer, No. 10.
- F. Steel Tapping Screws for Concrete Masonry: Self-tapping screws with threads for masonry, with hex washer head and neoprene washer, 3/16-inch diameter by 1-1/2-inch length, and with organic coating.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual and Division 7 Section "Sheet Metal Flashing and Trim" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Metal Drip Edges: Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 3. Metal Flashing Terminations: Fabricate from stainless steel.
- B. Flexible Flashing: For concealed flashing use one of the following:
 - 1. Rubberized-Asphalt Flashing: Composite flashing consisting of rubberized-asphalt compound, bonded to high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
 - 2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."
- D. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's recommended products.

2.8 STONE ACCESSORIES

- A. Compressible Filler: ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from
 - 1. **[Neoprene]**.
 - 2. **[Urethane]**.
 - 3. **[PVC]**.
- B. Weep Hole/Vent Products: Round plastic tubing, medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.

2.9 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, **[Type IV]**, closed-cell product extruded with an integral skin.

2.10 MASONRY CLEANERS

- A. Acidic Cleaner: **[insert manufacturer and product]**.

2.11 MORTAR MIXES

- A. Preblended, Dry Mortar Mix: **[insert manufacturer and product]**.
 - 1. Furnish preblended mix.

2. Measure quantities by weight to ensure accurate proportions.
 3. Thoroughly blend ingredients before delivering to Project site.
- B. Mortar for Stone Masonry: Comply with ASTM C 270 Type S, Proportion Specification.
- C. Pigmented Mortar: Provide pigments to produce color required.
1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 3. Mix to match Architect's sample.

2.12 STONE FABRICATION

- A. Fabricate stone to comply with applicable stone association or, by recommendations of stone source.
1. **[Granite]**: NSI – Dimensional Stone Design Manual
 2. **[Dolomitic Limestone]**: Marble Institute of America (MIA) "Dimensional Stone-- Design Manual IV."
- B. Fabricate stone to produce pieces indicated on Drawings, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face.
- C. Cut and drill sinkages and holes in stone for anchors and supports.
- D. Inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
1. Clean sawed backs of stone, unless otherwise indicated.
- E. Shape stone for type of masonry (pattern) as follows:
1. Sawed-bed, range ashlar with uniform course heights and uniform lengths as indicated on Drawings.
 2. Sawed-bed, range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 3. Sawed-bed, broken-range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 4. **[Sawed] [Split]**-bed, random-range ashlar with random course heights and random lengths (interrupted coursed).
 5. Coursed rubble.
 6. Uncoursed rubble (fieldstone).
 7. Polygonal or mosaic.
- F. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.
1. Finish exposed ends of copings to match exposed face, unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and conditions with Installer present.
- B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
- C. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Clean surfaces that are dirty or stained. Scrub with fiber brushes, then drench with clear water. Use cleaning compounds recommended by manufacturer.

3.3 SETTING OF STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
 - 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - 3. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- E. Maintain uniform joint widths. Minor variations are required to maintain bond alignment.
 - 1. At narrowest points, joints not less than: 1/4 inch.
 - 2. At widest points, joints not more than: 1/2 inch.
- F. Provide sealant joints of widths and at locations indicated.

1. Sealants: Refer to Division 07 Section "Joint Sealants."
 2. Keep sealant joints free of mortar and other rigid materials.
- G. Install expansion strips in sealant joints at locations indicated.
- H. Install embedded flashing[**and weep holes**].
1. At stud-framed walls:
 - a. Extend flashing through stone masonry
 - b. Up the face of sheathing at least
 - 1) **[8 inches]**
 - 2) **[12 inches]**
 - 3) **[16 inches]**,
 - c. Behind weather-resistant sheathing paper.
 2. At multiwythe masonry walls, including cavity walls:
 - a. Extend flashing through stone masonry,
 - b. Turned up a minimum of
 - 1) **[4 inches]**
 - 2) **[8 inches]**
 - 3) **[12 inches]**
 - 4) **[16 inches]**
 - c. Extend into or through inner wythe.
 3. At concrete backing:
 - a. Extend flashing through stone masonry,
 - b. Turned up:
 - 1) A minimum of **[4 inches]**.
 - 2) A minimum of **[6 inches]**.
 - 3) A minimum of **[8 inches]**.
 - 4) A minimum of **[12 inches]**.
 - c. Insert in reglet.
 4. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 5. At sills, extend flashing not less than 4 inches at ends.
 6. At ends of head and sill flashing turn up not less than 2 inches to form end dams.
 7. 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.
 8. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant.
 9. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.
- I. Flexible Flashing with Metal Drip Edge:
1. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- J. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.

1. Space weep holes 24 inches maximum o.c.
2. Space weep holes formed from plastic tubing or wicking material 16 inches o.c.
3. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
4. Place cavity drainage material in cavities.

3.4 STONE MASONRY COURSING

- A. Ashlar Pattern: Arrange stones in range ashlar pattern:
1. Course heights as indicated.
 2. Length:
 - a. **[Uniform].**
 - b. **[Random].**
 3. Uniform joint widths, with offset between vertical joints as indicated.
- B. Broken-range Ashlar Pattern: Arrange stones in broken-range ashlar pattern:
1. Uniform course heights
 2. Random lengths
 3. Uniform joint widths.
- C. Random-Range Ashlar Pattern: Arrange stones in three-course, random-range ashlar pattern
1. Random course heights
 2. Random lengths (interrupted coursed)
 3. Uniform joint widths.
- D. Rubble Pattern: Arrange stones with joint widths indicated.
1. **[Coursed rubble pattern.]**
 2. **[Uncoursed rubble pattern.]**
 3. **[Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.]**
- E. Polygonal Stone Pattern: Arrange stones in polygonal (mosaic) pattern with uniform joint widths.

3.5 CONSTRUCTION TOLERANCES

- A. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Plumb:
1. Vertical Lines and Surfaces of Walls not to exceed:
 - a. 1/4 inch in 10 feet (6 mm in 3 m).
 - b. 3/8 inch in 20 feet (10 mm in 6 m).
 - c. 1/2 inch in 40 feet (12 mm in 12 m) or more.
 2. External corners, expansion joints, and other conspicuous lines not to exceed:
 - a. 1/8 inch in 10 feet (3 mm in 3 m).
 - b. 1/4 inch in 20 feet (6 mm in 6 m) or more.
- C. Variation from Level:

1. [Bed joints and] Lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, not to exceed:
 - a. 1/4 inch in 20 feet (6 mm in 6 m).
 - b. 1/2 inch in 40 feet (12 mm in 12 m) or more.

D. Variation of Linear Building Line:

1. Positions shown in plan not to exceed:
 - a. 1/2 inch in 20 feet (6 mm in 6 m).
 - b. 3/4 inch in 40 feet (12 mm in 12 m) or more.

E. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

F. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.6 ANCHORED MASONRY INSTALLATION

- A. Anchor stone masonry to concrete and unit masonry with veneer anchors.
- B. Anchor stone masonry to framing with screw-attached veneer anchors.
- C. Embed veneer anchors in mortar joints of stone masonry.
- D. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, joints, and perimeter of wall.
- E. Anchor stone trim with stone trim anchors. Provide compressible filler in ends of dowel holes and bottoms of kerfs. Fill remainder of anchor holes and kerfs with mortar.
- F. Set stone in full bed of mortar with full head joints. Build anchors into mortar joints as stone is set.
- G. Provide 2-inch cavity between stone masonry and backup construction. Keep cavity free of mortar droppings and debris.
 1. Minimize mortar protrusions into cavity.
- H. Rake out joints for pointing with mortar to uniform depths.

3.7 POINTING

- A. Remove dust and mortar particles from stone joints. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar.
- B. Place and compact pointing mortar in layers not more than 3/8 inch deep.
- C. Tool joints when pointing mortar is thumbprint hard to produce the following joint profile:
 1. Joint Profile: Concave.

3.8 ADJUSTING

- A. Remove and replace damaged stone masonry. Repair stone masonry using methods approved by Architect.
- B. Remove and replace defective joints.
- C. Remove and replace stone masonry not matching approved Samples and mockups.
- D. Remove and replace stone masonry not complying with other requirements indicated.
- E. Replace stone masonry to match approved Samples and mockups, comply with other requirements, and show no evidence of replacement.

3.9 CLEANING

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: Clean stone masonry as recommended by fabricator.

END OF SECTION